School of Information Systems

IT Governance and Green IT Model for Large Mauritian Organisations

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**This thesis is presented for the Degree of
Doctor of Philosophy
of
Curtin University**

October 2016

DECLARATION

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human Ethics (for projects involving human participants/tissue, etc):
The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number # IS_12_36 and # IS_14_20.

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Date: October 2016

ABSTRACT

The pervasiveness of Information Technology (IT) in business has led to significant interest in both its strategic and environmentally sustainable use. Literature indicates that focus on IT governance helps to better achieve business vision, mission and objectives. These also include environmental sustainability as business stakeholders grow increasingly concerned about the world's climate change. IT has both significant environmental impacts and the potential for sustainable business practices, making Green IT an important component of IT governance. Yet, IT governance and Green IT research in developing countries, particularly Small Island Developing States (SIDS) with high IT use, is scarce. This is the case for the SIDS of Mauritius which has both a high IT dependency and a strong vision of sustainability. While several Mauritian businesses apply some IT governance and Green IT measures, much scope for improvement remains for the island to achieve its 2030 vision of excellence in IT and environmental sustainability. This is particularly relevant for large businesses from the island's main economic sectors of Finance, Tourism, Textile, IT and Sugar which are characterised by their prominent IT use. This study aims to bridge the gaps identified by providing an IT governance and Green IT model (ITGM) to guide large Mauritian businesses from key economic sectors in deriving maximum IT value both from a business and sustainability angle.

A mixed-methods approach comprising exploratory case studies and a survey was used to examine the initial model derived from the literature review. Case studies were established using interviews and document analysis. Twelve senior managers from ten large companies in Mauritius, two from each economic pillar of the island, were interviewed in regard to their IT governance and Green IT practices. The resulting content was analysed to generate a first draft of the ITGM. This was followed by content analysis of company policy documents, annual reports and relevant legislations and government documents to refine the initial ITGM draft. The latter coupled with further literature findings constituted the basis for a questionnaire survey distributed to a population of 192 companies from the five main industries of

Mauritius. One hundred and nine companies responded resulting in a high response rate of 56.8%. Survey data were analysed using Exploratory Factor Analysis followed by Confirmatory Factor Analysis and results merged with the draft ITGM to produce a final ITGM.

The final ITGM therefore merges IT governance and Green IT in one comprehensive model to address this research gap. The ITGM shows that IT governance and Green IT do appear on the agenda of key Mauritian companies. A preference for centralised or hybrid modes of control was noted. Several IT governance and Green IT mechanisms have also been implemented. These are both internally and externally motivated, as well as encouraged through support mechanisms such as tax rebates. The ITGM thus forms the basis of good IT governance and Green IT practice among large Mauritian organisations.

Nevertheless, areas of improvement exist. Recommendations include having an IT executive on the board of directors, adopting IT governance frameworks, an integrated Green IT policy, Green IT audits, monitoring, reporting, as well as IT governance and Green IT training. Limitations include the inability to interview both IT and business executives from the same company, insufficient access to company IT policies, the hitherto unreleased National Green IT Strategy, lack of an accurate population of large Mauritian companies and a low participation rate from the textile industry. The ITGM is also limited to only key economic sectors of Mauritius. Future work could involve widening the research scope to both IT and business executives, SMEs, other industries and SIDS.

This research provides guidelines for optimal and sustainable IT use in Mauritian businesses. It aligns with the Mauritian government's vision to become a leading ICT hub and a prime example of environmental sustainability. Findings can also be applied to other SIDS with high IT dependency for their efficient IT use.

ACKNOWLEDGEMENTS

My first tribute goes to my PhD supervisor, Professor Vanessa Chang, without whom the completion of this thesis would have been impossible. Thank you Vanessa for your trust in me as your PhD student and for helping me from day one with my proposal. Thank you for supporting me with priceless feedback and advice throughout my entire PhD journey. Every Skype call and exchange of emails with you has served to wipe away my doubts and fears. You are blessed with an amazing gift of turning what appears complex to simplicity! You have been a great source of encouragement, never letting me waver. Thank you for being such an inspiration!

I am highly indebted to Dr. Tomayess Issa, my PhD co-supervisor, for her unfaltering guidance. Tomayess, your diligence has been an amazing driving force. You have never left my side and for that, I am extremely grateful. Thank you for helping me structure my thoughts during chaotic times, for always adding a little innovative extra to my work and for organising most of our Skype calls. You are a pillar of strength and inspiration. Working under your supervision has been an immense privilege.

Thank you Curtin University for having awarded me the Curtin Offshore Partner Research Scholarship (COPRS) without which I would never have been able to study in such a prestigious environment. Being a PhD student at Curtin not only gave me my wonderful supervisors, but it also provided me with access to a tremendous wealth of resources for a highly enjoyable research experience.

I am also grateful to Professor Eric Charoux, Executive Director of Charles Telfair Institute (CTI), and Mrs. Odylle Charoux, CTI Director of Academic Affairs. Thank you, Eric, for helping me find my way in the world of Mauritian executives and senior managers. Thank you for challenging me whenever you felt that I was prey to stagnation. This has always driven me to work even harder. Thank you, Odylle, for believing in me but, more importantly, for helping me believe in myself and consistently pushing my limits. Thank you for reviving my PhD dream – a dream which, for years, had remained lost in my day-to-day routine.

I am grateful to all the executives and managers who took time off from their busy schedule to participate in my interviews and complete my survey. I am aware that some of you went out of your way to welcome me at your premises and to prepare for my interview. Such assiduousness on your behalf has greatly contributed to the quality of my research data.

I would also like to thank some CTI friends without whom my PhD experience would have been less smooth. Kanya, you have been a remarkable and selfless industry liaison. Thank you for your constant assistance even when your own work load was at its peak! Thank you, Gilliane, for sending all my survey invitations. Thank you Jeyna, Lalita and Varsha for getting some of my questionnaires filled. Thank you, Shafiiq, fellow PhD student, for your positive vibes during this research journey. A special thank you to Dr. Karlo Jouan for his wise words of advice whenever I felt lost and for helping me secure data when most doors were shut.

Above all, this thesis is dedicated to my wonderful family whose love and support constitute the very foundation of my work. Papi, thank you for instilling in me a desire for research right from my tender childhood. Thank you for always believing that I could contribute to knowledge and for watching over me from the clouds. Mami, you have always been my ocean of strength and unwavering support. On my busy days, you have been more of a mother than a grandmother to my children. Thank you for all your love and for making my life so easy. My star husband, Amar, thank you for filling my life with positivity, unconditional love and understanding even on the days when you were my punching ball! Thank you, my lovely babies, Charm and Shayan, for lighting my life and energising me with your daily showers of hugs and kisses. The thought of seeing both of you at the end of a long day of tedious work and study has, at countless times, been a tremendous source of motivation. You have and will always be my lovely, little “battery chargers”. Thank you also to my brother and sister-in-law for shouldering some of my week-end responsibilities to allow me to work on my thesis.

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1.1 Overview

With the advent of technological advancement and corporate responsibility, the traditionally reactive function of Information Technology (IT) in corporate organisations has given way to a more pro-active and strategic role (ITGI 2011; ISACA 2012). IT is now recognised as an unequivocal strategic enabler in the achievement of organisational goals (Arvidsson, Holmstrom, and Lyytinen 2014; Jafari 2014; Coltman et al. 2015). According to Gartner (2016), worldwide IT spending is soaring with predictions of $3.54 trillion for 2016 as compared to $3.52 trillion dollars in 2015. As IT investments rise, executives increasingly seek IT value by matching IT with business and vice versa (Buchwald, Urbach, and Ahlemann 2014). This requires a clear definition of IT accountabilities and the implementation of mechanisms to facilitate the tuning of business and IT to the same frequencies (De Haes and Van Grembergen 2008). Such harmony between business and IT for the achievement of business goals constitutes the foundation for enterprise IT governance (ChePa et al. 2015).

Green IT or the environmentally responsible use of IT is a crucial dimension of IT governance (Bai and Sarkis 2013; Akman and Mishra 2015; Bohas and Poussing 2016). The world is facing an increasing number of environmental challenges. Temperatures are increasing, sea levels are rising and natural disasters are more frequent (Bruckner 2011). More than ever, the environment is a major area of concern for countries around the world (Babin and Nicholson 2011). From the Kyoto Protocol signed in 2005 by 128 countries (Chuang and Huang 2014) to the 2015 Paris Climate Conference (COP 21) uniting over 190 countries (UNEP Climate Action 2015a), nations around the world are addressing the global issue of climate change. Governments and environmental groups are aware that they cannot fight the environmental sustainability battle without the help of businesses (UNEP Climate Action 2015b). Organisations are therefore increasingly expected to balance financial viability with social and environmental implications (Marker, Johnsen, and Caswell 2009; Nidumolu, Prahalad, and Rangaswami 2009; Smith and Sharicz 2011). For this, Green IT embedded in organisational IT governance is vital to enforce both ecological IT use and the implementation of IT for environmentally sustainable business practices (Jenkin, Webster, and McShane 2011).

Although literature abounds in IT governance research (Weill and Ross 2004; De Haes and Van Grembergen 2009b; Wilkin and Chenhall 2010; Debreceny and Gray 2013) and Green IT has been explored by several researchers (Chen, Boudreau, and Watson 2008; Murugesan 2008; Molla, Cooper and Pittayachawan 2011; Cai, Chen and Bose 2013), little work has been done to merge both in developing countries, especially Small Island Developing States (SIDS) with both high IT dependency and extreme vulnerability to threats of climate change. Mauritius is one such island. The island topped the Mo Ibrahim index of African governance from 2000 to 2015 (Mo Ibrahim Foundation 2015), has a strong focus on the digitalisation of its economy (Government Information Service 2016), and has both signed and ratified the United Nations Paris Climate Agreement in 2015 (Government of Mauritius 2015). In its 2030 vision, the government of Mauritius places particular emphasis on good governance, IT excellence and sustainability (Sourcemauritius.com 2015). Yet, the governance of IT and Green IT in Mauritius remains largely unexplored. This research therefore aims at merging the Mauritian drives for excellence in governance, IT and environmental sustainability to formulate an IT governance and Green IT model (ITGM). It is envisioned that this model will assist Mauritian companies in maximising both their IT business value and sustainability quotient.

1.2 IT governance

Emerging primarily from the need to align IT and business, the concept of IT governance began to appear in literature in the late 1990s (Bhattacharjya and Chang 2007). In 1998, the Information Systems Audit and Control Association (now known as ISACA), a leading global organisation promoting Information Systems best practice, founded the IT Governance Institute (ITGI) to assist businesses in the adoption of IT governance (ISACA 2016). Several definitions of the term have appeared in research literature since. Most of them include IT leadership and oversight of IT to best support the achievement of business strategies (De Haes, Van Grembergen, and Debreceny 2013). As escalating IT budgets clash with poor track records of IT projects (The Standish Group 2011), companies are required to tread more cautiously when investing in IT. Valuable returns on IT investments depend less on the technology but more on its governance for clearer IT accountabilities and a strong focus on the alignment of IT with business objectives (Peterson 2004). The governance of IT is therefore imperative for companies to extract maximum business value from IT and increase their profits (Lunardi et al. 2014).

Numerous benefits underlie the adoption of IT governance. Effective governance of IT brings business and IT alignment (ITGI 2011) since it is widely accepted that companies can improve their performance only if their IT is strongly tied to their business needs (Reich and Benbasat 2000; Luftman 2003; Chan, Sabherwal, and Thatcher 2006; De Haes and Van Grembergen 2009; Huang, Zmud, and Price 2010). As businesses govern their IT better, they are able to clearly formulate IT decision accountabilities to ensure that IT matches business goals (Peterson 2004; Weill 2004). Both IT and business managers understand each other better and collaborate on IT issues to best assist business and vice versa (Nolan and McFarlan 2005; Chan, Sabherwal, and Thatcher 2006). IT investments are more than ever driven by business value resulting in better profits (Wilkin and Chenhall 2010) and improved IT risk management (Raghupathi 2007). IT governance thus offers considerable improvement in business performance (ITGI 2011).

Sidorova et al. (2008) noted a research shift from the technological aspect of IT to the business aspect of IT. This is reflected by considerable research on the governance of IT in multiple countries (discussed further in Chapter 2). Many of these countries are developed but some also belong to the developing end of the world. Yet, despite a growing IT drive in Mauritius (DCDM Research 2010), to the researcher’s knowledge, IT governance remains mostly unexplored amongst businesses on the island. An understanding of IT governance in Mauritius is therefore warranted to both gauge existing IT governance practices and provide recommendations to optimise IT potential for business benefit.

1.3 Green IT

Apart from the strategic role of IT as a business enabler, business IT is also increasingly viewed through an environmental lens. Murugesan (2008, 25) defines Green IT as “The study and practice of designing, manufacturing, using and disposing of computers, servers and associated subsystems – such as monitors, printers, storage devices and networking and communication systems - efficiently and effectively with minimal or no impact on the environment.” Green IT revolves around two main facets: IT as an environmental destroyer and IT as an ecological solution (Molla and Abareshi 2012). On the negative side, IT is accused of boosting business carbon footprint through increased energy consumption and CO_2 emissions resulting from growing information needs (Bengtsson and Ågerfalk 2011). More than 50% of business IT energy consumption could have been avoided through more efficient technology, better systems design or improved awareness (Jenkin, Webster, and McShane 2011). As data centres get bigger, they consume considerable energy for both power and cooling (Erek et al. 2009). Rapid technological advancements also result in toxic e-waste which is not always disposed of responsibly (Chen, Boudreau, and Watson 2008). Therefore, measures such as server virtualisation, improved data centre design and e-waste recycling need to be adopted (Hammadi and Mhamdi 2014). On the positive side, IT can play a pivotal role in fostering environmentally sustainable business practices (Jenkin, Webster, and McShane 2011). For example, IT can facilitate environmental auditing and reporting, enable information on sustainable behaviour to be communicated, and promote cloud services and paperless offices (Murugesan 2008; Vykoukal, Wolf, and Beck 2009). As business stakeholders grow increasingly environment-conscious, businesses now have the opportunities to curb the negative and promote the positive ecological impacts of their IT (Molla, Cooper, and Pittayachawan 2011).

Yet, businesses lack Green IT leadership (Wabwoba et al. 2013), and Green IT knowledge is sparse (Chou 2013). The absence of a strong Green IT focus in organisations is deplored (Bose and Luo 2011). There is a dearth of Green IT literature (Ardito and Morisio 2014). This is particularly the case in developing countries, especially Mauritius where, despite some attempts made by the government to promote Green IT in businesses (National Computer Board 2015), research in the field is rare. Therefore, there is a need to explore the implementation of Green IT in Mauritian enterprises to better understand their current Green IT initiatives and pave the way for recommendations to optimise their business IT potential for environmental sustainability.

1.4 The need for an IT Governance and Green IT model

Businesses are increasingly expected to strike the right balance between profitability and environmental sustainability (Marker, Johnsen, and Caswell 2009; Nidumolu, Prahalad, and Rangaswami 2009; Smith and Sharicz 2011). Unless boards of directors and senior management support sustainable business behaviour and value-add, clear environmental considerations can never be embedded in organisational strategies (Alänge and Steiber 2009). Strong Green IT concern from business leaders and embedded in IT governance is therefore essential for organisations to contribute to environmental sustainability while optimising IT use. This is supported by Bose and Luo (2011) who contend that the evolution of business and IT alignment into a strategic business priority, along with escalating stakeholder pressure to contain business carbon footprints, pave the way for inevitable adoption of IT governance and Green IT. In addition, as business process improvement drives technological priorities, the integration of Green IT to enforce sustainable business practices that merge cost effectiveness and stakeholder expectations is crucial (Unhelkar 2011). Yet, businesses hesitate to adopt a Green IT approach (Watson, Boudreau, and Chen 2010). An appropriate IT governance and Green IT model to guide them in their need to match business and sustainable IT strategies is therefore a must.

The need for an IT governance and Green IT model to assist businesses in their governance of IT and sustainable IT endeavours constitutes the basis of this research. Mauritius was found to be an ideal candidate for this study for three reasons: (1) its strong IT dependency (Gilwald and Islam 2011; Kalumiya and Kannan 2015), (2) its constant quest for sustainability, particularly as a Small Island Developing State (Government of Mauritius 2015), and (3) the lack of research in both areas of Mauritian IT governance and Green IT. The final IT Governance and Green IT model (ITGM) generated in this research not only identifies IT governance and Green IT mechanisms currently implemented by Mauritian businesses, but also provides an overview of their decision structures as well as internal and external driving factors. The ITGM consequently constitutes the basis for a set of recommendations provided to Mauritian businesses for them to best use their IT in the achievement of strategic business and environmental goals.

1.5 Research objectives

This study focusses on the development of an IT governance and Green IT model within the context of Mauritian businesses. The scope of this research has been narrowed down to large organisations found to most commonly adopt IT governance measures as compared to smaller organisations (Gutierrez, Orozco, and Serrano 2009). Company industry also influences the implementation of IT governance (Nolan and McFarlan 2005). This study was limited to the five main pillars of the Mauritian economy namely, Finance, Tourism, Textile, IT and Sugar (The World Bank 2015a).

The primary aim of this research is to develop an IT Governance and Green IT model (ITGM) to understand current IT governance and Green IT practices in large Mauritian companies from the five main industries of the island. It is envisaged that the ITGM would provide grounds for recommendations to Mauritian key businesses to assist them in optimising their IT use for both business and sustainability benefits. This aligns with the vision of the Mauritian government to promote the business-enabling potential of IT (Gilwald and Islam 2011) and to turn Mauritius into a prime example of sustainability (Ministry of Environment and Sustainable Development 2013).

The main objectives of this research are therefore to:

1. Examine IT governance and Green IT measures practised in large organisations from the five pillars of the Mauritian economy.
2. Recognise and ascertain IT governance and Green IT drivers in large organisations from the five leading sectors of the Mauritian economy.
3. Develop an IT governance and Green IT model (ITGM) to guide large Mauritian companies from the five leading economic sectors in optimising their IT use.

1.6 Research questions

Based on the research objectives, the following research questions were framed to develop an IT Governance and Green IT model for large Mauritian organisations to use their IT efficiently and sustainably:

RQ1: What IT governance and Green IT measures are practised in large organisations from the five pillars of the Mauritian economy?

RQ2: How can IT governance and Green IT measures be applied in large Mauritian organisations to maximise their IT use?

1.7 Practical research significance

From a practitioner perspective, the outcomes of this research not only assist businesses in optimising sustainable IT use; they also align with the strategic vision of the Mauritian government. As a Small Island Developing State, Mauritius has to face numerous limitations: (1) its small size, (2) geographical distance from several leading markets, (3) heavy dependency on international trade, (4) a dearth of natural resources, and (5) extreme vulnerability to the dangers of climate change (UNDESA Division for Sustainable Development 2014). Mauritius is conscious of its constraints and is particularly wary of its susceptibility to global temperature rises and economic fluctuations. To build environmental resilience and secure a safe place on the world market, it is imperative that Mauritian strategies focus on the reinforcement of IT usage and reduction of carbon footprints. This has led to numerous strategic plans. For example, the National Information and Communication Technology Strategic Plan re-emphasises the Mauritian government's faith in the power of IT for business process efficiency, added competitiveness and resilience (Gilwald and Islam 2011). The "Maurice Ile Durable" Policy, Strategy and Action Plan formalises the government's vision of turning Mauritius into a sustainable island (Ministry of Environment and Sustainable Development 2013). IT superiority and environmental sustainability rank high among the island's priorities whether in its latest budget ("Mauritius Budget Speech 2015-2016" 2015) or in its 2030 vision (Sourcemauritius.com 2015). Therefore, this study is of significant interest to both Mauritian businesses and the Mauritian government as its resulting ITGM and recommendations provide a guide for Mauritian businesses and government agencies to better harness the power of IT for improved business value and added contribution to the sustainability drive of Mauritius.

1.8 Theoretical research significance

From a theoretical angle, the lack of conceptual models reconciling the governance of IT with Green IT has been noted in developing countries (as discussed in Chapter 2). This is especially apparent for Small Island Developing States with high IT dependency which, to the researcher's knowledge, remain unexplored from an IT governance and Green IT perspective. Mauritius is one such island. The development of the ITGM therefore contributes to literature by providing an insight into the unexplored terrain of IT governance and Green IT in Mauritian businesses, as well as provide recommendations for improved sustainable IT use. These could also be useful to other SIDS with a high IT agenda.

1.9 Research approach

This research is guided by a pragmatist philosophy. It uses a mixed methods approach which reconciles qualitative and quantitative methods. The qualitative phase rests on case studies built from interviews and an analysis of relevant documents to further enrich the findings (Yin 2009). An initial conceptual ITGM was derived from a review of literature. Interviews of executives and senior managers from large Mauritian company representatives from each key economic sector followed. Content analysis of interview findings resulted in a first draft of the ITGM. Company policy documents and government documents relevant to IT governance and Green IT were then analysed to further refine the draft ITGM. This drove the quantitative phase implemented to further emphasise factors influencing the concepts explored (Creswell and Plano Clark 2011), namely, IT governance and Green IT. A survey instrument was developed from the draft ITGM and further literature review. This was administered to IT managers and executives from large key Mauritian companies. Survey data was analysed using Exploratory Factor Analysis followed by Confirmatory Factor Analysis. Findings both triangulated and enriched the draft model to produce the final ITGM.

1.10 Thesis outline and structure

This thesis is organised in eight chapters outlined below:

- Chapter 1 provides an overview of this study and discusses the structure of the thesis.
- Chapter 2 documents findings from a comprehensive review of IT governance and Green IT literature, points out gaps in literature to justify the research and culminates in an initial conceptual ITGM.

- Chapter 3 analyses several research approaches before explaining and justifying the research design for this study. This includes a detailed explanation of the chosen mixed-methods approach comprising of a qualitative case study phase followed by a quantitative survey. Data collection and analysis methods used in each phase are also discussed.
- Chapter 4 explains the interview process, presents interview findings and analyses results to produce a first draft of the ITGM.
- Chapter 5 analyses IT governance and Green IT-related company as well as national strategies and policies before presenting an enriched draft ITGM.
- Chapter 6 discusses the survey process. It describes questionnaire items, survey administration and analysis to further refine the ITGM
- Chapter 7 presents the final ITGM and discusses each of its components before linking them to worldwide best practice.
- Chapter 8 concludes the thesis by summarising research contributions, providing recommendations as well as discussing research limitations and avenues for future work. It is followed by the reference list and appendices.

1.11 Chapter summary

The power of IT to improve business value and enable sustainable business processes can be harnessed by organisations through effective IT governance and Green IT. This research aims at reconciling IT governance and Green IT in the context of key Mauritian organisations through the development of a conceptual model (ITGM). The model not only identifies IT governance and Green IT measures and influencing factors: it also serves as the basis for a set of recommendations for improved business IT use and sustainability. The ITGM is the first of its kind as, to date, no such model has been developed for Mauritius or any other Small Island Developing State with high IT dependency. It also aligns with the vision of the Mauritian government to turn Mauritius into an example of sustainability and IT excellence. The research uses a mixed-methods approach. The qualitative phase comprises case studies built on interviews and document analysis, whereas the quantitative phase relies on surveys. The chapter ends with an overview of the thesis structure.

The first phase of this research involved a review of literature in order to develop a conceptual IT governance and Green IT model. This is discussed in the next chapter.

Chapter 2: Literature Review

2.1 Introduction

Information Technology (IT) has long emerged from its traditional role as organisational enabler to become a focal part of business strategy (Raghunathan and Raghunathan 1989). With IT quickly turning into a vital organisational artery, making the right IT decisions for the benefit of business is crucial (Ferguson et al. 2013). Yet, organisational IT disasters remain perennial (Luftman and Brier 1999; Dhillon 2005; Nolan and McFarlan 2005; Raghupathi 2007; The Standish Group 2011). IT surveys have consistently revealed a staggering rate of IT investment failures of around 20% – 70% (ITGI 2008). This is unacceptable for businesses, particularly since they are increasingly dependent on IT for both their operations and growth (Goosen and Rudman 2013). For this reason, senior and executive level management cannot afford to dissociate themselves from IT decisions (De Haes, Van Grembergen, and Debreceny 2013). Hence, more and more organisations are turning to IT governance for increased business IT value (Peterson 2004; Weill and Ross 2004; Bowen, Cheung and Rohde 2007; De Haes and Van Grembergen 2009a; ITGI 2011).

Another growing business IT area is that of Green IT. As businesses are increasingly expected to contribute to environmental sustainability, the role of IT in this endeavour cannot be ignored. Businesses need to both "green" their IT and harness its potential to support environmentally responsible behaviours (Elliot 2007). Commitments to sustainability require good governance (Smith and Sharicz 2011; den Uyl and Driessen 2015). The inclusion of Green IT in an IT governance model would therefore help to comprehensively guide businesses in all their IT decisions.

Such guidance is also relevant for Mauritian businesses. With both IT and sustainability escalating in strategic importance, Mauritian companies require IT governance and Green IT implementation for improved productivity and environmental responsibility. Therefore, this research is intended to address the IT governance and Green IT research gap in order to better guide large organisations from dominant Mauritian industries in their strategic IT decisions.

Following a description of its scope, this literature review analyses existing IT governance and Green IT research to identify gaps and provide a rationale for this study. Pertinent mechanisms and relevant theories from literature are combined to generate a conceptual IT governance and Green IT model (ITGM) which guides the rest of this research. The research scope is then defined.

2.2 Scope of the Literature Review

A number of scholarly databases were accessed for the purpose of this literature review. The databases most used were ProQuest, Science Direct, Business Source Complete, Business Source Premier and Emerald. Specific keywords were entered for a thorough search of material relevant to IT Governance and Green IT. The ones pertaining to the governance of IT include "IT governance", "enterprise governance of IT" and "business and IT alignment" whereas key terms such as "Green IT", "Green IS", "Green ICT" and "IT sustainability" resulted in literature findings on the ecologically responsible use of IT. The key terms "model" and "framework" were also added to the previously identified search words to identify IT governance and Green IT models already developed. These keywords resulted in a total of approximately 500 articles. Abstracts and, where required, the full text were then reviewed to shortlist articles to around 120 (approximately 71 predominantly on IT governance and 49 on Green IT) based on their relevance to this literature review. In order to ensure that most articles were relatively recent, mostly those articles dated from 2000 to 2015 were retained. Any articles that were consulted although they were not published within this period were mostly used to trace back the history of key terms or to cite definitions and theories. Many of the retained articles were published in reputed journals such as: European Journal of Information Systems, Information and Management, International Journal of Accounting Information Systems, Information Technology and People, Journal of Information Systems, Journal of Information Technology and MIS Quarterly.

Along with scholarly papers, eight conference papers were also cited in this literature review since they were found to contain pertinent information. Out of these, seven focussed on Green IT. These were primarily from proceedings of the Pacific Asia Conference on Information Systems (PACIS), Portland International Conference on Management of Engineering and Technology (PICMET) and Americas Conference on Information Systems (AMCIS). Only one conference paper on IT Governance was retained as it was found to extensively discuss the relationship between IT governance and business/IT alignment. This paper was published in the Annual Hawaii International Conference on System Sciences proceedings.

Several reports also contributed useful information to this literature review. These are summarised in Table 2.1. IT governance information including global reports and frameworks were primarily obtained from the main organisation for IT governance best practice, namely the ISACA-founded IT Governance Institute. Statistics on IT ecological impacts and global Green IT were obtained from reputed sources including The Climate Group, Gartner, CFO Research Services, Fujitsu and Symantec. Information about IT and sustainability in Mauritius were also sourced from Mauritian reports, national strategic plans and published research from Statistics Mauritius. World Bank country diagnostics also provided information on the Mauritian economy and its key industries.

Table 2.1: Summary of reports used in the literature review

Reports	Information
Mingay, Spafford and Wheeler (2012); ISACA (2012; 2014); ITGI (2007; 2008)	IT governance frameworks
ITGI (2003; 2008; 2011)	IT governance reports
DCDM Research (2010); International Telecommunications Union (2015); Statistics Mauritius (2015a)	ICT development in Mauritius
Gilwald and Islam (2011)	Mauritius IT strategic plan
Committee on Corporate Governance (2004)	Corporate governance in Mauritius
Berkhout and Hertin (2001); CFO Research Services (2009); Gartner (2007); The Climate Group (2008)	Impacts of ICT on environmental sustainability
Fujitsu (2010); Symantec (2009)	Green IT global data
Elahee (2009); Ministry of Environment and Sustainable Development (2011; 2013)	Sustainability initiatives in Mauritius
Ministry of Information and Communication Technology (2013)	Green IT strategies for Mauritius
Statistics Mauritius (2015b)	Environmental statistics for Mauritius
The World Bank (2015a; 2015b)	Mauritius country diagnostic

The rest of this chapter is divided into multiple sections for a comprehensive review of IT governance and Green IT. Section 2.3 focusses on IT governance. Its subsections provide definitions, benefits, issues, analysis of existing models and views of IT governance from the perspectives of developed as well as developing countries. The need for IT governance research in Mauritius is then deduced. Section 2.4 defines Green IT and discusses its benefits and issues. Section 2.5 brings IT governance and Green IT together to justify the inclusion of the latter in the IT governance arena. It provides an analysis of IT governance and Green IT frameworks before looking into IT governance and Green IT research in developed and developing nations. The section ends with a justification of IT governance and Green IT research in the Mauritian context. Section 2.6 discusses IT governance and the Green IT theories guiding this research, while section 2.6 provides a summary of gaps identified in the literature review. Section 2.8 combines both selected theories and research gaps to develop a conceptual IT governance and Green IT model. Finally, section 2.8 provides a summary of the research scope.

2.3 IT Governance

The ISO 38500 standard for IT Governance (2008, quoted in Bin-Abbas and Bakry 2014, 261) defines IT as the resources including Information Communication

Technology (ICT) "required to acquire, process, store and disseminate information." This research shall therefore use the term IT and ICT interchangeably.

More than just a service provider, IT is now viewed as a strategic partner (Tambe and Hitt 2012). Its potential for business growth along with business efficiency is becoming increasingly clear, resulting in strategically driven and controlled IT investments – in other words, IT governance (Van Grembergen and De Haes 2008). Spurred by earlier research on business/IT impact, alignment and investment, the term IT governance (ITG) stems from the late 1990s (De Haes, Van Grembergen, and Debreceny 2013). It made its first prominent appearance in literature by Brown (1997) who examined what were referred to as "IS Governance" solutions and later, by Sambamurthy and Zmud (1999) who discussed the notion of IT Governance. In 2003, a Gartner survey of senior IT managers propelled IT governance to third place in their top ten priority issues (Bhattacharjya and Chang 2007). Since then, IT governance has only grown in importance, particularly under the championing of its primary knowledge and research centre, the IT Governance Institute (ITGI) (ITGI 2015). ITG is now rooted in corporate governance exigencies as it requires management to take a keen interest in IT investments and performance in line with business needs (Rubino and Vitolla 2014).

This section first defines ITG prior to analysing its benefits and issues. Existing ITG frameworks are then explored before looking into its implementation in developed and developing countries. A rationale for ITG research in the Mauritian context is then provided.

2.3.1 IT governance definition

Several definitions of IT governance have emerged from literature (Webb, Pollard and Ridley 2006). These are summarised in Table 2.2. From the definitions, it can be seen that IT governance has evolved from IT activity oversight to a more strategic role in the achievement of business goals, thereby affirming its governance roots and leading to its new appellation - Enterprise Governance of IT (EGIT). The need for IT governance mechanisms is also apparent for valuable IT investments. In fact, Weill (2004) stipulates that, while many organisations have some form of IT governance, effective ones have a set of mechanisms that drive business/IT partnership to achieve business goals. IT decision accountabilities also recur in most of the definitions. ITG is therefore seen to be a mix of mechanisms and IT decision accountabilities for strategic IT use in business.

Some definitions were found to emphasise the responsibilities of executives and ITG boards. Yet, ITG is also expected to be understood and implemented at operational and management levels (Sohal and Fitzpatrick 2002; Van Grembergen and De Haes 2008; Willson and Pollard 2009). In fact, Willson and Pollard (2009) contend that effective IT governance relies heavily on the strong buy-in and participation of managers across all organisational levels for the achievement of a common IT vision. Both executive oversight and lower level management understanding and commitment are therefore required for successful ITG implementation. In this study, IT governance is therefore defined as a combination of IT decision accountabilities and supporting mechanisms overseen by executives but understood and implemented by lower levels of management for a shared IT strategy that supports business goals. The benefits of ITG are discussed next.

Table 2.2: Definitions of IT Governance

Authors	IT Governance Definition
Sambamurthy and Zmud (1999, 261)	"IT governance arrangements refers to the patterns of authority for key IT activities in business firms, including IT infrastructure, IT use and project management"
IT Governance Institute (2003, 10)	"IT governance is the responsibility of executives and the board of directors and consists of leadership, organisational structures and processes that ensure the enterprise's IT sustains and extends the organisational strategies and objectives"
Weill and Ross (2004, 1)	"IT governance is the decision rights and accountability framework for encouraging desirable behaviours in the use of IT."
Peterson (2004, 8)	"The distribution of IT decision making rights and responsibilities among enterprise stakeholders, and the procedures and mechanisms for making and monitoring strategic decisions regarding IT."

Authors	**IT Governance Definition**
ISO/IEC 38500 (2008, quoted in De Haes, Van Grembergen and Debreceny 2013, 309)	"The system by which the current and future use of IT is directed and controlled. Corporate Governance of IT involves evaluating and directing the use of IT to support the organisation and monitoring of this use to achieve plans. It includes the strategy and policies for using IT within an organisation."
Van Grembergen and De Haes (2009, quoted in De Haes, Van Grembergen and Debreceny 2013, 309)	"Board overseeing the definition and implementation of processes, structures and relational mechanisms in the organisation that enable both business and IT to execute their responsibilities in support of business/IT alignment and the creation of business value from IT enabled investments."
Huang, Zmud and Price (2010, 288)	"Involves efforts by an organisation's leadership to influence IT-related decisions through the location of decision rights and the structure of the decision process."

2.3.2 Rationale for IT governance

As shown in Figure 2.1, ITGI (2003) identifies five integrated, focal areas of concern for IT governance: (1) IT delivered business value (VD), (2) strategic alignment of IT with business (SA), (3) management of IT resources (RM), (4) risks (RK) and (5) IT performance (PM). Effective IT governance supports each area to improve organisational performance. This is discussed next in more detail.

Strategic IT alignment refers to IT investments which satisfy business requirements and optimise business processes (Law and Ngai 2007). Following a survey of more than 800 respondents across 21 countries, the ITGI (2011) global status report on enterprise IT governance rates strategic IT and business alignment as the prime impetus for the implementation of IT governance. Strategic business/IT alignment is not only the foundation of IT governance but also one of the primary concerns of IT managers (Roses, Brito, and Lucena 2015; Coltman et al. 2015). Only if IT strategies match business objectives can IT deliver organisational value (Wilkin and Chenhall 2010). The deployment of effective IT governance in organisations allows managers to have a shared understanding of both IT and business (Luftman 2003) thereby better equipping them to support IT decisions that best align with organisational strategies for maximum IT value (Peterson 2004; Weill 2004; Nolan and McFarlan 2005; Chan, Sabherwal, and Thatcher 2006; De Haes and Van Grembergen 2009a). IT governance thus increases strategic IT alignment which, in turn, leads to better organisational performance (Cragg 2002; De Haes and Van Grembergen 2009b; Wilkin and Chenhall 2010).

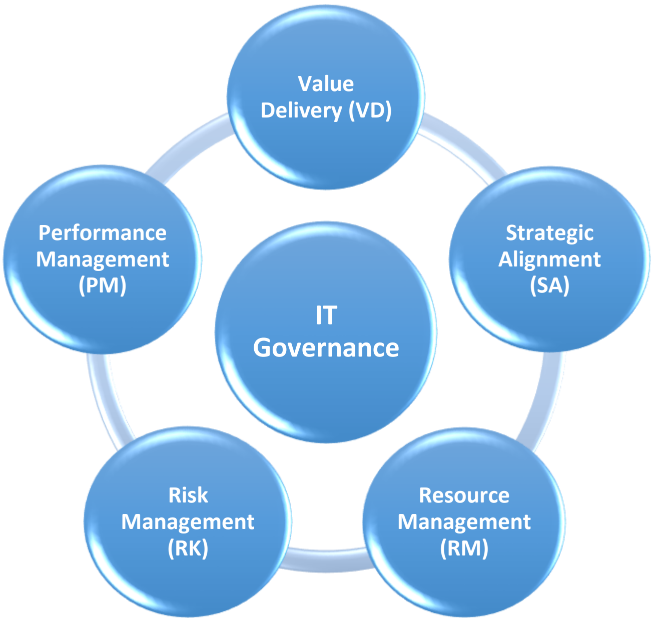


Figure 2.1: Five focal concerns of IT Governance (adapted from ITGI 2003) – prepared by the Author.

Businesses will fail to maximise IT benefits if boards and executives do not oversee IT resource management (ITGI 2003). IT governance is imperative for sound management of human and technological IT resources used for both business sustainability and growth. Effective ITG requires clear definitions of IT roles, rights and accountabilities in order for a business to achieve its goals (Peterson 2004). Managers have a shared understanding of both IT and business, thereby better equipping them to make and support IT decisions that align with organisational strategies (Nolan and McFarlan 2005; Chan, Sabherwal, and Thatcher 2006; Bowen, Cheung and Rohde 2007). Relevant stakeholders are involved in IS/IT strategic planning (Gregor, Hart, and Martin 2007) as opposed to isolated IT decisions which often lead to clashes and inefficiencies (Weill and Ross 2004). ITG training is encouraged both for effective IT leadership (Wilkin and Chenhall 2010) and IT implementation (Tallon 2008). Organisational rules for efficient IT use and the technology required to power business strategies are also guided by ITG (Weill and Ross 2004).

Another prominent benefit of IT governance is improved risk management (Marks 2009; ITGI 2011; Debreceny 2013; ChePa et al. 2015). The role of IT in business remains paradoxical due to both its risk-curbing (e.g. through enabling internal controls) and risk-triggering (e.g. security breaches) nature. This only shows the prominence of IT in enterprise risk management and the resulting importance of effective IT Governance (Debreceny 2013). Growing demands for information storage and IT use in organisations have increased the pressure on business to minimise the possibility of IT security breaches (Khan 2006). This particular IT risk could discourage businesses from complying with regulations and may even compromise corporate reputation. To decrease the probability of such risks, the tone needs to be set right at the top (Raghupathi 2007). Both boards and executives need to understand the IT risks involved, contribute to their management and ensure that effective control mechanisms are implemented (ITGI 2003; van den Berg 2015). Risk management frameworks issuing from good IT governance can also help minimise IT risks arising from the delivery of IT services, the involvement of IT in business innovations and a missed opportunity to use IT for the benefit of the business (Fischer 2009). In addition, policies for the ecological disposal of IT can assist in the management of IT environmental risks (Raghupathi 2007).

A vital goal of IT governance is good IT performance management (Simonsson, Johnson, and Ekstedt 2010). Effective IT governance involves the constant monitoring of IT implementations for continuous improvement (Sohal and Fitzpatrick 2002; Cragg, Caldeira, and Ward 2010). This involves the measurement and tracking of IT performance based on clear financial (e.g. Net Present Value and Return on Investment) and non-financial indicators such as customer satisfaction, organisation business score card, and service level improvement (Bowen, Cheung, and Rohde

2007). Weill and Ross (2004) use four criteria to determine IT governance performance: IT use cost effectiveness, effective use of IT for growth, effective use of IT for asset utilisation and effective use of IT for business flexibility. Post-implementation IT reviews for increased business IT value are also strongly advocated (Tallon, Kraemer, and Gurbaxani 2000).

Value delivery is an outcome of strategic IT alignment as well as risk, resource and performance management (ITGI 2003). As IT expenditure inflates, so does the firm's expectations of valuable returns on IT investments (Mithas et al. 2012). Literature highlights numerous benefits of IT governance associated with improved business value. These include superior business reputation (Bowen, Cheung, and Rohde 2007) resulting from improved business performance (Chan, Sabherwal, and Thatcher 2006; ITGI 2011) such as cost reductions, better risk management (Raghupathi 2007; Marks 2009) and enhanced business/IT communication and transparency (ITGI 2011). The implementation of IT governance mechanisms becomes even more attractive when seen that companies with superior IT governance earn 20% more profits due to clear allocation of IT accountabilities and close alignment of IT investments with business objectives (Weill and Ross 2005). Lunardi et al. (2014) also equate the implementation of IT governance mechanisms with increased firm profitability. Business value is further derived from the sound governance of IT used to manage business information and knowledge for effective business decision-making (Van Grembergen and De Haes 2008). ITG also supports effective IT involvement in corporate governance (Willson and Pollard 2009), particularly when used to meet increasingly rigid financial reporting requirements (Robinson 2005; Marks 2009).

IT governance is therefore critical for optimal IT use in business. Strategic alignment is facilitated, IT related investments are guided by specific business needs, IT risks are contained, IT performance monitored for continuous improvement and IT business value maximised. Yet, as discussed in the next section, effective ITG implementation remains a challenge for businesses.

2.3.3 IT governance issues

Despite its numerous benefits, IT governance constantly appears in the top 10 concerns of CIOs (Smits and van Hillegersberg 2014). ITG has been tagged as an ever-changing and challenging phenomenon (Sambamurthy and Zmud 1999) that is further complicated by the various expectations from different enterprise stakeholders and executives (Peterson 2004). The intricacy of IT governance is further reiterated by De Haes and Van Grembergen (2004) who claim that there is no ‘one size fits all’ ITG solution - what works for one company may not for another. This could be due to their difference in size and/or industry and/or geographical location resulting in the need for different combinations of IT governance mechanisms (Van Grembergen and De Haes 2008).

Another major challenge hindering the implementation of IT governance is the result of insufficient communication (ITGI 2011) and collaboration between business and IT (Licker 2007). This is despite recognition from literature that (1) effective communication between IT and business executives is crucial for optimal IT use in business (Reich and Benbasat 2000), (2) shared understanding between the CIO, CEO and other top managers is the essence of good IT governance (Sohal and Fitzpatrick 2002; Law and Ngai 2007), (3) organisations that clearly communicate their governance mechanisms are more likely to achieve their “desirable IT behaviours” (Weill and Ross 2005, 28) and (4) collaboration among IT and business stakeholders establish a strong foundation for the realisation of business and IT goals (Peterson 2004). In addition, though IT governance is more successful in organisations where senior managers are able to explain their IT governance mechanisms, many managers are ignorant or not forthcoming where IT governance is concerned (Weill and Ross 2004). This lack of IT governance leadership is also identified by the Global Status Report on Enterprise ITG as one of the main barriers to successful IT governance (ITGI 2011).

It can be deduced that for organisations to reap the benefits of IT governance, its intricacies need to be better understood. This would not only improve communication and understanding among business and IT executives, but would also help IT governance to smoothly permeate the culture of the enterprise. Sound models to guide executives in the governance of their enterprise IT are therefore required. These are discussed next.

2.3.4 IT governance models and frameworks

IT governance models consist of organisational structures, business processes and management guidelines for the sound governance of IT (Lunardi et al. 2014). They support effective use of IT resources and provide transparency through well-defined accountabilities (Faria et al. 2015). An IT governance framework builds on models to comprise "guiding principles and good practices that are explicitly designed to be adapted by adopting organisations" and may also include standards such as the ISO/IEC 2008 (De Haes, Van Grembergen, and Debreceny 2013, 308). Several frameworks have emerged in an attempt to improve the understanding and implementation of enterprise IT governance. These are analysed in the following subsection.

2.3.4.1 IT governance assisting frameworks

Table 2.3 summarises various frameworks for IT governance support. Six Sigma and the Capability Maturity Model (CMMI) are restricted to the improvement of processes. The Committee of Sponsoring Organisations of the Treadway Commission (COSO) framework is criticised for being too high level to fully support IT audit tests (Tuttle and Vandervelde 2007), whereas the Committee of Sponsoring Organisations Enterprise Risk Management (COSO ERM) framework remains limited to IT risks. Project management methodologies alone remain inadequate to fully guide the enterprise governance of IT as project management is only a subset of IT governance (Sharma, Stone, and Ekinci 2009). As a result, these frameworks can only complement a wider IT governance framework.

Table 2.3: IT governance assisting frameworks (ITGI 2004)

IT governance support area	Framework	Description
Process Improvement	Six Sigma	Data-driven methodology for process improvement and defect reduction.
	CMMI	Organisational maturity assessment model providing guidelines for process improvement.
Risk management	COSO ERM	Enterprise risk management framework for the identification, assessment, response, communication, monitoring and control of risks.
Project management	PMI/PMBOK; PRINCE 2	Methodologies defining processes for the effective management of projects.

2.3.4.2 IT Governance Standards

Some internationally recognised standards are also useful in the governance of IT. These are briefly described in Table 2.4. However, while providing guidance on IT governance, none of these standards can be used in isolation to cover the full scope of IT governance. ISO 9000 is too generic in nature. ISO 17799, ISO 27001 and ISO 27002 focus on IT security governance alone, whereas the scope of both ISO 20000 and ISO 38500 excludes process details. Therefore, the standards discussed remain complementary to a more detailed IT governance framework.

Table 2.4: Summary of standards assisting IT governance

Category	Standard	Description
IT process quality	ISO 9000	De facto set of standards for continuous process improvement including IT processes (Moeller 2013).
IT security governance	ISO 17799	Specifies processes for different areas of IT security such as access controls (Brown and Nasuti 2005).
	ISO 27002	Specifies areas (e.g. access control, system development and maintenance, compliance, business continuity) requiring guidelines for IT security (Moeller 2013).
	ISO 27001	Specifies how to best apply guidelines in ISO 27002 by defining IT security risk management requirements and certifying business Information Security Management Systems (Mohamed and Kaur 2012)
IT Service Management	ISO 20000	Specifies a set of requirements needed for the successful delivery of IT facilities without process details, and certifies effective use of IT Service Management framework (IT process maps 2015).
IT governance	ISO 38500	Proposes essential guiding principles and tasks for IT governance without being process-specific (ITGI 2009)

2.3.4.3 ITIL v3

The Information Technology Infrastructure Library (ITIL) was developed in the 1980s by the Central Computer and Telecommunication Agency of the UK Government to describe processes for the efficient management of IT services (ITIL Central 2014) . Now in its third version (ITIL v3) and certified by ISO 20000, the framework guides service and operational levels of agreements as well as the delivery and support of IT (Simonsson, Johnson, and Ekstedt 2010). ITIL v3 provides senior business and IT management with guidance on the management and delivery of optimal, business-aligned IT services. It is structured under 5 main IT governance phases:

- **Service Strategy** - provides guidance on the development and implementation of long-term IT service plans for business value.
- **Service Design** - designs IT services delivering business value by translating new IT requirements from strategy to architecture, technology, processes, interfaces and continuous service improvement design.
- **Service Transition** - brings IT services live by managing the change brought to the organisation, associated risks and expected business value.
- **Service Operation** - ensures business value by delivering agreed level of IT services including technology, infrastructure and applications.
- **Continual Service Improvement** - continuously evaluates and improves IT services to maintain business value (Cartlidge et al. 2012)

Dubey and Hefley (2011) also propose a Green ITIL solution for environmentally sustainable IT service management. However, despite its wide acceptance and its service strategy component, the main focus of ITIL v3 is the management of IT services for business efficiency. This relates to the effective running of IT operations as opposed to IT governance which promotes the use of IT to achieve current and future demands of key business stakeholders (Peterson 2004). ITIL v3 remains limited as far as strategic IT decisions are concerned (Simonsson, Johnson, and Ekstedt 2010); hence the need for a more comprehensive IT governance framework.

2.3.4.4 COBIT 4.1, Val IT and Risk IT

With a wider IT governance scope than ITIL v3, Control Objectives for Information and Related Technology (COBIT) is commonly recognised as the default IT governance framework (De Haes and Van Grembergen 2008; Simonsson, Johnson, and Ekstedt 2010). Framed by ITGI, COBIT 4.1 guides businesses in setting their IT objectives (ITGI 2007). This results in the fusion of business and IT to maximise IT benefits (ISACA 2014).

COBIT 4.1 defines 34 processes summarised under four domains of IT governance:

- **Plan and organise (PO)** - for the establishment of strategies and policies to optimise business IT use.
- **Acquire and Implement (AI)** - for the selection, development or procurement, implementation integration and monitoring of appropriate IT solutions aligning with business IT strategy.
- **Deliver and Support (DS)** - for the delivery of IT service and its associated support including security, user support and data management.
- **Monitor and Evaluate (ME)** - for the assessment of adherence to IT plan including measurement of IT systems' contribution to the achievement of business objectives, internal control and regulatory compliance (ITGI 2007; Goosen and Rudman 2013).

However, COBIT 4.1 does not adequately describe governance processes vital for IT use to be effectively organised, controlled and maximised (IT Governance Network 2011). Thus, to complement COBIT 4.1, ITGI developed Val IT and Risk IT. Val IT takes over where COBIT 4.1 ends to assist boards and executive management in IT investments for business value (Simonsson, Johnson, and Ekstedt 2010). Risk IT provides a detailed framework for the management of IT risks for improved IT control (ISACA 2014). However, three separate frameworks are tedious to handle; hence COBIT 5.

2.3.4.5 COBIT 5

COBIT 5 merges COBIT 4.1, Val IT and Risk IT into a single, integrated and improved framework for effectively translating stakeholder requirements into IT strategies for business/IT alignment (ISACA 2012). Stakeholders could range from top executives in the business to regulatory bodies in the business environment. The first step in COBIT 5 is to identify them. The framework then defines processes for prioritising stakeholder expectations and identifying how IT can assist in fulfilling them. The next step is to determine who shoulders the IT accountability (IT Governance Network 2011). This stakeholder-oriented approach not only assists in aligning IT with business; it also helps to minimise IT risks (Rubino and Vitolla 2014).

COBIT 5 further distinguishes itself from its predecessor by providing a holistic approach which includes both IT governance and IT management as two separate components. COBIT 5 thus integrates current ITIL prescriptions with IT strategy (Rubino and Vitolla 2014). While its IT governance section defines processes for evaluating stakeholder requirements, setting business IT direction and monitoring the achievement of agreed objectives, its IT management processes cover the planning, building, running and monitoring of tasks designed to meet the set goals (ISACA 2012). New processes in COBIT 5 ensure that the enterprise scope of IT governance and management encompasses all business and IT activities. Roles and accountabilities are delineated for clarity and transparency. COBIT 5 also identifies IT governance enablers which are not explicitly defined in its predecessor. These include:

- **Principles, policies and frameworks** to guide management in their IT decisions.
- **Processes** for implementing set tasks in the achievement of objectives.
- **People, skills and competencies** to complete set tasks.
- **Structures** defining entities responsible for key enterprise decisions.
- **Information** which is either required to run the organisation or is generated by organisational processes.

- **Culture, ethics and behaviour** for business/IT collaboration.
- **Services, infrastructure and applications** which deliver organisational IT requirements (ISACA 2014).

Although COBIT 5 is more comprehensive and inclusive of business and IT activities than its predecessor, this strength has also proved to be a weakness. The framework is now more tedious and complex (De Haes, Van Grembergen, and Debreceny 2013; Devos and Ginste 2015). COBIT 5 has also been criticised for its lack of sustainability guidance (Mingay, Spafford, and Wheeler 2012; Moeller et al. 2013; Merhout and O'Toole 2015).

2.3.4.6 IT governance implementation framework

As shown in Figure 2.2, this framework goes beyond processes to also include decision-making structures and relational mechanisms for a holistic approach to IT governance (De Haes and Van Grembergen 2004; Peterson 2004; Weill 2004; Weill and Ross 2005). Some of the measures proposed under each mechanism are further discussed in Chapters 7 and 8.

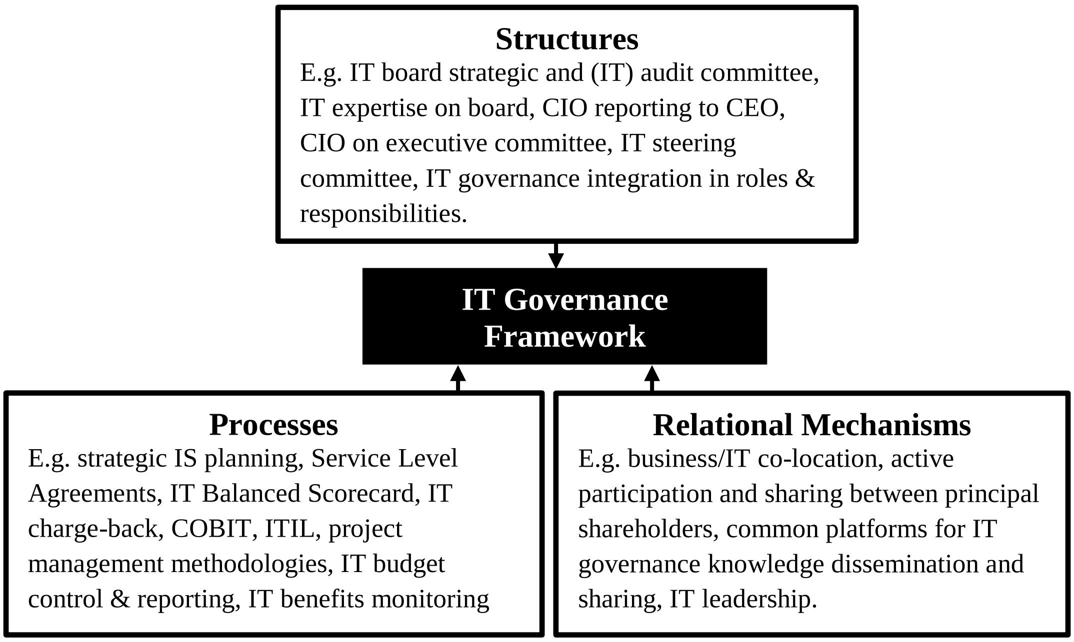


Figure 2.2: IT governance framework (Van Grembergen and De Haes 2008; De Haes and Van Grembergen 2009b)

Structural capability relates to formal positions such as liaison roles (e.g. CIO) or groups (e.g. steering committee) to connect IT and business in IT decision making whereas processes formalise methodologies used to enable IT decision making and their monitoring (Peterson 2004; Weill 2004; Bowen, Cheung and Rohde 2007). Despite structures and processes, the successful alignment of IT decisions with business objectives is not conceivable if IT stakeholders do not work together to converge their IT expectations to best meet organisational goals (Chan, Sabherwal, and Thatcher 2006; Bowen, Cheung and Rohde 2007; Heart, Maoz, and Pliskin 2010). Addressing this need, relational mechanisms refer to the active involvement and collaboration among executives, IT and business management for the realisation of IT and business goals (Peterson 2004). Effective IT governance therefore rests on the formalisation of roles and processes for IT decision making as well as a collaborative environment where IT and business stakeholders work together to optimise organisational IT use.

While the IT governance implementation framework identifies different structures, processes and relational mechanisms that could be deployed, the challenge of establishing the optimum combination of mechanisms remains (De Haes and Van Grembergen 2008). Mechanisms for sustainability guidance are missing and the framework lacks clarity in its definition of IT decision accountabilities.

2.3.4.7 The IT governance matrix

To assist in the design and communication of IT decision accountabilities, Weill and Ross (2004) propose the IT governance matrix. This approach enables an enterprise to map its IT decisions with its IT decision-taking accountability groups referred to as governance archetypes on only one page (Weill and Ross 2004). In his research on IT governance in top performing firms, Weill (2004) classified organisational IT decisions under five major domains: (1) IT principles which consist of guidelines on the use of IT in the organisation, (2) IT architecture which defines policies and rules defining technical choices that govern how IT will be used in the organisation, (3) IT infrastructure strategies for determining hardware/software and IT human resource requirements, (4) business application needs which specify the rationale behind the acquisition or internal development of IT applications and (5) IT investment and prioritisation to justify the choice of and amount spent on IT projects. Weill (2004) also categorised IT governance archetypes as business monarchy, IT monarchy, feudal, federal, IT duopoly and anarchy. Under a business monarchy, only senior level executives (CxOs) are allowed to make IT decisions whereas in an IT monarchy set-up, the IT decision-making rights are those of IT executives. The feudal category gives IT decision-making autonomy to individual business units or functions, whereas the federal model involves both CxOs and Business Unit (BU) leaders with, sometimes, the participation of IT leaders in the decision-making process. IT duopoly involves coordinated decision-making between IT leaders and either CxOs or BU leaders, while anarchy leaves the decision to individual users (Weill 2004).

Following the identification of IT decision domains and governance archetypes, Weill and Ross (2004; 2005) suggest that organisations clarify their IT governance goals before looking into practices and mechanisms that would best assist in their achievement. They recommend that IT governance mechanisms deployed for specific IT decision types be mapped against their corresponding governance archetype in the IT governance matrix shown in Table 2.5 in order to design their IT governance on a page.

Table 2.5: The IT Governance Matrix (Weill 2004)

	DECISION DOMAIN				
GOVERNANCE ARCHETYPE	IT Principles	IT Architecture	IT Infrastructure	Business Application Needs	IT Investment
Business Monarchy					
IT Monarchy					
Federal					
Duopoly					
Feudal					

The IT governance matrix therefore complements the IT governance framework by providing a simple and effective way of specifying, analysing and communicating the company's IT decision-making and accountability structure. However, issues of optimum use of IT mechanisms and sustainability guidance remain.

2.3.5 IT governance in developed countries

The concept of IT governance has been extensively researched in the developed world. Literature points to the United States (US) for ITG origins (Brown 1997; Sambamurthy and Zmud 1999). Despite its worldwide presence, the roots of the IT Governance Institute lie in US (ITGI 2015). Extensive ITG research has been conducted in several other developed countries as shown in Table 2.6. It appears that most of the more recent IT governance studies from the developed world focus on the identification of drivers, enablers and even inhibitors to come up with ITG success formulae. The next section explores IT governance research conducted in developing countries.

Table 2.6: Literature on IT governance in developed countries

Reference	Country	Description of Study	Research approach	Findings
Ali and Green (2012)	Australia	Studies IT governance mechanisms that affect IT governance.	Web-based survey of 1176 Australian ISACA members with 110 valid cases.	IT governance is significantly enhanced by: • A culture of IT compliance • Senior management involvement • Communication systems • IT performance measurement
Bernroider (2008)	Austria	Investigates the role of IT governance in driving ERP projects.	Survey of 1000 Austrian firms with 209 valid returns.	ERP projects are more successful where IT governance is driven by strategic direction, participative decision making (including all key stakeholders) and, for large organisations, top management commitment.
Bowen, Cheung and Rohde (2007)	Australia	Investigates factors affecting IT governance structures, processes and IT success performance measures.	Case study (using semi-structured interviews) based on one Australian organisation.	Effective IT governance is equated with: • Shared business and IT understanding • Active IT steering committees • Balanced business and IT representation in IT decision taking • Clearly communicated and comprehensive IT strategies and policies
Bradley et al. (2012)	United States	Studies IT governance and its impact on risk management and value delivery in hospitals.	Survey of 164 CIOs of United States hospitals.	IT governance is more prominent when: • CIOs have more structural power • Both business and IT contribution to IT decision taking • Organisation has a more entrepreneurial culture

Reference	Country	Description of Study	Research approach	Findings
Buchwald, Urback and Ahlemann (2014)	Germany, Austria and the Netherlands	Investigates factors affecting IT governance, ITG success and its impact.	Interviews of 28 IT decision makers at top to medium management levels from 19 multinationals.	Successful ITG requires: • Active management support and commitment • Reinforcement of IT value as a business enabler • Adequate regulations • An understanding of the IT value chain
De Haes and Van Grembergen (2009b)	Belgium	Studies the relationship between business/IT alignment and IT governance structures, processes and relational mechanisms.	Multiple research methods including literature search, pilot case research, Delphi research, business/IT alignment benchmarking and extreme case research applied to 33 companies from the Belgian financial industry.	Business/IT alignment is improved when a set of mature IT governance practices are implemented.
Huang, Zmud and Price (2010)	USA	Studies the influence of IT steering committees and communication policies on IT governance.	Case study based on 3 organisations from the USA.	IT use is more efficient when • IT policies and guidelines are well communicated • IT steering committees comprise of both business and IT senior managers
Lee, Lee and Jeong (2008)	Korea	Examines IT governance inhibitors and their impact on organisational IT maturity.	Survey of 96 leading companies of Korea.	ITG inhibitors include lack of • Business/IT communication • Stakeholder involvement • Clear IT governance policies • Clear IT governance processes • Financial support

Reference	Country	Description of Study	Research approach	Findings
Pang (2014)	United States	Studies IT governance and business value in public sector organisations.	Stochastic frontier model followed by regression with data obtained from US reports.	Legislative prescription of the establishment of a CIO is required to optimise IT investments and cost in public sector organisations.
Schlosser et al. (2015)	United States	Studies the efficiency of IT governance mechanisms in improving business/IT alignment.	Survey data from 132 US banks	Social alignment between business and IT is driven by numerous IT governance mechanisms including: • Top management commitment • IT representation on the board • Collaborative IT planning • IS training • Regular meetings and business/IT liaisons
Sharma, Stone and Ekinci (2009)	Britain	Studies IT project management and IT governance	Interview of senior managers from 10 British organisations involved in major IT projects.	ITG is improved when IT project managers are well trained and organisation follows well established project management methodologies. Beyond effective project management, ITG also requires senior management commitment, governance skills and a culture of governance for strategic IT alignment and return on investment.
Smits and van Hillegersberg (2014)	Netherlands	Studies IT governance effectiveness in theory and practice.	Delphi study involving 14 Dutch CIOs responsible for IT budgets above €25 million	There remains a mismatch between IT governance in theory and practice.
Turel and Bart (2014)	Canada	Studies Board of IT governance influencers and consequences.	Survey of board members from Canadian organisations. 171 valid responses obtained.	Increased board IT governance results in improved organisational performance.

Reference	Country	Description of Study	Research approach	Findings
Willson and Pollard (2009)	Australia	Studies practical implementation of IT governance for optimal IT use.	Case study (based on interview of both IT and business managers) of one large Australian company.	IT governance goes beyond IT governance structures, processes and relational mechanisms to also depend on: • organisational historical context • performance management at several organisational levels • shared strategic vision • Senior, middle and lower-level management commitment.

2.3.6 IT governance in developing countries

As shown in Table 2.7, ITG research from developing nations appears to be rather recent. Information Security Governance seems to be a popular area of research due to its criticality in IT risk management. IT governance benefits, drivers and inhibitors were also investigated. ITG methods, mechanisms, frameworks and evaluation approaches were developed for specific countries. However, ITG seems to have been mostly explored at the more developed end of the developing country spectrum. For example, though still categorised as developing, Brazil, India, China, South Africa, Saudi Arabia and Indonesia (listed in Table 2.7) have emerged among the 20 largest economies of the world (G20 Turkey 2015). Bahrain figures among high income economies defined by the World Bank as having per capita Gross National Income exceeding $12, 276 (United Nations Secretariat 2012). Romania is a member of the European Union and enjoys exposure to the big economies of Europe (Gill 2013). Malaysia benefits from a sustained, high-income economy (van Trotsenberg 2015). Taiwan is not only a high income country but was declared as a developed market more than a decade ago by the International Monetary Fund (Bojinov 2015).

Interest in the governance of IT is nevertheless noted in some developing nations with lesser income. These are classified by the World Bank as lower income developing economies such as Tanzania with a per capita GNI not exceeding $1,005 and middle income countries such as Ghana and Thailand with per capita GNI ranging from $1,006 to $12, 275 (United Nations Secretariat 2012). Nfuka and Rusu (2011) acknowledge the increased number of IT applications in Tanzania and the resulting ITG concern in Tanzanian organisations. Yaokumah (2014) deplores the lack of top management commitment towards IT security in low-income developing countries such as Nigeria and Ghana, and stress the importance of IT security governance as a means of encouraging foreign investment. Jairak, Praneetpolgrang and Subsermsri (2015) focus on the governance of IT in universities in Thailand. The dearth of ITG research in other lower income developing nations is, however, deplored. This is particularly conspicuous in Small Island Developing States with high IT dependency which, following the researcher's review of literature, do not appear to have been studied. It is thus important to extend this body of research to such nations to optimise their IT use.

Table 2.7: Literature on IT governance in developing countries

Reference	Country	Description of Study	Research approach	Findings
Abu-Musa (2010)	Saudi Arabia	Investigates Information Security Governance (ISG) in Saudi Arabian organisations.	Survey of Saudi Arabian organisations listed in the Saudi Stock Market and Saudi Chambers of Commerce Index.	Saudi Arabian organisations lack: • Clearly communicated IT security strategies and policies • Disaster recovery plans • Clearly defined ISG roles and responsibilities • Alignment between ISG and business strategy. • ISG processes including those relating to performance measurement and risk assessment.
Bahl and Wali (2014)	India	Studies the impact of ISG on the quality of information security services delivered by software services provider.	Survey of security professionals from 22 software service providers across India.	ISG has a significant impact on the quality of Information security services for IT outsourcing companies offering software services.
Bermejo, Tonelli and Zambalde (2014)	Brazil	Proposes a method to develop IT governance in public organisations of Brazil.	Method derived from literature review and applied to five public Brazilian organisations.	Method proposed relies on IT governance mechanisms which focus on: • Hybrid strategies based on structures of duopoly for strong business IT collaboration. • Cross training to improve business IT communication and decision-making. • Processes for effective IT acquisition, service quality and architecture management.

Reference	Country	Description of Study	Research approach	Findings
Bin-Abbas and Bakry (2014)	Saudi Arabia	Develops a simple approach for IT governance evaluation with emphasis on the human dimension of IT governance.	Integrates key ITG methods, Six Sigma phases for continuous development, knowledge management and sharing to develop ITG evaluation approach applied to one Saudi organisation.	Proposes 50 control elements under four main categories to assess ITG: (1) strategy, (2) technology, (3) organisation and (4) people.
Cobo, Vanti and Rocha (2014)	Brazil	Seeks to develop an approach for the evaluation of ITG in strategic alignment.	Uses fuzzy multi-criteria decision methodology to develop model then applied to big Brazilian retail company	ITG assessment model based on maturity levels of COBIT processes.
Dong (2012)	China	Examines decision execution mechanisms of IT governance during Customer Relationship Management (CRM) use and performance management.	Survey of 82 firms located in Beijing.	Top management (vertical) commitment has a greater impact on the effective implementation and performance of enterprise-wide IS such as CRM. Business/IT (horizontal) collaboration favour effective process alignment.
Elagha (2014)	Bahrain	Studies impact of IT governance domains, maturity and mechanisms on effective IT governance.	Survey of 20 Emirati organisations.	IT governance is enforced by implementing processes for Business/IT alignment, IT resource and risk management, IT performance measurement and IT value delivery assessment. These require a culture of IT governance, IT strategic and steering committees, effective communication and senior management involvement.
Goosen and Rudman (2013)	South Africa	Development of an ITG best practice framework for both strategic and operational level.	Literature review of best practice ITG frameworks.	Integrated ITG control framework based on COBIT, ITIL and ISO 27002.

Reference	Country	Description of Study	Research approach	Findings
Ismail (2008)	Malaysia	Investigates IT governance, funding and structure in Malaysian universities.	Malaysian university case study based on interviews of users and campus information system information service providers.	Lack of collaboration and communication in IT decision-making is deplored. A new structure for improved IT planning and with clearly defined roles and responsibilities is proposed.
Jairak, Praneetpolgrang and Subsermsri (2015)	Thailand	Develops a set of IT governance ITG practices for Thai universities following Sufficiency Economy Philosophy (SEP)	Literature review followed by in-depth interviews of CIOs from 20 Thai universities, five IT experts and five SEP experts.	Identifies a set of IT governance principles developed from SEP based on nine dimensions: (1) IT business/strategy alignment, (2) value creation from IT sources, (3) IT project investments, (4) IT budget management, (5) IT HR management, (6) IT user management, (7) IT for university social responsibility, (8) Green IT and (9) IT department quality assurance.
Kanapathy and Khan (2012)	Malaysia	Explores relationship between ITIL and firm annual turnover, size and number of IT staff.	Survey of 84 Malaysian Multimedia firms	Positive relationship between ITIL implementation and annual turnover, firm size (number of employees) and number of IT staff.
Lunardi et al. (2014)	Brazil	Studies the impact of IT governance on firm financial performance.	87 listed Brazilian companies from 29 different industries investigated. Data collected from Economatica Tools of Investment.	Firm profitability increases with the adoption of IT governance. Greater improvements in profitability are noted in the year following adoption of ITG mechanisms as opposed to the year of implementation.
Nastase and Unchiasu (2012)	Romania	Studies IT governance perception and maturity in Romanian businesses.	Survey of Romanian professional associations and large companies.	Study reveals IT governance interest among senior management of Romanian companies although CIO is not part of executive management and IT still needs to make its way to becoming a business enabler.

Reference	Country	Description of Study	Research approach	Findings
Nfuka and Rusu (2011)	Tanzania	Investigates the impact of critical success factors (CSF) on IT governance.	Survey of Tanzanian public sector organisations.	ITG performance is improved with: • Senior management, stakeholders and business/IT personnel involvement in IT. • Strategic business/IT alignment • IT governance training, awareness and the attraction and retention of competitive IT leadership and professionals. • IT value performance measurement and benchmarking.
Ruey-Shiang, Che-Pin and Shih (2013)	Taiwan	Investigates relationship between IT management and IT governance.	Survey of 69 respondents including members of the Taiwanese branch of ISACA and Taiwanese enterprise managers.	A higher level of IT management results in a higher level of IT governance.
Teo, Manaf and Choong (2013)	Malaysia	Studies IT practitioners' perception of effectiveness of ITG initiatives.	Survey of 167 IT practitioners (non-managerial)	Perceived level of ITG effectiveness was different for different IT practitioners (having different job functions) confirming the need for ITG guidance.
Tsai et al. (2011)	Taiwan	Studies relationship between team risk factors and ITG in an Enterprise Resource Planning (ERP) environment.	Survey of 175 ERP project manager, senior managers and board directors from Taiwanese organisations with ERP experience.	Strategic alignment is the predominant ITG area. ITG was less successful where ERP project team members lacked ERP knowledge and there was insufficient team member cross-functionality.
Wibowo and Yuwono (2008)	Indonesia	Studies drivers, influencing factors and inhibitors of ITG	Study of 18 cases within large Indonesian companies.	Identifies several drivers (e.g. shareholder pressure), enablers (e.g. top management support) and ITG inhibitors (e.g. lack of formal ITG processes).
Yaokumah (2014)	Ghana	Studies information security governance (ISG) within industry sectors of Ghana.	Web survey involving 112 Ghanaian organisations from different industry sectors.	ISG is only partially implemented across Ghanaian industries with the finance industry taking the lead. Alignment of ISG to business strategy and performance measurement require improvement across all industries.

2.3.7 IT governance in Mauritius

Discussions on developed and developing countries so far have inferred that ITG research among developing nations concentrates mostly on the upper income range with only a few studies conducted in lower income sections and no focus on Small Island Developing States. Mauritius is a middle income, small island developing country with high IT dependency (The World Bank 2015a). It is therefore a strong candidate for new ITG investigation as discussed next.

2.3.7.1 The Mauritian context

Before looking into the need for ITG research in Mauritius, it is important to understand the Mauritian business context. From its independence in 1967 to now, the Mauritian economy has undergone a paradigm shift by moving away from a mono-crop dependency to embrace manufacturing and services industry. The Mauritian economy currently rests on five main economic pillars comprising of three service sectors (finance, tourism and ICT), textile and sugar industries (The World Bank 2015a). These are summarised in Table 2.8.

Table 2.8: Overview of Mauritian economic pillars from 2014 data obtained from The World Bank (2015a; 2015b)

Industry	GDP	Growth	Challenges
Finance	9%	5.4%	• Offshore sector faced with more stringent regulations and increased competition.
Tourism	7%	4.1%	• Hit by 2008 European economic crisis. • Losing competitiveness – expensive destination and limited air access. • Slipped from 53rd in 2001 to 58th in 2013 on World Economic Forum's Travel and Tourism Competitiveness Index (TTCI).
ICT	7%	6.4%	• Broadband tariffs are still not competitive enough. • Lack of ICT resources with advanced skills.
Textile	4.9%	1.5%	• Multilateral liberalisation of trade and erosion of trade preferences.
Sugar	2.4%	declining	• Multilateral liberalisation of trade and erosion of trade preferences.

As seen in Table 2.8, the main industries of the island face considerable challenges. Being a small island nation, Mauritius suffers from small economies of scale and a heavy dependency on international trade (UNDESA Division for Sustainable Development 2014). Its industries operate in a highly competitive environment. The finance sector has to align with increasingly stringent regulations. The tourism industry needs to continuously increase its standards to justify the island's expensive brand. ICT is in dire need of advanced training. Both the sugar and textile industries have to rise above past preferential benefits. In fact, although still considered as a major Mauritian economic pillar, the sugar industry is facing such a decline in growth (The World Bank 2015a) that its main players have diversified to include cane-related manufacturing such as the production of energy from bagasse.

2.3.7.2 The need for IT Governance research in Mauritius

More than ever, the Mauritian government is aware that its key industries need a push for improved productivity, competitiveness and resilience, particularly since its GDP growth was less than expected in 2014 – 3.5% as opposed to the projected 3.7% - 4% (The World Bank 2015a). Small island nations such as Mauritius strongly depend on ICT to sustain their economic growth since IT permeates all their industries (UNDESA Division for Sustainable Development 2014). The Mauritian government has placed considerable faith in IT both in its National ICT Strategic Plan 2011 – 2014 (Gilwald and Islam 2011) and its economic blue-print for the achievement of high income status by 2025 (Kalumiya and Kannan 2015) to boost the island's critical business sectors. The Mauritian government also aims at transforming the island into a leading hub of ICT excellence (Gilwald and Islam 2011) and the focus of its 2016-2017 National Budget is on Mauritius as a Digital Economy (Government Information Service 2016).

Mauritius therefore strongly relies on IT. This is reflected in its ICT development index (captures ICT readiness, intensity and capability) which rose from 5.34 in 2013 to 5.67 in 2014 (Statistics Mauritius 2015a). Mauritius also ranks first in the African region in terms of ICT development (International Telecommunications Union 2015). Mauritian businesses' dependence on IT continues to grow - 83% in 2001 to 97% in 2008 (DCDM Research 2010). Therefore, IT governance is crucial to optimise business/IT partnership. However, despite recognition of the importance of IT strategies to drive optimal IT use, only 34% of Mauritian businesses have an IT strategy. Although 64% of Mauritian businesses claim to have an IT/IS security policy, only 18% have adopted IT security standards and 49% believe in making their policies easily accessible to their staff members (DCDM Research 2010). While the Mauritian National Code of Corporate Governance recognises the value of IT for effective corporate governance, it lacks guidelines for the enterprise governance of IT (Committee on Corporate Governance 2004). It is seen that, while some Mauritian businesses have started to implement IT governance guidelines, there remains much scope for guidance as far as their IT governance implementation is concerned. Without strong IT governance to maximise IT performance, the island cannot achieve its goal of becoming a regional ICT leader. This study therefore aims to provide an IT governance model to guide Mauritian businesses from key economic sectors so that they can reap maximum benefits from IT.

2.4 Green IT

As discussed earlier, much of ITG research has focussed on IT use, infrastructure, architecture, investment and business needs as key IT governance decision areas (Weill 2004; Weill and Ross 2005; De Haes and Van Grembergen 2009a). Yet, an emerging area of enterprise ITG lies in the potential of IT for ecological sustainability or Green IT (ITGI 2011). Hence, this research includes Green IT in its ITG approach for businesses. Green IT is discussed next.

Although IT is arguably one of the causes of environmental degradation owing to its energy requirements and disposal issues, its judicious use can turn it into a powerful solution for business environmental sustainability (Chen, Boudreau and Watson 2008). For example, IT supports behaviour changes that promote the conservation of energy and can play a pivotal role in the diffusion of sustainability information to create an organisational culture that promotes employee awareness and commitment to ecologically sound IT ventures (Harmon and Demirkan 2011). For improved environmental sustainability, businesses are expected to maximise ecological benefits and minimise environmental impacts arising from their IT use – initiatives commonly referred to as Green IT (Ijab et al. 2010).

The last decade has seen Green IT propelled among important business concerns (Harmon and Auseklis 2009). Mines (2008) envisioned $4.8 billion dollars of user spending on Green IT services by 2013. Unhelkar (2011) predicts Green IT integration in the optimisation of business processes by Chief Information Officers. In their survey of 1052 companies worldwide, Symantec (2009) revealed that (1) Green IT is considered essential, (2) features high on organisational sustainability agendas and (3) Green IT budgets are on the rise. Yet, in spite of the vital role of IT in the sustainability challenge, Green IT remains a nascent research area (Melville 2010; Donnellan, Sheridan, and Curry 2011).

The following subsections discuss Green IT and its governance in more detail. The term is defined, and its benefits and issues are analysed before exploring IT governance and Green IT frameworks. Green IT and ITG research in developed and developing countries is then investigated before justifying the need for IT governance and Green IT research in the Mauritian context.

2.4.1 Green IT definition

With increasing research for the past two decades on both the impact of IT on environmental issues and its role in solutions for environmental sustainability, Green IT can be considered to be in its adolescence phase (El Idriss and Corbett 2016). Several Green IT definitions have emerged since with some of them provided in Table 2.9. As seen in the table, most Green IT definitions consider environmental sustainability throughout the IT lifecycle. A few authors also make the distinction between ecological IT which they refer to as Green IT and sustainability-enabling IT which they term as Green Information Systems (IS). For example, Dedrick (2010) views Green IT as a means of mitigating IT carbon emissions and Green IS as the utilisation of IS to solve environmental problems. Likewise, Molla and Abareshi (2012) define Green IT as the greening of IT production, use and disposal whereas they refer to Green IS (or IT for Green) as the application of IT for greener business processes. Butler (2011, 7) refers to Green IS as "Green IT-enabled Information Systems" for ecological business practices. Yet, the link between Green IT and Green IS remains strong since both relate to the role of IT for environmentally sustainable business. Consequently, this research uses the term Green IT to include both sustainable IT and Green IS practices.

Table 2.9: Green IT definitions

Author(s)	Definition
Elliot (2007, 107)	"Design, production, operation and disposal of ICT and ICT-enabled products and services in a manner that is not harmful and may be positively beneficial to the environment during the course of its whole-of-life."
Murugesan (2008, 25)	"The study and practice of designing, manufacturing, using and disposing of computers, servers and associated subsystems – such as monitors, printers, storage devices and networking and communication systems - efficiently and effectively with minimal or no impact on the environment."
Dedrick (2010, 174)	"The Green IT view sees IT primarily as a problem to be mitigated; for example, data centres are a rapidly growing source of carbon emissions and need to be made more energy efficient to reduce their impact on the environment. The Green IS view sees information systems as a possible solution to many environmental problems."
Bose and Luo (2011, 38)	"Green IT refers to the using of IT resources in an energy-efficient and cost-effective manner."
Butler (2011, 4)	Green IT is the "environmentally sustainable design, manufacture, packaging and distribution of IT artefacts." Green IS refers to "Green IT-enabled Information Systems."
Molla, Cooper and Pittayachawan (2011, 73)	"Systematic application of ecological-sustainability criteria (such as pollution prevention, product stewardship, use of clean technologies) to the creation, sourcing, use and disposal of the IT technical infrastructure as well as within the IT human and managerial practices."

Chou and Chou (2012, 447)	"The practice of designing, manufacturing and using computers, servers and various peripherals efficiently and effectively in order to minimise environmental damage."
Molla and Abareshi (2012, 92)	"Making IT production, use and disposal greener refers to Green IT" whereas "using IT to make enterprises greener is IT for Green (or Green IS)."

The Green IT definition of Molla, Cooper and Pittayachawan (2011) is also found to be the only one to encompass IT human and managerial practices which include Green IT beliefs, strategies and policies essential for the governance of environmentally sustainable IT. However, this definition focusses primarily on environmentally sustainable IT to the detriment of IT for sustainability. Therefore, taking into consideration all definitions analysed, this research defines Green IT as the implementation of ecological practices across IT technical infrastructure as well as within IT human and managerial practices throughout the IT lifecycle (design, sourcing, implementation and disposal) and in the application of IT for business environmental sustainability.

The importance of Green IT in businesses is analysed next.

2.4.2 Rationale for Green IT

The ICT industry has been held responsible for 2% of the world's carbon emissions (Gartner 2007). If not contained, ICT carbon emissions are projected to rise to an alarming 6% by 2020 (Fujitsu 2010). Consequently, numerous researchers have expressed concern regarding increased energy consumption, subsequent costs and CO_2 emissions resulting from growing information needs and business reliance on IT (Elliot and Binney 2008; Murugesan 2008; Vykoukal, Wolf, and Beck 2009; Watson, Boudreau, and Chen 2010; Bose and Luo 2011; Bengtsson and Ågerfalk 2011). Others have emphasised energy demands of business data centres not only for their tremendous power intake but also for their cooling requirements (Kurp 2008; Harmon and Demirkan 2011; Uddin and Rahman 2012). The Climate Group's SMART 2020 report (2008) projects a rise in data centre power consumption from 330 billion kWh in 2007 to 1012 billion kWh by 2020 if energy requirements remain uncontrolled. Literature has also unveiled the growing problem of toxic e-waste arising from the fast pace of technological advancements (Chen, Boudreau, and Watson 2008; Krikke 2008; Murugesan 2008; Molla and Abareshi 2011). Therefore, 'green' IT solutions are critical. These involve energy efficient hardware, virtualisation, thin client computing, cloud computing, IS energy performance management and e-waste recycling (Chen, Boudreau and Watson 2008; Murugesan 2008; Unhelkar 2011; Bose and Luo 2011; Jain, Benbunan-Fich, and Mohan 2011; Hammadi and Mhamdi 2014).

Paradoxically, IT can also be a solution to the problem. According to the Organisation for Economic Development (OECD), positive IT environmental impacts are three-tiered (Berkhout and Hertin 2001). At the first level, IT can be used to support environmental audits, monitoring and reporting (Chen, Boudreau, and Watson 2008; Murugesan 2008; CFO Research Services 2009; Jain, Benbunan-Fich, and Mohan 2011). At the second level, dematerialisation brought by IT results in decreased material use and increased resource efficiency through behavioural changes such as telecommuting, use of energy efficient hardware and paperless offices (Erek et al. 2009; Molla et al. 2009; Vykoukal, Wolf, and Beck 2009; Bengtsson and Ågerfalk 2011). At a deeper level, IT can contribute to inculcating sustainability attitudes to produce positive environmental performance (Gholami et al. 2013).

In fact, the #SMARTer2030 ICT Solutions for the 21st Century Challenges report predicts that Green IT could reduce carbon emissions by as much as 20% by 2030 and that ICT contributions to the global emissions footprint should decrease to 1.97% in 2030 as opposed to 2.3% in 2020 due to the ecological ICT investments of companies and rising energy efficiency of IT devices (GeSI 2015). With the increasing scarcity of natural resources and the resulting growth in their prices, sustainability considerations in corporate IT are mandatory to demonstrate business commitment to the stewardship of resources, thereby attracting and retaining the loyalty of investors, customers and suppliers (Chen, Boudreau and Watson 2008; Bose and Luo 2011). Many corporate buyers are already demanding that their suppliers follow the green path and customers expect businesses to divulge their carbon impacts which influence corporate reputation and consequently market and share value (Murugesan 2008; Erek et al. 2009). Green computing initiatives also ensure legislative compliance (Olson 2008; Beloglazov, Abawajy, and Buyya 2011) and provide additional business capabilities including resilience (Watson, Boudreau, and Chen 2010), sustained competitiveness and reduced costs (Cai, Chen, and Bose 2013). Literature also supports increased environmental and overall firm performance resulting from the successful adoption of green technology (Xia, Chen, and Zheng 2014).

Therefore, as key business stakeholders turn into fervent sustainability advocates, Green IT becomes a strategic business imperative governing both the sustainable use of IT in the enterprise and IT's role shift from mere economic benefactor to sustainability enabler (Molla, Cooper, and Pittayachawan 2011). However, as discussed next, Green IT is not without issues.

2.4.3 Green IT issues

Two of the main barriers to the adoption of Green IT are lack of clarity in business value and insufficient Green IT leadership (Bose and Luo 2012; Chou 2013; Wabwoba, Wanyembi, and Omuterema 2012). Dedrick (2010) also identifies the absence of IT energy cost chargeback as a demotivating factor since this may take the responsibility for and control of IT energy reductions away from the CIO. Insufficient knowledge, understanding and awareness of Green IT is also another issue (Chou 2013). More Green IT guidance is therefore required in order for businesses to make the best use of IT for sustainability.

Yet, IT researchers have been accused of being too slow in recognising the urgent need to work on environmental sustainability (Watson, Boudreau, and Chen 2010). Green IT literature is sparse (Ardito and Morisio 2014) and there is little focus on sustainability in IT research (Dao, Langella, and Carbo 2011). Faced with only limited guidance, organisations remain hesitant about their Green IT path (Elliot and Binney 2008; Watson, Boudreau, and Chen 2010; Bose and Luo 2011). Erek et al. (2009) as well as Bose and Luo (2011) call for more research in the development of IT sustainability benchmarking models. To address this gap in research, Molla and Cooper (2009) devised the G-Readiness framework. This is discussed next.

2.4.4 The G-Readiness Framework

Devised by Molla and Cooper (2009), the G-Readiness framework evaluates organisational environmental considerations in IT acquisitions, operations, systems and disposal for continuous sustainability improvement. G-Readiness refers to "an organisation's capability in greening IT in order to reduce IT, business process, and supply chain related emissions, waste and water use; improve energy efficiency; and generate green economic rent" (Molla, Cooper, and Pittayachawan 2011, 73). The G-Readiness framework is based on five vital constructs believed to underlie successful Green IT practices. These are discussed below with more measures under each construct detailed in Chapters 7 and 8.

- **Attitude:** Commitment to Green IT ventures depends largely on the values of business and IT leaders (Chen, Boudreau, and Watson 2008; Bose and Luo 2011; Akman and Mishra 2015). Such attitude fuels both the need to comprehend IT sustainability threats and opportunities that Green IT can deliver to the enterprise (Molla and Cooper 2009).
- **Policy:** The 'right' attitude towards sustainability is likely to translate into Green IT policies that guide sustainable behaviours across the IT resource lifecycle, from purchasing to operations and finally disposal (Raghupathi 2007; Murugesan 2008). Policies reflect an enterprise's Green IT stance to guide successful Green IT practice (Chou 2013).
- **Practice:** Actions do not always match and are not always driven by policies (Molla, Cooper, and Pittayachawan 2011). Organisations may also differ in their adoption and implementation of Green IT ventures (Elliot and Binney 2008). Green IT practice evaluates the extent to which sustainability is actually considered when buying, using and disposing of IT equipment (Molla, Cooper,

and Pittayachawan 2011). These include green IT criteria such as energy consumption in the purchase of IT equipment (Erek et al. 2009), IT recycling (Chuang and Huang 2014), as well as data centre design and cooling (Gu et al. 2013).

- **Technology:** This parameter relates to the acquisition and/or development of green technology (Molla and Cooper 2009) to promote efficient IT energy consumption, reduce IT CO_2 emissions, replace high carbon emitting equipment and monitor carbon emissions (Elliot and Binney 2008; Molla, Cooper, and Pittayachawan 2011).
- **Governance:** Green IT initiatives are driven by clarity in accountabilities, roles and responsibilities. Green IT processes need to be formalised, budget allocated and the contribution of IT to business sustainability monitored and reported (Molla et al. 2009; Molla, Cooper, and Pittayachawan 2011). Governance also establishes whether Green IT is the prerogative of the CIO or Environmental Manager (Elliot and Binney 2008; CFO Research Services 2009).

G-Readiness therefore evaluates organisational Green IT capability from human (attitude), managerial (policy and governance) and technical (practice and technology) angles and provides a benchmark to better devise strategies for the continuous pursuit of Green IT initiatives (Molla and Cooper 2009; Molla, Cooper, and Pittayachawan 2011). However, the framework focuses primarily on ecological IT and fails to sufficiently consider IT potential for improved sustainability in business processes (Buchalcevova 2015). Guidelines or approaches to best assist organisations in their Green IT adoption are not included in the G-Readiness framework and IT governance does not form part of its intended scope. The next section discusses IT Governance and Green IT.

2.5 IT governance and Green IT

With growing stakeholder pressure for ecological responsibility, business leaders cannot afford to wear environmental blinkers. Success in business environmental sustainability works hand-in-hand with good governance (Merad et al. 2013; den Uyl and Driessen 2015). Sustainability therefore needs to be upheld by boards and top management to set the organisational tone for environmental responsibility (Alänge and Steiber 2009; Smith and Sharicz 2011). Extending this line of thought to IT governance, it can be deduced that Green IT considerations emanating from top level management (Akman and Mishra 2015) and rooted in IT governance practices are essential for organisations to benefit from the power of IT to enhance environmental sustainability.

Green IT concerns should undoubtedly be included in IT governance decisions (Jairak, Praneetpolgrang, and Subsermsri 2015), particularly since Green IT has been foreseen to become the most important strategic IT decision in the near future (Akman and Mishra 2015). In its report, CFO Research Services (2009, 4) suggests that, while the first wave of Green IT has been characterised by energy efficiency and waste minimisation across the IT lifecycle, businesses should now be ready to ride the second wave of Green IT through the implementation of more structured "policies, practices and investments" driven by business and IT leaders. This new strategic turn has been further confirmed by Harmon and Demirkan (2011) who argue that businesses need to embark on this extended view of Green IT which they claim emerges from changing corporate expectations from a society that is increasingly aware of the strategic role of business in adopting sustainability. This is critical to (1) clearly allocate responsibilities, accountabilities and control for Green IT ventures to maximise their sustainability value (Molla, Cooper and Pittayachawan 2011) and (2) fuel organisational acquisition of IT tools and capabilities required to achieve sustainability objectives (Chen, Boudreau, and Watson 2008; Molla and Cooper 2009; Dao, Langella, and Carbo 2011).

Green IT is a vital piece of the IT governance puzzle. This is supported by ITGI's global survey of enterprise level IT (ITGI 2011) which reported that 25% of its survey respondents were looking into Green IT initiatives. CFO Research Services' (2009) survey of finance and IT executives from 353 large companies around the world also found that more than a third of their respondents allocated at least 15% of their IT budget to Green IT ventures. Green IT has also figured in Gartner's list of top ten strategic IT trends since 2008 (Hanne 2011). Thus, research for the development of an IT governance and Green IT model would benefit businesses in their strategic quest for improved IT value from both a business and sustainability perspective. Frameworks incorporating Green IT in the governance of IT are discussed in more detail below.

2.5.1 IT Governance and Green IT frameworks and models

Some Green IT consideration was seen in the review of enterprise IT governance and Green IT literature. For example, Korte, Lee and Fung (2013) discuss the integration of sustainability in existing IT management frameworks such as Six Sigma, COBIT, ITIL and Prince 2, even though IT governance and Green IT mechanisms for improved guidance would have helped to better guide organisations in their governance of Green IT. Other researchers have come up with new ITG frameworks and models. These are discussed in the following subsections.

2.5.1.1 The Envirability-RMIT Green ICT framework

Philipson's (2010) organisation, Envirability, collaborated with RMIT university to develop a Green ICT Framework which refines G-Readiness. The framework identifies five Green IT actions (attitude, policy, practice, technology and metrics). Cutting across the first four Green IT actions are Green IT approaches categorised into four main pillars: (1) equipment lifecycle which covers IT procurement and disposal, (2) end user computing which defines user control over their IT use, (3) enterprise computing and data centre that encompass IT functions controlled at organisational level (e.g. data centres) and (4) ICT as a low-carbon enabler which includes IT solutions for sustainability. The fifth Green IT action (metrics) includes Green IT measurement units, monitoring (or measurement), management of Green IT improvement actions and mitigation to ensure permanent improvement (Philipson 2010). The framework is represented in Figure 2.3.

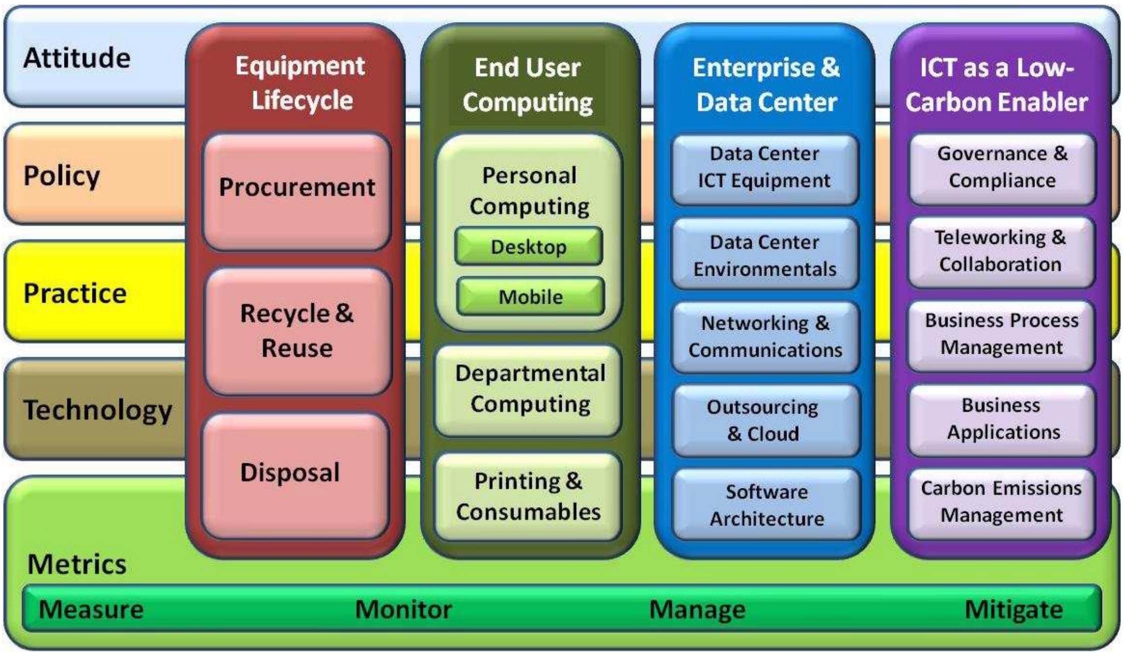


Figure 2.3: The Envirability-RMIT Green ICT Framework (Philipson 2010)

It can be seen that this Green ICT framework extends the G-Readiness model by adding Green IT approach details (equipment lifecycle, end user computing, enterprise and data centre, and ICT as a low carbon enabler) including further emphasis on 'greening' by IT as indicated by its 4th pillar (ICT as a low carbon enabler). Nevertheless, despite the identification of Green IT metrics, the Green ICT framework has limited focus on IT governance intricacies which are essential for successful Green IT implementation. It does not provide Green IT accountability guidance and lacks IT governance process, structure and relational details.

2.5.1.2 The Sustainable Information and Communication Technology framework

As shown in Table 2.10, the Sustainable Information and Communication Technology (SICT) framework complements the G-Readiness model by identifying nine building blocks used to assess organisational Green IT capability (Donnellan, Sheridan, and Curry 2011).

Table 2.10: Capability building blocks of sustainable ICT framework (Donnellan, Sheridan, and Curry 2011)

Category	Capability Building Block	Description
Strategy and planning	Alignment	Define and execute the ICT sustainability strategy to influence and align to business sustainability objectives.
	Objectives	Define and agree on sustainability objectives for ICT.
Process management	Operations and life cycle	Source (purchase), operate, and dispose of ICT systems to deliver sustainability objectives.
	ICT-enabled business processes	Create provisions for ICT systems that enable improved sustainability outcomes across the extended enterprise.
	Performance and reporting	Report and demonstrate progress against ICT-specific and ICT-enabled sustainability objectives, within the ICT business and across the extended enterprise
People and culture	Adoption	Embed sustainability principles across ICT and the extended enterprise.
	Language	Define, communicate, and use common sustainability language and vocabulary across ICT and other business units, including the extended enterprise, to leverage a common understanding.
Governance	External compliance	Evangelise sustainability successes and contribute to industry best practices.
	Corporate policies	Enable and demonstrate compliance with ICT and business sustainability legislation and regulation. Require accountability for sustainability roles and decision-making across ICT and the enterprise.

The SICT framework adds a people and culture dimension to Green IT for a common understanding and adoption of Green IT practices. It also includes a governance component to contribute to industry best practice, demonstrate legislative compliance and ensure accountability for Green IT decisions. However, while the SICT framework provides a good basis for Green IT maturity assessment, it does not provide sufficient governance details including mechanisms to guide businesses in their Green IT endeavours.

2.5.1.3 Contingency Model of Green IT Governance

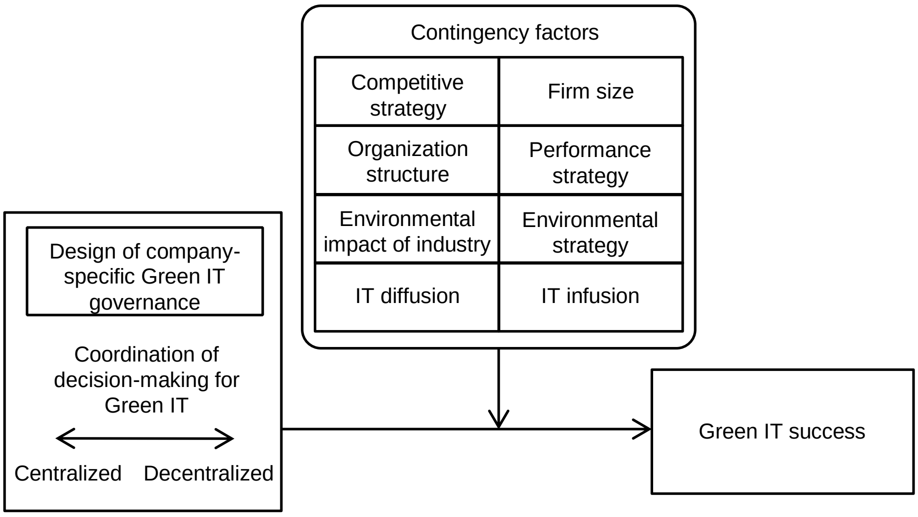


Figure 2.4: Contingency Model of Green IT Governance (Schmidt and Kolbe 2011)

Schmit and Kolbe (2011) developed the Contingency Model of Green IT Governance shown in Figure 2.4. Their model demonstrates that contingency factors influence the best mode of Green IT governance for a company. Companies with conservative competitive strategies tend to adopt a centralised decision-making strategy, as compared to a preference for decentralised decision-making shown by companies with more aggressive strategies. Larger firms tend to invest more in Green IT and show a more decentralised governance of Green IT. Organisational structure also dictates the extent of centralisation and, aligning with Weill and Ross (2005), profit oriented performance strategies warrant centralised Green IT governance, as opposed to the decentralised approach of growth oriented strategies. Companies from industries with a high environmental impact are more control-oriented and proactive organisations prefer a decentralised approach to environmental decision-making whereas reactive ones tend to prefer more centralisation. The greater the extent of IT diffusion, the more IT energy consumption and the higher the importance of Green IT measures supported by a decentralised model. However, while the framework is useful for organisations to determine their preferred Green IT archetype based on their contingencies, it was not intended to provide guidelines for Green IT governance.

2.5.1.4 Green IT Value Model

Chou and Chou (2012) provide a model for determining Green IT value. As illustrated in Figure 2.5, businesses need to first recognise the potential of Green IT (awareness) before translating this realisation into Green IT initiatives (translation) which should then be monitored and improved (comprehension) to achieve Green IT satisfaction (Green IT value) leading to environmental sustainability. While this model provides a clear and simple pathway for Green IT implementation, it does not include any Green IT approaches. Also, although it specifies the monitoring of Green IT endeavours through the establishment of metrics and constant measurement, further IT governance guidelines are lacking.

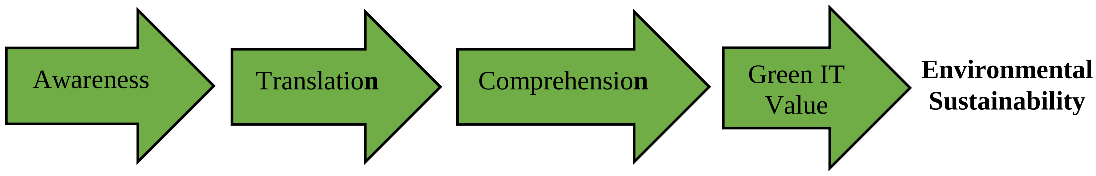


Figure 2.5: Green IT value model (Chou and Chou 2012)

2.5.1.5 Green IT Framework for Data Centres

Developed by Uddin and Rahman (2012), the Green IT framework for data centres provides a comprehensive guide for the establishment of green data centres starting from their planning to the identification, procurement, implementation and continuous improvement of Green IT. Green IT practices not only include virtualisation and cloud solutions but also focus on Green data centre infrastructure, architecture and IT equipment. The model also includes several Green IT governance measures such as Green IT goals, metrics, low carbon enabling policies, monitoring and control.

However, the model is limited to data centres. Consequently, it fails to cover the entire organisational IT and lacks guidelines for IT-enabled sustainable business practices.

2.5.1.6 UK Government Combined Assessment Model for Green ICT

This model provides a detailed roadmap of recommended Green IT measures and their maturity assessment. As shown in Table 2.11, IT functions are grouped under four categories, each further divided into sub-categories for which directions are summarised in the model and details provided in an ICT workbook (GOV.UK 2013). The model is highly comprehensive and provides different ICT management perspectives including ICT services, investment and project management. Its directions constitute a good guide for businesses. Both Green IT use and IT solutions for sustainability are considered. The model also includes numerous IT governance details including structures (e.g. embedding Green ICT into CIO objectives), processes (e.g. environmental cost and benefits assessments) and relational mechanisms (e.g. dissemination of data and information policies and practices for minimising environmental impacts). However, the model was designed to address only the needs of the public sector.

Table 2.11: UK Government Combined Assessment Model for Green ICT (GOV.UK 2013)

Category	Sub-category	Directions
Managing ICT services	Governance & promotion	Embedding Green ICT into CIO objectives, ICT governance and sustainability governance; Seeking improvement and innovation; developing leadership, sponsorship and engagement
	Enterprise and Solutions Architecture	Aligning technical architectures and strategies with Green ICT principles of maximising utilisation, efficiency, sharing and consolidation while minimising environmental impacts.
	Capacity planning	Matching ICT capacity to demand with minimal headroom to meet safety and resilience.
	End-user support	Reducing environmental impacts of support services including help desk, training, patching, upgrading; Moving to remote support models.
	Information and data	Ensuring optimal information management through life, with data and information policies and practices minimising environmental impacts, removing duplication, using collaboration tools, tiering and compression services for storage.

Category	Sub-category	Directions
	Disposal	Assessing impacts of extending asset life at refresh points; recording/ tracking of all ICT device disposals by weight; adopting Waste Hierarchy to minimise disposal - Re-use, Re-furbish, Re-cycle, and Re-claim.
Managing ICT technology	Utilisation	Maximising use of assets, within business safety and accessibility/availability requirements; minimising energy consumption and carbon emissions in meeting demands.
	Consolidation	Minimising number of assets deployed to deliver functionality and access levels required; seeking economies of scale down the supply chain; moving from delivery of assets to adoption of services
Changing ICT services	Investment Decisions	Including assessment of the environmental costs and benefits across the life cycle in business cases, approval & prioritisation of processes and gate reviews for ICT investments; assessing actual environmental costs and benefits as part of benefit realisation plans.
	Running Projects	Reducing environmental impacts from project work through adoption of lower carbon ways of working; adopting principles of re-use, sharing, and the use of virtual teams and collaboration tools.
	Solution design	Assessing ICT solutions to reduce bad and enhance good sustainability outcomes; integrating Green ICT efficiencies and exploitation assessments for business green efficiencies at key points in design of Business and ICT solutions.
	Procurement	Procurement of ICT systems and services adopting (1) Government Buying Standards, (2) Sustainable Procurement policies, (3) Standard terms and conditions for sustainability; sweating assets to end of life and avoiding refresh; minimising consumption and supply chain emissions; exploiting opportunities for sharing, consolidation, re-use and recycling at end of useful life; moving from owning ICT assets and infrastructure to service and Cloud provisions.
Exploiting ICT	Electronically enabling customer services	Delivering services to customers anywhere, anyhow and at any time.
	Travel reduction	Utilising collaboration services to reduce travel and physical meetings.
	Resource optimisation	Using ICT smartly to reduce the amount of material the organisation uses in operating its business.
	Energy optimisation	Reducing the amount of energy that is needed to run the organisation.
	Space optimisation	Reducing the amount of space the organisation has to occupy.
	Corporate reporting	Enabling the organisation to report on its environmental performance by having clear baselines and trajectories.
	Corporate integration	Encompassing related strands of Travel, Estates and HR within a single focus on environmental impact management.

2.5.1.7 Green ICT Readiness Model for organisations in developing countries

Wabwoba et al. (2013) extended the G-Readiness model of Molla, Cooper and Pittayachawan (2011) to adapt it to organisations in developing countries, particularly in the Kenyan context. As shown in Figure 2.5, the model adds ICT personnel Green IT awareness and skills as a major influencer for the first five components of the model and as a key factor for Green ICT readiness.

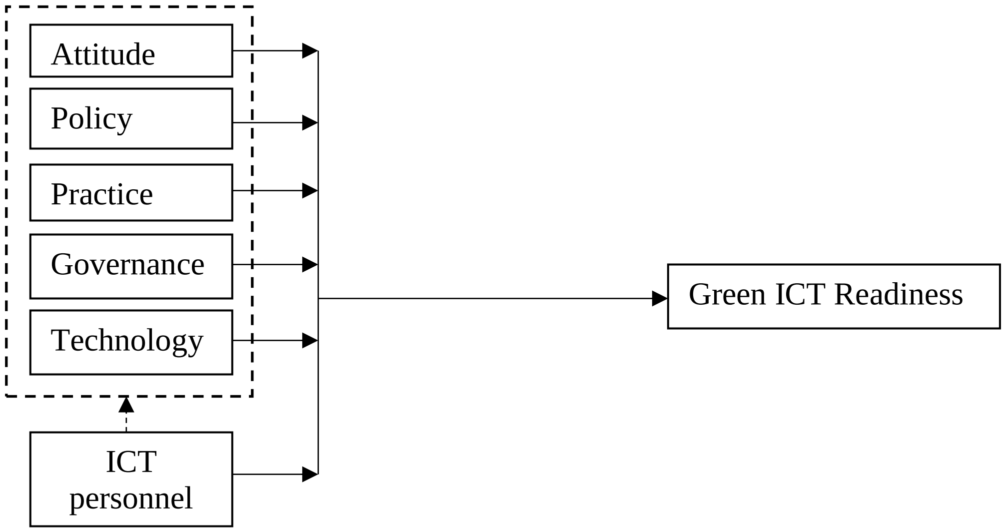


Figure 2.6: Extended Molla's G-Readiness Model for companies in developing countries (Wabwoba et al. 2013)

However, even though this model adapts G-Readiness to the developing context, it lacks detailed Green IT guidelines and IT governance mechanisms to best support organisations in their IT governance and Green IT endeavours.

2.5.1.8 Green ICT Maturity Model for Small and Medium Enterprises

Developed by Buchalcevova (2015), the Green ICT Maturity Model for Small and Medium Enterprises (GICTMM4SME) categorises Green IT under four domains: Green of ICT, Green by ICT, People & Culture and Governance. The model is illustrated in Figure 2.6.

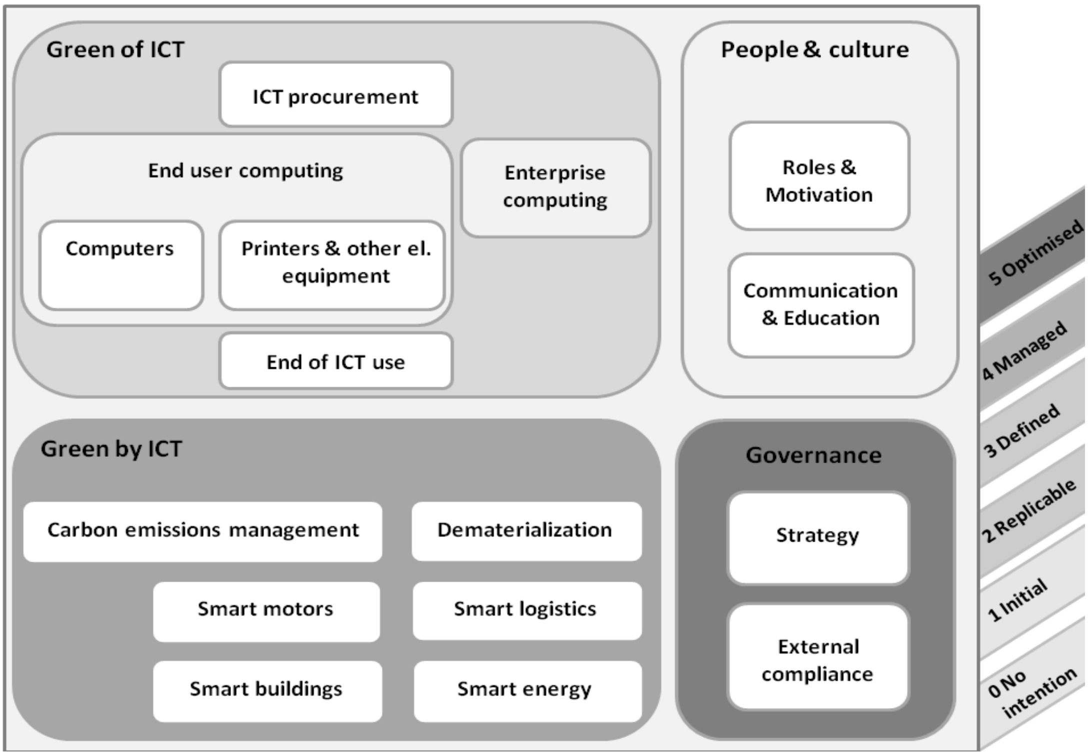


Figure 2.7: Green ICT Maturity Model for SMEs (Buchalcevova 2015)

As opposed to previously discussed models, GICTMM4SME explicitly defines Green IT (referred to as Green ICT) and IT-enabled sustainability measures (referred to as Green by ICT). Its people and culture dimension considers the importance of communication and education along with the need to define Green IT roles and provide motivation. The model also brings governance on the table by specifying the need for Green IT strategies and compliance with external exigencies. Using defined weights for each category, the model enables Green IT maturity levels to be determined for continuous improvement. Yet, while GICTMM4SME clearly embraces both Green IT angles along with Green IT governance, the lack of IT governance structures, processes and mechanisms is apparent. The model is also primarily designed for Czech Small and Medium Enterprises (SMEs).

2.5.1.9 Summary of IT governance and Green IT framework/model analysis

Once IT governance and Green IT frameworks and models from literature were analysed, their target as well as their Green IT and IT governance components were mapped as shown in Table 2.12.

Table 2.12: IT governance and Green IT framework/model mapping

Framework/model	Target	Green IT component	IT Governance component
Envirability-RMIT Green ICT framework	Organisations of different sizes and from multiple industry sectors	Covers both ecological IT and IT for green business processes	Lacks details on IT governance mechanisms
SICT framework	Not specified	Covers both ecological IT and IT for green business processes	Lacks details on IT governance
Contingency model for Green IT governance	Not specified	Proposes a Green IT governance framework based on influencing contingency factors	Does not provide guidelines on Green IT governance
Green IT value model	Not specified	Insufficient Green IT guidelines	Insufficient IT governance guidelines
Green IT framework for data centres	Organisational data centres	Limited in scope – comprehensive Green IT support for data centres but lacks Green IT guidelines.	Limited in scope
UK government Green ICT combined assessment model	UK public sector	Comprehensive	Comprehensive
Green ICT Readiness Model	Organisations in developing countries	Insufficient guidance on Green IT and IT for Green approaches	Lacks details on IT governance mechanisms
Green ICT maturity model for SMEs	Czech SMEs	Covers both ecological IT and IT for Green business processes	Lacks details on IT governance mechanisms

From the mapping, it can be seen that most of the frameworks/models analysed either provide limited IT governance guidance or lack depth in both their Green IT and IT governance directives. Although more comprehensive than the other models discussed, the UK Green ICT model was found to be limited in scope since it targeted the public sector alone. An IT governance and Green IT model to better guide a wider scope of businesses for optimal strategic and sustainable IT is therefore warranted. In addition, the G-Readiness framework which forms the basis of many of the frameworks analysed was derived from a "desk-based" approach. The need for it to be further explored in practice, particularly from an in-depth case study perspective and within a single country context, has been expressed (Molla, Cooper, and Pittayachawan 2011).

To further identify gaps in existing literature, IT governance and Green IT from the perspectives of different countries (developed followed by developing) are explored next.

2.5.2 Green IT and its governance in developed countries

Several Green IT initiatives have emerged from the developed world. The European Union (EU) issued legislations such as the Restriction of Hazardous Substances (RoHS) and the Waste Electrical and Electronic Equipment (WEEE) to minimise IT toxicity and encourage greater responsibility for IT disposal respectively (Hanne 2011). The European Commission (European Commission Joint Research Centre 2015) issued a code of conduct for energy efficiency in data centres. Despite its international status, the Green Grid consortium for IT resource efficiency is headquartered in the United States (The Green Grid 2015). Nations such as UK, United States and Australia are viewed as Green IT pioneers and leaders (Fujitsu 2010). These countries, along with other developed nations such as Japan and Denmark, are backed by strong policies and/or Green IT strategies to drive their Green IT practices (Taruna, Singh, and Joshi 2014). Consequently, considerable Green IT research stems from the developed world. Some examples are summarised in Table 2.13. It can be seen that, while these studies focus on Green IT strategies, capabilities and/or drivers, a detailed governance guidance, essential for successful Green IT, is not provided.

Table 2.13: Green IT research in developed countries

Reference	Country	Description of Study	Research approach	Findings
Arnfalk et al. (2016)	Sweden	Studies the use of virtual meetings.	Case study of 20 Swedish public agencies.	One of three virtual meetings replaced a business trip.
Buchalcevova (2015)	Czech Republic	Designs Green ICT maturity model.	Evaluates model through surveying 43 Czech SMEs.	Green ICT maturity model for Green ICT capability evaluation.
Butler (2011)	Europe and US	Studies the role of Green IS in environmental sustainability.	Case study of two IT manufacturers from Fortune 500 and based in US.	Builds a Green IS theoretical model.
Gu et al. (2013)	Netherlands	Studies Green IT measures applied to data centres.	Industrial study of Dutch data centres.	Provides Green IT practices for sustainable data centres.
Hedman and Henningsson (2011)	Denmark	Investigates Green IT company strategies.	Case study of 14 Danish companies.	Identifies a mix of 3 Green IT strategies: (1) review of existing activities to see which classifies as Green IT, (2) resource and energy efficiency via Green IT and (3) redesign of company processes to maximise Green IT.
Molla and Abareshi (2012)	Australia	Investigates organisational motivations for the Green IT adoption.	Online survey of 176 CIOs and IT managers from Australian firms.	Cost and energy reductions are the main drivers of Green IT.
Molla, Abareshi and Cooper (2014)	Australia	Studies green beliefs and attitudes among IT professionals.	Sample of 322 IT professionals analysed using SEM.	Green IT beliefs are directly related to Green IT attitudes. Green IT applications are inconsistent among IT professionals.
Molla, Cooper and Pittayachawan (2011)	Australia, New Zealand & US	Explores business Green IT capabilities.	Survey of 143 CIOs or equivalent.	Green IT readiness framework

2.5.3 Green IT and its governance in developing countries

Compared to developed nations, not only do developing countries use less IT, but they also face more serious concerns including poverty, illiteracy and sickness (Hanne 2011). Consequently, the developing world places less emphasis on Green IT. It is therefore not surprising that Green IT maturity levels are lower in developing countries as opposed to their more developed counterparts (Wabwoba et al. 2013). Yet, as ICT use increases in developing countries, many face issues of e-waste (Taruna, Singh, and Joshi 2014). Businesses from the developing world are also starting to realise the opportunities being missed from the sustainable implementation of IT (Hanne 2011). An increasing demand for Green technology and services for sustainable economic growth is therefore noted among developing countries (Hasper 2009). Some even have Green IT strategies. For example, India has committed to reducing its IT emissions and both South Africa and Kenya have e-waste schemes (Taruna, Singh, and Joshi 2014). Some Green IT research has also been conducted in a developing country context. Table 2.14 shows a few examples identified from literature.

Table 2.14: Green IT research in developing countries

Reference	Country	Description of Study	Research approach	Findings
Cai, Chen and Bose (2013)	China	Studies the role of IT for Chinese environmental sustainability.	Survey of 70 Chinese firms analysed using PLS.	Green IT brings cost reduction and competitive advantage to firms in China.
Gholami et al. (2013)	Malaysia	Studies Green IS perceptions of senior managers.	Survey of 495 organisations in Malaysia.	Coercion (e.g. regulations) influences Green IS adoption.
Wabwoba, Wanyembi, and Omuterema (2012)	Kenya	Studies barriers to Green IT implementation in Kenya.	Multiple case survey	Barriers include lack of Green IT skills and training, budget, top management support, legislations, resistance, business value uncertainty.
Wabwoba, Wanyembi, and Omuterema (2013)	Kenya	Studies Green ICT Readiness in Kenya.	Survey of 4 cases in Kenya.	Identifies a lower green ICT readiness in developing countries and extends the G-Readiness model to add ICT personnel preparedness.
Zhang and Liang (2012)	China	Studies the promotion of Green IT in China	Document review and interviews.	Develops a Green ICT framework built on innovation systems.

An interest in Green IT promoters, barriers and readiness is noted amongst some developing nations. Nevertheless, Green IT research in developing nations remains scarce. This is supported by Taruna, Singh and Joshi (2014) who deplore a general lack of Green IT focus in the developing world. Wabwoba et al. (2013) also call for more research on how to best apply Green IT in the developing context. The lack of enterprise governance research in the Green IT studies analysed is also noted. Green IT and its governance therefore constitute an important area of research to assist firms from developing countries in their ecological IT use. This is especially applicable to small island developing nations which are not only expected to develop their ICT focus for improved productivity (UNDESA Division for Sustainable Development 2014), but need to focus on Green IT endeavours to limit their high exposure to changing climatic conditions. Mauritius is no exception as discussed next.

2.5.4 Green IT and its governance in Mauritius

As a small island nation, Mauritius is highly vulnerable to the dangers of climate change. The country figures among the World Bank's top ten for exposure to natural disasters which directly affect its tourism and sugar industries (The World Bank 2015a). It is also ranked 14th on the WorldRiskIndex of the 2014 WorldRiskReport (World Economic Forum 2014) which measures environmental vulnerabilities.

Numerous concerns have been expressed with regard to carbon emissions and electricity use in Mauritius (Elahee 2009; The Ministry of Environment and Sustainable Development 2011; Teeluck, Pudaruth, and Kishnah 2013). This was reiterated by the Mauritian government during the 2015-2016 Budget where commitment to pollution prevention, cleaner production and energy efficient practices was reinforced ("Mauritius Budget Speech 2015-2016" 2015). One of the government's biggest initiatives is the "Maurice Ile Durable" (MID) project for green Mauritius which was launched in 2008 to give a new thrust to sustainability concerns among the island's environmental stakeholders (The Ministry of Environment and Sustainable Development 2011). In addition, the island's drive for a green economy (ION News 2014) shows effort towards the reconciliation of its economic benefits and environmental resilience. This ecological concern is also noted in its 2030 vision where Mauritius commits to a 30% reduction in Greenhouse Gas (GHG) emissions as reinforced by its INDCs (Intended Nationally Determined Contributions) submitted to the United Nations Framework Convention on Climate Change (UNFCC) in line with the 2015 Paris Climate Conference (Government of Mauritius 2015). This goal cannot be achieved without a strong business partnership (Ministry of Environment and Sustainable Development 2013).

The role of IT in this sustainability quest has not been ignored. The National Computer Board (NCB) of Mauritius has produced a series of guidelines to promote the green use of IT and the ecologically responsible disposal of e-waste by Mauritian businesses (National Computer Board 2011). The NCB also organised Green IT workshops and training in areas such as the EU Code of Conduct for Data Centres for IT energy efficiency in businesses (National Computer Board 2015). A national Green ICT policy is also on its way (Ministry of Information and Communication Technology 2013).

Yet, 2014 Mauritius environment statistics (Statistics Mauritius 2015b) indicate a rise of 3.8% in the island's GHG emissions (from 3,543 thousand tonnes in 2013 to 3,676 thousand tonnes in 2014). The high IT dependency of Mauritius not only contributes to its energy consumption and GHG emissions, but also generates significant e-waste, 10,000 tonnes of which were reported in 2010 (Ministry of Information and Communication Technology 2013). These remain insufficiently managed for sustainable IT disposal (Teeluck, Pudaruth, and Kishnah 2013) and do not help the island's image or aspiration to become a regional ICT leader. This shows a need for greater governance in Mauritian Green IT endeavours. Review of existing literature also shows a dearth of empirical studies investigating Green IT and its governance among the island's businesses. More emphasis on the environmental IT domain of Mauritian businesses is therefore required.

To further frame IT Governance and Green IT research in Mauritius, guiding theories needed to be explored and selected. This is discussed in more detail in the next section.

2.6 Gaps in IT governance and Green IT research

Despite IT governance models and frameworks, IT governance remains a dominant IT issue faced by businesses (ISACA 2011; Parker 2010). Problems of poor communication and collaboration among IT stakeholders as well as the lack of senior management commitment towards ITG remain (ITGI 2011). Clearly, there appear to be disparities between theory and practice (Wilkin and Chenhall 2010). For example, Smits and van Hillegersberg (2014) find that, despite links between adopted ITG frameworks and prioritised IT governance disciplines (e.g. IT security frameworks such as ISO 27000 and the IT security discipline), there remains a discrepancy between ITG in practice and the theoretical dimensions of IT governance such as IT decision authority, performance, capability and risk management. Ferguson et al. (2013) also point out that IT governance best-practices available from literature are largely based on conceptual ideas. A need to further explore IT governance in the day-to-day running of organisations therefore appears necessary to better guide enterprises in their ITG endeavours.

Despite the importance of IT governance for sustainable IT, relevant frameworks analysed were found to either provide limited practical IT governance and Green IT guidance or be restrictive in scope. An IT governance and Green IT model to better guide businesses for optimal strategic and sustainable IT is therefore warranted. Molla, Abareshi and Cooper (2014) also highlight inconsistency in Green IT actions and implementations among IT professionals (e.g. while 60% of their sample population implemented power management IT functions, only 30% would switch off their computers when not in use). This shows the need for more governance to better inculcate Green IT beliefs and attitudes. On a global level, Green IT implementation remains elementary. In its report on global Green IT benchmarks, Fujitsu (2010) identifies a low global Green IT maturity level of 56.4 (out of 100) resulting from a staggering lack of Green IT awareness and monitoring. Fujitsu (2010) recommends that countries around the world rise from their slumber and bridge the gap between

Green IT potential and practice. This cannot happen if Green IT is not properly governed.

Several reasons have spurred the need for this research. Firstly, while it appears that the concept of IT governance has been extensively covered in theory, more research to better guide the governance of IT in practice is warranted (Wilkin and Chenhall 2010; Smits and van Hillegersberg 2014). A review of IT governance frameworks has revealed the need for deeper investigations regarding an optimal mix of IT governance mechanisms and the inclusion of environmental sustainability in IT strategies. Limited IT governance research among lower income developing countries, particularly small island nations with high IT dependency, was also noted. These include Mauritius. Despite the island's considerable focus on IT for improved business value, the lack of investigation into existing IT governance measures and IT governance guidelines for businesses in the country is highly conspicuous.

Moreover, although the importance of sustainability in the effective governance of IT has been discussed in literature, the novelty of Green IT in businesses, lack of awareness as well as the limited focus on IT governance in Green IT frameworks has resulted in calls for deeper investigations, especially in developing countries including small island developing nations. This is particularly relevant to the Mauritian context, where despite its vulnerability to environmental changes and the government's keen interest in turning Mauritius into a sustainable island, insufficient Green IT research was noted.

Given the above, this study is intended to bridge the gaps identified by examining IT governance and Green IT in the Mauritian business context. It is envisaged that the resulting IT governance and Green IT model will encourage Mauritian companies to exploit their IT potential, thereby assisting the Mauritian government both in its IT focus and sustainability vision.

The initial IT Governance and Green IT model including control mechanisms, executive attitudes and capabilities is now ready to be defined as discussed next.

2.7 The initial IT Governance and Green IT conceptual model

The IT Governance and Green IT model (ITGM) developed from an analysis of the literature is shown in Figure 2.8. The model includes ITG decisions and accountabilities (archetypes) framed by Weill (2004). Green IT complements Weill's (2004) IT decision types since it was found to be increasingly considered in strategic IT. ITG mechanisms detailed in the ITG framework of De Haes and Van Grembergen (2008) and Green IT mechanisms represented by the first four G-Readiness constructs coined by Molla and Cooper (2009) support the ITG decision accountabilities. The fifth G-Readiness construct, governance (Molla and Cooper 2009), is not included as a Green IT mechanism since it is a part of the other two sections of the model (IT decision accountabilities and governance mechanisms).

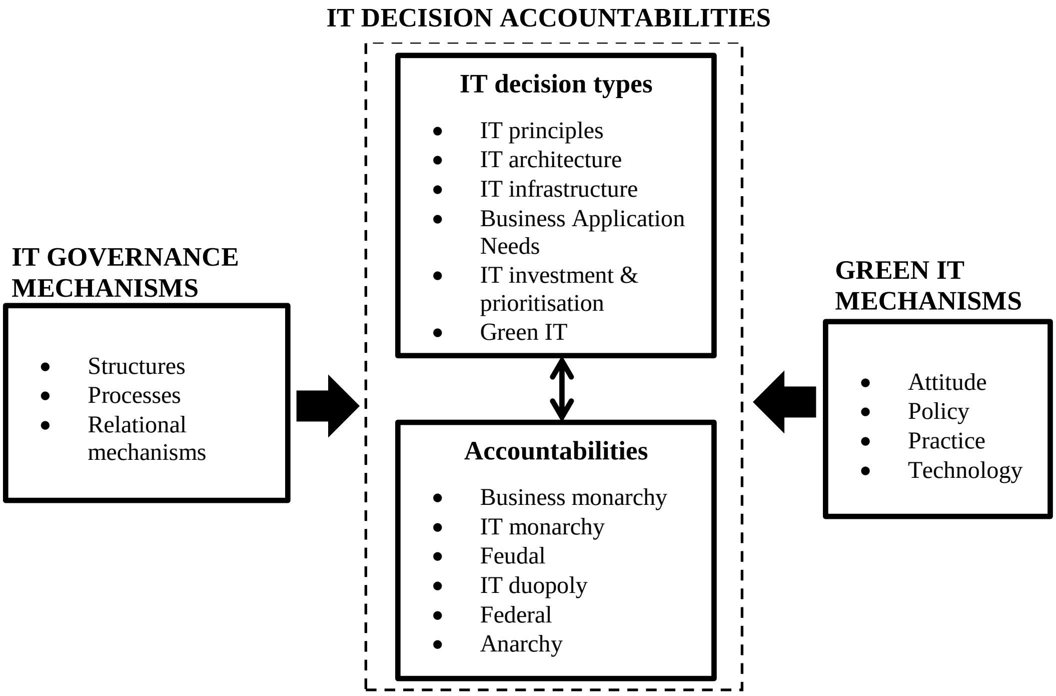


Figure 2.8: Conceptual IT governance and Green IT model (Adapted from Weill (2004), De Haes and Van Grembergen (2008), Molla, Cooper and Pittayachawan (2011))

As it combines IT governance and Green IT in a single model, the ITGM addresses one of the major gaps identified in this literature review - insufficient sustainability focus in current ITG frameworks and limited ITG considerations in existing Green IT models. It is envisaged that, by studying this model from a Mauritian business perspective, insights will be provided to ITG (including Green IT) mechanisms used in practice. Resultant findings would then be used to enrich the ITGM. This would not only address the dearth of ITG research noted from a practical angle but would also study ITG in the mostly unexplored context of a small island, developing nation. Recommendations for an optimal mix of ITG and Green IT mechanisms for Mauritian businesses to maximise their strategic IT use while contributing to the island's vision of environmental sustainability would then be proposed. Both the ITGM and proposed recommendations could then serve as a starting point for further investigations into other small island developing nations.

Once the conceptual ITGM was finalised, the research scope needed to be defined. This is explained in the next section.

2.8 Research scope

This study focusses on large, essentially private Mauritian businesses from the five pillars of the Mauritian economy. As discussed in section 2.3.7.1, the Mauritian economy primarily relies on its financial, tourism, textile, IT and sugar sectors; hence the choice of confining the research scope to these industries. Large businesses were also preferred due to their more prominent IT governance focus as compared to their smaller counterparts (Gutierrez, Orozco, and Serrano 2009; Debreceny 2013). This can be explained by the financial potential of larger businesses to invest in strategic IT solutions and a need for more IT control resulting from a larger number of divisions (Chan, Sabherwal, and Thatcher 2006). Most heads of IT from larger businesses also tend to be members of senior management, thereby better promoting IT governance practice (ITGI 2011). In addition, large firms are in greater need of Green IT measures as opposed to small companies due to their higher IT energy consumption, particularly when powering data centres (Erek et al. 2009). Large organisations are also more likely to engage in Green IT initiatives due to their greater availability of resources and technical expertise (Bose and Luo 2011; Molla and Abareshi 2011).

The private organisations in Mauritius dominate its economic landscape as reflected in the 2015 Top 100 Mauritian Companies report which features eight (including the top two) private companies among the top ten businesses with the highest turnover (DCDM Research 2015a). The report also shows that the main economic sectors of the island are principally driven by private enterprises (DCDM Research 2015a). Large businesses essentially from the Mauritian private sector and across the island's economic pillars therefore provide a good starting point for studying ITG in the Mauritian context. A few large enterprises from the public and parastatal categories belonging to the selected industries were also considered.

2.9 Chapter Summary

This chapter provides a review of IT governance and Green IT literature to frame this research. It was found that IT governance comprises IT decision accountabilities and mechanisms. The need for executives and lower levels of management to have a shared understanding for IT governance oversight and implementation was also identified. IT governance in this research is therefore defined as a combination of IT decision accountabilities and supporting mechanisms overseen by executives but understood and implemented by lower levels of management for a shared IT strategy that supports business goals. It was also found that adding Green IT to the IT governance scope enables IT strategies to be implemented for business environmental sustainability. Following the analysis of several Green IT definitions from literature, technology, human and management practices were identified as key areas of the Green IT domain. Two dimensions of Green IT are also discussed in literature: ecologically responsible IT and the use of IT for environmentally sustainable business processes. Green IT can be implemented across all phases of the IT lifecycle. This research therefore defines Green IT as the implementation of ecological practices across IT technical infrastructure as well as within IT human and managerial practices throughout the IT lifecycle (design, sourcing, implementation and disposal) and in the application of IT for business environmental sustainability.

The merging of IT governance and Green IT was found to bring numerous business benefits including increased business legitimacy and performance. Yet, literature reveals the need to better study IT governance in practice, create more Green IT awareness and provide more Green IT focus on ITG frameworks and vice versa. A dearth of IT governance and Green IT research in developing countries featuring outside the World Bank-defined, high income spectrum and belonging to the small island developing nation group with high IT dependency was also conspicuous. Mauritius features in this category. Despite its high IT focus and exposure to environmental issues, the island lacks ITG and Green IT research. An IT governance and Green IT model would bridge this gap to better guide Mauritian businesses in their sustainable and strategic IT use.

IT governance and Green IT accountabilities and mechanisms identified from literature were therefore merged to generate a conceptual IT governance and Green IT model backed by research theory. This model is enhanced by studying both IT governance and Green IT among large Mauritian companies from key economic sectors. This would not only provide a view of current ITG and Green IT practices in key Mauritian firms; it would also serve as a basis for recommendations to optimise strategic and environmentally sustainable IT usage. Before commencing the investigation at company level, the research approach needed to be defined. This is explained in the next chapter.

Chapter 3: Research Approach

3.1 Introduction

Information Systems research is characterised by a vast possibility of research approaches (Becker and Niehaves 2007). These need to be established before data can be collected and analysed. As shown in Figure 3.1, Saunders, Lewis and Thornhill (2009) present these various considerations in the form of a research 'onion' which depicts the numerous layers that need to be 'peeled off' when structuring research. The first 'peel' or researcher decision concerns the research philosophy or paradigm. This guides the research approach, overarching the array of possible research strategies. Analysis of the latter would facilitate a choice of strategy or strategies and time horizons for the research. The nucleus of the 'onion' is then reached whereby decisions on how data will be collected and analysed are made.

This chapter discusses each layer of the onion in the context of this research to describe its approach. For each 'peel', various possibilities are described and analysed in the context of information systems (IS) research, before selecting and justifying the most suitable one(s) shown in dark red in Figure 3.1. The chapter culminates in the research process flow which describes how the research proceeds in order to achieve its desired outcomes.

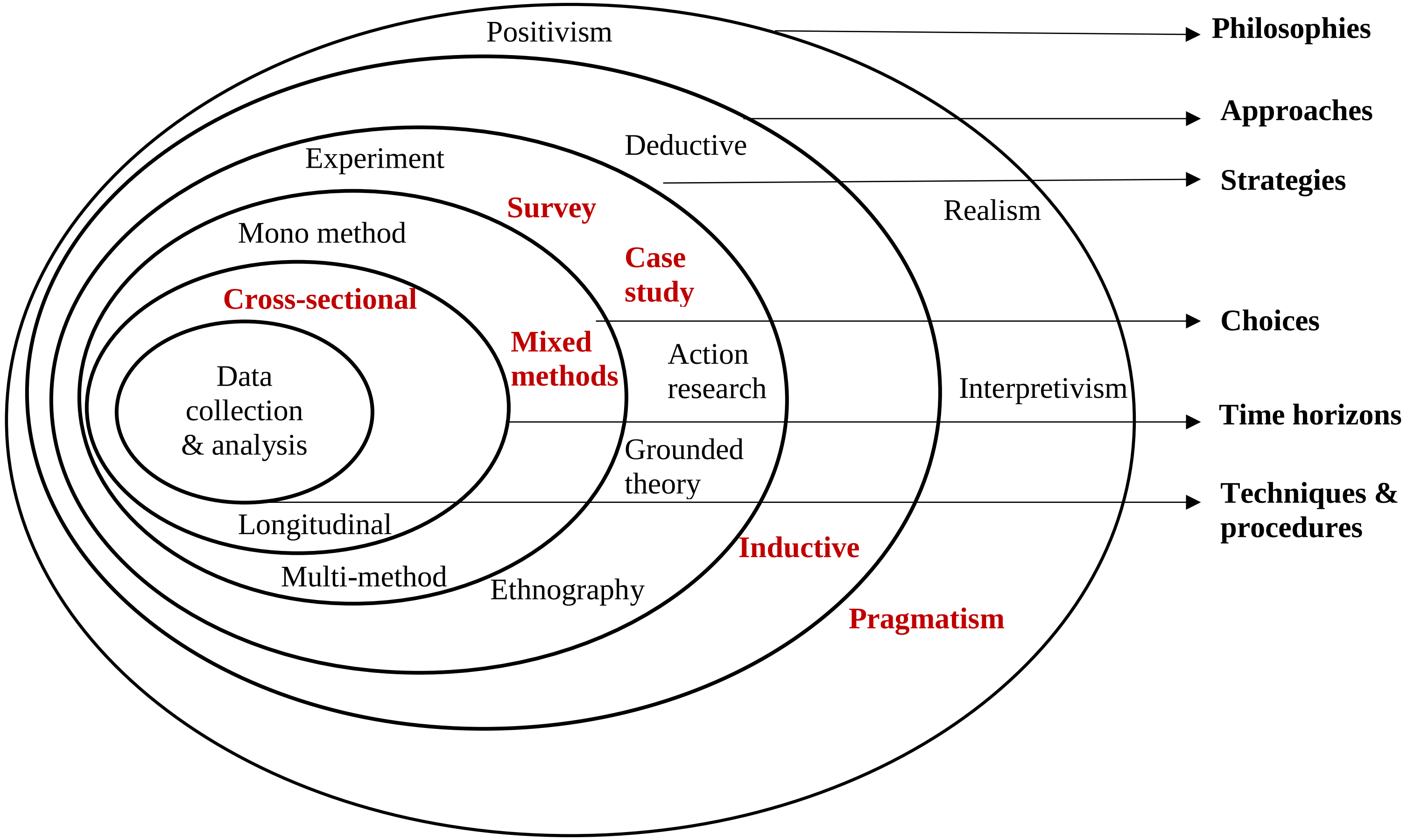


Figure 3.1: The research 'onion' (Saunders, Lewis, and Thornhill 2009)

3.2 Research paradigms in IS research

The first research 'onion' layer to be unpeeled is the research paradigm or philosophy. This refers to the beliefs which guide the research (Cohen, Manion, and Morrison 2000). The chosen paradigm forms the critical basis of research as it sets the tone for the knowledge to be developed and its underlying research strategy (Saunders, Lewis, and Thornhill 2009).

Information Systems (IS) research is primarily characterised by three paradigms: positivism, interpretivism and critical realism (Galliers 1991; Orlikowski and Baroudi 1991). Pragmatism, based on the plurality of paradigms, has also been advocated in IS research (Goles and Hirschheim 2000; Baskerville and Myers 2004). To choose the most appropriate paradigm, it was important to compare them with respect to their research beliefs. The latter include four main views in research philosophy: (1) ontology or the claims about the nature of reality, (2) epistemology or how the knowledge is known, (3) axiology or the ethical values underlying the knowledge and (4) methodology or the processes leading to the knowledge (Mertens 2007). Methodologies can be primarily categorised as qualitative (generates or uses non-numerical data), quantitative (generates or uses numerical data), or mixed methods which combines both qualitative and quantitative approaches (Teddlie and Tashakkori 2009). Table 3.1 compares the research paradigms identified with respect to their four dimensions. Each philosophy is then further discussed in the context of information systems (IS) research before selecting and justifying the chosen one.

Table 3.1: Comparison of positivism, interpretivism, critical realism and pragmatism

	Positivism (Chen and Hirschheim 2004; Saunders, Lewis and Thornhill 2009)	**Interpretivism** (Chen and Hirschheim 2004; Saunders, Lewis and Thornhill 2009)	**Critical Realism** (Orlikowski and Baroudi 1991; Saunders, Lewis, and Thornhill 2009; Mingers, Mutch, and Willcocks 2013)	**Pragmatism** (Saunders, Lewis, and Thornhill 2009; Teddlie and Tashakkori 2009)
Ontology (nature of reality)	• Reality is human-independent. • Research interpretation is objective.	• Reality is constructed through social interactions. • Research interpretation is subjective.	• Research interpretation is objective, but depends on an understanding of social structures contributing to the phenomenon (social conditioning)	• Views regarding the nature of reality are diverse. • Both objective and subjective perspectives are considered.
Epistemology (how the research is known)	• Hypotheses, models or causal relationships are tested for possibilities of generalisation.	• Meaning is constructed from human and social interactions (non-deterministic)	• Events are caused by structures and mechanisms (observable or not). • Knowledge can only be derived by including the social actors involved in the research context.	• Different views are explored to derive knowledge.
Axiology (ethical values underlying research)	• Value-free - researcher is completely dissociated from data (objective).	• Value-bound – data collection process is inclusive of researcher who interacts with participants (subjective).	• Value-laden – researcher is biased by his/her experiences and views.	• Values are important, since both objective and subjective outlooks are considered.
Methodology (processes that lead to the research results)	• Typically uses quantitative methods (e.g. surveys), but can also be qualitative.	• Qualitative methods, such as field studies engaging researcher in the social context.	• Either qualitative or quantitative or both. • Tends to involve long term and ethnography studies. • Critiques reality.	• Both qualitative and quantitative methods (pluralistic, mixed methods).

3.2.1 Positivism

The positivist philosophy is based on the premise that outcomes are determined by causes which need to be explored through specific, researcher-detached measurements (Creswell 2003). Positivism is a reductionist approach in which the problem is broken down into smaller, theory-driven statements such as hypotheses (Creswell 2003) which are verified to look for possibilities of generalising results (Chen and Hirschheim 2004). IS research has been traditionally guided by positivism (Orlikowski and Baroudi 1991; Chen and Hirschheim 2004). This has served to establish validity and rigour in the establishment of IS research in practice (Chen and Hirschheim 2004). However, the positivist's quest for generalisability could result in an inaccurate picture of reality due to a disregard for both social context and the people actively involved in its construction (Orlikowski and Baroudi 1991).

3.2.2 Interpretivism

Unlike positivism, interpretivism constructs meaning by subjectively seeking to understand human social interactions (Walsham 1995). In IS research, the interpretivist researcher participates in the enquiry in order to understand its social setting and IS influence (Klein and Myers 1999). The strength of interpretivism therefore lies in its consideration of social contexts and their human interactions. However, this can also be a weakness since meaning is often derived from the perceptions and interpretations of participants. If the latter err, then results could be misleading (Orlikowski and Baroudi 1991).

3.2.3 Critical realism

Critical realism is based on a philosophy that knowledge is generated from the identification of "causal mechanisms, of a variety of kinds, some of which may be non-physical and non-observable", the interaction of which could shed light on the research situation (Mingers, Mutch, and Willcocks 2013, 797). Critical realism in IS research serves to objectively explain phenomena within a social context (Tsang 2014). It also aims at examining IS under an alternative lens to challenge the status-quo and critique the tacit role of IS in organisations as a means of suggesting change (Smith 2006; Cecez-Kecmanovic 2011). Critical realism in IS research tends towards historical examinations of organisational Information Systems to challenge "regimes of truth" and study transformations brought by IS (Cecez-Kecmanovic 2011, 444). Critical realism thus favours longitudinal explorations based on historical studies and ethnography (Orlikowski and Baroudi 1991) - strategies which can be very time consuming (Saunders, Lewis, and Thornhill 2009).

3.2.4 Pragmatism

The choice of positivism versus interpretivism in IS research has been widely debated (Walsham 1995; Dubé and Paré 2003; Chen and Hirschheim 2004; Goldkuhl 2012). While positivists take pride in the objective validity of their research outcomes, interpretivists value subjective perspectives considered indispensable for knowledge gathering (Becker and Niehaves 2007). Critical realism does present an alternative to the two conflicting approaches by providing an objective view and critique of reality within a social realm (Smith 2006). However, this philosophy is not suitable when the research does not challenge the status-quo and/or when historical studies are not on the agenda. The question which then arises is whether a researcher is bound to only one philosophy. The solution to this quandary lies in pragmatism which embraces appropriate perspectives from multiple philosophies (Goles and Hirschheim 2000; Mackenzie and Knipe 2006). Pragmatism puts the research questions at the centre of the problem, and considers both objective and subjective views in the quest for answers (Teddlie and Tashakkori 2009). The pragmatist therefore embraces pluralism since certain stages of the research may require social interactions between the researcher and research participants whereas others may require greater objectivity (Teddlie and Tashakkori 2009).

3.2.5 The chosen paradigm

As this research aims to explore IT governance and Green IT practices and drivers in key Mauritian companies to produce recommendations for maximised IT use (refer to research questions in section 1.6), it was thought that the adoption of a single paradigm stance was inappropriate. Instead a more diverse perspective was considered in order to benefit from the strengths of different paradigms, minimise their weaknesses, and provide a comprehensive picture of IT governance and Green IT across large companies from Mauritian economic pillars. Ontologically, it was decided to combine the rigour and validity of objectivity with the details of social constructivism. Epistemologically, it was thought best to explore multiple views to provide an enriched picture of the desired knowledge. Methodologically, diversity of methods to benefit from both qualitative and quantitative processes was sought. In addition, although this research does not involve historical studies, its critical slant arising from a desire to provide IT governance and Green IT recommendations for an improvement of the current situation in key Mauritian businesses, adds a critical realist flavour to the study. Therefore, based on the need for paradigm plurality, the pragmatism philosophy was chosen to guide the research design.

3.3 Research approach

Once the paradigm had been chosen, the ‘approaches’ layer of the research ‘onion’ shown in Figure 3.1, needed to be peeled by analysing two divergent research approaches: deductive and inductive. Both approaches rely on existing literature as a starting point. However, while the deductive approach sets out to prove that a theory is right or wrong through generating, measuring and testing hypotheses, the inductive method is based on the collection of data from which patterns and meaning are derived (Gray 2013). Since this research is aimed at understanding IT governance and Green IT in large businesses from main Mauritian industries, it is exploratory in nature and thus has no hypotheses. Instead, the primary aim of this research is to generate meaning from the identification of common IT Governance and Green IT themes. Hence, it needs to begin on a broad basis, which should keep narrowing as more light is shed on the research context until an accurate picture of the situation emerges (Saunders, Lewis, and Thornhill 2009). The approach used for this research is therefore inductive.

3.4 Examining research strategies

Peeling the first two exterior layers of the research 'onion' resulted in the selection of pragmatism and induction as the research philosophy and approach respectively. With these in mind, the next layer of the research 'onion' was removed to examine possible research strategies or methods. Research methods refer to well-defined activities undertaken in research to generate results (Mingers 2001). They guide the identification of samples, collection of data, and their resulting analysis (Rajasekar and Philominathan 2013). Since this research is not intended to investigate the impact of independent variables on dependent ones (Saunders, Lewis, and Thornhill 2009), experiments were not considered as a potential research strategy. Instead, inductive methods from both the quantitative and/or qualitative category which are commonly adopted in IS research were investigated. The most popular ones include surveys and case studies followed by action research (Chen and Hirschheim 2004). Other methods adopted for inductive IS research include ethnography (Myers 1999) and grounded theory (Urquhart, Lehmann, and Myers 2010). Table 3.2 compares the characteristics, strengths and limitations of each research strategy identified.

Following the analysis of research strategies, three were immediately ruled out. Action research was not considered appropriate since this research does not involve practical problem solving. Action research would have required the participation of company executives which could have been a challenge owing to their busy schedules. As seen in Table 3.2, both ethnography and grounded theory could have been ideal strategies for this research given their rich, context-inclusive approach. However, they were rejected due to their lengthy or uncertain duration which could have been problematic given the time constraints of this study. Due to these considerations, case studies and surveys were chosen as the most suitable strategies for this research.

Table 3.2: Analysis of potential IS research strategies

IS Research Strategy	Surveys (Pinsonneault and Kraemer 1993; Gable 1994; Saunders, Lewis, and Thornhill 2009)	Case studies (Benbasat 1987; Kathleen M. Eisenhardt 1989; Dubé and Paré 2003; Yin 2009)	Action Research (Baskerville 1999; Saunders, Lewis, and Thornhill 2009)	Ethnography (Myers 1999; Jebreen 2012)	Grounded Theory (Shannak and Aldhmour 2009; Urquhart, Lehmann, and Myers 2010; Birks et al. 2013)
Description	• Quantitative • Information gathered from a sample generalises to a population. • Particularly useful when combined with other qualitative methods.	• Qualitative or mixed. • Focus is on a 'real life' context. • Uses several sources of evidence to triangulate or add to results.	• Qualitative • Practical, action-oriented and iterative. • Useful for problem solving and learning. • Active researcher and participants' involvement	• Qualitative • Researcher immerses in context to better understand it. • Researcher is 'on the field'.	• Qualitative • Builds theory from data. • Uses constant comparison and iterative analysis of data from different views. • Ends with theoretical saturation.
Strengths	• Economic way to collect a lot of data from multiple respondents. • Large sample size supports generalisability of findings.	• Provides rich view of research context. • New insights into research phenomenon could emerge.	• Knowledge is of immediate benefit to participants. • Links theory to practice.	• Provides deep understanding of context • May reveal different perspectives from 'accepted' ones.	• Useful when no previous theories exist. • Flexible in sampling and data analysis. • Context -inclusive

IS Research Strategy	**Surveys** (Pinsonneault and Kraemer 1993; Gable 1994; Saunders, Lewis, and Thornhill 2009)	**Case studies** (Benbasat 1987; Kathleen M. Eisenhardt 1989; Dubé and Paré 2003; Yin 2009)	**Action Research** (Baskerville 1999; Saunders, Lewis, and Thornhill 2009)	**Ethnography** (Myers 1999; Jebreen 2012)	**Grounded Theory** (Shannak and Aldhmour 2009; Urquhart, Lehmann, and Myers 2010; Birks et al. 2013)
Limitations	• Poor response rate. • Data collected is limited to survey questions.	• No control over research conditions. • Context-specificity could deter ability to generalise.	• Mostly practitioner-driven for organisation problem solving - researcher has little control.	• Lengthy process. • Context-specific findings could limit ability to generalise.	• Relies on data saturation – research time frame is difficult to predict.

3.5 The chosen research strategy

Once various research strategies were analysed, the next layer of the research 'onion' was ready to be removed in order to choose the best method or combination of methods. Options include (1) mono method or the selection of only one strategy, (2) multi-method or multiple strategies belonging to only one category (qualitative or quantitative) and (3) mixed methods which combine strategies from different categories (Saunders, Lewis, and Thornhill 2009). The case study and survey approaches needed to be further analysed before making a research strategy choice.

3.5.1 The case study approach

According to (Benbasat 1987, 370), "a case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organisations)". Although essentially qualitative, the case study approach could also result in findings of a mixed nature (Eisenhardt 1989; Yin 2009). Case studies are favoured when the study (1) addresses the "how" or "why" behind a phenomenon, (2) does not require control over research conditions and (3) involves in-depth exploration of a current phenomenon in real life (Yin 2009). For these reasons, case studies are particularly useful in IS research which seeks a rich understanding of rarely explored, IS-related behaviour within its organisational context (Benbasat 1987). Dubé and Paré (2003) further contend that case studies in IS research bring a well-rounded view of the intricacies of organisational IS and can help point towards new business directions for IS improvement. Based on these rationales, the case study approach was deemed appropriate for this research since it involves an in-depth exploration of the "how" and "why" behind IT governance and Green IT practices in the real-life context of large Mauritian organisations and aims at providing recommendations for improvement. Yet, despite the popularity of the case study strategy in IS research (Tsang 2014), the generalisability of its findings is often questioned due to the small sample size involved (Lee 1989; Cavaye 1996; Dubé and Paré 2003; Tsang 2014). However, this is not an issue for this research since the question of generalisability does not arise when research is inductive and exploratory in nature (Pinsonneault and Kraemer 1993; Saunders, Lewis, and Thornhill 2009).

Once this method had been chosen, the decision of whether to adopt a single-case or multiple-case approach needed to be made (Benbasat 1987; Eisenhardt 1989). A single case study is appropriate when the case studied is critical or unique (Benbasat 1987), whereas multiple case studies provide a rich picture of the phenomenon based on strong empirical evidence (Eisenhardt and Graebner 2007; Yin 2009). The multiple case option was selected since this research aims at providing a comprehensive view of IT governance and Green IT in key Mauritian companies.

3.5.2 The survey approach

The survey approach is the most popular research strategy in IS research (Orlikowski and Baroudi 1991; Chen and Hirschheim 2004). It involves the collection of data through questionnaires and is essentially quantitative in nature (Chen and Hirschheim 2004). Surveys are particularly useful for exploratory research where large volumes of data need to be collected economically from a considerable population (Saunders, Lewis, and Thornhill 2009). Surveys were found to be an appropriate strategy for this research in order to reach a wide population of large Mauritian companies for an expanded IT governance and Green IT view. However, surveys are limited to a questionnaire and may not be suitable when in-depth data is sought; hence the need to combine them with other methods such as the case study approach for added data richness (Pinsonneault and Kraemer 1993; Gable 1994). A combination of both case studies and surveys therefore appeared to be most appropriate for this research.

3.5.3 The chosen research approach – mixed methods

A mixed methods (MM) approach was chosen and this option was justified by several reasons. Firstly, combining the case study and survey approaches aligns with the pragmatist philosophy of this research which advocates both a qualitative and quantitative perspective (Teddlie and Tashakkori 2009). Secondly, a combination of both strategies makes for a more comprehensive research as it uses several data sources

(Greene, Caracelli, and Graham 1989). Thirdly, the richness of case studies compensates for the lack of depth which could result from the survey approach (Pinsonneault and Kraemer 1993; Gable 1994). Fourthly, a mixed-methods approach would instil greater confidence in research results through the triangulation and clarification of findings (Greene, Caracelli, and Graham 1989; Venkatesh, Brown, and Bala 2013). Finally, the mixed-methods approach answers the numerous calls made to extend IS research to a more pluralistic view (Lee 1999; Mingers 2001; DeSanctis 2003; Chen and Hirschheim 2004) so that the resulting variety in methods can provide an enriched perspective of the IS research context (Mingers 2001).

3.6 Time horizon

The research strategy having been chosen, the ‘time horizon’ layer needed to be peeled off the research ‘onion’. This involves the decision of whether the research outcomes would be based on a “snapshot” of the phenomenon being studied at a specific point in time or on a series of observations over a period of time (Saunders, Lewis, and Thornhill 2009, 155). The snapshot view is referred to as cross-sectional (Orlikowski and Baroudi 1991), whereas the longer time horizon constitutes a longitudinal approach (Chen and Hirschheim 2004). While the longitudinal strategy provides a rich perspective of the phenomenon being explored through the observation of organisational change over time, the cross-sectional one benefits from a shorter time frame (Saunders, Lewis, and Thornhill 2009). For this research, time constraints permitted only a cross-sectional approach for the collection of both case study and survey data.

3.7 Research design - data collection and analysis

The final layer of the research ‘onion’ (‘data collection and analysis’) was now ready to be removed by designing the research. A research design sets out the plan for collecting and analysing data (Creswell and Plano Clark 2011). For this research, the design includes the identification of the unit of analysis, an overall plan for the selected mixed methods strategy, and an understanding of how data will be collected and analysed. These are discussed in the subsections which follow.

3.7.1 Unit of analysis

The first step in designing the research was to identify the unit of analysis. This refers to individuals, groups or a whole organisation (Benbasat 1987; Yin 2009) which would reflect research outcomes, and from whom the data would be collected. (Teddlie and Tashakkori 2009). For this research, the prime unit of analysis is the organisation as the study focusses on IT governance and Green IT from leading Mauritian companies. It is to be noted that in some cases, organisations were found to belong to the same overarching group (for example, group or consortium of companies) and share the same business and IT executives as well as IT governance and Green IT policies and characteristics. These were treated as a single company.

3.7.2 Designing the mixed methods research strategy

Several research design typologies exist for mixed-methods research. From the nine possibilities summarised in Figure 3.2, it can be seen that the choice of mixed methods typology depends on two main areas: time order of methods (concurrent v/s sequential) and method priority (Johnson and Onwuegbuzie 2004). Greene (2008) adds one more primary dimension: the decision of whether methods are mixed as the inquiry proceeds, or at the end. All three areas were considered when designing this research.

Time Order Decision

		Concurrent	**Sequential**
Paradigm emphasis decision	**Equal status**	QUAL + QUAN	QUAL → QUAN QUAN → QUAL
	Dominant status	QUAL + quan QUAN + qual	QUAL → quan qual → QUAN QUAN → qual quan → QUAL

‘Qual’ = qualitative; ‘Quan’ = quantitative; ‘+’ symbolises concurrent; ‘→’ symbolises sequential; capital letters denotes higher priority (or weight), as opposed to lower case letters which denote lower priority (or weight).

Figure 3.2: Mixed methods research design matrix (Johnson and Onwuegbuzie 2004).

A sequential strategy was selected for this research in preference to the concurrent time order option. This is because the sequential approach enables the researcher to expand on findings by feeding the results of one method into another to develop a more elaborate view of the research situation (Creswell 2003). Since little information is available about the current state of IT governance and Green IT in large Mauritian businesses, it was important to explore the current situation through a qualitative case study first in order to develop an initial IT governance and Green IT model (ITGM). This would have sufficient elements to further build on and consolidate research findings through a survey. Therefore, an exploratory, sequential design was chosen. This typology starts with a qualitative collection and analysis of data (Creswell and Plano Clark 2011). As the enquiry proceeds, case study extracted themes serve as input for the development of a quantitative (survey) instrument, which is then used to extend the investigation to a larger population (Johnson, Onwuegbuzie, and Turner 2007). Both qualitative and quantitative approaches have equal status in the research. The integration of both research outcomes needed to be decided next. Since for this research, survey findings would both triangulate and extend case study outcomes (Teddlie and Tashakkori 2009; Creswell and Plano Clark 2011), it was decided to combine the results of both approaches at the end in order to generate a final IT governance and Green IT model. Each stage of the mixed-methods design is discussed in more detail in the sections which follow.

3.7.3 Selecting cases

Prior to collecting case study data, cases need to be selected. This requires that the number of cases be determined, case selection criteria be defined and sampling technique be chosen. Eisenhardt (1989) suggests an acceptable range of four to ten cases. She posits that fewer than four cases could lead to unconvincing results while the complexity and huge volume of data from more than ten cases would be difficult to manage. This research focusses on five key industries of the Mauritian economy and consequently, it was decided to study two companies from each sector. This led to a total of ten cases for a sufficiently wide view of IT governance and Green IT across each economic pillar of the island.

The characteristics of each of the ten cases needed to be defined next. These started with the definition of ‘large companies’ which were the object of this study. According to the *Small and Medium Enterprises Development Authority (SMEDA) Act 2009*, Mauritian companies generating an annual turnover less than Rs10 million (approximately AUD 365K and USD 282K), are classified as small, whereas those with an annual turnover between Rs10 million and Rs50 million (approximately AUD 1.8 million and USD 1.4 million) are categorised as medium. Large companies were those generating a yearly turnover exceeding Rs50 million. Next, with IT governance and Green IT being the phenomena under study, the other vital criterion for case selection was the implementation of IT governance and Green IT practices within the shortlisted organisations. This was based on three characteristics. Firstly, with IT governance being the prerogative of board of directors and executive-level management (Peterson 2004; ITGI 2007; De Haes and Van Grembergen 2009), it was important to select companies headed by a board and Chief Executive Officers (CxOs). Secondly, the chosen companies needed to have a strong IT infrastructure without which there would be little scope for IT governance and Green IT (Molla, Cooper, and Pittayachawan 2011). Thirdly, it was important that the selected companies show concern about their environmental impacts since this is one of the prime drivers of Green IT (Chen, Boudreau, and Watson 2008; Molla and Abareshi 2011). Therefore, case candidates needed to have the following characteristics:

- Annual turnover greater than Rs50 million.
- Organisational structure headed by a board of directors and team of executives.
- High level of IT infrastructure.
- Inclusion of environmental concerns in organisational strategies.

Cases were then selected based on theoretical sampling. According to Eisenhardt and Graebner (2007, 27), theoretical sampling refers to the selection of cases which are “particularly suitable for illuminating and extending relationships and logic among constructs.” The websites of large companies from the five main sectors of the economy were therefore scanned to select the ten companies that met the established criteria.

3.7.4 Collecting case study data

Once the selection has been made, case study data can be collected. Typical case study data collection techniques include interviews, documents, observation and even questionnaires (Eisenhardt 1989). Observation was not considered appropriate for this study since it would require the researcher to be part of several organisations over an extended period of time (Saunders, Lewis, and Thornhill 2009). Questionnaires were also not included in the case study phase as these would be used as a survey instrument once more information about IT governance and Green IT in large Mauritian companies was obtained. Therefore, interviews and documents remained as potential data collection methods. In line with Yin's (2009) recommendation for multiple methods in case study research, it was decided to use both methods for added richness of findings. Interviews and documents are introduced next and discussed in more details in Chapters 4 and 5 respectively.

3.7.4.1 Interviews

Interviews are one of the most popular research methods used extensively in IS research (Schultze and Avital 2011). They consist of an interaction between two people where the interviewer (researcher) poses questions to an interviewee (Teddlie and Tashakkori 2009). In case study interviews, interviewees are part of the phenomenon studied and add depth to the collected data (Eisenhardt and Graebner 2007; Yin 2009). Interviews can be classified as structured, semi-structured or unstructured (Saunders, Lewis, and Thornhill 2009). Structured interviews involve a set of questions which are formulated in advance and rigidly adhered to (Cohen, Manion, and Morrison 2000). They are mostly quantitative in nature (Saunders, Lewis, and Thornhill 2009). Semi-structured interviews provide the advantage of having a predefined list of questions to guide the interview while maintaining flexibility in exploring answers further through additional questions (Saunders, Lewis, and Thornhill 2009). Unstructured interviews are completely open and flexible with no set questions (Cohen, Manion, and Morrison 2000). For these reasons, semi-structured and unstructured interviews are considered to be qualitative and are particularly useful for exploratory research where there is often a need to probe deeper for required data

(Saunders, Lewis, and Thornhill 2009). The semi-structured interview approach was adopted in this research to build case studies. This allowed the interview to be guided by 'a priori' IT governance and Green IT themes identified from literature while keeping the flexibility to seek more information for a deeper insight.

Interviewees had to be contacted next. Since IT governance is overseen by executive level management (ITGI 2003; Peterson 2004; Raghupathi 2007), members of executive management such as the company Chief Information Officer (CIO) or IT Head, Chief Financial Officer (CFO), Chief Operating Officer (COO) and Chief Executive Officer (CEO) were targeted for the interviews. These were identified from each company's website and their contact details were obtained either directly from the website or by calling the company. Each executive leader was then contacted by email or telephone to secure interview appointments.

The validity and reliability of interviews needed to be considered next (Healey and Rawlinson 1993; Saunders, Lewis and Thornhill 2009). One of the biggest strengths of qualitative interviews is their validity or "goodness of data" which arises from the ability of the interviewer to request or provide clarifications, explore the topic from different angles and dig deeper for new insights (Sykes 1991, quoted in Healey and Rawlinson 1993, 345). However, interview reliability or replicability (Yeung 1995) could be questioned due to two possible forms of bias: interviewer and interviewee or response bias (Miles and Huberman 1994). Interviewer bias occurs when the body language, language or tone of the interviewer leads the interviewee to respond in a manner which may not reflect the truth. Response bias results from the interviewee giving answers that are perceived to conform to acceptable or even negative organisational behaviour (Saunders, Lewis, and Thornhill 2009). Both these forms of bias can be decreased if research questions are provided to interviewees in advance so that they are better prepared (Saunders, Lewis, and Thornhill 2009) thereby reducing the possibility of their being influenced by the interviewer or organisational perceptions. Reliability of interview data can also be enhanced through triangulation with other data collection methods (Yin 2009). Therefore, for this research, interview questions were sent to interviewees in advance once interviews had been secured.

Documents and survey findings were used to triangulate interview results where possible.

3.7.4.2 Documents

Documents can include minutes of meetings, shareholder reports or even public records (Saunders, Lewis, and Thornhill 2009). In case study research, documents are commonly used to corroborate and supplement data derived by other methods (Bowen 2009; Yin 2009). For this research, company documents from selected cases were found to document some IT governance and Green IT practices within organisations, whereas government documents provided information about IT governance and Green IT drivers, incentives and support mechanisms affecting the companies studied. The company documents studied included annual reports and, where available, IT policies whereas government documents included legislations, the National Code of Corporate Governance, and national strategies, policies and guidelines.

3.7.5 Analysing case study data

Qualitative data is generally analysed using content analysis (Zhang and Wildemuth 2005). Hsieh and Shannon (2005, 1278) define qualitative content analysis as "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns." They identify three main categories of qualitative content analysis: (1) conventional content analysis where codes are identified directly from text, (2) directed approach which identifies pre-identified themes from existing research and (3) summative content analysis which involves the counting and comparing of key words (Hsieh and Shannon 2005). Content analysis can also be classified as deductive or inductive (Elo and Kyngäs 2008). The deductive method consists of validating data belonging to pre-identified categories (Hsieh and Shannon 2005) which could be derived from a preliminary model (Miles and Huberman 1994). The inductive approach consists of identifying new categories by grouping emerging, similar data under themes (Zhang and Wildemuth 2005).

Both directed and conventional approaches were adopted for this research. Having identified a set of ‘a priori’ codes or themes for IT Governance and Green IT from literature, the directed content analysis approach enabled data belonging to existing themes to be deduced. On the other hand, the conventional method was appropriate to inductively analyse emerging themes. The qualitative content analysis process and draft IT governance and Green IT model resulting from interview and document data are described in Chapters 4 and 5 respectively.

3.7.6 Developing the survey instrument

Once the case study phase is complete, the survey phase begins with the development of the survey questionnaire. As the aim of the survey was to both triangulate and extend case study findings, its questions were primarily derived from the preliminary ITGM deduced from the case study phase and literature review as well as some new elements from literature. This ensured content validity which refers to the extent to which a data collection instrument covers the intricacies of the constructs being explored (de Vaus 2002). The instrument was then pre-tested to identify and correct any problems prior to administering the questionnaire (Hair et al. 2010). Pre-testing an instrument helps to ascertain its face validity (de Vaus 2002). The latter refers to the extent to which the contents of an instrument appear to measure the constructs being explored (Bornstein 1996) and is assessed by having the instrument ratified by a group of people to see whether it makes sense (de Vaus 2002). For this research, the questionnaire was checked by research supervisors and experts with IT governance and Green IT experience before it was finalised. Details of the questionnaire design are provided in Chapter 6.

3.7.7 Collecting survey data

The collection of survey data requires that a population of respondents be identified before selecting a sample and administering the questionnaire. Saunders, Lewis and Thornhill (2009) strongly advise researchers to identify a population which is as accurate as possible, even if it requires combining information from multiple sources. For this research, the population of large companies (yearly turnover exceeding Rs50 million as per *Small and Medium Enterprises Development Authority (SMEDA) Act 2009*) from the five pillars of the Mauritian economy was identified from the 2007 database of the Central Statistical Office (CSO) of Mauritius which was the only one available during this phase of the research. Consequently, this population was refined by calling as many of the companies on the list as possible to discover closures or mergers and find out whether the company was headed by an executive team and had strong IT infrastructure. Some of this information was also obtained from company websites. Groups sharing the same policies, practices, IT manager or CIO, as well as business executives were considered as one company. The 2012 directory of IT companies was also consulted to update the population of eligible companies from this sector.

Population identification is followed by sampling. For this research, it was decided to send questionnaires to all companies identified in the population to increase the chances of having a reasonable response rate to ensure reliable findings. This is because, in addition to their stringent schedules, executives and top managers targeted by the survey often face an overload of survey requests resulting in notoriously low response rates (Cycyota and Harrison 2002). In fact, Cycyota and Harrison (2006) recommend an acceptable response rate of 32% at high level organisational levels, whereas Baruch and Holtom (2008) consider 35% - 40% as adequate.

With the questionnaire finalised and population identified, the survey is ready to be administered. For this research, both company executives (including business and IT) and IT managers were targeted as survey respondents. This decision was made for two reasons. Firstly, although IT governance primarily concerns executive level management (ITGI 2003a; Peterson 2004; Raghupathi 2007), it also relies heavily on the strong buy-in and participation of managers across all organisational levels (Willson and Pollard 2009; Ruey-Shiang, Che-Pin, and Shih 2013). Secondly, several companies from the identified population did not have a CIO, and the inclusion of IT managers in the survey added an IT perspective to the data. A list of CEOs' and, where available, CIOs' and/or IT managers' names, telephone numbers and e-mail addresses was therefore compiled for each targeted company. These were obtained from company websites, liaison networks or a phone call to the company. As suggested by

Cycyota and Harrison (2006), contacts through an existing network of executives were also included in the list, where appropriate, to increase the response rate. A cover letter requesting and encouraging participation in the survey (de Vaus 2002) was then sent together with the questionnaire to each potential respondent. The letter explained the aim of the research and established topic salience to further boost response (Dillman and Carley-Baxter 2000; Cycyota and Harrison 2006; Rogelberg and Stanton 2007).

Except for rare cases where there appeared to be a preference for hard copies, both the letter and questionnaire were distributed to potential respondents by email, as opposed to directly delivering or sending them by post. This was because time was of the essence and electronic distribution of the questionnaire demonstrated a concern for Green IT. Email surveys have also been found to have better response rates (54.7%) than traditional mail surveys (44.7%) (Baruch and Holtom 2008). Each email was personalised and sent directly to potential respondents to increase chances of response (Schaefer and Dillman 1998). While an online version of the questionnaire was created using Qualtrics Survey Software (Qualtrics 2015), it was decided to send another interactive version using Adobe software. This format retained the advantage of quick completion since it did not have to be filled online and enabled the researcher to more efficiently keep track of respondents (the questionnaire was sent back to the researcher once completed) for more personalised follow-ups. Respondents who preferred completing the online version of the questionnaire were given the option to do so. Both versions provided an interactive means of completing the questionnaire, thereby facilitating the process and increasing the response rate (de Vaus 2002).

Saunders, Lewis and Thornhill (2009) recommend follow-ups after one week of questionnaire distribution in order to increase the rate of response. Follow-ups are important since passive non-respondents may either not have received or misplaced the survey, could have been taken up by other commitments or forgotten about the survey altogether (Rogelberg and Stanton 2007). Follow-ups also hihglight the importance of the survey and the respondent's participation (Cycyota and Harrison 2002). For this research, these were mostly done by phone, in an attempt to be more convincing. Where respondents could not be reached by phone, follow-up emails were sent. Details of survey population and response rate are provided in Chapter 6.

3.7.8 Analysing survey data

Prior to analysis, raw data collected from questionnaires needs to be converted into a format that can be analysed This involves numerically coding data (where appropriate), recording it using data analysis software, and checking for errors (Creswell and Plano Clark 2011). A coding scheme or codebook (Saunders, Lewis, and Thornhill 2009) containing codes allocated to possible responses for each questionnaire item (except for open-ended questions) was first created. This facilitated numerical coding of relevant questionnaire data, as well as data entry in an SPSS 21.0 file. Data collected by the researcher was coded and recorded as and when usable questionnaires were received, with each record being checked twice to minimise errors.

The next step was to confirm whether survey items reflected their corresponding mechanism accurately (validity) and consistently (reliability). Failure to do so could result in inaccurate statistical conclusions (Segars 1997). Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were used to explore validity and reliability. Both techniques complemented each other to confirm whether theoretically expected behaviours defined by IT Governance and Green IT mechanisms survey items were accurately and reliably demonstrated by the surveyed population. EFA was used to identify latent variables or factors grouping items under each IT governance and Green IT mechanism. CFA was then applied to confirm the extent to which items represented their corresponding factor. Both techniques are described in more details in Chapter 6.

Following the recommendations of Straub, Boudreau and Grefen (2004) for IT research, three forms of validity were explored: construct validity, factorial validity and unidimensional validity. Construct validity determines the extent to which survey items capture the essence of an underlying latent variable or factor under which they are grouped (Segars and Grover 1993). This is demonstrated when factor items show both convergent and discriminant validity. Convergent validity explores the extent to which items within factors are related, whereas discriminant validity confirms whether items across different factors are unrelated (Gefen 2003). Factorial validity goes one step further to ratify if all factors represent one underlying construct (Straub, Boudreau, and Gefen 2004) and unidimensional validity checks if each item reflects only one latent variable (Gefen 2003). The reliability of items under each factor was determined through their internal consistency. This evaluates the extent to which items correlate with each other and is measured using the Cronbach's (1951) alpha index.

3.7.9 Putting it all together

The CFA of survey data often requires that some items from the initial model be excluded to ensure model fit. Hair et al. (2010) recommend that such results be interpreted with care. It may happen in such cases that the model which finally fits the data is far different from the initial model used to collect it (Maccallum 1986). Thus, changes to a model must be made carefully, with items causing model mis-specifications sometimes being retained due to their theoretical grounding (DiStefano 2005) and face validity (Hair et al. 2010). CFA has also been criticised for resulting in a tendency to accept the first model which fits the data without exploring other alternatives (Maccallum and Austin 2000). Therefore, to further answer the research questions about IT governance and Green IT measures in large companies from key economic sectors of Mauritius, the final ITGM was formulated by combining case study and survey results. The resulting model was then strongly supported by theory. This theoretically-reinforced amalgamation of results served to prevent the consideration of the model fit alone to the detriment of otherwise valid IT governance and Green IT practices, and allowed the exploration of different alternatives for corroboration and expansion of results.

3.8 Ethics approval

Ethics approval was sought from the Curtin University Human Research Ethics Committee for the entire data collection (namely interviews and online survey) and analysis phase of this research. In line with the ethics policy of Curtin University, consent was sought from all research participants (including for interview audio recording) via a consent form for interviews and a consent clause in the participants' information sheet of the survey questionnaire. The research purpose was explained and the confidentiality of data assured. Participants were also provided with the contact details of both the researcher and research supervisors in case of doubts or apprehensions.

3.9 Research process flow chart

The research process is summarised in Figure 3.3. Phase 1 (Chapter 2) consists of a review of literature to better understand the research context and examine existing IT governance and Green IT models to generate a conceptual ITGM. Phase 2 (Chapter 4) involves qualitative interviews and their data analysis to result in the first ITGM draft. This is followed by phase 3 (Chapter 5) which consists of qualitative document analysis to refine the draft ITGM. Phase 4 (Chapter 6) comprises survey data collection and quantitative analysis to develop the final ITGM. The last phase includes a discussion of the final ITGM (Chapter 7) followed by recommendations, limitations and suggestions for future work (chapter 8).

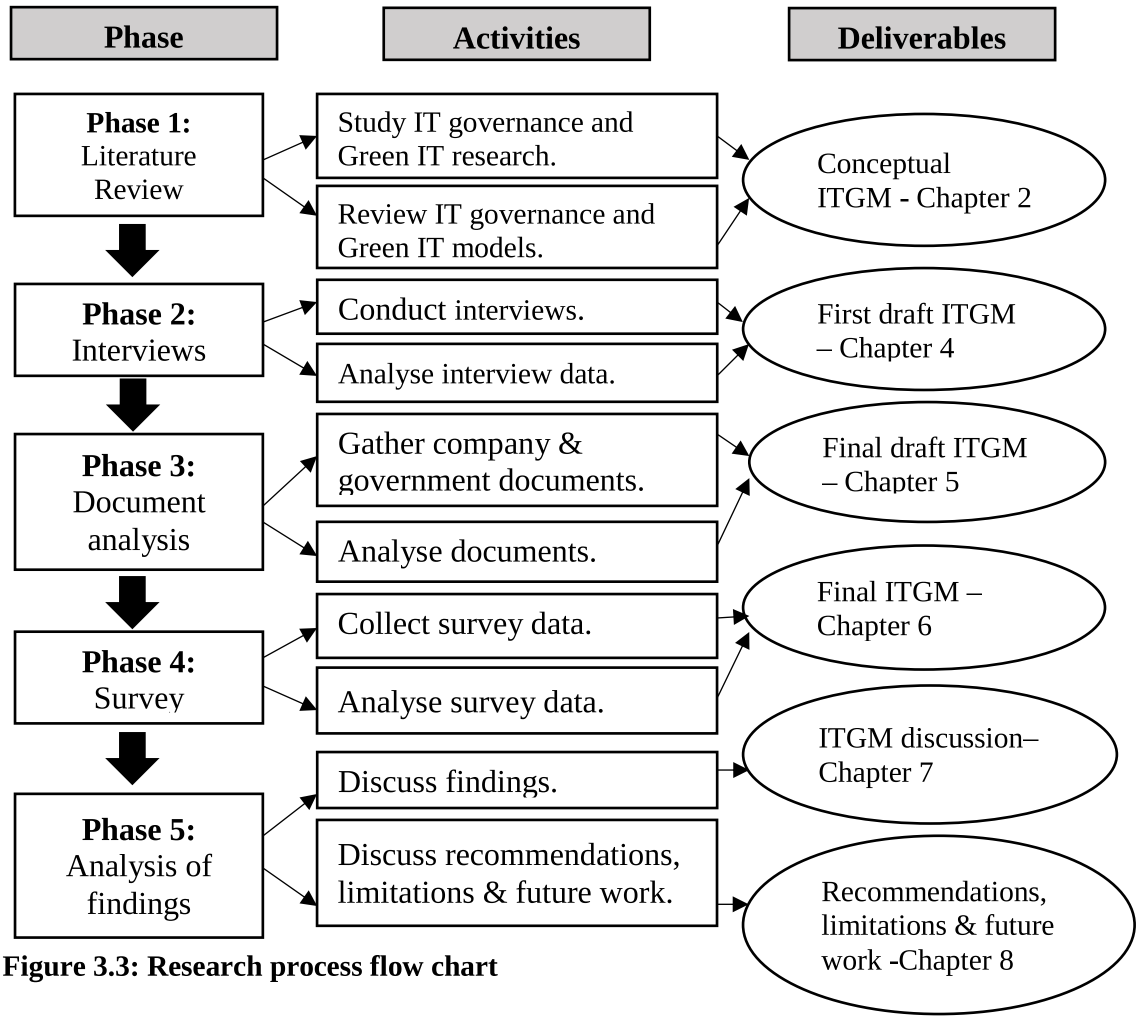


Figure 3.3: Research process flow chart

3.10 Chapter summary

This chapter explains the research decisions made at each layer of the research 'onion' starting from the research philosophy to the research approach, method, time horizon and design. The pragmatist philosophy was found to most appropriately guide this study due to its plurality. The exploratory nature of the research favoured an inductive strategy for which several research methods were analysed. A mixed methods approach combining qualitative and quantitative phases was thought to best assist in answering the research questions. The resulting research design combined the richness of case studies with the rigour of surveys in a sequential process. Interviews and documents were selected as case study data sources with content analysis found suitable for the analysis of the data and the subsequent drafting of an IT governance and Green IT model. The latter, coupled with other relevant items from literature, would then serve as a basis for the design of a questionnaire to be administered during the survey. Factor analysis (exploratory and confirmatory) was chosen to analyse the validity and reliability of survey data. Survey outcomes would then be merged to those of the case study to triangulate and extend results for the development of the final ITGM. This chapter also discusses ethical considerations and provides a summary of the research process in Figure 3.3.

Once the research process was finalised, the case study phase could commence. The next chapter discusses the interview section of the case study.

Chapter 4: Interview

4.1 Introduction

This chapter describes the interview phase of the research and its resulting data analysis leading to a draft ITGM. The chapter explains the interview process starting with the selection of companies and interviewees to the preparation, conduct and transcription of interviews. It then describes how interview data was summarised in a matrix format and analysed using content analysis to create the ITGM.

4.2 Interview data gathering

As part of the first phase of the case study research, ten companies were selected (based on the criteria established in Chapter 3) prior to interviewing some of their executives to gather data. Each interview was one hour long and was secured through company liaisons. This section describes each of the selected companies before explaining how interviews were planned and conducted.

4.2.1 Company descriptions

To preserve their anonymity, each company studied was allocated a code based on their industry. The prefix ‘S’ was used for the Sugar/Cane industry, ‘T’ for the Tourism industry, ‘Txt’ for the Textile industry, ‘F’ for the Finance industry and ‘IT’ for the ICT industry. Each prefix was then followed by ‘Org1’ or ‘Org2’ depending on whether the company was the first or second one to be explored within the industry. Table 4.1 and Table 4.2 show annual turnover and number of employees respectively for each company from 2011 – 2015. The data was primarily obtained from annual company reports. However, not all annual reports contained employee numbers. In such cases, employee data was elicited from the company’s Human Resource or website. Unfortunately, IT_Org2 employee numbers could not be obtained for 2011 and 2013. The subsections which follow briefly describe each company.

Table 4.1: Company turnover from 2011-2015

Company code	Company Turnover (Rs. million)				
	2011	**2012**	**2013**	**2014**	**2015**
S_Org1	3, 953	3, 870	3, 930	3, 878	2, 918*
S_Org2	4, 223	4, 185	4, 078	3, 905	1, 410**
T_Org1	1, 979	2, 007	2, 564	3, 525	2, 672*
T_Org2	3, 723	3, 650	4, 080	4, 209	6, 304
Txt_Org1	2, 046	1, 988	2, 125	2, 097	2, 100
Txt_Org2	944	983	1, 069	876	706
F_Org1	2, 018	2,170	2, 848	2, 772	2, 534*
F_Org2	570	637	537	718	658*
IT_Org1	239	223	253	249	262
IT_Org2	1, 363	1, 405	1,441	1,559	1,188*

* 9 months period ended September 2015

** Half year ended June 30, 2015

Table 4.2: Company workforce from 2011 – 2015

Company code	Number of employees				
	2011	**2012**	**2013**	**2014**	**2015**
S_Org1	1, 438	1, 215	1, 512	1, 523	1, 460
S_Org2	1, 300	1, 334	1, 303	1, 982	2, 023
T_Org1	2, 977	2, 937	2, 968	2, 956	2, 993
T_Org2	3, 053	3, 415	3, 540	3, 700	3, 707
Txt_Org1	1, 602	1, 611	1, 603	1, 706	3, 100
Txt_Org2	1, 515	1, 515	1, 532	1, 538	1, 442
F_Org1	435	450	448	434	416
F_Org2	279	302	295	299	314
IT_Org1	107	102	106	128	121
IT_Org2	Not available	110	Not available	114	180

4.2.1.1 Sugar Cane Industry – Organisation 1 (S_Org1)

S_Org1 is one of the most well-established sugar and energy manufacturing groups in the Mauritian cane industry. The group appears among the Top 100 Mauritian companies and is among the pioneers to be listed on the Stock Exchange of Mauritius (SEM). It also has a strong presence in the African region. The group is led by a board of twelve directors (two executive and ten non-executive), and a dynamic executive team including the company CEO (Chief Executive Officer), CSO (Chief Sustainability Officer) and Group IT Head. IT is recognised for its prime strategic importance and the group goes to great lengths to invest in up-to-date systems for production efficiency and competitiveness. S_Org1 also stands out by virtue of its strong environmental engagement with a focus on energy and waste reduction, environmental monitoring and reporting.

4.2.1.2 Sugar Cane Industry - Organisation 2 (S_Org2)

One of the pioneers of the cane industry in Mauritius, S_Org2 is a well-renowned group not only in Mauritius but also in the African region. From being primarily sugar-oriented, the group diversified its operations to include activities such as energy and alcohol production. The group holds a distinguished position among the Top 100 Mauritian companies and is listed on the SEM. It is governed by a board comprising of eleven directors (four non-executive, three independent and four executive), as well as an effective leadership team of CxOs including its CEO, CFO (Chief Financial Officer) and CIO (Chief Information Officer). The group’s Information Systems are at the heart of its major processes and critical to its strategic operations. S_Org2 is also committed to minimising its environmental impact, promulgating environmental awareness and sustainability reporting.

4.2.1.3 Tourism Industry - Organisation 1 (T_Org1)

T_Org1 is one of the leading groups of luxury hotels and resorts in Mauritius which has a strong presence in neighbouring islands of the region. Among the Top 100 Mauritian companies, the group is also listed on the SEM. Nine directors (four non-executive, two independent and three executive) sit on the group board and the group CxOs include its CEO, CFO and CIO. The group relies strongly on its Corporate and Hotel Management Information System as well as its social media presence to make a difference in the quality of service provided. It also strives to respect the environment and has a strong focus on energy and waste reduction.

4.2.1.4 Tourism Industry - Organisation 2 (T_Org2)

Listed on the SEM, T_Org2 is a Mauritian group of luxury hotels and resorts which has also expanded to other islands in the region. The group appears in the list of Top 100 Mauritian companies. Its board comprises of twelve directors (seven non-executive, three independent and two executive) and it is effectively managed by a strong executive team which includes its CEO, CFO and Group IT Head. T_Org2 relies heavily on its information systems for the smooth running of its operations and has successfully implemented its e-strategy for a marked online presence including e-booking. The group is strongly driven by technological excellence and innovation to obtain an edge over competition. It is also committed to exercising environmental responsibility and maintains a strong focus on energy efficiency and ecological waste management.

4.2.1.5 Textile Industry - Organisation 1 (Txt_Org1)

Txt_Org1 is a subsidiary segment of the SEM-listed, textile cluster of one of the largest conglomerates of the island with regional presence. The board of directors of the textile cluster comprises of nine directors (four non-executive, three independent and two executive). Txt_Org1 is effectively managed by its CEO and a team of executive directors who are also board members. Executive management has a strong belief in Information Technology innovations as a means of continually improving productivity. Txt_Org1 also prides itself on its strong environmental management programme which focuses on carbon footprint monitoring and reduction.

4.2.1.6 Textile Industry - Organisation 2 (Txt_Org2)

Txt_Org2 is a family owned and run business with a strong legacy of textile manufacturing in Mauritius. Its board of directors is limited to family members. The company is led by its CEO and his team which includes the company Head of IT. The organisation relies heavily on its Enterprise Resource Planning (ERP) system and its board is highly committed to environmental sustainability with a strong focus on energy consumption reduction and monitoring.

4.2.1.7 Finance Industry – Organisation 1 (F_Org1)

One of the leading groups in the Mauritian financial industry and with some regional visibility, F_Org1 specialises in insurance, pension schemes, loans and investments. The group is listed on the SEM. Its board comprises of eleven directors (two executive, five independent and four non-executive) and the group is led by its CEO and a team of senior managers including the Group CFO and Head of IS. Since the late 1970s, the group has invested in the use of IT as a strategic enabler. This is reflected in its current IT strategy which focuses on improved efficiency, decision-making and industry resilience. The group is aware of its obligations towards the environment and consequently weighs its decisions with respect to both financial and environmental implications.

4.2.1.8 Finance Industry – Organisation 2 (F_Org2)

F_Org2 is a provider of financial solutions, targeting both local and international markets. Fifty percent of the company is owned by a SEM listed local group with the remaining belonging to a major player of the African financial market. Eight directors (four non-executive, three non-executive and one executive) sit on the company board and its executive team is led by the company CEO, Deputy CEO and COO (Chief Operational Officer). With information technology at the forefront of its operations, F_Org2 demonstrates strong technological focus in order to achieve strategic business alignment. The company is also committed to the protection of the environment and supports multiple environmental initiatives to 'green' its operations.

4.2.1.9 IT Industry – Organisation 1 (IT_Org1)

A subsidiary of one of the largest, SEM-listed conglomerates of the island, IT_Org1 specialises in the provision of cross-industry, IT solutions to businesses across the region. The company CEO is a member of the conglomerate board of twelve directors (eight non-executive, three independent and one executive) and is supported by a leadership team having strong IT expertise. The company's strong belief that IT drives business and vice-versa results in a focus on strategic IT use that aligns with the conglomerate's IT and business strategy. IT_Org1 also recognises the need to be environmentally responsible and its CEO acknowledges that there is a lot of work to be done in this direction. This is reflected in the conglomerate's environmental policy.

4.2.1.10 IT Industry – Organisation 2 (IT_Org2)

IT_Org2 is also a subsidiary of one of the largest, SEM-listed groups on the island. The company has forged its way to becoming one of the leading, regional specialists in IT products, solutions and services across multiple industries. The company is headed by its Managing (Executive) Director who is also a member of the group board comprising of ten directors (one non-executive, six independent and three executive). The company Managing Director is assisted by a team of executives with strong IT expertise. IT is used to support all organisation functions and showcase IT best practices. From its environmental policy it is evident that the company has made a strong environmental commitment, with Green IT being at the centre of one of its environmental projects.

4.2.2 Interviewees

Unfortunately, it was difficult to secure interviews with business executives. Only in three cases (Txt_Org1, IT_Org1 and F_Org2) did the company Executive Director, CEO and COO respectively agree to be interviewed. Instead, most of the business executives who had been contacted preferred the CIO to be interviewed or, where there was no CIO, delegated the interview to the company Head of IT at senior management level (referred to as Group IT Manager in some companies). For S_Org1, the Chief Sustainability Officer (CSO) also participated in the interview with the Group IT Manager. For T_Org1, the Quality Manager in charge of the company's green policies was interviewed together with the company CIO. The researcher was unable to interview both the IT and business executives from the same company. Table 4.3 provides a summary of interviewees from each company.

Table 4.3: Company interviewees

Pillar	Company	Interviewees
Sugar/Cane	S_Org1	Group IT Manager; CSO
	S_Org2	CIO
Textile	Txt_Org1	Executive Director
	Txt_Org2	Head of IT
ICT	IT_Org1	CEO
	IT_Org2	Project Management Unit & IT Manager
Tourism	T_Org1	CIO; Quality Manager
	T_Org2	Group IT Manager
Finance	F_Org1	CIO
	F_Org2	COO

4.2.3 Interview Preparation

Prior to conducting the interviews, interview questions had to be designed. These were centred on 'a priori' IT Governance and Green IT themes identified in the literature review. Questions were designed to better understand company background and structure, as well as its IT governance and Green IT decisions, accountabilities and mechanisms. To increase validity and reliability of interview results, as suggested by Rowley (2012), interview questions were validated with some colleagues and research supervisors to check if they were not leading or vague. The questions were then submitted to the Curtin University Human Research Ethics Committee which subsequently gave them the required approval.

Interviewees were contacted first by phone to make the interview request and then by e-mail to confirm the interview date, time, duration and location. As described in section 3.7.4.1, for improved reliability of results (Saunders, Lewis, and Thornhill 2009), interview questions (see Appendix A), participant information sheet (see Appendix B) and interview consent form (see Appendix C) were sent to the interviewee by email to enable him/her to come prepared for the interview. The information sheet also included a confidentiality clause. This was important to reassure the interviewee about the anonymity of the company and interviewee as well as the privacy of the data gathered (Healey and Rawlinson 1993).

Before each interview, some background research on the company and, where possible, the interviewee(s) was always conducted. This was mostly done by studying the company website which also often included the interviewee profile.

4.2.4 Conducting the Interview

As indicated in Table 4.3, twelve interviews were carried out. Most interviews were conducted face to face on the company premises. The interviewer began each interview by stating the purpose of the interview before requesting permission to audio record the session. This enabled the interviewer to better focus on the interview and simultaneously keep an accurate record of all responses. Where audio recording permission was not granted, the interviewer took notes for each response provided. In cases where the interviewee did not have immediate answers (e.g. responsibilities of the energy officer at Txt_Org2), responses were obtained through follow-up emails. For S_Org2, the interviewee was unable to schedule a face-to-face interview but sent his responses to all questions and follow-up questions by email.

4.3 Data Preparation

As a prelude to data analysis, a written account of the interview data needs to be produced (Zhang and Wildemuth 2005). In this research, this was done in two phases: interview data transcription and data summary. Each phase is described in the sections which follow.

4.3.1 Data transcription

In order not to lose the essence of the data, it was important to produce a transcript of the recording soon after each recorded interview (Ghauri and Gronhaug 2005). Where interviewees were not comfortable with audio recording, written notes were taken during the interview and a full transcript was produced immediately after each interview to ensure that the complete data was captured. Where email interviews were conducted, the data obtained was still transcribed in the same format as for face-to-face interviews to facilitate analysis. Schilling (2006) suggests that prior to transcribing data, questions pertaining to the number of interview questions and amount of information to be recorded arise. In this case, the researcher elected to transcribe everything that was discussed during the interview to ensure that no data was omitted.

Each transcript included the date and time of the interview, job title of the interviewee, each interview question and corresponding answer. To distinguish between interviewee(s) and interviewer, and to maintain the anonymity of each interviewee, codes were used to identify speakers (Saunders, Lewis, and Thornhill 2009). For example, S_ORG1_I1 represents the first interviewee from the first organisation selected from the sugar industry.

Once each transcript was produced, it was carefully checked and edited by listening to the recording a second time while reading the written version of the interview. This enabled any transcription errors such as typing errors and omissions to be identified and corrected. Each transcript was then saved separately using a specific file name to facilitate access but preserve confidentiality, e.g. S_Org1_T.docx contains the transcript of the interview conducted at the first organisation from the sugar industry.

4.3.2 Data summary

Transcripts provide 'extended text' which needs to be reduced and displayed in a format more conducive to analysis. For example, interview data can be summarised as matrices to facilitate analysis (Miles and Huberman 1994; Elo and Kyngäs 2008). As the data is displayed, it moves up one level of abstraction from being just descriptive to explanatory (Bazeley 2009). With IT Governance and Green IT accountabilities, decisions and mechanisms identified as 'a priori' themes and following Weill and Ross's (2005) matrix approach of specifying company IT governance, a matrix display format was adopted to summarise the interview data.

As illustrated in Appendix D (Tables D.1 – D.5), matrices were compiled for IT Governance and Green IT **accountabilities**, **structures**, **processes** and **relational mechanisms** respectively. Each matrix was used to explore accountabilities or mechanisms across the six IT decisions types identified from literature review (**IT investment and prioritisation**, **business application needs**, **IT infrastructure**, **IT**

architecture, **IT principles** and **Green IT**). Other Green IT mechanisms including Green IT **attitude**, **policy**, **practice** and **technology** were also summarised in matrix format. Not only did the matrices facilitate data categorisation, but organising the data in this format also made the comparison of IT Governance and Green IT between companies from the same industry as well as across industries easier. The next sections illustrate how interview content was analysed.

4.4 Interview content analysis

Once each matrix was filled for IT governance and Green IT accountabilities and mechanisms, the data coded in each matrix was analysed using the qualitative content analysis method to pick up similarities and emerging patterns across the ten companies studied. This is discussed in the sections which follow.

4.4.1 Analysing IT governance accountabilities across IT decision types

Weill and Ross (2005) stress the importance of establishing IT decision-making accountabilities in order for IT to align with business objectives. Identifying who is/are responsible for business IT decisions is therefore crucial for good governance of IT. As discussed in section 2.3.4.7, Weill (2004) identifies six categories of IT accountability groups which he refers to as "IT archetypes". These include executive ownership of IT decisions (**business monarchy**), IT executive accountability (**IT monarchy**), Business Unit (BU) Head responsibility (**feudal**), collaborative ownership among both business executives, IT executives and BU Heads (**federal**), IT executive ownership shared with either business executives or BU Heads (**IT duopoly**) and end user responsibility (**anarchy**). Archetypes may vary depending on the decision type. Identifying and analysing IT decision-making archetypes across IT decision types is therefore required to better understand IT governance accountabilities within the companies studied. Table D.1 from Appendix D provides the data matrix produced to summarise company IT accountabilities pertaining to each IT decision type starting from Green IT decision-making accountabilities to decisions relating to IT investment, business application needs, IT infrastructure, architecture and principles. Analysis of archetypes across each IT decision type revealed several common accountabilities.

These are summarised in the concept map in Figure 4.1. For example, Green IT accountability is held by either business and IT executives or IT executives only – hence the identification of business or IT monarchy as a Green IT accountability archetype. Company executives are accountable for IT investment and prioritisation and are therefore governed by a business monarchy. Decisions regarding business application needs are not only the responsibility of both business and IT executives, but also involve BU Heads. This accountability takes different forms including business monarchy, IT duopoly and, where BU Heads also hold direct accountability, federal. IT infrastructure and architecture decisions involve both business and IT executives either in a business monarchy or IT duopoly. Accountability for IT principles involve business and IT executives either in an IT duopoly, business monarchy or, when BU Heads are also responsible, federal archetype. Accountabilities are analysed in more detail in the sections below.

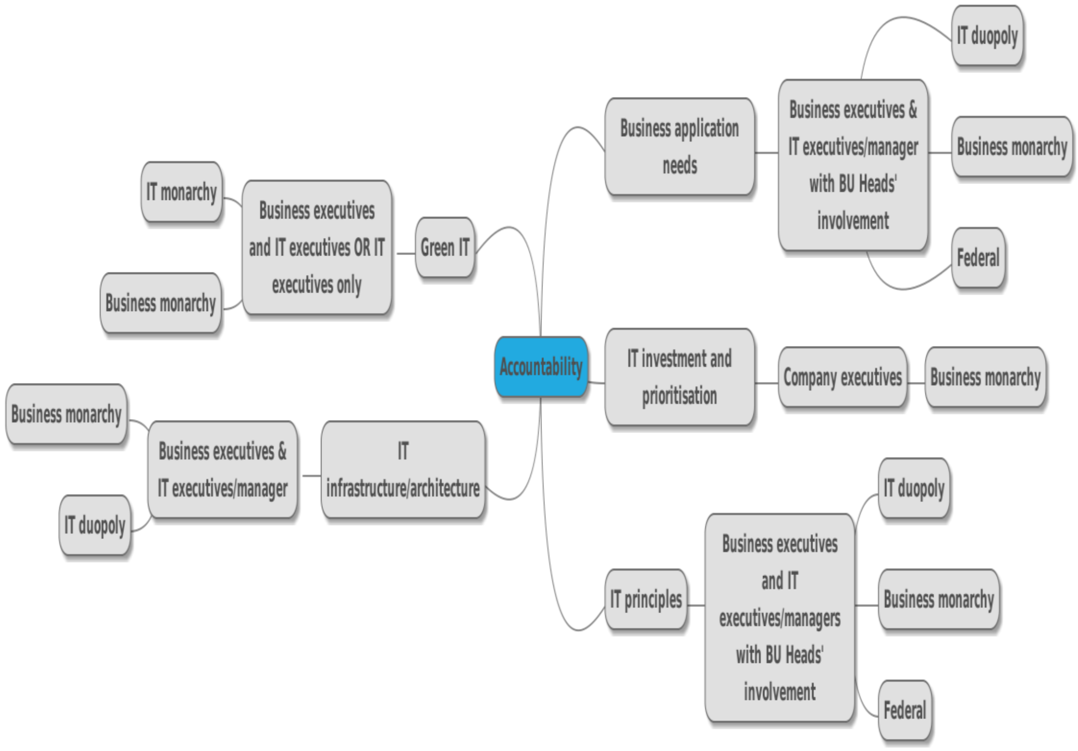


Figure 4.1: Concept map illustrating accountabilities across IT decision types.

4.4.1.1 Green IT accountabilities

Green IT accountabilities were found to be the prime responsibility of business and IT executives (business monarchy) or IT executives only (IT monarchy). Business monarchy is particularly apparent in the sugar and textile companies where Green IT decisions are driven by business executives. For the tourism companies, Green IT responsibility resides with either the CIO (IT monarchy) or the business executive (business monarchy) following input from the Head of IT. Accountabilities for the finance companies vary from the CIO (IT monarchy) to the IT executive committee (business monarchy), whereas for IT_Org2 the Managing Director (business monarchy) drives Green IT decisions. Interviews also showed that even when Green IT accountability rests on a business monarchy, company executives responsible for IT (CIO, COO, Executive/Managing director, CFO, or Managing Director) are mostly involved in the decision. A possible explanation could be that the implementation of Green IT initiatives is primarily the responsibility of the Head of IT. The only exception is IT_Org1 where Green IT decisions are driven by individual BU Heads. However, decisions are still guided by IT knowledge, since at IT_Org1 all BU Heads have strong IT backgrounds. The interview also revealed that, currently, Green IT is not one of the company's top considerations; hence the lack of CEO ownership for Green IT decisions.

4.4.1.2 IT investment and prioritisation accountabilities

IT investment and prioritisation decisions are the responsibility of company executives (business monarchy). IT budgets and enterprise-wide IT investments also have to be approved by the board, while other IT investments require executive approval. Clearly, IT investment decisions are not isolated from the business strategy and executives are concerned about wise IT choices for business benefits. The exception in this case is S_Org2 where accountability is federal as it is not only shared between business executives and CIO: BU Heads also own the decision, showing that they are important stakeholders in aligning IT investments with business value. Business executive approval, however, remains the prime archetype adopted for IT investment and prioritisation decisions.

4.4.1.3 Business application needs accountabilities

Business application needs decisions were found to be the responsibility of business and IT executives/managers with the involvement of BU Heads. For example, the sugar companies have adopted the federal accountability mode for their business application decisions. The decision is a collaborative one involving business executives, IT Heads and BU Heads to ensure that whether purchased, customised or internally developed, IT solutions merge business unit requirements with strategic IT objectives. The textile companies and IT_Org2 have a similar approach where IT managers collaborate with business executives to reach a decision. However, in this case, BU or Factory Heads bring their input to the decision instead of being directly accountable; hence the IT duopoly model. For T_Org1, business executives are accountable for business application decisions (business monarchy), with equal responsibility shared among the IT executive (CIO), and the business executives (COO and CEO) of the IT steering committee. Again, decisions are made following the inputs from BU Heads.

T_Org2 also follows the business monarchy model. However, in this case, the CFO, also Head of IT in the company, makes business application decisions following input from the IT manager who, in turn, liaises with hotel General Managers, Residential Managers and department Heads. For IT_Org1, any business executive can take the accountability. However, it is important to note that for IT_Org1, each business executive heads a business unit and forms part of the executive committee. At both F_Org1 and F_Org2, IT and BU Heads were found to share responsibility for small technical changes related to existing IT solutions such as upgrades to meet business unit needs. In these cases, the CIO is accountable for the technical aspects of the change and the BU Head is responsible for its alignment with business unit requirements. However, if the decision involves strategic IT solutions or is enterprise-wide, following inputs from BU Heads, accountabilities rest with the executive committee and the board; hence the business monarchy mode for both financial companies.

Therefore, for all the companies interviewed, it can be concluded that along with IT and/or business executives, business application decisions also involve BU Heads. This involvement is either as an equal partner in the decision (federal) or as a source of input prior to decision-taking for business executives to combine business unit IT needs with strategic business considerations. Therefore, business monarchies or IT duopolies (both with BU Head involvement) or federal archetypes involving business and IT executives as well as BU Heads, determine the accountabilities regarding business application needs.

4.4.1.4 IT infrastructure and architecture accountabilities

It was found that, for most of the selected companies, IT infrastructure and IT architecture decisions were based on the same accountability model involving business executives and IT executives/managers. For example, for the sugar companies, purely technical infrastructural decisions (e.g. server purchase) or architectural decisions rely solely on the company IT executive/Head (CIO or IT manager). However, for enterprise-wide, strategic decisions, business executives also need to be involved; hence an IT duopoly for S_Org1. For S_Org2, this decision is taken collaboratively by the CIO, business executives and the BU Heads. A similar structure is seen in the finance companies where purely technical decisions rely on the CIO alone, whereas business and IT executives collaborate (business monarchy) for infrastructural and architectural decisions relating to enterprise-wide, strategic IT solutions. A business monarchy model is also adopted by T_Org1, where IT and business executives collaborate. The CFO and IT manager (IT duopoly) shoulder infrastructural and architectural responsibility for T_Org2. Likewise, the Executive Director/CEO and IT manager form an IT duopoly to drive both IT infrastructure and architecture in the textile companies. At IT_Org2, the Managing Director collaborates with the IT Project Coordinator (IT duopoly) for infrastructural IT decisions and the Group IT Coordinator (business monarchy) for IT architectural decisions. The Group IT Coordinator is responsible for architecture standardisation across the group, and thus needs to be involved. At IT_Org1, the CEO joins the CFO for IT infrastructure accountability (business monarchy) and shares with the Data Centre Manager the responsibility for IT architecture decisions (business monarchy).

Therefore, enterprise-wide IT architecture and architecture decisions rest primarily on a business monarchy or IT duopoly mode. In either case, both business executives and IT executives/Heads hold accountability for strategic infrastructural and architectural IT decisions. S_Org2 appears to be the exception where BU Heads also take responsibility. However, irrespective of the mode of accountability, the responsibility of business and IT executives/Heads for strategic decisions regarding IT infrastructure and architecture was common to all study participants (businesses).

4.4.1.5 IT principles accountabilities

Accountability for IT principles is mostly shared between IT managers/executives and business executives who demonstrate concern for IT use that aligns with business objectives. For example, for the textile companies and T_Org2, business executives and IT managers (IT duopoly) collaborate on this decision. For T_Org1, the finance and IT companies, business and IT executives (business monarchy) shoulder the responsibility for organisational IT use. For F_Org2 and IT_Org2, the board is also involved. The sugar companies demarcate themselves here by also including BU Heads (federal) in this decision.

4.4.1.6 Summary of findings for IT decisions accountabilities

Therefore, based on the analysis of company accountabilities across the five economic pillars of the Mauritian economy, the following inferences were made:

- Green IT accountabilities are mostly business or IT monarchy-based and rely on strong organisational IT responsibility.
- The business monarchy model dominates IT investment and prioritisation decisions. Input/collaboration from BU Heads is solicited and board approval required for the IT budget. For IT investments, board/executive level consent is sought.
- Decisions for business application needs include BU Heads (input or responsibility) and business executives and/or IT executives/managers.

- IT infrastructural and architectural decisions impacting the whole enterprise or business strategy are taken collaboratively by business executives and IT executives/managers. This is primarily represented by either business monarchies or IT duopolies.
- Responsibility for IT principles is mostly shared by business executives and IT executives/managers. Sometimes, BU Heads are also involved.

The derived conclusions were used to develop the first draft of the IT Governance and Green IT model (ITGM) consisting of IT decision types and their corresponding accountabilities. This is illustrated in Figure 4.2. Findings from the interview data are illustrated in red and the section referring to IT decision accountabilities (4.4.1) specified.

IT DECISION ACCOUNTABILITIES

IT decision types	Accountabilities
IT Investment and Prioritisation	Business monarchy
Business Application Needs	Business monarchy or IT duopoly (both with BU Head input) or federal
IT Infrastructure IT Architecture	Business monarchy or IT duopoly
IT Principles	Business monarchy or IT duopoly or federal
Green IT	Business or IT monarchy

Section 4.4.1

Figure 4.2: Draft 1 of ITGM with IT decision types and accountabilities

4.4.2 Analysing IT governance structures across IT decision types

Unless business managers and executives are also involved in IT decision-making, IT use cannot be maximised to achieve company objectives (Peterson 2004). Structures need to be set up to facilitate the liaison between IT and business management for alignment of their objectives (De Haes and Van Grembergen 2009b). Therefore, it is important to analyse the structures of the ten companies explored in order to obtain a clearer view of their IT Governance and Green IT. Table D.2 in Appendix D illustrates the data matrix summarising their IT governance and Green IT structures across IT decision types.

Following an analysis of the IT governance and Green IT structure matrix, common structures were identified across all IT decision types. These are illustrated in Figure 4.3 and include short reporting lines between business and IT as well as the presence of various committees to facilitate business and IT liaison. Structures and findings are further discussed in the sections which follow.

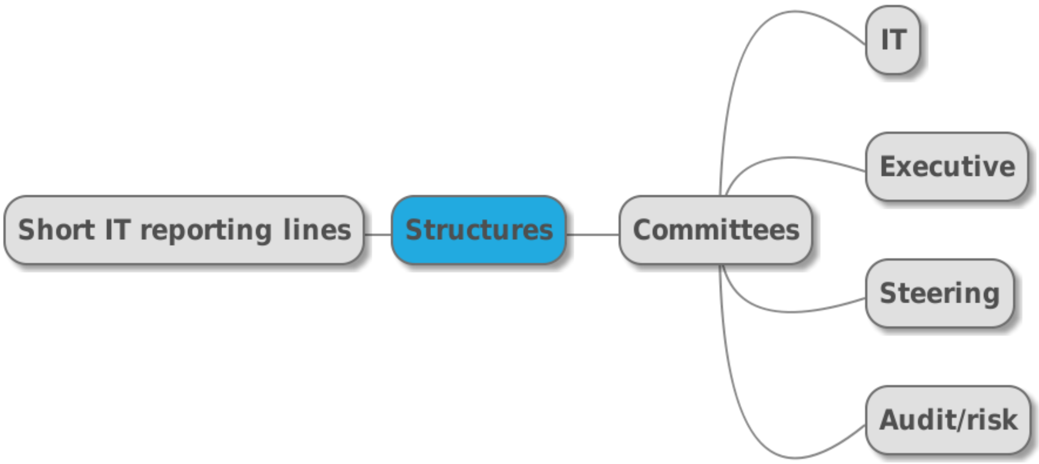


Figure 4.3: Concept map illustrating common structures across IT decision types.

4.4.2.1 Structures common to all IT decision types - short IT reporting lines

Nolan and McFarlan (2005) claim that the presence of at least one IT expert on the company board helps challenge traditional IT practices to assist the board to ascertain business IT adequacy and risks. This was not found to be the case for the companies surveyed where, although CIOs or IT Heads often deliver IT presentations to the board, except for the IT companies studied, none of the others have an IT expert on their board of directors. However, this was compensated by short IT board liaison reporting lines. For example, at T_Org1, F_Org1, S_Org2 and the textile companies, the IT Head (CIO or IT manager) reports to the CEO/Executive Director who is the board IT liaison. At S_Org1 and T_Org2, Group IT managers report directly to the company CFO who then liaises with the CEO representing IT at board level. At F_Org2, the company IT Head reports directly to the COO who is responsible for IT in the organisation.

IT reporting lines differ for the IT companies. IT_Org2 is a member of a group of companies consisting of numerous clusters. One of the clusters is the Technology Cluster of which IT_Org2 is a member. Consequently, IT_Org2 is governed by three boards: the Technology Operational Board, Technology Cluster Board and Group Board. The Group IT Coordinator is in charge of coordinating and standardising IT use across the entire group and is a member of the Group as well as Technology Cluster Board. The Managing Director (MD) heads the Technology Cluster Board which includes the Financial Manager along with representatives from the Group Board. IT_Org2 also functions under the Technology Operational Board of which the Technology Cluster MD and IT Project Coordinator are part to take IT decisions at the company level. Therefore, the IT Project Coordinator reports to the Technology Cluster MD who then reports to the Cluster and Group Board. IT_Org1 also stands out from the other companies with its different structure. Business executives (referred to as 'partners' in the company jargon) with strong IT expertise head each service line/function and report to the CEO who represents IT at board level.

Hence, despite the differences noted for the IT companies, it can be concluded that short reporting lines exist between IT Heads and business executives since, for all the companies, IT Heads were found to report directly to either the company CEO, MD, COO or CFO.

4.4.2.2 Structures common to all IT decision types –committees

IT, executive and steering committees were also found to add structure to IT decisions. For example, at T_Org1, the CIO is a member of an IT steering committee (including CEO and COO) which oversees IT decisions in the organisation and liaises with the board for approval where required. The committee also has an IT security sub-committee which reports back to the IT steering committee on company IT security issues.

Quote from CIO of T_Org1: "The IT steering committee comprises of the CIO, CEO and the COO. It also has sub-committees such as the IT security committee which report back to the IT steering committee."

At F_Org2, the COO, responsible for IT in the company, joins the CEO and Deputy CEO (DCEO) to form the IT executive committee, a sub-committee of the company executive committee, which meets on a monthly basis to make strategic IT decisions. The IT executive committee nominates project owners for IT projects and ensures that for high cost, high risk projects, the project owner is from senior management as opposed to smaller projects which are driven by middle management (e.g. a Head of Department). Similarly, for IT_Org1, the CEO and his 'partners' make up the executive committee responsible for aligning the company's IT strategy with its business strategy. At S_Org1 and T_Org2, although not formally referred to as an IT committee, the IT manager, CFO and CEO constitute a group which meets regularly to discuss IT decisions and projects. For Txt_Org1, S_Org2 and the finance companies, the IT manager/CIO joins other members of top management in IT project steering committees, often led by the CEO (or COO) and responsible for overseeing strategic IT projects (e.g. implementation of new Enterprise Resource Planning System (ERP)). Further analysis of the data obtained showed that for T_Org1, F_Org1 and S_Org2, the CIO/IT manager is also a full member of the executive committee responsible for overseeing IT decisions having a business strategic impact.

At IT_Org2, the company structure is governed by a set of hierarchical boards which, in turn, consist of committees. IT decisions with little strategic impact are overseen by the Technology Operational Board of which the IT Project Coordinator and Technology Cluster MD are members. However, strategic IT decisions require approval from the Cluster Board and Group Board of which the MD and Group IT Coordinator are members. This approval ensures that IT usage aligns with group business and IT decisions. The group also aims at IT standardisation across its companies; hence the strong involvement of the Group IT Coordinator in its IT decisions. Despite the different structure at IT_Org2, its executives with IT responsibility are also found to be on the same committee or board as business executives, thereby facilitating strategic IT decisions.

Committees for IT Audit/Risks at board level were found to be a common structure across all the companies. While being IT-specific only for S_Org2, in addition to other functions, these committees were found to be responsible for the review of IT processes, IT security and risks.

Quote from CIO of S_Org2: "Business processes supported by IT are reviewed periodically by external auditors and discussed at the level of the board IT audit committee."

4.4.2.3 Green IT structures

A few structures were identified for Green IT decisions. For example, for S_Org1, it was found that the IT manager works with the Chief Sustainability Officer (CSO) and CFO to implement Green IT solutions. The CSO and CFO then report to the CEO who is the board liaison for green IT projects.

Quote from S_Org1: "The realisation of Green IT projects is under the responsibility of the Group IT Manager who reports to the CFO and takes decisions with the collaboration of the Chief Sustainability Officer but the driver is really the CEO who is the liaison for Green IT investments to be approved by the board."

A similar structure was found for S_Org2, except that the CIO collaborates with the Corporate Social Responsibility (CSR) Office for Green IT solutions. This office is driven by the company's CEO. For Txt_Org1, the IT manager implements the Executive Director's vision for IT-driven process efficiencies, whereas for Txt_Org2, the IT manager collaborates with the board-appointed energy officer for energy-efficient IT and IT-driven solutions. Little structure exists for Green IT implementation at IT_Org1. On the other hand, at IT_Org2, Green IT measures are driven by the IT Project Coordinator and Managing Director at the Technology Board level with the MD liaising with Cluster and Group Board for approval. For T_Org1, the CIO sometimes collaborates with the Quality Manager to implement Green IT in line with the organisation's Green IT mission, whereas for T_Org2, the IT manager implements some Green IT measures under the aegis of the CFO. In the case of F_Org1, although there are no formal structures for Green IT, the CIO strongly believes in the power of

IT to drive sustainable behaviours, hence driving some Green IT projects. For F_Org2, Green IT is managed by the IT committee (CEO, DCEO, and COO). Therefore, it can be seen that some Green IT structures have been set up: namely, a Chief Sustainability Officer (CSO) and Corporate Social Responsibility (CSR) office respectively for the sugar companies, a green energy officer for Txt_Org2, technology board supervision for IT_Org2 and IT committee for F_Org2.

4.4.2.4 Summary of findings for IT decision structures

Based on the analysis of company structures within and across the five economic pillars, the following conclusions were drawn:

- Short reporting lines exist between business and IT.
- Committees are set up for improved IT decisions. Examples include IT committees, IT steering committees, project steering committees and company executive committees to ensure strategic IT decisions. Audit/risk committees at board level also include IT audits as one of their functions.
- Some companies have specific structures in place to support Green IT decisions.

The above interview inferences were added to draft 1 of the ITGM to add structures (in red) influencing IT decisions and their accountabilities as well as their corresponding section. The resulting draft 2 of the ITGM is illustrated in Figure 4.4.

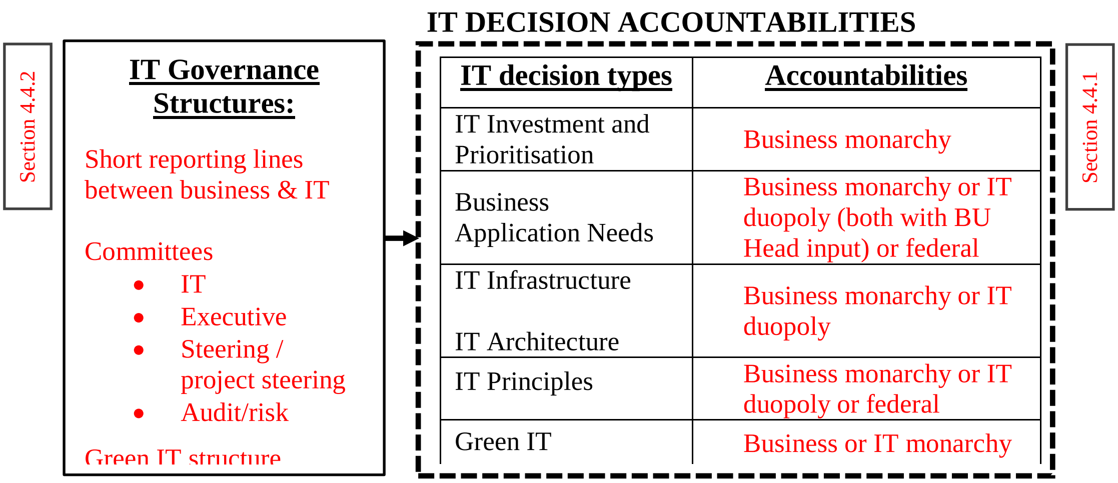


Figure 4.4: Draft 2 of ITGM with IT decision accountabilities and IT governance structures.

4.4.3 Analysing IT governance processes across decision types

With accountabilities and structures in place, methodologies (processes) to enable both the implementation and monitoring of IT decisions have to be formalised to ensure the effective governance of IT (Peterson 2004). Enterprise governance of IT decisions cannot be successful without the orchestration of decision-making processes (Huang, Zmud, and Price 2010). Therefore, processes adopted by the ten companies across decision types were analysed for a deeper understanding of their IT governance and Green IT commitment. Table D.3 from Appendix D illustrates their IT governance and Green IT processes across each IT decision type. A number of common processes specific to each IT decision type were identified following content analysis. These are illustrated in Figure 4.5. For example, IT investment and prioritisation processes include a centralised, yearly IT budget, its monitoring and reporting, business cases to justify IT investments decisions and assessment of IT performance value. Decisions regarding business application needs rest on IT acquisition and development strategies to decide on whether applications should be outsourced, developed in-house or purchased as off-the-shelf packages. IT infrastructure processes include Service Level Agreements (SLAs) and charge-back of IT costs. IT architecture decisions rely on IT policies and processes. IT principles are based on IT best practice, keeping abreast of IT innovations as well as a company strategic IT direction such as a Strategic Information Systems Plan. Processes for each IT decision type are discussed in more detail in the sections which follow.

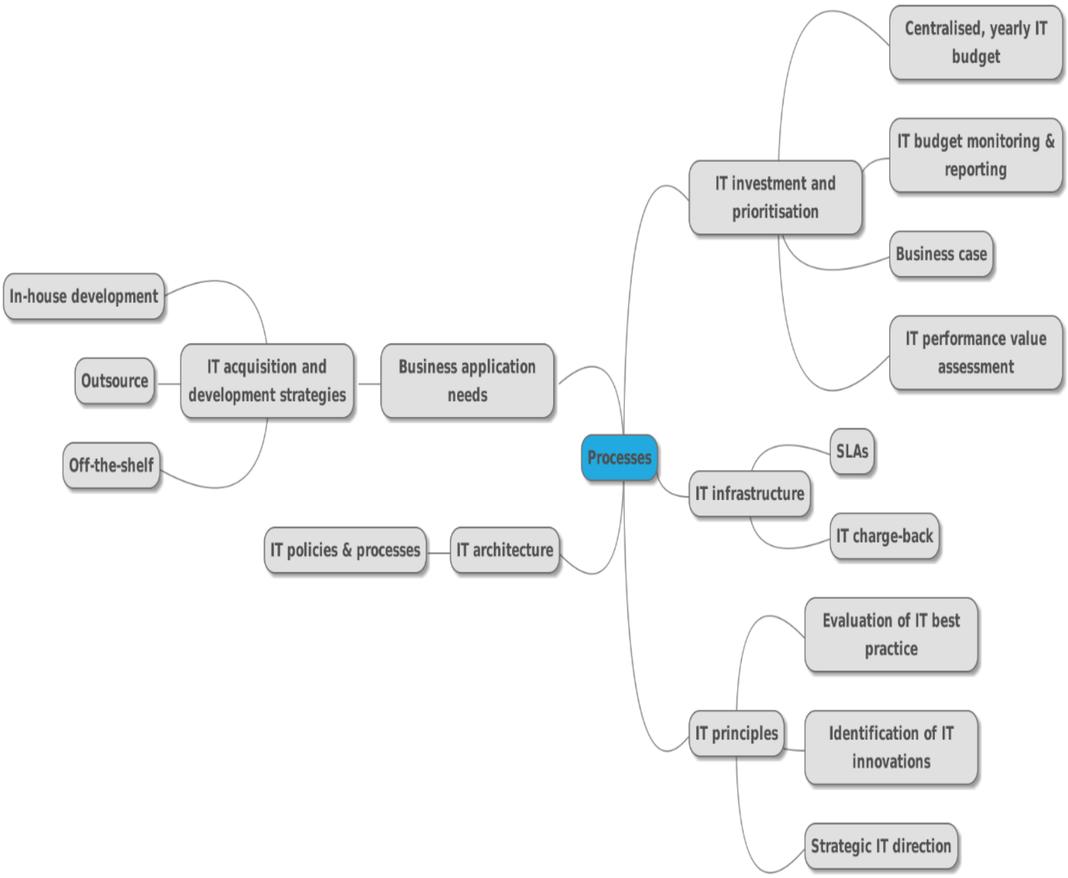


Figure 4.5: Concept map illustrating common processes across IT decision types.

4.4.3.1 IT investment and prioritisation processes

IT investment and prioritisation processes were analysed first. Most companies were found to have a centrally managed, yearly IT budget set by IT Heads or IT steering committees based on projected IT investments and approved by the board. IT costs are then closely monitored and reported back during the year to ensure that IT services are controlled and delivered within the set budget.

Quote from COO of F_Org2: "One month before the presentation of the budget, the Head of IT would talk to the Head of business lines and other departments and then gather their IT requirements to be able to set up an IT budget."

The selection and prioritisation of IT projects were found to be based on business cases for all the selected companies. For example, financial appraisals including ROI, cost/benefit analysis and/or NPV assessment were found to be conducted by all the businesses explored. In addition, the sugar companies and Txt_Org1 evaluate the impact on people, existing systems and processes when selecting IT projects. IT_Org1 also conducts a risk assessment prior to IT investments whereas T_Org1 supports its IT project selection and prioritization with an analysis of the company strengths, weaknesses, opportunities and threats (SWOT analysis).

Although their techniques sometimes differ, assessment of IT investment value was also found to be common in all companies. Regular meetings for feedback on IT investments between IT Head and executives are conducted at S_Org1. For S_Org2, textile, IT and finance companies, IT performance evaluation is more specific and relies on the measurement of pre-defined key performance indicators such as cost reduction, process cycle-time reduction, and measurement of downtimes. On the other hand, the tourism companies evaluate IT performance using customer IT satisfaction surveys. For T_Org1, helpdesk calls are also monitored, whereas at T_Org2, IT cost performance is evaluated during strategic meetings between the CFO and financial controller. None of the companies was found to have an IT balanced scorecard, although it was found that T_Org1 and IT_Org1 tie their IT performance to their overall organisational scorecard. Nevertheless, the use of both business cases to support their IT investment and the assessment of IT investment business benefit, show that the companies studied are concerned about investing in IT for business value.

4.4.3.2 Business application needs processes

The processes related to business application needs were found to centre on IT acquisition and development strategies which include outsourcing decisions and the choice of in-house development versus off-the-shelf packages. For the sugar companies, outsourcing of the development of major bespoke applications such as ERP systems was found to be common due to lack of resources. The textile companies prefer greater control over their IT and hence either customise or develop their software in-house. While some of their IT packages are off-the-shelf, their critical IT solutions (e.g. ERP) are bespoke. Both IT companies opt for off-the-shelf packages with little customisation for IT_Org1 and some in-house customisation where required for IT_Org2. It was found that IT_Org2 outsources its infrastructure services to another company from within the Technology cluster of the group so that control remains internal. None of the tourism companies outsource their IT systems, although they differ in their software acquisition practices. While T_Org1 oscillates between off-the-shelf and in-house bespoke applications depending on their feasibility study, T_Org2 opts for off-the-shelf IT solutions which are customised in-house. The finance companies follow the same strategy as T_Org2, although some less critical activities such as the loan tracking application are developed in-house at F_Org2. Also, while at F_Org1 software support is outsourced, this is handled internally at F_Org2 for faster response. However, F_Org2 does outsource some its less critical IT systems for cost-effectiveness.

Quote from T_Org2: "All our software applications are off-the-shelf. Of course, they will be configured in-house based on requirements."

Therefore, most companies were found to customise and/or develop their critical IT systems in-house for greater control. The only exceptions were the sugar companies which outsource the development of their ERPs due to insufficient expertise and for cost benefits. This behaviour is explained by Ali and Green (2012) who contend that, as IT requirements escalate in complexity, organisations with insufficient resources may need to outsource even vital IT systems. Moreover, excluding IT companies, T_Org2 and F_Org1, all the other companies were found to have a mix of bespoke and off-the-shelf solutions depending on the criticality of the IT-enabled business process, and for cost effectiveness. The off-the-shelf strategy of the IT companies was explained by the need for both businesses to showcase the software which they sell to their clients. F_Org1 and T_Org2 have based their off-the-shelf approach on their organisational strategy which, in turn, focuses on industry best practice.

4.4.3.3 IT infrastructure processes

An analysis of the IT infrastructure processes in these companies revealed that Service Level Agreements (SLAs) with external service providers are commonly implemented. IT charge-back was another practice identified in most of the companies.

Other IT infrastructure processes included training plans for software updates (S_Org2), competency matrix for IT training gaps (T_Org1), and IT asset management tool for IT infrastructure control (S_Org1). However, these processes were not common to all the companies.

Quote from F_Org1: "IT is charged back on a user basis. For example if a server cost is Rs1000 and that server is shared among 5 departments, then depending on the number of heads in each department, the IT cost is apportioned and charged back."

4.4.3.4 IT architecture processes

Enterprise-wide processes for IT architecture compliance help to lower IT costs (Weill and Ross 2005). Consequently, IT architecture processes were examined next. Most companies explored were found to have an IT policy document to standardise IT processes including IT security. The only exception is S_Org1 where a specific IT policy document has not been compiled. However, IT rules regarding technology use have been documented in a section of its Human Resource policy document. S_Org1 has also standardised its IT access control security processes, indicating the existence of enterprise-wide IT processes across the company. Company IT policies are analysed in more details in the next chapter. Txt_Org1 and T_Org1 were also found to have formalised Standard Operating Procedures to support the strategic use of their IT.

Quote from T_Org1: "We have numerous IT rules and policies which dictate the steps and processes for IT governance issues such as security, database, disaster recovery plan and risk management."

Various IT governance frameworks have gained industry acceptance with Control Objectives for Information and Related Technology (COBIT) and Information Technology Infrastructure Library (ITIL) being amongst those most commonly used (Robinson 2005; Simonsson, Johnson, and Ekstedt 2010; Ko and Fink 2010). However, the use of IT governance frameworks was conspicuously absent in most of the companies explored. The only exception was S_Org2 which has adopted several ITIL practices. Moreover, project management frameworks were rarely used. Exceptions include S_Org2 which uses the Prince2 project management methodology and the IT companies which have developed their own project management methodologies based on project management best practice. IT_Org2 also has an IT Administration and Project Management Unit responsible for overseeing IT projects.

Therefore, while numerous IT architecture processes were identified for each of the ten companies studied, only IT policies including IT security were identified as a common process. The use of IT governance frameworks and project management methodologies was also found to be rare.

4.4.3.5 IT principles processes

Processes related to IT principles were examined next. For all the companies, IT principles were found to be based on evaluations of best practice. However, some interviewees admitted that pragmatic decisions and trade-offs are sometimes made to align with the business context. For example, at IT_Org1, IT solutions which respond to requirements but do not necessarily align with current practices are sometimes adopted due to their lower costs. Also, as mentioned by the IT manager at IT_Org2, sometimes the blind following of best practice is like "using a big hammer to hit a small insect." Often, business requirements are much narrower in scope.

Awareness of technological innovations to identify opportunities for business value was also found to be common practice governing IT use in the organisations surveyed. Sometimes vendor-driven, it was found that all IT Heads and/or their team members are expected to keep up to date with the latest technology while on the look-out for innovations that could bring competitive advantage.

Quote from IT_Org2: "Our people are hired because they are best in their category. They are expected to keep their knowledge up to date. They are also sent to forums across the world – in Hong Kong, Europe, the States, South Africa – to keep themselves up to date so that they come back with the latest technology all the time."

Except for S_Org1 and the textile companies, Strategic Information System Plans (SISP) were identified for all companies. These aim at business/IT strategic alignment and are regularly reviewed following business strategy revisions. For IT_Org2, the IS strategic plan is in the process of development. The same applies to T_Org2 where, currently, the formulation of IT strategies is on the CFO's annual list of IT requirements. In the case of Txt_Org1, despite not having a strategic IS plan, the Executive Director's IT vision for the company is embedded in the IT manager's job objectives over a period of six months. Similarly, S_Org1 does not have a formal SISP, but establishes its IT strategy every year following its yearly IT risk assessment. Therefore, it was found that most companies establish an IT strategic direction in line with business objectives.

4.4.3.6 Green IT processes

According to Molla and Cooper (2009), Green IT monitoring is a crucial governance mechanism for organisational Green IT success. Unfortunately, these monitoring measures were identified in only a few of the companies studied. For example, S_Org1 was seen to measure its yearly weight of electronic (including IT) waste in addition to conducting an IT baseline survey to set quantifiable targets for Green IT measures as part of its Environmental Management System. It also issues annual GRI sustainability reports including e-waste reporting. These have been made public via its company website since 2010. Both S_Org1 and T_Org2 have implemented software to measure energy consumption in their server room, while IT_Org2 joins S_Org1 in monitoring printer use. As part of its green certification (Blue Carbon Eco-label), Txt_Org1 uses software to measure its IT carbon footprint. While both T_Org1 and Txt_Org2 monitor their energy consumption, this is not specifically IT-related. None of the other companies appears to have adopted Green IT monitoring and reporting measures.

4.4.3.7 Summary of findings for IT decision processes

To summarise, an analysis of the IT governance processes of the IT decision types for the ten companies explored revealed the following:

- All of the companies studied have processes for IT cost and value control as follows:

    - Most companies have a centrally managed, yearly IT budget which is regularly monitored and reported.
    - For strategic IT benefits, IT investments are supported and prioritised using business cases including financial and non-financial applications as well as an assessment of risks.
    - IT performance value is assessed using measures ranging from measurement of KPIs to feedback meetings. None of the companies uses IT balanced scorecards.
    - IT charge-back and SLAs are common processes for IT infrastructure control.
- All companies have IT acquisition and development processes facilitating buying, building or outsourcing decisions for their IT solutions as follows:
    - Where in-house IT expertise is insufficient (sugar companies), the development of IT solutions (even critical ones) is outsourced for cost-effectiveness.
    - Despite the availability of IT skills, an exclusive off-the-shelf strategy is implemented when:
        - IT solutions used need to be showcased for marketing purposes (IT companies) and
        - industry best practice is off-the-shelf.
    - Otherwise, where IT skills are available internally, a combination of bespoke and off-the-shelf applications is used.
        - Critical IT solutions are customised or developed in-house for greater control.
        - Non-critical IT solutions are acquired from off-the-shelf, where more cost effective.
- For all companies, strategic IT use is based on the following processes:

- IT principles are based on an assessment of best practice and latest technologies for potential business opportunities.
- IT policies including IT security have been formalised to standardise the IT architecture of all the companies.
- Most companies are concerned about the formalisation of their business IT strategic direction. Many of them have achieved this through a Strategic Information Systems Plan.

- IT governance and project management methodologies are not commonly used.
- Green IT monitoring and reporting are rare.

Common processes influencing IT decisions were compiled and added (in red) to the ITGM to produce its third draft depicted in Figure 4.6.. Sections referring to each ITGM block are also included for clarity.

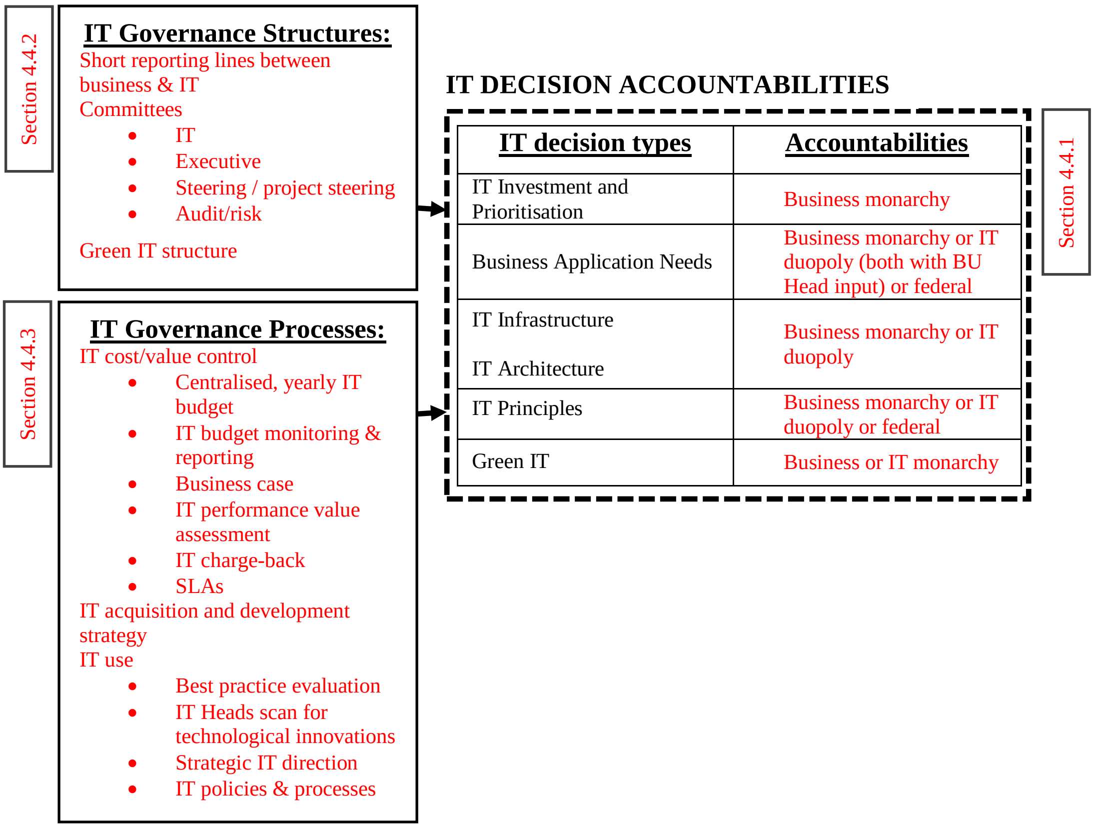


Figure 4.6: Draft 3 of ITGM with IT decision accountabilities, IT governance structures and processes.

4.4.4 Analysing IT governance relational mechanisms across IT decision types

Despite structures and processes, the governance of IT cannot be effective if IT stakeholders do not work together to resolve their differences and converge their expectations for IT solutions that best meet organisational goals (Peterson 2004). Relational mechanisms ensure effective participation and collaboration among CxOs, IT and BU leaders (De Haes and Van Grembergen 2009b). Therefore, the relational mechanisms employed were analysed to identify the measures applied for increased synergy between IT and business. Table D.4 from Appendix D summarises IT governance and Green IT relational mechanisms identified in each IT decision type for the ten companies. Following their analysis, similarities in relational mechanisms were summarised in Figure 4.7. Formal and informal communication fostered by business and IT co-location or centralised business and IT meetings were found to be common relational mechanisms for all IT decision types. Specific to IT architecture decisions, IT governance knowledge management for the dissemination of strategic IT rules and processes to both business and IT was found to be practised by all the companies. These relational mechanisms are discussed in more detail in the sections which follow.

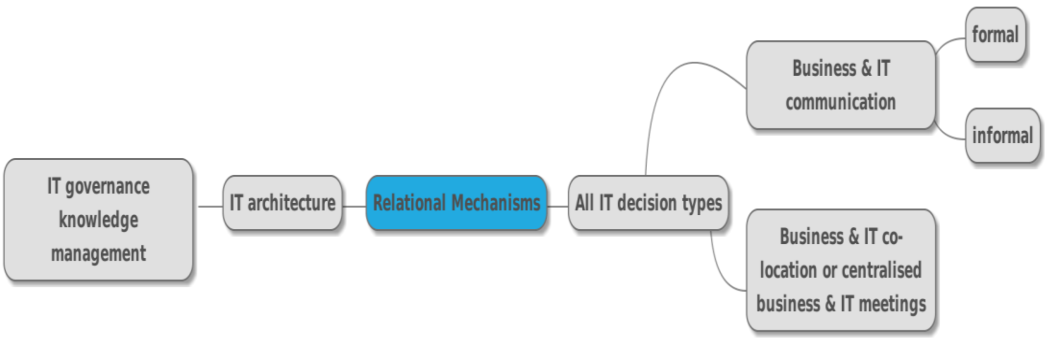


Figure 4.7: Concept map illustrating common relational mechanisms across IT decision types.

4.4.4.1 Relational mechanisms common to all IT decision types – Business/IT communication mechanisms

Several mechanisms to facilitate business/IT partnership were identified. Irrespective of the IT decision type, all companies were found to have an open communication culture (both formal through meetings and informal) not only between IT and business executives, but communication between IT, Head of Departments/BUs and users was also emphasised. Common to all companies was the belief that constant communication between IT and business enhances business/IT understanding so that IT requirements can align with business objectives. Such communication also encourages open discussions about IT risks. Co-location of business and IT was also found to be common for the sugar, textile, and IT companies as well as for F_Org2.

Quote from Txt_Org1: "The IT team is located in the same office and they are close to the main users. Communication also flows between business and IT as everyone is accessible – the door is always open."

For the tourism companies, this was not found to be feasible since hotels are scattered across numerous geographical locations, although co-location of business and IT exists at their Head Office. A similar situation exists for F_Org2 where not all branches and departments are located within the same building. However, for both tourism companies and F_Org2, despite the difficulties arising from the co-location issue, regular, centralised meetings uniting business and IT representatives across all geographical locations are organised to facilitate business/IT communication.

Therefore, business/IT partnership through constant formal and informal communication is a relational mechanism that is used regularly to facilitate all six IT decisions across the companies studied. This was found to be often catalysed by co-location or, where not possible, regular meetings uniting business and IT people spread across multiple locations.

4.4.4.2 IT architecture relational mechanisms

Relational mechanisms specific to IT architectural decisions were also identified. De Haes and Van Grembergen (2008) classify knowledge management as one of the critical drivers for IT to align with business. These include systems such as the company Intranet to facilitate the communication of IT processes. Most companies were found to have adopted mechanisms for the communication of their IT policies and processes. At S_Org2 and F_Org1, IT policies and processes are included in the "employee handbook" with some of them being emphasised in the company Ethics Manual. All Txt_Org1 employees are required to read and sign a copy of the IT policies before this is returned and filed. The IT and tourism companies as well as F_Org2 and S_Org1 post their policies/processes on the company Intranet. In addition, at T_Org1, the IT security sub-committee issues newsletters for IT security communication.

Quote from F_Org2: "We have an Intranet and our IT policies are located there for anyone working in the organisation to have access."

4.4.4.3 Green IT relational mechanisms

Although not common among all companies studied, a few of them have set up mechanisms for employee Green IT awareness. For example, S_Org2 launched awareness campaigns at the beginning of 2013 to sensitise their employees to environmental sustainability including Green IT. Its Green IT policy is also easily accessible to its employees via the company Intranet, noticeboards and posters. Similarly, the toner/cartridge disposal policy of S_Org1 is found on the company intranet for easy employee access. Txt_Org2 promotes Green IT awareness amongst employees in regular emails. At F_Org2, users are regularly made aware of the importance of Green IT practice such as switching off computers before leaving the office and not keeping their screens live when not in use in order to save energy. Unfortunately, Green IT employee awareness mechanisms were not evident in the other companies.

Quote from S_Org2: "The group's green policy is formally documented and communicated to employees by the CSR office. It was also part of a full awareness month recently. The green IT policy which encompasses the actions taken through the "better" usage of technologies is communicated by the CSR office as well through posters, notice boards, Intranet, etc."

4.4.4.4 Summary of findings for IT decisions relational mechanisms

Therefore, an analysis of relational mechanisms across the ten companies revealed the following:

- Formal and informal communication between IT and business is common as a means of aligning IT solutions with business goals and for the identification of risks.
- Communication between business and IT is facilitated by business and IT co-location or regular meetings across locations.
- IT governance knowledge management is a common mechanism used to communicate IT policies.
- With some exceptions, few companies focus on creating Green IT awareness among their employees.

Draft 4 of the ITGM (Figure 4.8) was then developed by adding common relational mechanisms (in red) affecting IT decisions to the model. Since IT governance structures, processes and relational mechanisms make up IT governance mechanisms, they were grouped under this heading. Sections referring to each ITGM accountabilities and mechanisms are also included.

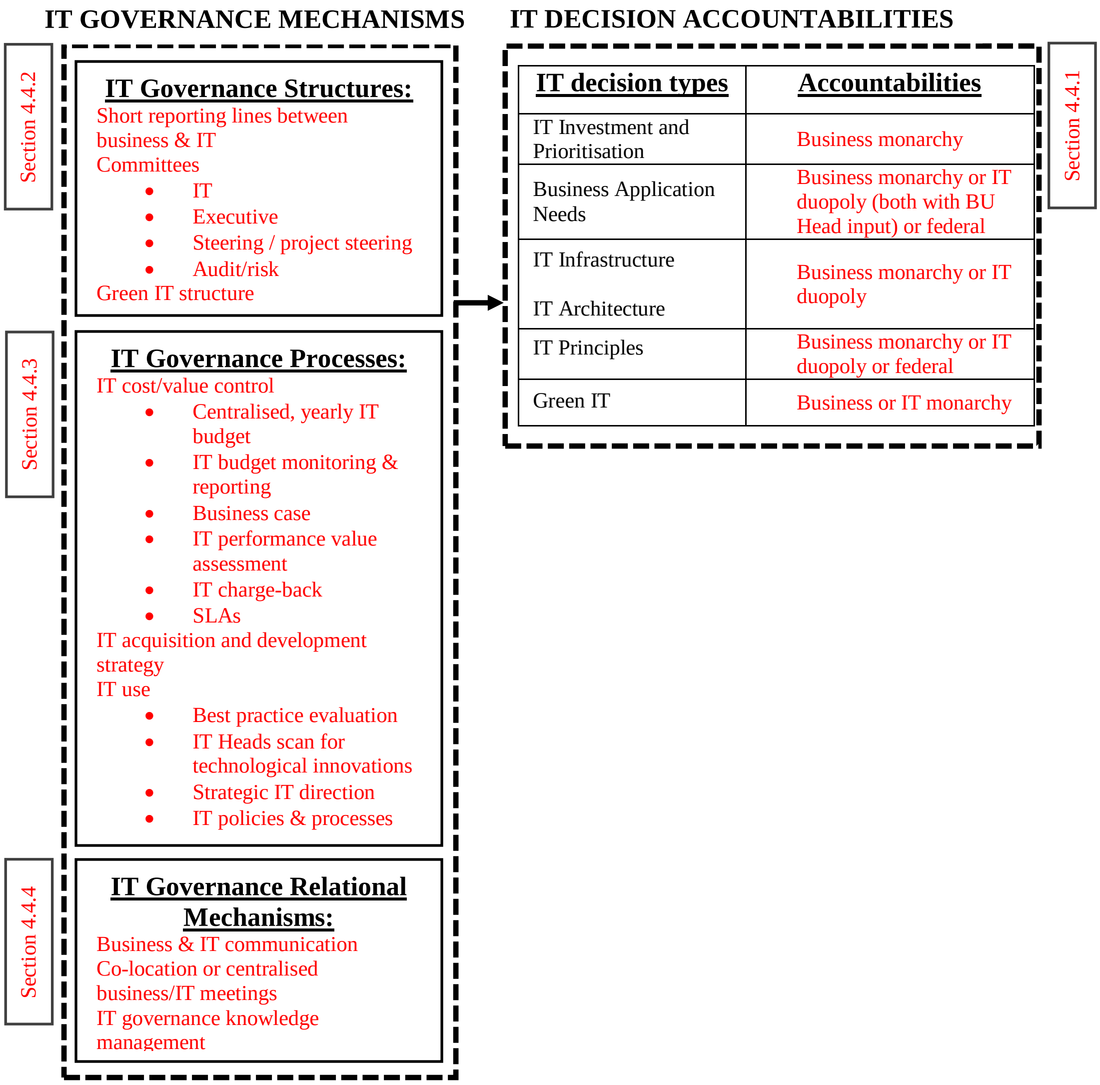


Figure 4.8: Draft 4 of ITGM with ITG decision types, accountabilities, structures, processes and relational mechanisms

4.4.5 Analysing IT Governance drivers across IT decision types

Three IT governance drivers were deduced from Figure 4.8 and the literature. The first one was IT cost and value optimisation which emerged from IT costs and investments control. This is because ITGM structure mechanisms such as the implementation of short IT and business reporting lines (Ferguson et al. 2013) and the set-up of steering committees are motivated by improved leadership, guidance and oversight of IT costs and value (Peterson 2004; Bowen, Cheung and Rohde 2007). In addition, IT cost and value optimisation drive the implementation of the ITGM relational mechanisms. For example, business/IT formal and informal communication, encouraged by their co-location, leads to improved business/IT collaboration which is essential for greater IT value (Chan, Sabherwal, and Thatcher 2006; Bowen, Cheung and Rohde 2007). The dissemination of IT governance knowledge is also driven by cost and value benefits as it makes IT managers more aware of IT governance, thereby increasing its effectiveness (Weill 2004).

Strategic IT alignment was the next driver found to encourage the implementation of ITGM mechanisms identified. For example, structure mechanisms such as short business/IT reporting lines and committees facilitate business IT leadership, thus helping to better align IT with business expectations (Peterson 2004). ITGM processes such as those related to strategic IT use are driven by the need for IT to match business requirements. The ITGM relational mechanisms enable business and IT to better understand each other for business and IT alignment (Goosen and Rudman 2013).

IT risk management was also found to drive IT Governance mechanisms. This was deduced from the presence of structure mechanisms such as risk committee for IT risk oversight, processes such as business case to minimise risks in IT invesments and relational mechanisms such as business/IT communication for shared business and IT responsibility to minimise IT risks. The three IT governance drivers identified (IT cost value optimisation, IT risk management and strategic IT alignment) as well as their corresponding section were added to the ITGM to produce draft 5, as illustrated in Figure 4.9.

IT GOVERNANCE MECHANISMS

Section 4.4.2

IT Governance Structures:

Short reporting lines between business & IT
Committees
- IT
- Executive
- Steering / project steering
- Audit/risk

Green IT structure

Section 4.4.3

IT Governance Processes:

IT cost/value control
- Centralised, yearly IT budget
- IT budget monitoring & reporting
- Business case
- IT performance value assessment
- IT charge-back
- SLAs

IT acquisition and development strategy
IT use
- Best practice evaluation
- IT Heads scan for technological innovations
- Strategic IT direction
- IT policies & processes

Section 4.4.4

IT Governance Relational Mechanisms:

Business & IT communication
Co-location or centralised business/IT meetings
IT governance knowledge management

IT DECISION ACCOUNTABILITIES

Section 4.4.1

IT decision types	Accountabilities
IT Investment and Prioritisation	Business monarchy
Business Application Needs	Business monarchy or IT duopoly (both with BU Head input) or federal
IT Infrastructure IT Architecture	Business monarchy or IT duopoly
IT Principles	Business monarchy or IT duopoly or federal
Green IT	Business or IT monarchy

IT Governance Drivers

Section 4.4.5

IT cost & value optimisation
IT risk management
Strategic IT alignment

Figure 4.9: Draft 5 of ITGM with ITG decision types, accountabilities, structures, processes, relational mechanisms and drivers

4.4.6 Analysing Green IT mechanisms across companies

Molla, Cooper, and Pittayachawan (2011) identify five main characteristics underlying the success of Green IT endeavours in an organisation. They claim that (1) top management positive **attitude** towards Green IT, (2) Green IT **policy** to standardise and communicate Green IT initiatives, (3) Green IT **practice**, (4) **technology** and (5) **governance** involving clear allocation of roles, accountabilities and monitoring of Green IT projects, lead to successful enterprise Green IT. Donnellan, Sheridan, and Curry (2011) also stress the importance of a common understanding of Green IT initiatives within the organisation, thereby showing the importance of relational mechanisms for Green IT. Since governance mechanisms including accountabilities, structures, monitoring processes as well as relational mechanisms have already been analysed for Green IT decisions, these were excluded in the analysis of Green IT mechanisms. Table D.5 from Appendix D summarises Green IT attitude, policy, practice and technology adopted by the ten companies explored.

Despite the absence of Green IT policies in most of the companies, numerous similarities in Green IT mechanisms were identified. These are illustrated in Figure 4.10. For example, the need for Green IT executive leadership to foster a positive Green IT attitude was commonly seen. Green IT practice mechanisms fell under three main categories, namely: (1) Greening IT including regular technological upgrades and Green considerations when purchasing IT, (2) Greening by IT measures such as the use of IT for more efficient production, video conferencing to minimise travel, e-transactions to cut down on paper use and Green printing, and (3) Green IT disposal through recycling, re-use or the services of Green IT disposal companies. Commonly used Green IT technology include energy-efficient hardware, virtualisation and software for resource efficiency. These are analysed in more detail in the sections which follow.

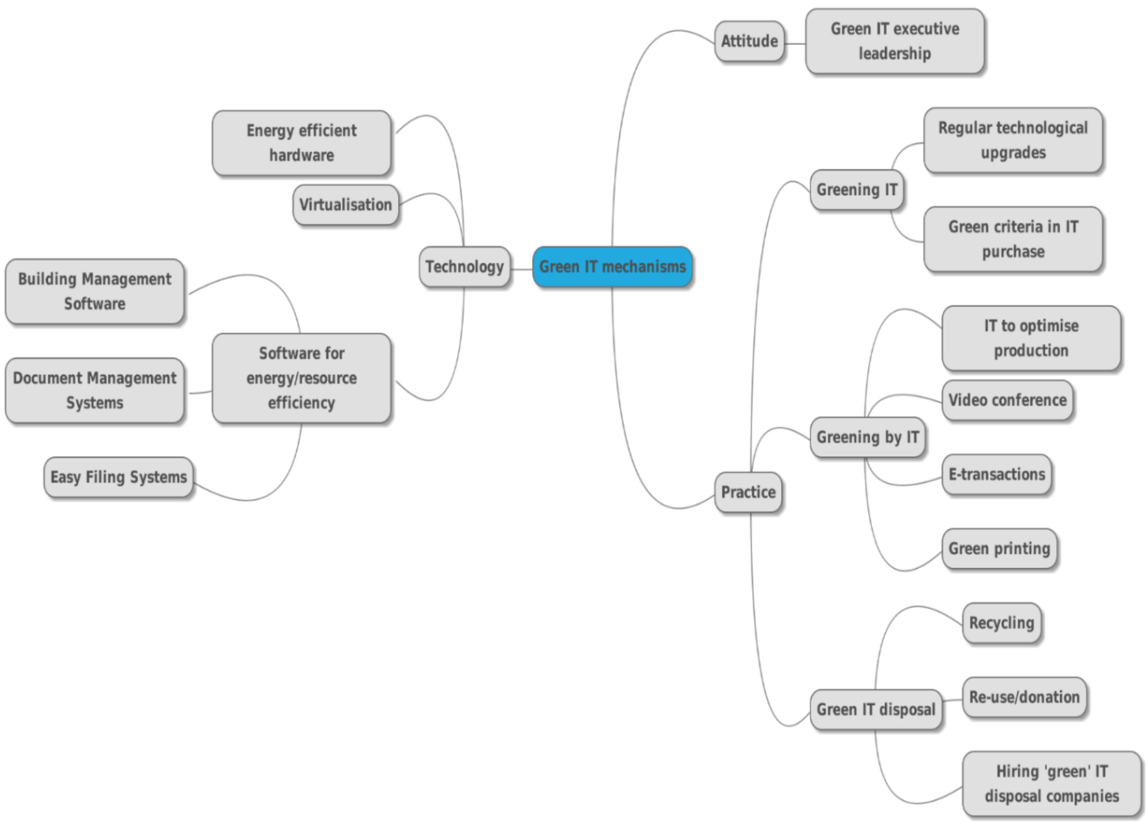


Figure 4.10: Concept map illustrating common Green IT mechanisms.

4.4.6.1 Green IT attitude

Business or IT executive leadership driving Green IT decisions was found to be a common attitude among most of the participating companies. For example, for the sugar companies, Green (including Green IT) initiatives trickle down the organisation from the CEO's vision. Similarly, for Txt_Org1, 'greening by IT' measures stem from the Executive Director's belief in the power of IT to improve resource and environmental efficiency. At T_Org2, using IT for energy consumption reduction is again triggered at business executive level. Business executives at both IT_Org2 and F_Org2 strongly champion Green IT projects. CIO leadership supporting Green IT endeavours was also found to be a useful mechanism encouraging Green IT at T_Org1 and F_Org1. At Txt_Org2, the CEO is committed to energy-efficient IT use. However, not much enthusiasm for Green IT was evident at the executive level of IT_Org1. This was not surprising as Green IT is currently not a company priority. However, during the interview, the CEO did admit that it is just a question of time before ecological IT concerns escalate in importance because of changing customer demands. Executive leadership therefore underlies the implementation of Green IT initiatives in most of the companies explored.

Quote from F_Org2: "Green IT drive comes from the top of the organisation – from the CEO."; Quote from F_Org1: "Green IT is driven by the CIO's personal conviction on the need to reduce our carbon footprint."

4.4.6.2 Green IT policy

S_Org1 was found to have formalised policies for the environmentally friendly disposal of toners and cartridges. It also includes ecological factors for IT purchase in its purchasing policy. A Green IT policy also exists at S_Org2. While IT_Org2 is in the process of developing a policy, Green IT considerations are included in the environmental policy of IT_Org1. However, a Green IT policy or environmental policy including Green IT was noticeably absent from companies in the remaining economic sectors.

4.4.6.3 Green IT practice

Many companies explored were found to 'green' their IT for energy and cost reductions. For example, in the IT and Tourism companies as well as S_Org1, Txt_Org2 and F_Org1, technological upgrades promoting energy efficiency is regular practice. Environmental criteria in IT purchase was also noted. For example, being Eco-Label registered, Txt_Org1 strives to reduce its carbon footprint by purchasing energy efficient technology. Moreover, S_Org2, T_Org2 and F_Org2 show a preference for technology which is labelled 'green' and/or provided by vendors demonstrating ecological concerns.

A number of the companies examined have also used 'greening by IT' solutions to promote energy- and cost-efficient behaviour. For example, Txt_Org1 uses IT solutions to optimise production by producing more in less time.

Quote from Txt_Org1: "For us, it's important to leverage on IT to ensure that we are more efficient in our productivity so that we produce more in a short period of time and use less energy."

T_Org1 encourages videoconferencing and telepresence as alternatives to travel, while both finance companies provide e-services. Green printing was also found to be a 'greening by IT' practice shared by all companies studied. The aim is to effect energy and cost efficiency by cutting down on the number of printers, amount of paper and the energy used for printing. For example, F_Org2 has set up a secured server with dedicated management access to reduce printing during management meetings. S_Org2, T_Org2, F_Org1, Txt_Org2 and IT_Org2 have all moved to centralised, shared printing. S_Org1, S_Org2 and IT_Org1 have invested in collaborative software to reduce printing. At IT_Org2, ecological printing is at the centre of a Green IT project initiated by employees which involves the generation of a print assessment report, an efficient printing plan followed by its implementation, monitoring and reporting. Double-sided printing is encouraged at F_Org2, the textile companies and T_Org1, whereas at S_Org1, F_Org1 and Txt_Org2, greater email use is favoured as an alternative to printing.

Several sustainable IT disposal practices were also identified. For example, S_Org1 and Txt_Org2 were found to recycle toners and cartridges. S_Org1 also encourages IT spare parts reuse. On the other hand, T_Org2 has chosen to donate some of its unused IT equipment as a form of IT reuse. In addition, all the companies support environmentally responsible IT disposal by using the services of IT recycling/disposal companies.

Quote from S_Org2: "The group is engaged in green initiatives at different levels. IT helps the initiative through the reduction of energy consumption and selection of equipment which hold green labels ensures that these consume less energy and are manufactured following international green guidelines. Other departmental programmes are present, such as centralisation of printing equipment and constant employees' awareness regarding the usage of printing facilities (i.e. paper). The *disposal of IT equipment is done through qualified organisations specialised in the dismantling and recycling of electronic equipment."*

4.4.6.4 Green IT technology

A number of energy-efficient IT solutions were found to enforce Green IT practice in the companies explored. Virtualisation for server and energy reduction is a common one. In addition, IT_Org2 and T_Org1 use cloud services. The adoption of energy-efficient hardware was already identified in section 4.4.6.3. This is further supported by the move to more energy saving servers. For example, Txt_Org2 has switched from tower to rack servers and T_Org2 has invested in blade servers. Software including Building Management Software for energy efficiency and collaborative software such as Easy Filing Systems or Document Management Systems for resource efficiency have also been adopted by numerous companies to facilitate Green IT practice.

Quote from IT_Org2: "We have implemented document management systems which avoid all sorts of paper work. We've also adopted electronic workflows which again avoid the usage of paper."

4.4.6.5 Summary of Green IT mechanisms

Therefore, following the analysis of Green IT, the following conclusions were derived:

- Green IT attitude
  - Green IT executive leadership drives Green IT among the companies.
- Green IT policy
  - Most companies do not have a Green IT policy.
- Green IT practice
  - All companies are concerned about 'greening' their IT through regular technological upgrades and by considering Green criteria when purchasing IT products.
  - 'Greening by IT' processes were common to all companies studied. These include processes such as e-transactions, videoconferencing, IT use for production optimisation and Green printing.

    - Environmental IT disposal through reuse, recycling or hiring of Green IT disposal companies is also common.

- Green IT technology
    - Energy-efficient hardware and IT processes such as virtualization are commonly used for improved energy efficiency and to lower costs. Software for energy management and resource efficiency are also adopted to facilitate green IT practices.

Common Green IT mechanisms influencing IT decisions and their corresponding section were then added to the ITGM to develop Draft 6. This is illustrated in Figure 4.11.

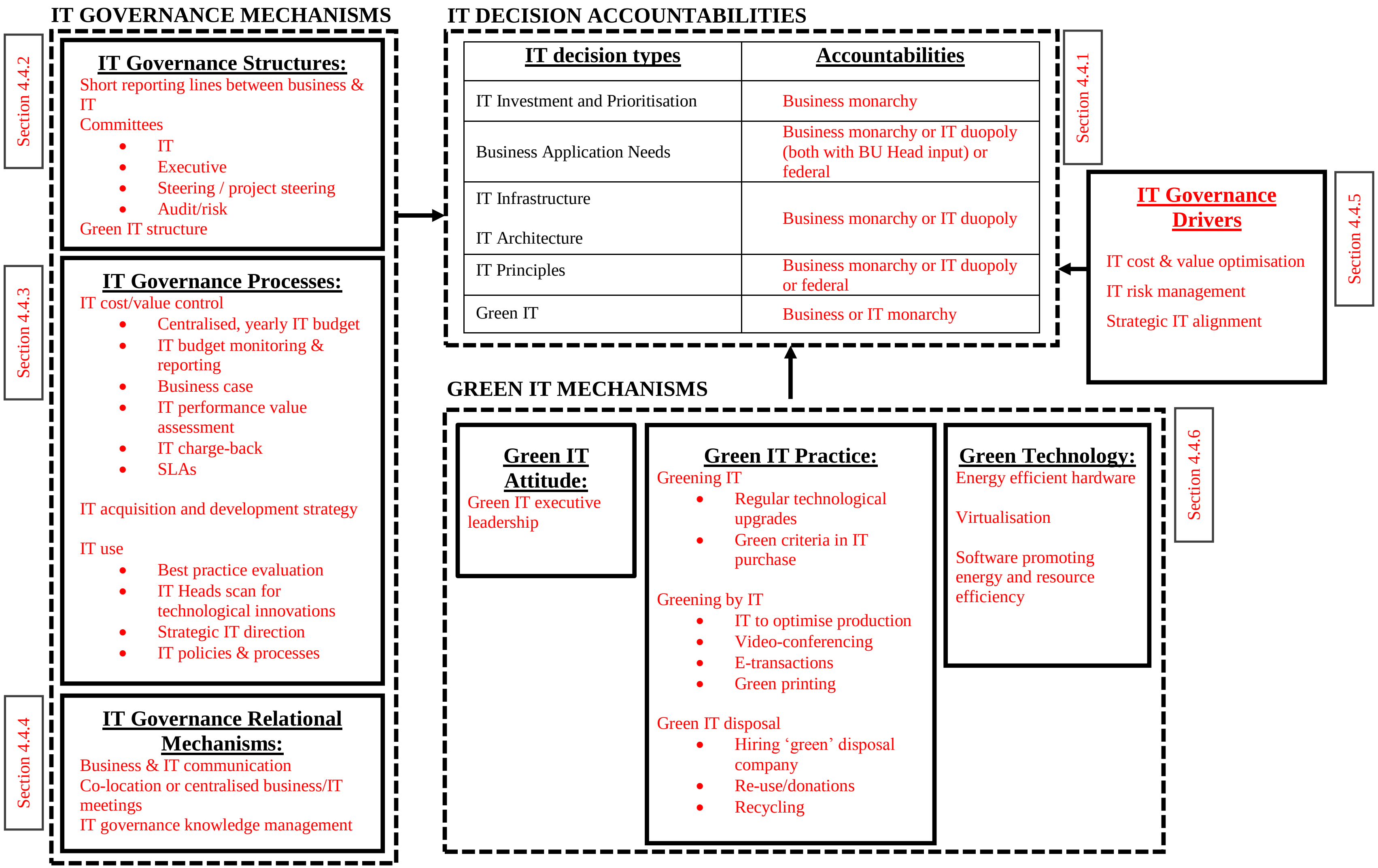


Figure 4.11: Draft 6 of ITGM with IT decision accountabilities, IT governance and Green IT mechanisms and IT governance drivers

4.5 Chapter summary

This chapter discusses the interview phase of this research. It describes the ten companies selected across the five pillars of the economy. It then discusses the interview process by explaining how data was collected, transcribed and prepared in a matrix format prior to being analysed using content analysis. IT governance and Green IT accountabilities, structures, processes and relational mechanisms for IT decision types are explored before synthesising findings into drafts of the IT Governance and Green IT Model. Green IT mechanisms including attitude, policy, practice and technology are also analysed and emerging patterns factored into the draft ITGM.

Several themes for IT decision accountabilities were identified. Whether business monarchy, IT monarchy or feudal, IT responsibility was found to be dominant under Green IT accountabilities. IT investment and prioritisation decisions were found to be primarily governed by a business monarchy. BU Head, business and IT involvement was common for decisions under the business application needs decision category. In this case, BU Heads were found to be either equal partners in the decision-making process (federal) or would provide their input prior to decision-making to ensure that the needs of the business unit are factored into the decision. Where IT infrastructure or architecture has an enterprise-wide and/or strategic impact, usually collaborative decisions were made by both business executives and IT Heads. IT usage accountability was found to be shared between business executives and IT Heads with the occasional involvement of BU Heads.

An analysis of IT structures also revealed several similarities. Short business/IT reporting lines was a feature common to all the companies. It was common to include the IT Head as a member of IT committees and/or steering committees. In some cases, the IT Head was also found to be a member of the company executive committee. All companies were found to have (IT) audit/risk committees for IT oversight. Some companies have also formalised Green IT structures.

Numerous parallels were drawn for process mechanisms. Green IT monitoring and reporting were found to be rare. A centrally managed, monitored and reported IT budget, along with business case analysing financial and non-financial IT investment impacts, were identified as the focal points guiding IT investment and prioritisation decisions. Evaluation of IT investment benefits was found to be crucial in order to determine the business value of implemented IT projects. Where skills and resources are available, business application decisions are governed by in-house customisation or development of prominent IT solutions for greater internal control. The lack of IT skills is addressed by outsourcing. Some companies were found to have an exclusively off-the-shelf strategy either to showcase their own IT solutions for marketing purposes or to follow industry best practice. Others oscillate between bespoke and off-the-shelf solutions depending on their cost and strategic value. Common IT infrastructure decision mechanisms include SLAs and IT charge-back. All companies have formally documented their IT architecture policies. However, rarely have IT governance and project management methodologies been adopted. IT use is dictated by the evaluation of best practice and IT Heads/team's knowledge of the latest technologies appropriate for the business and mostly guided by strategic IT relevance. Many of the companies studied have formalised this in a Strategic Information Systems Plan.

For all companies, the findings for the relational mechanisms pertaining to all decision categories included formal and informal communication between business and IT stakeholders for business alignment of IT solutions. This was found to be enhanced by business and IT co-location or centralised meetings in cases where business and IT stakeholders are geographically dispersed. Knowledge management for the dissemination of IT policies was also identified as a common process. However, despite a few exceptions, Green IT awareness was not identified as a company prerogative.

Based on IT governance mechanisms identified from interviews and the literature, three factors were found to drive the implementation of IT governance in the companies explored. These were categorised as IT cost and value optimisation, IT strategic alignment and IT risk management before adding them to the draft ITGM.

Several Green IT characteristics were also revealed. For example, Green IT executive leadership was found to be an important attitude to promote company Green IT.

Additionally, energy efficiency and cost reductions were identified as the main Green IT drivers. Consequently, 'greening IT' initiatives such as regular technological upgrades and the inclusion of environmental criteria in IT purchase were found to be common. 'Greening by IT' strategies such as electronic transactions, 'green' printing, video conferencing as an alternative to travel and use of IT to optimise production were also identified as Green IT practices. In addition, ecological IT disposal through an IT disposal company, IT reuse or recycling were found to be common. Popular technology adopted to support Green IT practice include energy efficient hardware, virtualisation and use of software for energy management and resource efficiency. In most cases, Green IT policies were conspicuous by their absence.

The next chapter analyses and discusses company and government documents. The findings from the analysis are used for another re-drafting of the ITGM.

Chapter 5: Analysis of Company and Government Documents

5.1 Introduction

Combining data gathering methods in case study research is not only useful to build a comprehensive picture of each case studied but also assists in triangulating the various data sources (Saunders, Lewis, and Thornhill 2009). This chapter presents the secondary data obtained from company documents, Mauritian laws and government strategies. It details the qualitative analysis of this data and resulting inferences to support interview information and identify new IT governance and Green IT determinants. It then adds new findings to the ITGM to produce a more complete model.

5.2 Company documents

Documents analysed from the Mauritian companies explored include annual reports to shareholders and IT policies formalising business IT processes and usage standards. Being publicly disclosed documents, all the annual company reports could be easily accessed. The reports were either retrieved from company websites or hard copies were obtained during visits to the companies. However, not all companies were willing to disclose their IT policies. Of those which were, copies of IT policies were provided by the CIOs or IT managers after they had been interviewed. Unfortunately, none of the companies with a Strategic Information Systems Plan was willing to share this document with the researcher. The next sections discuss each document that was made available for analysis and justifies its inclusion in this research.

5.2.1 Annual Reports

Holder-Webb et al. (2007) identify annual reports as one of the main reporting formats adopted by large companies for governance transparency. This is also seen in large Mauritian companies which are mandated by the National Code of Corporate Governance to draft and communicate annual reports so as to disclose their governance practices to stakeholders. With IT governance ensuing from good corporate governance principles (Willson and Pollard 2009) and Green IT concerns increasingly permeating IT governance decisions (Chen, Boudreau, and Watson 2008), it is not surprising that these annual reports disclose information about IT governance mechanisms and, in some cases, IT environmental responsibility. At the time of document analysis, 2011 and 2012 annual reports were accessible to the researcher. These were analysed to further identify themes influencing IT governance and Green IT in large Mauritian companies.

5.2.2 Company IT policies

Effective IT governance relies on the formalisation and communication of IT policies including IT processes and their expected outcomes (Bowen, Cheung, and Rohde 2007). Additionally, Raghupathi (2007) suggests that IT policies should focus on environmental considerations such as IT asset disposal in order to enhance company reputation. Consequently, company IT policies were analysed for a better insight into their governance of IT and Green IT. All companies studied were found to have IT policies. However, not all of them were willing to make their policies available. A summary of relevant policies made accessible by companies is provided in Table 5.1.

Table 5.1: IT policies made available for analysis

Pillar	**Company**	**IT policies**
Sugar/ Cane	S_Org1	Purchasing policy; Disposal of toners and ink cartridges policy
	S_Org2	Not provided
Textile	Txt_Org1	Information and Communication Technology usage policy
	Txt_Org2	IT usage policy
ICT	IT_Org1	Not provided
	IT_Org2	IT policy currently being revamped – not provided
Tourism	T_Org1	IT policies
	T_Org2	Not provided
Finance	F_Org1	Computer and Information Systems usage policy
	F_Org2	Information Technology security policy and IT usage guiding principles

5.3 Government documents

The external environment within which a company operates strongly influences its governance of IT (Mohamed and Kaur 2012). This includes the regulatory environment as well as other government guidelines and support mechanisms for business. Mauritius is no exception. With financial scandals around the world highlighting the importance of good corporate governance, the Mauritian government understands that the island needs to adapt to changing trends in order to remain globally competitive; hence the enactment of laws, practices and strategies to regulate good governance practices (Committee on Corporate Governance 2004). The following sections provide an insight into the government documents analysed to identify factors relevant to the ITGM.

5.3.1 Regulatory framework

The governance of IT is more effective when controlled by legislation (Pang 2014). Legislative compliance also promotes sustainable IT use in firms (Donnellan, Sheridan, and Curry 2011). Numerous legislations have been established to ensure that organisations are responsibly governed. Reputed ones include the *Sarbanes-Oxley Act 2002* (SOX) of the United States which was institutionalised to improve corporate governance including IT governance (Brown and Nasuti 2005) and the Basel II (now superseded by Basel III) Accord passed for the protection of banks against risks such as those related to technology (Mohamed and Kaur 2012). Organisations are therefore expected to conform to legislations in their governance of IT and its environmental impact. The regulatory framework within which Mauritian businesses operate was therefore analysed for a better understanding of their IT governance and Green IT drivers. Relevant Mauritian legislations were accessed from the Government of Mauritius web portal. A summary of legislations related to IT governance and Green IT is provided in Table E, Appendix E .

5.3.2 National Code of Corporate Governance

The National Code of Corporate Governance is intended to guide the direction and control of Mauritian listed or large private companies, banks and non-banking financial institutions to meet their stakeholder expectations (Committee on Corporate Governance 2004). The Code operates on a "comply or explain" basis under the aegis of the National Committee on Corporate Governance (NCCG).

The growing interest in enterprise IT governance has been propelled by the rising importance of corporate governance in organisations (Willson and Pollard 2009). Sound governance is also considered a sine qua non for organisational carbon footprint reductions (Nidumolu, Prahalad, and Rangaswami 2009). Therefore, to better understand the factors influencing enterprise governance of IT and Green IT in Mauritian organisations, the island's National Code of Corporate Governance was retrieved from the NCCG website and analysed. A summary of IT governance and Green IT-related guidelines from the National Code of Corporate Governance is provided in Table F, Appendix F .

5.3.3 National strategies, policies and guidelines

Formalised policies and processes grounded in best practice guide organisations in defining and implementing their IT strategies (Beachboard 2005). The Mauritian government's staunch faith in the power of IT for business value and sustainable development has been translated into numerous strategic plans, policies and guidelines. These were retrieved from the Government of Mauritius web portal and studied to better understand their influence on company IT governance and Green IT. Documents analysed include:

- National Information and Communication Technology Strategic Plan (NICTSP) 2011-2014 to boost IT use across all economic sectors and transform Mauritius into a leading, regional ICT hub (Gilwald and Islam 2011).

- 'Maurice Ile Durable' (MID) Policy, Strategy and Action Plan which formalises the Mauritian government's vision for a sustainable Mauritius (Ministry of Environment and Sustainable Development 2013)
- National Programme on Sustainable Consumption and Production (NP SCP) 2008-2013 to promote energy efficiency and waste management responsibility in both consumption and production (Ministry of Environment and Sustainable Development 2008).
- National Green Information Technology Strategy, Policy and Action Plan which details the Mauritian government's vision of a Green economy based on technological excellence (Ministry of Information and Communication Technology 2013). This document still awaits formalisation by the current Mauritian government.
- National Computer Board (NCB) Green IT guidelines which promote environmentally friendly uses of technology in business (National Computer Board 2011).

5.4 Document content Analysis

Qualitative content analysis was used to analyse the company and government documents obtained. A deductive content analysis approach was first used to triangulate several IT governance and Green IT themes inferred from interview data and was included in the ITGM. This approach involved scanning documents several times to find IT Governance and Green IT accountabilities and mechanisms. In the process, useful data not belonging to previously identified themes were also picked up. Elo and Kyngäs (2008) suggest that such data be analysed inductively by grouping similar data under new themes. The new data was therefore coded and categorised into emerging IT governance and Green IT determinants including external drivers, government incentives and IT governance support frameworks for IT business value and ecological sustainability. The next sections describe these findings in more detail.

5.4.1 IT governance and Green IT accountabilities

Except for the IT policy documentation of F_Org2, no other analysed document provided specific information on IT decision accountabilities. The IT policy of F_Org2 specifies the role of the board in approving IT policies. It also establishes the authority of top management in the approval of IT project proposals and the creation of Project Steering Committees chaired by a company executive to oversee critical IT projects. This aligns with information derived from the company COO interview where it was found that all F_Org2 IT decisions are characterised by a business monarchy.

5.4.2 IT governance and Green IT structures

Management knowledge of IT and board oversight of IT adequacy emphasised in the National Code of Corporate Governance (Committee on Corporate Governance 2004) were found to support several IT governance structures common to all IT decision types. The presence of risk and audit committees to control organisational risks including IT risks associated with all IT decisions was also a main theme in many of the analysed documents. These findings are discussed and compared with interview data in the sections which follow.

5.4.2.1 Structures common to all IT decision types – IT committees and short reporting lines between business and IT

Little information on IT executive and steering committees could be gleaned from the explored documents. One exception is F_Org2 where, aligning with some of the information obtained from the company COO interview, its IT policy specifies the creation of project steering committees to oversee critical IT projects and IT steering committees to validate IT policies. On the other hand, there was no allusion to short reporting lines between business and IT in any of the documents studied.

However, sections of the National Code of Corporate Governance were found to support the implementation of both mechanisms. For example, the Code highlights management knowledge of IT and board oversight of the adequacy of technology used in the business as important criteria for business/IT alignment (Committee on Corporate Governance 2004). IT committees including executive or steering committees with both management and IT participation help to enforce management IT knowledge. In addition, short reporting lines between IT and business executives help to promote board oversight of business IT use. Therefore, IT committees and short business/IT reporting lines as IT governance structures assist businesses to enforce the Code.

5.4.2.2 Structures common to all IT decision types - Risk and audit committees

The presence of a risk and audit committee at board level was a salient mechanism present in all of the examined company annual reports. For example, the annual reports of T_Org1 reveal that it has an Audit & Risk Management Committee which oversees the company's risk management process. The committee is also responsible for formulating, implementing and overseeing strategies and policies constituting the group's risk management framework. The identified risks include technological risks which could severely disrupt the business as well as environmental risks which could present a serious threat to company reputation. T_Org2 has established a Risk and Audit Committee at board level responsible for overseeing the company's internal controls and risk management systems which include IT. In S_Org1, IT risks are reported to the Risk & Audit Committee, while for S_Org2, these are overseen by a board IT Audit Committee which includes both external auditors and company directors. Both Txt_Org1 and Txt_Org2 were found to have Audit Committees at board level responsible for overseeing company risks including IT risks such as IT system failures. A similar pattern was also seen for both IT_Org1 and IT_Org2 where risks are reported back to the group level Risk and Audit Committee. An IT audit structure at the board level is in the process of being established at IT_Org2.

The need for risk and audit committees as an IT governance structure supporting executive control over company IT risks is also supported by the National Code of Corporate Governance (Committee on Corporate Governance 2004). The Code identifies IT audits as a company director prerogative and mandates the creation of audit/risk board committees for monitoring internal control systems, policies and risk management processes including IT.

Risk and audit committees exercising control over company IT risks at board level were therefore identified as an IT governance structure implemented by all companies studied and mandated by the National Code of Corporate Governance. This finding confirms the presence of risk and audit committees as a commonly adopted IT governance structure.

5.4.2.3 Green IT structures

The upcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) recommends that Green IT accountability be allocated to either the company CIO, environmental managers or CSR managers. However, little evidence of Green IT structures was identified from company documents analysed. The only exception were the annual reports of S_Org1 which disclose the appointment of a management system representative per group entity responsible for the implementation and maintenance of ISO 14001 and ISO 9001. This is overseen by the Chief Sustainability Officer who reports back to the board.

5.4.2.4 Summary of findings for IT decisions structure

The following conclusions on IT governance structures pertaining to IT decisions were reached after an analysis of company and government documents:

- IT committees and short reporting lines between business and IT are supported by National Code of Corporate Governance recommendations.
- The presence of risk and audit committees at board level is confirmed in annual reports and mandated by the National Code of Corporate Governance.
- Green IT structures are recommended by the National Green IT Strategy, Policy and Action Plan.

5.4.3 IT governance and Green IT processes

Numerous IT governance process mechanisms were identified in all IT decision types during the interviews. Findings from the analysis of documents supported many of them. In some cases, the information found in documents enabled a more thorough exploration of a previously identified mechanism or the discovery of a new one. These are detailed for each IT decision type in the sections which follow.

5.4.3.1 IT investment and prioritisation processes

The National Code of Corporate Governance highlights management responsibility for the evaluation of the business IT cost/value relationship (Committee on Corporate Governance 2004). This finding supports a number of mechanisms identified during the interviews and was included in the ITGM. For example, all company IT projects are justified by business cases including both financial and non-financial criteria to prove business value and their performance is assessed following implementation. To improve IT cost control, IT budgets are also centralised, allocated on a yearly basis, monitored and reported on.

5.4.3.2 IT business application needs process

While some of the IT policies analysed identify procedures for the acquisition of information systems, none was found to recommend conditions for in-house development, off-the-shelf solutions or outsourcing. Information on processes for meeting business application needs could not be found in other studied documents either. Therefore, the analysis of documents did not enable the triangulation of IT acquisition and development strategy as an IT governance process.

5.4.3.3 IT infrastructure processes

Interview data analysis identified IT charge-back and SLAs as process mechanisms supporting IT infrastructure decisions. While these mechanisms are not explicitly mentioned in the documents analysed, the National Code of Corporate Governance emphasis on management responsibility for business IT cost/value relationship

(Committee on Corporate Governance 2004) supports their implementation. This is because both IT charge-back and SLAs assist management to ascertain the value of an IT service.

5.4.3.4 IT architecture process – IT policies

Analysis of the accessible IT governance policy documents revealed that IT policies essentially focus on the standardisation of company IT use, IT security and roles of the IT department. For example, both textile companies have documented IT usage policies. Txt_Org1 has formalised an IT usage policy to ensure standardised IT behaviours among all employees. These include guidelines for the use of email, respect of copyright, physical security (including access to server room), data security, backups and restoration. Txt_Org2 compiled its IT usage policy as part of its Worldwide Responsible Accredited Production (WRAP) codes and practices requirements. This includes guidelines on IT security (access control, antivirus and firewalls), backup and restoration, 24/7 availability of IT system, upgrades and auditing to ensure policy compliance. T_Org1 was found to have an extensive array of IT policies to guide both IT usage and IT processes including responsibilities of IT staff, IT security, business continuity, IT acquisition and audit checklist.

Both of the finance companies have formalised their IT usage policies. F_Org1's computer systems usage policy outlines the security and confidentiality expected of company IT users. The policy also specifies access controls and highlights the responsibility of the IT department in protecting company data. Compared to F_Org1, IT policies for F_Org2 were found to be much more comprehensive and detailed. The document not only specifies expected IT behaviours related to data access, confidentiality, integrity and availability; it also clearly spells out several top management accountabilities (refer to section 5.4.1). The document additionally specifies the role of the IT department in formulating and maintaining the policy document as well as that of the Control and Compliance department to ensure policy adherence. The policy also establishes the IT acquisition process.

Therefore, although the interview data revealed that all companies had documented IT policies with a focus on IT security, the analysis of the IT policy documents showed that their scope differs across companies. However, common features identified across all IT policies analysed were rules for IT usage standardisation, IT security measures and the formalisation of IT department responsibilities.

5.4.3.5 IT architecture process – Risk management framework

Although only identified for S_Org1, IT_Org1 and the finance companies during interviews, the annual reports revealed the presence of a risk management framework for each company. For example, in its annual report, F_Org1 discloses that in accordance with its risk management framework, all company risks including IT risks are identified and reported to management, the Audit & Risk Committee and board before being managed. F_Org2 reports the establishment of a robust, Basel II- based, risk management framework which includes management of IT risks. Both S_Org1 and S_Org2 annual reports identify a risk management framework detailing the process for risk identification and response. Similarly, both the textile and tourism companies have risk (technological and environmental) management frameworks overseen by their respective Risk and Audit Committees. A similar pattern is seen in both IT_Org1 and IT_Org2 whose risk management frameworks include risk identification, assessment, response and monitoring. These are then reported back to the group level Risk and Audit Committee.

The need for risk management frameworks as an IT governance process is also mandated by the National Code of Corporate Governance. The Code recommends the implementation of a Risk Management System defining the process for risk identification, assessment, response and reporting in areas including IT, and allocates this responsibility to a Risk and Audit Committee at board level for greater control (Committee on Corporate Governance 2004).

The Mauritian regulatory framework further enforces the need to implement risk management frameworks. For example, the *Insurance Act 2005* as well as the Bank of Mauritius (BOM) Guidelines on Internet Banking (Bank of Mauritius 2001), Operational Risks (Bank of Mauritius 2008) and Corporate Governance (Bank of Mauritius 2012) stress the importance of risk management frameworks for improved risk (including IT risks) monitoring and control. Other laws reinforcing the importance of IT security measures and risk management across industries include the *Electronics Transaction Act 2000*, the *Computer Misuse and Cybercrime Act 2003*, and the *Data Protection Act 2004*.

A risk management framework, mandated by the National Code of Corporate Governance and the Mauritian legislative environment, was therefore found to have been established and disclosed by all companies studied. This IT governance and Green IT process mechanism substantiates the information gathered from interviews and is a new addition to the ITGM. The identification of risk management frameworks also serves to further confirm IT risk management as an IT governance driver.

5.4.3.6 IT principles process

Interview data revealed that most company executives believe in establishing a strategic direction for IT to maximise business/IT alignment. It was found that most companies translate this vision in their SISP. This mechanism is supported by the National Code of Corporate Governance which mandates IT board oversight for business/IT alignment (Committee on Corporate Governance 2004). However, no SISP was disclosed to the researcher for further exploration.

5.4.3.7 Green IT process

Green IT monitoring and reporting initiatives were difficult to find in the analysed documents. The only exceptions were the sugar companies. S_Org1 disclosed the measurement and reporting of its e-waste in its annual reports. While not specifically mentioning Green IT measurement, S_Org2 reiterated its intention to publish its first GRI sustainability report for environmental transparency and to promote environmental awareness among its stakeholders. Therefore, this lack of Green IT monitoring aligns with interview data where few companies were found to measure and track their Green IT progress.

5.4.3.8 Summary of findings for IT decisions processes

Based on the analysis of IT governance and Green IT documents, the following inferences were made regarding IT decision processes:

- A number of process mechanisms from interview data analysis were supported by the documents analysed. These include:
    - Business case analysis
    - IT performance value measurement
    - Central, yearly IT budget
    - IT budget monitoring and reporting
    - IT charge-back
    - SLAs
    - IT policies
    - Strategic IT direction
- Further exploration of IT policies identified IT usage, IT security and IT department responsibilities as common policy themes.
- A risk management framework was identified as a new process common to all companies studied.
- Aligning with interview data, Green IT monitoring was found to occur rarely.

5.4.4 IT governance and Green IT relational mechanisms

The documents yielded little information to support the interview findings regarding relational mechanisms. The only information obtained supported the IT governance knowledge management relational mechanism of the ITGM. For example, analysis of F_Org1 and Txt_Org1 IT usage policies confirmed that employees are required to sign these documents as a proof of policy communication before the document is filed and a copy handed to the employee. Analysis of the F_Org2 IT policy revealed the responsibility of its Human Resource department to spread awareness of the policy guidelines. No other relational mechanism could be found in the documents.

5.4.5 Green IT attitude mechanism

The forthcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) highlights Green IT executive leadership as a key mechanism for sustainable behaviour. The document stresses a top-down approach for Green IT implementation and the allocation of Green IT resources including budgets for the implementation of Green IT initiatives. The need for Green IT monitoring, auditing and reporting is also emphasised. This would be impossible without executive level commitment to Green IT endeavours. Therefore, the 'Green IT executive leadership' mechanism that emerged from company interviews is supported.

5.4.6 Green IT policy mechanism

Interview data revealed that S_Org2 has a documented Green IT policy and that Green IT considerations are included in IT_Org1's overall Group Green policy. Unfortunately, none of these documents was made available for further analysis. However, S_Org1 provided the researcher with policies related to the ecologically responsible acquisition (including IT) and disposal of toners and cartridges. Some evidence of Green IT guidelines was also discovered in IT usage policies. For example, the IT usage policy of F_Org1 promotes energy efficient IT use. Similarly, the IT policy of F_Org2 recommends the efficient use of IT to avoid unnecessary waste.

Although some companies document Green IT recommendations either as purchasing and disposal policies or in a minor section of their IT usage policies, Green IT policies are scarce. This aligns with previous interview findings that the documentation of Green IT guidelines is a rare feature.

5.4.7 Green IT practice and technology mechanisms

Several annual reports disclosed 'greening by IT' mechanisms and the green technology adopted to implement them. For example, F_Org2 supports electronic modes of communication including electronic statements, workflow assessment for energy efficiency and the acquisition of a Document Management System to cut down on paper use. Similarly, T_Org1 reports back on the implementation of its customised energy monitoring system and mentions the regular review of IT operations for continuous improvement of energy efficiency. T_Org2 demonstrates its trust in latest technology for sustainability by disclosing the installation of its Building Management System for energy conservation. Similarly, both textile companies report on their ongoing reviews of IT-driven processes for more energy-efficient production.

Moreover, it was found that Green IT practice and technology mechanisms were supported by several government documents. For example, the National Programme on Sustainable Consumption and Production (Ministry of Environment and Sustainable Development 2008) supports IT energy efficiency (‘Greening IT’), the use of IT for resource-efficient business processes (‘Greening by IT’ and Green technology mechanisms) and environmentally friendly disposal of e-waste (Green IT disposal). The ‘Maurice Ile Durable’ Policy, Strategy and Action Plan (Ministry of Environment and Sustainable Development 2013) establishes policies for energy efficiency and sustainable consumption and production (SCP). These support ‘Greening IT’, ‘Greening by IT’ and the adoption of Green technology mechanisms. The MID policy promotes sustainable e-waste management thus backing the ‘Green IT disposal’ mechanisms. Similarly, the forthcoming National Green IT Strategy, Policy and Action Plan recommends sustainable IT waste management (Green IT disposal), IT energy consumption reduction (‘Greening IT’) including energy efficient printing (Green printing) and sustainable data centre management as well as the use of IT as a carbon reduction enabler.

Therefore, both company and government documents were found to support Green IT practice and technology mechanisms identified from interviews. Annual reports disclose ‘Greening by IT’ practices such as e-transactions and the newly identified practice of continuously reviewing processes to improve IT use for energy efficiency. They also report back on the adoption of software for energy efficiency (such as Building Management Systems) and resource optimisation (such as Document Management Systems). Government environmental and Green IT documents also support ‘Greening IT’, ‘Greening by IT’ and Green IT disposal mechanisms as well as the adoption of Green technology mechanisms.

5.4.8 IT governance and Green IT drivers

Analysis of company and government documents revealed a number of drivers fuelling the implementation of IT governance and Green IT in Mauritian businesses. Since these factors were not previously identified during interviews, they were inductively coded and grouped under sub-categories. These include certifications and accreditations endorsing IT governance and environmentally responsible processes that increase stakeholder confidence, resilience to perennial industry challenges, and compliance with existing laws and the changing legal environment. The following sections describe each driver in more detail.

5.4.8.1 Certifications and accreditations

As discussed in section 2.3.4.2, IT governance includes the implementation of international standards governing information systems (Mohamed and Kaur 2012). As firms increasingly face market pressure for environmental responsibility, a number of them turn to certifications to confirm their environmental legitimacy. These include ISO 14000 certified Environmental Management Systems to set up and evaluate environmental policies (Paulraj and de Jong 2011), ISO 50001 for energy reduction (Simon, Karapetrovic, and Casadesús 2012) and ISO 14064 for greenhouse gas monitoring and reporting (Rankin, Windsor, and Wahyuni 2011). With Green IT practices resulting in environmental responsibility, energy efficiency and carbon footprint reduction, their contribution to the achievement of such certifications cannot be neglected. Several examples of certifications supporting IT governance or environmental stewardship were found in company annual reports and IT policies. Except for F_Org1 and S_Org2 where certifications were not considered to be a priority, all the other companies were found to be either certified or working towards certification for at least one standard. This is discussed in more detail below.

For example, F_Org2 was found to be ISO 17799 certified for its information security management. Similarly, IT_Org1 demonstrates a high level of IT security through its ISO 27001 certification. This confirms the organisational focus on IT security governance and risk management. In addition, several hotels from both T_Org1 and

T_Org2 are members of the Leading Hotels of the World Consortium (LHW) as part of their quality stamp. Membership of the LHW is awarded following an audit of the full client experience starting from reservation to departure. Since for both groups, IT is a key enabler of most hotel services, achievement of the LHW is a driver for effective IT governance.

Analysis of annual reports also showed that a number of the companies studied focus on environmental certifications. For example, the Thermal Energy Operations of S_Org1 are ISO 14001 certified based on their Environmental Management System. Similarly, T_Org2 is in the process of setting up an Environmental Management System with environmental teams in all its hotels in view of achieving ISO 14000 certification. T_Org1 has currently applied for Green Globe certification to demonstrate its efforts to ensure environmentally responsible performance including energy efficiency. Txt_Org2 is WRAP certified as a means of promoting ethical manufacturing including environmental compliance. The company is also aspiring to ISO 50001 certification to validate its energy efficiency and efforts to reduce its carbon footprint. Similarly, Txt_Org1 aims to reduce its energy consumption at each processing stage to cut down on energy costs and carbon emissions. This has resulted in its acquisition of the Mauritius Blue Carbon Footprint Eco Label certification based on ISO 14064 for greenhouse gas emission inventories and ISO 14067 for the measurement and reporting of carbon footprint including its IT carbon footprint. This certification is awarded by the Mauritius Export Association (MEXA) and the auditing of carbon footprint is based on the greenhouse gas protocol and is the responsibility of an official third party assessor. The certification has been applauded by customers who more than ever show a preference for environmentally responsible suppliers. Both IT companies explored are ISO 9001 certified, thus demonstrating their commitment to quality management. While there is little Green IT focus at IT_Org1, the Green IT efficient printing project of IT_Org2 was an integral part of the continuous improvement requirement of its ISO 9001 certification.

The acquisition of IT governance and Green IT certifications is also supported by a number of government strategies. For example, The National ICT Strategic Plan (Gilwald and Islam 2011) encourages the adoption of ISO 27001 certifications to endorse IT security. The MID strategy (Ministry of Environment and Sustainable Development 2013) recommends the acquisition of green certifications, whereas the National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) expresses the intention of the Mauritian government to enforce Green IT certifications once the plan has been formally released.

The analysis of company annual reports and IT policies showed that most companies explored hold or are aspiring to hold certifications ratifying their IT governance and environmental responsibility including Green IT. The need to acquire such certifications is also reflected in government strategies. Certifications and accreditations were therefore added to the ITGM as a driver of IT governance and Green IT excellence.

5.4.8.2 Industry resilience

The annual reports were found to discuss a number of challenges faced by the different industries explored. Turbulences in the global economic scene, particularly in the island's main Eurozone market, have impacted on all Mauritian economic pillars. An excessive number of hotel rooms in proportion to booked airline seats, soaring air fares resulting from increased fuel cost and high airport taxes have led to an erosion of quality in the tourism industry. European Union debates over the elimination of its sugar quotas have been threatening the Mauritian sugar industry and the multilateral liberalisation of textile trading has been particularly trying for the textile industry. Such challenges have resulted in new measures being adopted to ensure market resilience. For example, in its 2012 annual report, F_Org1 specifies that changes in the economic environment have called for a new IT strategic plan with a view to tightening its Risk Management Framework for improved operational control and efficiency. Such disclosure is recommended by the National Code of Corporate Governance which stresses the responsibility of the board to report internal control and risk management systems. This reassures stakeholders, particularly shareholders that the business environment is secure (Committee on Corporate Governance 2004) and helps to build market resilience.

Additionally, with shareholders, customers and other stakeholders becoming increasingly environmentally conscious, organisations have no other choice but to demonstrate ecological responsibility for added resilience. This is reflected in the National Code of Corporate Governance which recommends the disclosure of company actions for environmental responsibility in corporate governance reports to boost trust and goodwill among increasingly environmentally conscious stakeholders (Committee on Corporate Governance 2004).

Therefore, the implementation and disclosure of IT governance and Green IT practices for business efficiency and environmental sustainability are essential if businesses are to remain competitive in their respective industries. Consequently, industry resilience was added to the ITGM as a driver of IT governance and Green IT.

5.4.8.3 Mauritian legal framework

A number of Mauritian legislations were found to drive IT governance and Green IT in Mauritian organisations. Mauritian laws focusing on risk management, audit and disclosure were found to influence enterprise governance of IT, while several Mauritian environmental laws were identified as Green IT drivers. Analysis of government strategies also revealed proposals for new laws to promote Green IT in Mauritian firms. These are discussed in the sections which follow.

5.4.8.4 Current Mauritian legal framework

The Mauritian regulatory framework influencing IT governance in Mauritian enterprises was found to focus on risk management, audit and disclosure. As mentioned in section 5.3.1, multiple laws mandate the importance of IT security and risk management across industries. The finance industry in particular is controlled by Mauritian laws. For example, the *Insurance Act* as well as the Bank of Mauritius (BOM) Guidelines on Internet Banking (Bank of Mauritius 2001), Operational Risks (Bank of Mauritius 2008) and Corporate Governance (Bank of Mauritius 2012) stress the need for audited security controls including IT. The BOM guidelines for Public Disclosure (Bank of Mauritius 2009) also mandate the need to inform stakeholders of risk management measures and controls as well as investments in IT. These enforce the management of IT security and risks in an industry which is reputed for its IT dependence. Disclosure of risk management and internal controls (including IT) is also mandated by the National Code of Corporate Governance under the *Financial Reporting Act 2004* and *Mauritius Companies Act 2001*.

The Mauritian environmental regulatory framework mandates overall environmental concern (*Environmental Protection Act 2002*), responsible waste disposal and audit (*Environmental Protection* (*Industrial Waste Audit) Regulations 2008*), and energy efficiency (*Energy Efficiency Act 2011* and *Building Control Act 2012*). The *Environmental Protection* (*Industrial Waste Audit*) *Regulations* is derived from the *Environmental Protection Act* and applies particularly to industrial activities relevant to sugar and textile companies. These could be requested to report on their environmental management plan, waste (including e-waste) generation and disposal. Similarly, under the *Energy Efficiency Act*, any company, as an energy consumer, could be asked to provide an audit of their energy use under the guidance of the Energy Efficiency Management Office (EEMO). This applies in particular to all large beneficiaries of concessionary electricity tariffs such as ICT operators and industrial consumers possessing an export enterprise certificate (e.g. textile companies) for them to retain the benefit (The 2013 Budget Speech 2013). This could explain why the business monarchy archetype governs Green IT decisions in the sugar and textile companies as top management oversight ensures energy-efficient behaviour for the maintenance of preferential electricity rates.

Therefore, it was found that the current legal framework seeks to enforce both IT governance and Green IT measures. IT governance mechanisms supporting risk management and IT security align with the expectations of the Mauritian legal framework. Green IT mechanisms demonstrating environmental responsibility, energy efficiency and ecological disposal of e-waste show compliance with Mauritian environmental laws. Hence, the current Mauritian legal framework was added to the ITGM as a driver of IT governance and Green IT.

5.4.8.5 Proposed additions to the Mauritian legal framework

Although frameworks intended to enforce the secure governance of IT have been institutionalised through the National ICT Strategic Plan (Gilwald and Islam 2011), this document highlights the need to review their legal mandate as a prime strategic area of intervention. For example, the plan recommends that third party IT security audits be made mandatory through statutory obligations. This would encourage Mauritian businesses to enforce IT governance mechanisms.

Similarly, additions to the legal framework to drive Green IT have also been suggested. The upcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) identifies regulatory enforcement of Green IT behaviour as a key success factor for a Green IT business culture. Table 5.2 illustrates some of the amendments to the current regulatory framework suggested in the document.

Table 5.2: Recommended regulatory amendments for the promotion of Green IT initiatives from the upcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013).

Sustainable IT Procurement

- Enforcement of Green IT standards in IT procurement.
- Take-back options from suppliers.
- Environment fee on energy inefficient equipment.

Reduce, reuse and recycle

- Mandatory environmentally friendly e-waste disposal.
- Penalties such as recycling tax and disposal fee.

Governance and compliance

- Mandate certifications endorsing Green IT standards.
- Enforce Green IT reporting in annual reports.

Green IT performance measurement

- Enforce Green IT audits through frameworks such as Energy Efficiency Management Office.

Collaboration with private sector and international institutions

- Develop guidelines for public private partnership.
- Work with international institutions for financial assistance, Green IT expertise and international best practices in collaboration with the National Green IT Advisory Unit.

From Table 5.2, it can be seen that the proposed additions to the existing legal framework are intended to reinforce Green IT procurement, waste management, governance, audits and collaboration. These would mandate Green IT standards in IT procurement and ensure that suppliers offer take-back options. Organisations would be legally bound to dispose of e-waste in an ecologically responsible manner and to acquire Green IT certifications. Environmental penalties such as fees for high energy consuming equipment, recycling tax and disposal fees would be enforced. Green IT auditing and reporting would be mandatory and Green IT collaboration with the public sector and international institutions would be better encouraged. Although the National Green IT Strategy, Policy and Action Plan remains to be officialised, its suggestions for greater Green IT regulation would motivate pro-active businesses to adopt and implement Green IT initiatives more effectively.

The Ministry of Environment and Sustainable Development (MID) strategy (Ministry of Environment and Sustainable Development 2013) also mandates changes in existing legislations to promote business environmental responsibility including Green IT. For example, the strategy echoes the intention of the Mauritian government to measure business sustainability progress through the legislation of an MID realisation index. The strategy also mentions the legislation of climate change regulations to set and achieve GHG emission targets. Since Green IT contributes to environmental sustainability and carbon reductions, the regulatory changes suggested in the MID strategy should drive business Green IT initiatives.

The Mauritian government’s diligence in pursuing its vision of turning Mauritius into an example of both IT and Green IT excellence is reflected in the National ICT Strategic Plan (Gilwald and Islam 2011), ‘Maurice Ile Durable’ Policy, Strategy and Action Plan (Ministry of Environment and Sustainable Development 2013) as well as the forthcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013). The enforcement of the proposed amendments to the Mauritian regulatory framework are just a question of time. This could explain why many of the Mauritian businesses studied are being pro-active in implementing IT governance and Green IT initiatives which are currently discretionary. A proposed amendment to the Mauritian legal framework was therefore added to the ITGM as an IT governance and Green IT driver.

5.4.9 External IT governance and Green IT incentives and support mechanisms

The analysis of government documents revealed a number of government-led initiatives aimed at encouraging Mauritian businesses to implement IT governance and Green IT measures. This new data was inductively coded and grouped to produce sub-categories including tax incentives, awards and government support mechanisms for business IT Governance and Green IT guidance. The next sections discuss these government-instigated incentives.

5.4.9.1 Green IT tax benefits

In accordance with the MID strategy (Ministry of Environment and Sustainable Development 2013) and as per the 2015 budget ("Mauritius Budget Speech 2015-2016" 2016), the current Mauritian regulatory framework provides incentives to encourage businesses to invest in Green IT. This is reflected in the *Income Tax Act* 2013 amendment which provides company tax benefits of 50% for Green technology and waives alternative minimum tax from the manufacturing and hotel industry as an incentive to invest in energy efficient equipment.

5.4.9.2 Green IT awards

Another incentive used to win business cooperation regarding environmental responsibility, and documented in the MID strategy (Ministry of Environment and Sustainable Development 2013), consists of rewards for environmentally sustainable practices. This includes Green IT and aims at driving Green IT executive leadership, practice and technology. Similarly, in its endeavour to develop a Green IT culture in Mauritius, the forthcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) specifies the recognition of Green IT initiatives through an award system.

5.4.9.3 Government support mechanisms

The analysis of government documents revealed a number of support mechanisms provided by the Mauritian government to assist Mauritian businesses with their implementation of efficient IT governance and Green IT measures. These support measures are included in the ITGM and are discussed in the following sections.

5.4.9.3.1 The National Computer Board

Operating under the aegis of the Ministry of Information and Communication Technology, the National Computer Board (NCB) is instrumental to achieving effective business utilisation of IT. The NCB oversees the operation of the Mauritian Computer Emergency Response Team of Mauritius (CERT-MU) set up and documented under the National ICT Strategic Plan (Gilwald and Islam 2011) to respond to IT security needs. CERT-MU is also responsible for spreading information security awareness. In that respect, it has formulated a number of information security guidelines available from its website and regularly organises IT security training for IT managers and CIOs. CERT-MU also assists in the implementation of ISO 27001 based Information Security Management Systems (ISMS) and can act as third party information security auditors as per ISO 27001 recommendations. Therefore, through the NCB, it can be seen that CERT-MU provides considerable support to businesses for IT security governance.

The NCB also plays a key role in promoting a Green IT culture on the island. For example, it drove the establishment of the National Green IT Strategy, Policy and Action Plan. The NCB also regularly organises Green IT certification training to build Green IT capacity in Mauritian companies (National Computer Board 2015) and has set up a Green ICT portal to publish Green IT guidelines based on best practice. For example, the NCB Green IT guidelines for business (National Computer Board 2011) suggest a set of actions to be implemented by businesses for (1) energy efficient IT use, (2) paper reduction, (3) sustainable IT procurement, (4) environmentally friendly disposal of IT equipment, (5) server optimisation and virtualisation and (6) collaborative ICT infrastructure.

The portal also provides information about Green IT standards such as Energy Star for energy efficiency certification and EPEAT (Electronic Product Environmental Assessment Tool) to assess the environmental friendliness of technology (National Computer Board 2014). These guidelines help Mauritian businesses to ‘green’ both their technology and their business processes.

5.4.9.3.2 Energy Efficiency Management Office

As part of the Mauritian government’s commitment to a sustainable Mauritius, the Energy Efficiency Management Office (EEMO) is mandated by the 2011 Energy

Efficiency Act. Consolidated in the MID strategy (Ministry of Environment and Sustainable Development 2013), the office is responsible for conducting or providing assistance with energy audits and providing energy efficiency support for carbon emission reductions. As part of the proposed future National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013), EEMO would also provide business support for the acquisition of energy efficiency certifications (such as the ISO 50001) which necessitate the implementation of Green IT measures.

5.4.9.3.3 Ministry of Local Government

The Mauritian Ministry of Local Government has set up the National Solid Waste Management Strategy which aimed at achieving a 40% waste recycle rate by 2015. The ministry also provides some support for the minimisation of waste generation. For example, it ensures that a list of recyclers including e-waste recyclers is published to facilitate sustainable e-waste management (Ministry of Local Government and Outer Islands 2014). With the formalisation of the National Green IT Strategy, Policy and Action Plan, the Ministry of Local Government would also be required to set up e-waste agencies to assist businesses to better manage their e-waste (Ministry of Information and Communication Technology 2013).

5.4.9.3.4 Upcoming Green IT Strategy, Policy and Action Plan initiatives

With the formalisation of the National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013), a number of initiatives (proposed list in Table G from Appendix G) to assist businesses in implementing Green IT will be recommended, supported by monitoring metrics and examples of international best practice. The availability of a range of proposed Green IT actions and suggestions on how to track their progress will help businesses to implement and track Green IT mechanisms.

The impending National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013) also earmarks the setting up of a National Green IT Advisory Unit (NGITAU) as a key step to support Green IT development in Mauritian businesses. The NGITAU will be responsible for providing Green IT expertise to Mauritian businesses. Its purpose is to promote business Green IT culture by spreading Green IT awareness including sharing of best practices and building capacity. The unit would also benchmark Green IT performance against international standards to ensure continuous improvement.

5.5 Refined draft IT Governance and Green IT model

The analysis of company and government documents served to validate a number of IT Governance and Green IT (ITG) mechanisms identified from interviews and documented in the ITGM. In addition, risk management frameworks were identified as a new IT governance process, and the regular reviewing of IT-driven operations to continuously improve the use of IT for energy efficiency was found to further support the Green IT practice mechanism. Factors influencing IT governance and Green IT measures were also discovered. These include IT governance and Green IT drivers, incentives and support mechanisms. As shown in Figure 5.1, new information that emerged from the analysis of company and government documentation was added (in blue) to the ITGM to supplement the interview data (in red). IT governance and Green IT drivers and incentives were clustered as ITG influencers since they motivate and guide the implementation of company IT governance. Sections referring to each ITGM box are also specified in the model. Red sections refer to accountabilities, mechanisms or drivers derived from interviews whereas blue sections refer to mechanisms or influencers resulting from company and government documentation analysis.

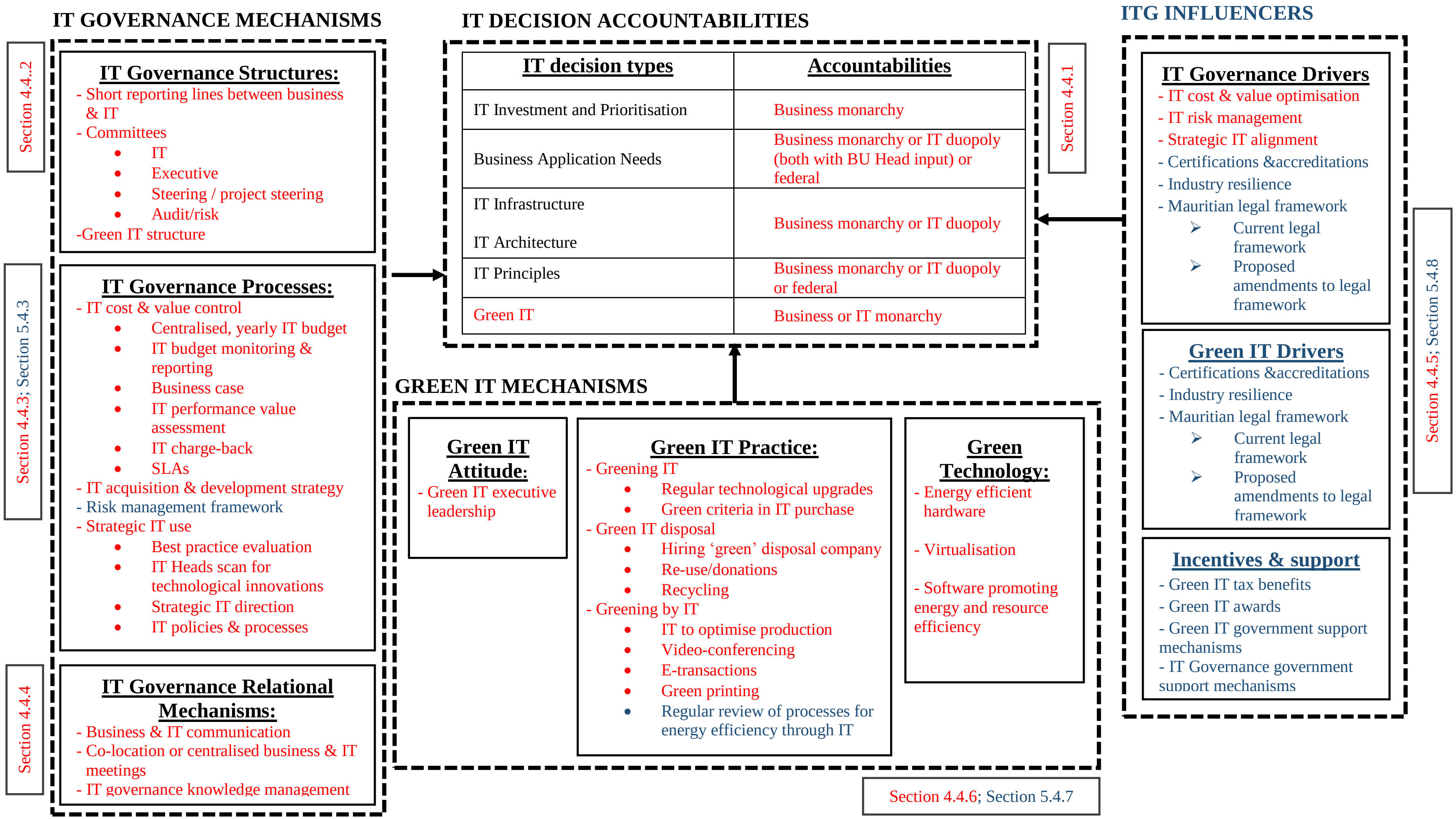


Figure 5.1: Refined draft ITGM including IT governance and Green IT decision accountabilities, mechanisms and influencers

5.6 Chapter summary

This chapter discusses the analysis of data obtained from company and government documents related to IT governance and Green IT. It describes the documents analysed and compares their information with IT governance and Green IT mechanisms deduced from previous company interviews. This enabled the triangulation of numerous ITGM mechanisms. New IT governance and Green IT mechanisms, drivers, incentives and support mechanisms also emerged and were added to the ITGM for a more comprehensive model.

Company and government documents revealed little information pertaining to IT accountabilities and relational mechanisms but served to triangulate several IT governance structures identified from interviews. These include IT committees, short reporting lines between business and IT as well as risk and audit committees. The need for Green IT structures reported in the National Green IT Strategy Policy also aligns with interview findings. Several process mechanisms for the various IT decision types were also supported by document data. These include business case analysis, IT performance value and a centralised IT budget. The adoption of IT charge-back and SLAs to facilitate top management control over IT infrastructural services was also backed by the analysed documents. IT policies formalising IT architectural decisions were identified as a common process mechanism. Analysis of policy documents helped to further identify common areas covered in the IT policies. These include IT usage standards, IT security and IT department responsibilities. Analysis of both company and government documents ratified risk management frameworks as a common process mechanism. The strategic direction of IT established by the board was also supported by documents explored and the inadequacy of Green IT tracking processes was established.

Documents were also found to support Green IT mechanisms. They confirmed the inadequacies of Green IT policies and confirmed that executive leadership was required to bring about a positive Green IT attitude in business. They also sanctioned Green IT practice and technology mechanisms. These include energy efficient IT, the use of IT for sustainable behaviour, ecological management of e-waste, environmentally friendly printing and Green technology including software for environmentally responsible business processes, and virtualisation.

Several determinants driving IT governance and Green IT in Mauritian businesses were identified from the analysis of documents. For example, both company and government documents highlighted the need for recognised certifications endorsing IT governance and Green IT in order to improve stakeholder trust. The challenge of remaining resilient in a trying economic climate was found to drive effective governance of IT and Green IT. The current Mauritian legal environment also influences enterprise governance of IT and its ecologically sustainable use. Future regulatory amendments are likely to encourage IT governance and Green IT practices.

Document analysis also revealed government-provided incentives and support bodies introduced to encourage IT governance and Green IT ventures. Incentives include Green IT tax concessions and awards. Support institutions include the NCB for IT security governance assistance through CERT_MU and Green IT recommendations through its Green ICT portal. The Ministry of Local Government was also found to provide assistance for the management of e-waste and the EEMO identified for energy efficiency support. Green IT initiatives documented in the imminent national Green IT strategic document would assist businesses to implement, monitor and benchmark their Green IT endeavours.

The newly identified IT governance processes, drivers, incentives and support mechanisms were added to the ITGM to increase its accuracy. To further refine the ITGM, IT governance and Green IT data were collected by means of company surveys and then analysed. This is discussed in the next chapter.

Chapter 6: Survey

6.1 Introduction

This chapter describes the survey conducted to further refine the IT governance and Green IT model (ITGM). It explains how the survey was designed and describes the target population. It reports on survey responses and analyses the demographic profiles of respondents. Techniques for survey data analysis are explained and analysis results presented. Survey findings are then used to triangulate previously identified results and newly emerged items are added to their corresponding section of the ITGM to produce its final version.

6.2 Designing the survey

It has been established that the aim of the survey was to triangulate interview and document analysis findings as well as unearth additional information to generate a comprehensive IT Governance and Green IT model. A survey questionnaire was therefore designed to investigate the presence of IT governance and Green IT mechanisms identified from both literature and previous results. The subsections which follow describe the structure and development of the survey instrument.

6.2.1 Questionnaire structure

Before designing the survey questions, it was important to structure the questionnaire to ensure that it covered all aspects of the survey. As shown in Figure 6.1, the questionnaire consisted of five main sections. Section one was designed to elicit information about the relevant organisation and the respondent's characteristics, while the remaining sections covered each of the four blocks identified from the ITGM draft, namely IT decision accountabilities, IT governance mechanisms, Green IT mechanisms and IT governance & Green IT influencers. As in the draft ITGM, each one of these four blocks was further sub-divided. The section on IT governance mechanisms was broken down into structures, processes and business & IT collaborative relationship (relational mechanisms). Green IT mechanisms were sub-divided into attitudes, policies, practices and technology. Finally, questions pertaining to IT governance and Green IT influencers were categorised as IT governance drivers, Green IT drivers and IT governance & Green IT incentives and support mechanisms.

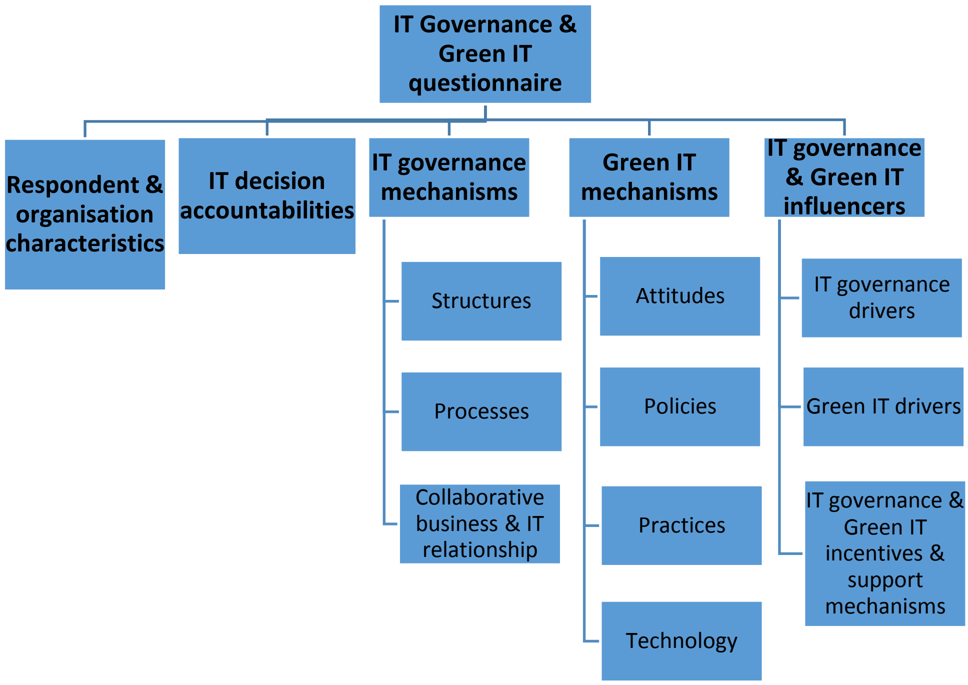


Figure 6.1: Structure of IT governance and Green IT survey instrument (questionnaire)

6.2.2 Questionnaire items

The next step was to design the questionnaire items. While the initial structure of the questionnaire shown in Figure 6.1 laid the foundation for content validity, its items also needed to provide sufficient coverage of IT governance and Green IT in key Mauritian companies. Therefore, except for the first section of the questionnaire which elicits demographic information (respondent job title, company industry and category), the questions for the remaining sections were derived from the literature review as well as prior findings from interviews and the document analysis. Questionnaire items and their corresponding sources are shown in Table H, Appendix H. To further ensure content validity, Green IT mechanisms and influencers blocks also included open sections inviting respondents to add any extra information not covered by the questionnaire.

6.2.3 Developing the survey questionnaire

The questionnaire was developed using the Qualtrics Survey Software (Qualtrics 2015). The first demographics section consisted of open-ended questions to elicit the respondent’s job title and two category questions to determine the company industry and category. The second section of the questionnaire on IT decision accountabilities was structured in a matrix format. This grid structure not only saves space, but also provides an easy-to-complete format for sets of similar questions (de Vaus 2002; Saunders, Lewis, and Thornhill 2009), particularly for business respondents (Dillman 2000). Since IT decision accountabilities needed to be investigated for each of the six IT decision types, the matrix format was deemed appropriate, as illustrated in Table 6.1. This enabled respondents to easily tick combinations of business executives, IT executives and Business Unit leaders responsible for each IT decision in their organisation.

Table 6.1: IT decision accountabilities section of questionnaire

	Business executives	IT executives/ Heads	Business Unit leaders
IT investments including IT project justification and prioritisation.	❑	❑	❑
Principles guiding organisational IT usage.	❑	❑	❑
Business need for purchasing or developing IT applications.	❑	❑	❑
Enterprise-wide IT infrastructure (technology and people) strategies.	❑	❑	❑
IT architecture, including policies and rules guiding organisational IT use.	❑	❑	❑
IT use to promote environmental responsibility.	❑	❑	❑

The last three blocks consisted of questions eliciting respondent opinion on IT governance and Green IT mechanisms as well as their motivating factors. These were presented as rating questions which enabled respondents to express their level of agreement or disagreement (de Vaus 2002), ranging from “strongly disagree” to “strongly agree”. As opposed to the often recommended 7-point Likert scale (Preston and Colman 2000; Finstad 2010), a 5-point Likert scale was selected to minimise chances of respondents becoming frustrated by the volume of information in the questionnaire, particularly if pressed for time (Preston and Colman 2000). This decision was also supported by the fact that the 5-point Likert scale is as “desirable” as its 7 or 10-point counterparts for quantitative data analysis methods such as confirmatory factor analysis (Dawes 2008, 75), chosen for this research.

To ensure face validity, the questionnaire was pre-tested by PhD supervisors and four IT experts with knowledge of IT governance and Green IT. Based on their feedback, some questions were re-worded and a few others broken down into two or more questions for clarity. The questionnaire was finally sent to the Curtin University Human Research Ethics Committee which subsequently gave its approval. The final version of the questionnaire used in the survey is provided in Appendix I .

6.3 The survey population

As shown in Table 6.2, a total of 192 large companies from the five main sectors of the Mauritian economy was obtained. It is to be noted that only four organisations are from the sugar industry. These are, however, four big groups on the island. As discussed in section 3.7.7, since response rates at top management level are generally low (Cycyota and Harrison 2002; Baruch and Holtom 2008), questionnaires were sent to all companies from the sample population to secure an acceptable response rate.

Table 6.2: Survey population

Industry	Total number of companies/groups
Textile	50
Sugar	4
Finance	43
IT	75
Tourism	20
TOTAL POPULATION	**192**

6.4 Administering the survey questionnaire

The questionnaires were distributed to executives and IT managers of each company in the population with follow-ups starting after a week. Unfortunately, follow-ups do not always increase the response rate at the organisational level (Baruch and Holtom

2008), particularly where executives are concerned (Cycyota and Harrison 2002). As shown in Table 6.3, this was reflected in this research, where after three months and numerous follow-ups, only 58 out of the 192 companies had responded (response rate: 30.2%) and 77 questionnaires received (the disparity between number of companies and questionnaires resulted from having more than one respondent – e.g. both CEO and Group IT Manager - in some companies). To further increase the number of responses, the rest of the survey data collection was outsourced for another three months to De Chazal Du Mée Research (DCDM Research 2015b), a renowned market and social research company in Mauritius. As can be seen from Table 6.3, DCDM Research was able to reach an additional 51 companies and collect 51 more questionnaires, leading to a total company participation of 109, from which 128 questionnaires were compiled. The company response rate increased to 56.8% which is above the 35% - 40% rate of acceptable organisational level response recommended by Baruch and Holtom (2008).

Table 6.3: Details of survey response

Industry	**Target population**	**Number of participating companies**			**Number of questionnaires**			
		Resear -cher	DCDM	Total	Resear -cher	DCDM	Total received	Total valid
Textile	50	8	5	13	8	5	13	13
Sugar	4	2	0	2	3	0	3	3
Finance	43	24	8	32	30	8	38	35
IT	75	13	36	49	25	36	61	58
Tourism	20	11	2	13	11	2	13	12
TOTAL	**192**	**58**	**51**	**109**	**77**	**51**	**128**	**121**

Of the 83 companies which did not participate in the study, 53 (63.9%) provided reasons for their refusal. These ranged from potential respondents being too busy (38%), to a lack of interest in the study (18%) or company confidentiality constraints (7.9%). Of the 128 questionnaires received, seven were incomplete and subsequently discarded, leaving data from 121 usable questionnaires (as shown in Table 6.3) to be recorded using SPSS 21.0.

Responses to open-ended questions on Green IT mechanisms and IT governance and Green IT influencers were found to be rare for questionnaires collected by both the researcher and DCDM Research. Although this could be explained by the length of the questionnaire (particularly as open-ended questions were found in the latter half of the instrument), it could also indicate that respondents had little to add regarding their Green IT initiatives as well as IT governance and Green IT drivers.

6.5 Company and respondents' demographic profile

The demographics of participating companies and their respondents were explored next. This is because understanding both the responding organisation and its representatives is important to ensure the relevance of collected data (Saunders, Lewis, and Thornhill 2009). Table 6.4 provides a summary of responses regarding respondent job title, company industry and category.

Table 6.4: Company and respondent profiles

Characteristics	Response options	Frequency	Percentage
Respondent job title	IT manager	71	58.7
	IT Executive	24	19.8
	Business Executive	26	21.5
Company industry	Finance	34	28.1
	Tourism	13	10.7
	Information & Communication Technology	58	47.9
	Sugar	3	2.5
	Textile	13	10.7
Company category	Private listed	44	36.4
	Private unlisted	67	55.4
	State enterprise	4	3.3
	Parastatal	6	5.0

As seen from Table 6.4, 58.7% of respondents were IT managers, 21.5% were business executives and only 19.8% were IT executives. These figures imply that the majority of respondents were not from the executive level. This low response rate from executives could be attributed to their time constraints and/or the possibility that they could have shied away from IT matters since, in many cases, executives informed the researcher that they had delegated the survey completion to their IT manager. The small percentage of IT executives could also be due to the absence of a CIO (or equivalent) role in many of the companies surveyed.

Despite a target of 50 companies from the textile industry, participation from this sector was found to be low (10.7%). In fact, potential respondents from this area were the hardest to access (29 textile companies never acknowledged receipt of the questionnaire despite numerous attempts to contact them). On the other hand, Information and Communication Technology (ICT) as well as finance companies were the most receptive to this study, with a percentage participation of 47.9% and 28.1% respectively. This could be attributed to their high population (75 for ICT and 43 for finance, compared to 4 for sugar/cane and 20 for tourism) but could also suggest considerable interest in the study from the ICT and finance industries due to their strong dependence on IT.

Table 6.4 also shows that the majority of companies which participated in the study belonged to the private sector - 36.4% from the private listed and 55.4% from the private unlisted category compared to 3.3% from state enterprises and 5% from the parastatal group. This is explained by the fact that key Mauritian industries are dominated by the private sector, resulting in the majority of companies in the targeted population being private.

Once the demographics of respondents were understood, survey data needed to be analysed to refine the ITGM. The next section explains the data analysis techniques used.

6.6 Survey data analysis

Survey data was analysed in two steps. First, categorical data obtained for each IT decision was examined for main accountability tendencies using SPSS 21.0. IT governance and Green IT mechanisms and influencers were then analysed for validity and reliability using exploratory and confirmatory factor analysis (EFA and CFA respectively). As its name indicates, exploratory factor analysis explores data in order to determine the underlying variables (referred to as latent variables or factors) under which it can be appropriately grouped (Hair et al. 2010). EFA is often used as a pre-requisite of CFA which confirms the validity and reliability of factors and their corresponding items (Suhr 2006). In other words, EFA starts the model definition and

CFA confirms whether the collected data fits the model (Hurley et al. 1997; Matsunaga 2010; Hair et al. 2010). Each technique is explained in more detail in the subsections below.

6.6.1 Exploratory factor analysis

To cluster survey items under factors, Williams, Brown and Onsman (2012) suggest a five-step approach summarised in Figure 6.2. This includes (1) establishment of factorability, (2) selection of an appropriate factor extraction technique, (3) determination of the number of factors to be generated, (4) choice of factor rotation method and (5) factor identification. The following subsections explain how each EFA step was conducted.

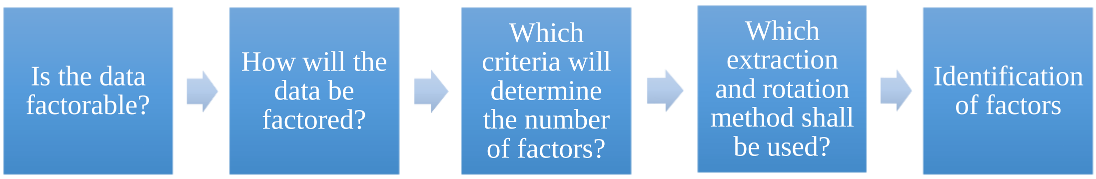


Figure 6.2: The 5-Step exploratory factor analysis approach adapted from Williams, Brown and Onsman (2012)

6.6.1.1 Step 1 – Determining factorability

Several criteria have been defined to establish factorability. For example, Tabachnick and Fidell (2014) recommend factor analysis for a minimum sample size of 300, especially for cases with a small number of factors grouping around three to four items. However, for smaller sample sizes (< 150), as is the case for this research (sample size: 121), the ratio of survey participants and factor items (subject to variable ratio) and the strength of inter-correlations among factor items (correlation coefficient) need to be analysed to determine factorability. Subject to variable ratios of at least 5:1 (Hair et al. 2010) and correlation matrices having several correlations exceeding 0.30 (Tabachnick and Fidell 2014) are favoured. Factorability is further determined using statistical indices. These include Bartlett's test of sphericity (Bartlett 1954, quoted in Pallant

2011, 183) significance ($p < 0.05$) and Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (Kaiser 1970, 1974, quoted in Pallant 2011, 183) exceeding 0.6 (Pallant 2011). All survey data mechanisms and influencers were found to satisfy the criteria for factorability specified. This will be demonstrated in section 6.7.

6.6.1.2 Step 2 – Selecting the method of extraction

Two main ways of extracting factors under EFA include the component model which does not account for measurement errors and the common factor model which does (Schmitt 2011). Maximum Likelihood (ML) factoring is one of the most frequently used common factor models, due to its stability, particularly when faced with uncertainty regarding the specification model (de Winter and Dodou 2012). However, ML requires the data to be normally distributed (Schmitt 2011). On the other hand, principal component analysis (PCA), one of the most commonly used component extraction methods for EFA (Schmitt 2011), does not require data normality (Kaplan 2009, quoted in Schmitt 2011, 307) and generally produces similar results to its pure EFA or common factor counterparts (Thompson 2004; Pallant 2011). Since the survey data to be analysed using EFA is ordinal, normal distribution was not possible. ML was therefore ruled out in favour of PCA.

6.6.1.3 Step 3 - Determining number of factors

Three commonly used approaches were considered when determining the number of factors to be extracted. These include eigenvalue, scree plot and parallel analysis (Costello and Osborne 2005; Pallant 2011; Hair et al. 2010; Tabachnick and Fidell 2014). The eigenvalue of a factor represents the total variance which it explains. Analysis of eigenvalues (or Kaiser's criterion) involves screening out all factors with eigenvalues less than 1. This technique is appropriate only for large sample sizes with around 40 variables. In other cases, the identification of an unreasonable number of factors is highly likely, hence its use for a quick initial estimate of factors only (Tabachnick and Fidell 2014).

Catell (1966, quoted in Pallant 2011, 184) proposes a second method called the scree test. Advocated by Costello and Osborne (2005), this approach consists of identifying clear breaks (or "elbows") in a plot of eigenvalues to retain only the factors before the break. A scree test is mostly based on the researcher's judgement and therefore tends to be subjective (Williams, Brown and Onsman 2012); hence the need to combine it with Horn's parallel analysis (Horn 1965, quoted in Pallant 2011, 184). This technique involves comparing the eigenvalues from factor analysis with the randomly generated eigenvalues from a data matrix of the same size. The random data can be obtained by running a Monte Carlo Parallel Analysis software configured to run with the same number of variables and respondents as for the EFA. Only those factors from EFA having eigenvalues exceeding their randomly generated counterpart are then retained (Hayton, Allenand Scarpello 2004). While parallel analysis (PA) seems to work better than the scree test (Zwick and Velicer 1986), Williams, Brown and Onsman (2012) recommend the combined use of both approaches for better results.

Therefore, for this research, it was decided to adopt a multiple approach strategy to determine the number of factors for extraction. Kaiser's criterion was used to obtain an initial idea of the possible number of factors. This was followed by a scree plot analysis to identify breaks and a comparison of eigenvalues with those from a randomly generated, same-size data set for PA.

6.6.1.4 Step 4 – Selecting the rotation method

Rotation groups items correlating highly with a factor together to facilitate the identification and interpretation of factors (Sass and Schmitt 2010). Rotation methods can be categorised as either orthogonal or oblique, each generating an uncorrelated and correlated factor solution respectively (Pallant 2011). Orthogonal rotation such as varimax is often the preferred option because of its simplicity in terms of understanding and describing. However, its underlying assumption about uncorrelated factors may not be true. In this case, oblique rotation is the more accurate option, despite its increased complexity in interpretation and reporting (Tabachnick and Fidell 2014). Therefore, for this research, it was decided to try the direct oblimin oblique rotation first. However, since most factors did not correlate ($r < 0.3$), the rotation method was switched to varimax to facilitate both the presentation of findings and their interpretation.

6.6.1.5 Step 5 – Identification of factors and their items

Once the method of factor extraction, techniques for determining number of factors and method of rotation is finalised, factor analysis is carried out (SPSS 21.0 was used in this research) to generate factors and their corresponding item factor loadings (λ). The latter refers to the extent to which factor items relate to or explain their factor (Saunders, Lewis and Thornhill 2009). However, factor items are not automatically retained. First, their reliability needs to be established by determining their internal consistency. This evaluates the extent to which factor items correlate with each other and is most frequently gauged using Cronbach (1951) alpha (α) (Sauders, Lewis and Thornhill 2009). Cronbach α values exceeding 0.7 indicate good internal consistency (Straub, Boudreau and Gefen 2004).

Next, the factor loading of each item needs to be analysed to determine whether it is within acceptable cut-off points. Comrey and Lee (1992, quoted in DiStefano 2005, 227) categorise loadings exceeding 0.7 as excellent, those above 0.63 as very good, 0.55 and above as good, 0.45 and more as fair and between 0.32 and 0.45 (exclusive) as poor. Then, to further decide which items to retain under a factor, their communalities need to be reviewed. The communality of an item refers to its percentage variance accounted for by all factors (Hair et al. 2010). A communality less than 0.3 for an item would indicate that it does not fit with other variables grouped under the same factor and should be removed (Pallant 2011). The analysis of communalities is also useful to confirm the quality of the factor solution. MacCallum et al. (1999) recommend communalities in the range of 0.5 for sample sizes between 100 and 200.

Therefore, for this research, the internal consistency of factor items was first checked, before analysing each factor item. The latter was removed if its factor loading was poor or worse (< 0.45) and/or the communality was not within the 0.5 range.

6.6.1.6 Summary of factor analysis

The factor analysis process used in this research is as follows:

1. Establish factorability using the following criteria:
    - Subject: variable ratio ≥ 5:1
    - Factor item correlations ≥ 0.3
    - Bartlett's test of sphericity significance ($p < 0.05$)
    - KMO > 0.6
2. Extract factors using PCA.
3. Determine number of factors using:
    - Factor eigenvalues > 1
    - Scree test
    - Parallel Analysis
4. Rotate factors using varimax factor rotation method.
5. Identify factors and items (using SPSS 21.0) based on the following criteria:
    - Cronbach $\alpha > 0.7$
    - Factor loadings (λ) ≥ 0.45
    - Communalities around 0.5

Factors and their items were then ready to be confirmed using CFA. The steps involved in CFA are explained in the sections which follow.

6.6.2 Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) enables the factor model to be validated, thereby strengthening confidence in the research results (Maccallum and Austin 2000). Once latent variables and their corresponding items have been established, the extent to which they fit the collected data is determined using confirmatory factor analysis. In CFA, the model to be confirmed is defined first, before specifying how the analysis would be conducted and assessing model validity. The latter includes identification of model fit and evaluation of its construct (convergent and discriminant), unidimensional and factorial validity (Gefen 2003). The steps involved in the CFA process are illustrated in Figure 6.3 and explained in more detail in the following sections.

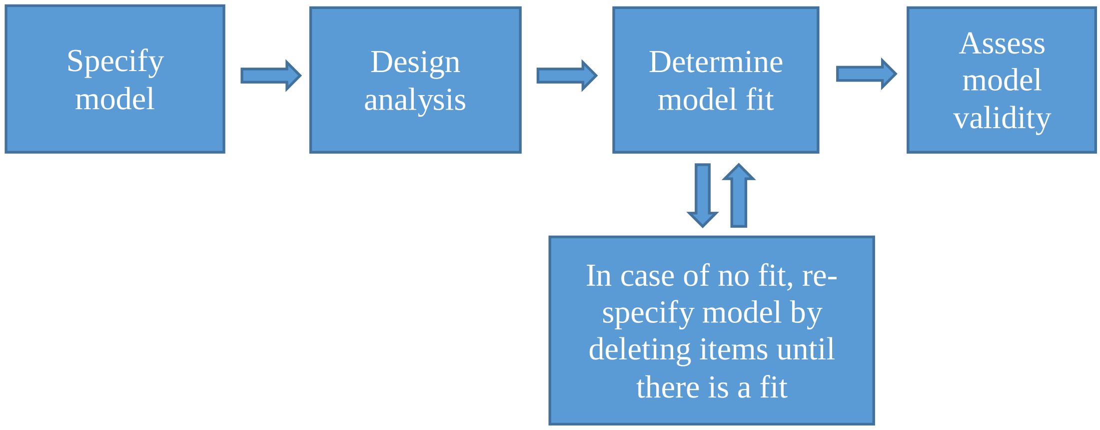


Figure 6.3: CFA steps adapted from Nunkoo and Ramkissoon (2012)

6.6.2.1 Model specification

Unlike EFA which is data-driven, CFA is theory-driven (Albright and Park 2009). It requires an 'a priori' specification of a model which contains latent variables and items hypothesised to relate to them (Curran, West, and Finch 1996; Jackson, Gillaspy, and Purc-Stephenson 2009); hence the need to create a model using EFA first. To avoid model mis-specifications, it was ensured that each factor included more than one item (Bollen 1989), with more indicators being better (Marsh et al. 1998; MacCallum et al. 1999) and that items under each construct were strongly correlated with Cronbach α exceeding 0.7 (Nunkoo and Ramkissoon 2012).

6.6.2.2 Designing the study

Once the model was specified, Hair et al. (2010) suggest that the CFA study be described. This includes key decisions regarding the software to be used for analysis, sample size considerations and method of confirmation. LISREL 8.80 (Jöreskog and Sörbom 2001) was selected as the CFA software. This is due to its widespread use, availability of an array of indices (DiStefano 2005) and its flexibility as it can alternate between program and model (Albright and Park 2009) when evaluating model fit. Next, the method of CFA estimation was chosen. Although Maximum Likelihood is one of the most commonly used CFA methods, it assumes continuous distribution of data and is therefore not appropriate for ordinal data, particularly in cases where there are five or fewer items per category (Flora and Curran 2004). Since the data to be analysed was primarily ordinal and that some factors had fewer than five items, polychoric correlations using weighted least squares (WLS) (Jöreskog and Sörbom 2001) was selected instead.

However, the issue with this technique is that it can be unstable with small sample sizes (Browne 1984). Although a minimum of 200 subjects as a sample size has been considered adequate (Bollen 1989; Byrd and Turner 2000), samples of at least 100 have been used in some CFA studies (DiStefano 2005). To avoid issues of model instability in such cases, Hair et al. (2010) suggest that a minimum sample of 100 be used where item communalities exceed 0.6. For communalities in the 0.5 range, Hair et al. (2010) recommend sample sizes of at least 150. Since for this research the minimum communalities are in the 0.5 range, the sample size of 121 raised an issue. To counteract this problem, a parallel model was adopted. As opposed to the unrestricted congeneric model where hypothesised relationships between a latent variable and its indicators (items) have different degrees of accuracy and measurement errors, in the parallel model, items hypothesised to relate to a factor are constrained to the same level of accuracy and measurement error value (Graham 2006). A parallel model is recommended as a means of enforcing model accuracy in cases where the sample size may not be large enough (Molla, Cooper and Pittayachawan 2011).

Therefore, for this research, LISREL 8.80 was used to run CFA using polychoric correlations with weighted least squares (WLS) and under parallel mode to generate a path diagram. As shown in Figure 6.4, the path diagram presents latent variables (LV), their hypothesised items (X), factor loadings (λ), error variance terms (e) representing the extent to which an item does not relate to its latent variable and correlation between LVs (if more than one). Under the parallel mode, factor loadings and error terms for all items under a latent variable are constrained to be equal.

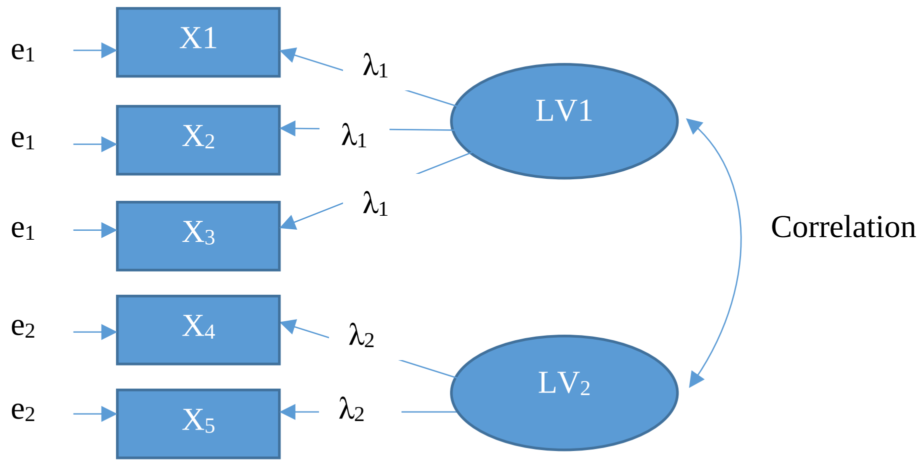


Figure 6.4: CFA path diagram generated under parallel mode

6.6.2.3 Determining model fit

Next, model fit needed to be determined. CFA determines model fit by using empirically-determined (free) and researcher-defined (fixed) estimates from measured data to generate a covariance matrix of factor items. The latter is then compared to the observed sample covariance matrix with small differences between the matrices indicating good model fit (Marsh, Balla, and McDonald 1988). The extent to which factors and their hypothesised items defined in a model are reflected by the collected data establishes whether or not there is model fit (Nunkoo and Ramkissoon 2012). To determine this, absolute (Hu and Bentler 1998), incremental (Bentler and Bonett 1980) and parsimonious (Mulaik et al. 1989) goodness-of-fit indices have been developed. These are compared to their typical cut-off values for model fit and any poor items are removed until the model suits the collected data (Nunkoo and Ramkissoon 2012).

Absolute fit indices (AFI) measure how well the observed data fit the researcher specified model (Hu and Bentler 1999). Its most commonly used indicator is the chi-square (χ^2) statistic (Nunkoo and Ramkissoon 2012). A non-significant ($p > 0.05$) and small χ^2 value relative to its degrees of freedom (*df*) is an indicator of good model fit (Dyer, Hanges, and Hall 2005). This is because the null hypothesis is defined as the absence of a close model fit (MacCallum, Browne, and Sugawara 1996). However, the smaller the sample size, the smaller the χ^2 value, leading to possibilities of model mis-specifications (Bentler and Bonett 1980). Alternative measurements include the goodness-of-fit index (GFI) and adjusted goodness-of-fit (AGFI) indices, both with cut-off values of 0.95. These have been criticised for model mis-specifications (Marsh, Balla and McDonald 1988). GFI tends to favour model complexity, since its value increases as the number of model parameters increase (Nunkoo and Ramkissoon 2012). Consequently, MacCallum and Austin (2000) strongly advise against its use and recommend the root mean square error of approximation (RMSEA) absolute fit index instead. This index has successfully eliminated the problem of sample size and is known to provide a good measure of model quality (Hu and Bentler 1998; Hu and Bentler 1999). Another recommended index is the standardised root mean residual (SRMR) which compares error in predicted covariance terms (or residuals) (Hair et al. 2010). For this research, a non-significant χ^2 was coupled with favourable RMSEA and SRMR values to validate the model. As recommended by Hu and Bentler (1998), values around or less than 0.06 for RMSEA and less than 0.08 for SRMR were used to infer model fit.

Independent of statistical significance, incremental fit indices (IFI) provide information about model fit by comparing competing models, with the most commonly used baseline model being the null model with which none of the factor items is correlated (Bentler and Bonett 1980). Commonly used IFIs include the Non-Normed Fit Index (NNFI) (Bentler and Bonett 1980) and the Comparative Fit Index (CFI) (Bentler 1990). As opposed to the initially developed Normed Fit Index (NFI), NNFI is unaffected by sample size (Bentler 1990). However, being non-normed, its values may be outside the 0 – 1 range (Bentler and Bonett 1980). On the other hand, CFI does consider sample size. However, as opposed to GFI, it remains unaffected by model parsimony (Nunkoo and Ramkissoon 2012). Both NNFI and CFI values were therefore used in this research. For both indices, a cut-off value of 0.9 was considered favourable for model fit (Hu and Bentler 1999).

The parsimonious fit index (PFI) relates model fit to model complexity by enabling the researcher to determine whether a model has not been overloaded with parameters to the detriment of a more parsimonious one (Hair et al. 2010). One of the most commonly used PFI which was used in this research is the parsimonious normed fit index (PNFI). PNFI allows the freeing of model parameters for improved fit (Mulaik et al. 1989). Good model fit was concluded for PNFI values exceeding 0.5 (Mulaik et al. 1989).

6.6.2.4 Model re-specification

Where a good fit was not identified, it was important to identify poor indicators before removing them from the model and testing again. Modification indices (MI) and standardised residuals, obtained from LISREL outputs, were analysed to locate indicators responsible for specification issues (MacCallum 1986). These determine unidimensional validity which checks that each item reflects only one latent variable (Gefen 2003). MI determines item loadings on latent variables other than the ones specified and by how much these would reduce the model χ^2 (Hair et al. 2010). Items with MI values above 5 indicate possibilities of cross-loadings (items loading on more than one latent variable) (Gefen 2003). These are considered problematic.

Hair et al. (2010) recommend that MI not be used as the sole basis for discarding items from the model. Instead, they suggest that residuals also be analysed. Residuals capture the amount of item variance not reflected by the model (Straub, Boudreau, and Gefen 2004). Standardised residuals are the most commonly analysed residual. They reflect the differences between generated and observed correlation matrices of CFA (Segars and Grover 1993). Large standardised residuals demonstrate excessive item variance not accounted for by the model, thereby leading to model unfit (MacCallum 1986). Standardised residuals exceeding 2.58 in absolute value are considered large (Segars and Grover 1993). Therefore, where goodness-of-fit indices demonstrated model unfit, both modification indices and standardised residuals were analysed to locate and remove problematic items. Care was taken to make only one modification at a time before re-testing, since one change can affect multiple areas of the model (MacCallum 1986).

6.6.2.5 Assessing model validity

Apart from unidimensional validity, convergent, discriminant and factorial validity also needed to be ascertained. Convergent validity explores the extent to which items within factors are related, whereas discriminant validity determines whether items for different factors are unrelated (Gefen 2003). Convergent validity is confirmed by statistically insignificant ($p > 0.05$) χ^2 and factor loadings exceeding 0.707 (Straub, Boudreau and Gefen 2004) for all ITGM mechanisms. Where more than one factor was identified for an ITGM mechanism or influencer, discriminant validity was assessed to find out whether factors were different from each other. This was determined by running a χ^2 test of difference comparing constrained (correlation between factors set to 1) and unconstrained (correlation between factors set free) factor pairs, one pair of factors at a time (Anderson and Gerbing 1988). A statistically significant lower value for the unconstrained model indicates discriminant validity (Anderson and Gerbing 1988). Factorial validity goes one step further to confirm that all factors represent one underlying construct (Straub, Boudreau, and Gefen 2004). Therefore, where more than one latent variable was identified for a mechanism or influencer, the extent to which the latent variables together represent their underlying mechanism was established by running a CFA for all factors demonstrating convergent and discriminant validity. Valid goodness-of-fit indices indicated factorial validity (Straub, Boudreau, and Gefen 2004).

6.6.2.6 Summary of Confirmatory Factor Analysis

Confirmatory Factor Analysis was therefore done as follows:

1. Specify model using the following criteria:
   - Factor number of items > 1
   - Cronbach $\alpha > 0.7$
2. Design study using the following:
   - LISREL 8.80 analysis software
   - Polychoric correlations using WLS in parallel mode
3. Determine model fit using the following criteria:
   - Non-significant ($p > 0.05$), small χ^2 relative to *df*
   - RMSEA ≤ 0.06; SRMR ≤ 0.08; CFI > 0.9; NNFI > 0.9; PNFI > 0.5
4. In case of model unfit, e-specify model and validate findings as follows:
   - Unidimensional validity based on:

    - MI < 5
    - Standardised residual < 2.58
  - Convergent validity based on:
    - Non-significant χ^2 ($p > 0.05$)
    - $\lambda \geq 0.707$
  - Discriminant validity based on:
    - Statistical significance ($p < 0.05$) for χ^2 test of difference
  - Factorial validity based on valid goodness-of-fit indices

A sample EFA to CFA conversion is provided in Appendix J.

6.7 Results of survey data analysis

This section presents the outcomes of the analysis of the survey data. Results obtained are then used to triangulate previously identified ITGM items and add new survey findings to the ITGM to produce its final version. Details of each ITGM mechanism or influencer under each ITGM block are provided in the subsections which follow.

6.7.1 IT decision accountabilities

Table 6.5 shows central accountability tendencies for each IT decision type generated using SPSS 21.0. The highest frequencies are highlighted in red. The table shows that IT investment and prioritisation accountabilities are most often owned by business executives and IT executives/Heads. Business monarchy (including CIO) or IT duopoly modes of accountability mostly govern the approval and prioritisation of IT projects. The survey also shows that the responsibility for decisions regarding business application needs is primarily shouldered by either IT executives/Heads alone or both business executives and IT executives/Heads. A tie between IT monarchy and business monarchy (including CIO) or IT duopoly is therefore identified when deciding between internal development and external acquisition of IT. As for IT infrastructure and architecture, IT executives/Heads lead the accountability list by far. The same is seen for IT principles and Green IT decisions. This shows that strategic decisions regarding IT capabilities, configuration choices and policies as well as IT usage (including sustainable IT use) are primarily governed by an IT monarchy.

Table 6.5: Summary of survey responses for IT accountabilities across IT decision types

IT decisions ↓	Business monarchy (business executives only)	IT monarchy (IT executives /Heads only)	IT duopoly (IT & BU leaders)	IT duopoly (IT & business executives) OR business monarchy (executives including IT executive)	Federal (business executives & BU leaders)	Federal (business executives, IT Heads & BU leaders)	Feudal (BU leaders only)
IT investment & prioritisation	12 (9.9%)	31 (25.6%)	15 (12.4%)	43 (35.5%)	2 (1.7%)	15 (12.4%)	3 (2.5%)
Business application needs	10 (8.3%)	33 (27.3%)	20 (16.5%)	33 (27.3%)	1 (0.8%)	14 (11.5%)	10 (8.3%)
IT infrastructure	10 (8.3%)	53 (43.8%)	16 (13.2%)	30 (24.8%)	1 (0.8%)	6 (5.0%)	5 (4.1%)
IT architecture	13 (10.7%)	67 (55.4%)	11 (9.1%)	24 (19.9%)	0 (0%)	5 (4.1%)	1 (0.8%)
IT principles	13 (10.7%)	66 (54.6%)	13 (10.7%)	21 (17.4%)	0 (0%)	3 (2.5%)	5 (4.1%)
Green IT	17 (14.1%)	58 (47.9%)	12 (9.9%)	18 (14.9%)	0 (0%)	11 (9.1%)	5 (4.1%)

The survey analysis of accountabilities was found to triangulate two previously identified ITGM findings. These include a preference for business monarchy when making investment-related IT decisions and IT monarchy prominence for Green IT strategies. New accountability inclinations also emerged for several IT decisions. These include IT duopoly (including business executives) as a commonly used accountability for IT investment and prioritisation decisions and IT monarchy, found to primarily govern IT decisions regarding business application needs, architecture and principles. As highlighted in orange in Figure 6.5, new findings were added to the IT decision accountabilities' block of the IT governance and Green IT model.

IT decision types	Accountabilities
IT Investment and Prioritisation	Business monarchy **or IT duopoly**
Business Application Needs	Business monarchy or IT duopoly (both with BU Head input) or federal **or IT monarchy**
IT Infrastructure IT Architecture	Business **or IT** monarchy or IT duopoly
IT Principles	Business **or IT** monarchy or IT duopoly or federal
Green IT	Business or IT monarchy

Figure 6.5: IT decision accountabilities in final ITGM

6.7.2 IT governance mechanisms - structures

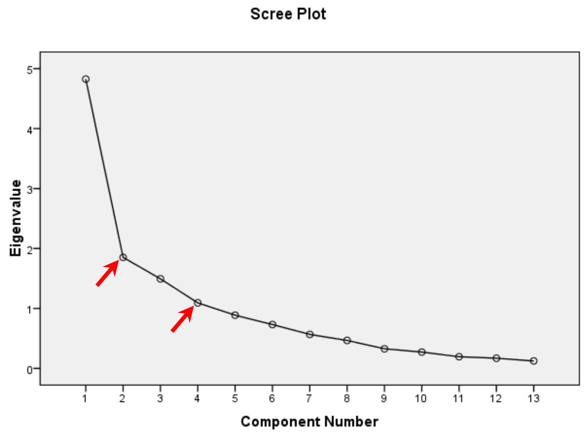
As indicated in Table 6.6, factorability of structure items was confirmed by a favourable subject to variable ratio (9:1) and KMO (0.733), as well as a significant Bartlett's test of sphericity ($p < 0.001$). Factorability was further established by factor item correlations exceeding 0.3. EFA was run for the 13 structure items using the principle component analysis method. This identified a four-factor solution, with each factor contributing 37.1%, 14.2%, 11.5% and 8.4% of the total variance respectively, thus explaining a total of 71.2% of the variance. Scree plot inspection revealed a marked elbow after one component and a smaller one after three (refer to red arrows in Table 6.6). Based on both PA results and scree plot analysis, it was decided to repeat EFA by forcing three factors (STRU1, STRU2 and STRU3). These contributed 37.1%, 14.2% and 11.5% of the total variance respectively (cumulative total of 62.8%). Table 6.6 summarises the EFA results for the three-factor solution along with results of the parallel analysis and Cronbach α of items under each factor. Three items were removed from the list mostly due to their low communalities (0.408, 0.405 and 0.378 respectively) as defined by MacCallum et al. (1999). These are shown in red in Table 6.6. STRUC7 was also removed due to its poor factor loading (0.437). Cronbach α values for the items retained under each factor were found to exceed 0.7 (α= 0.844; 0.875; 0.895 for STRU1, STRU2 and STRU3 respectively), thus confirming the internal consistency of factor items.

Table 6.6: Summary of EFA, Cronbach α, scree plot and PA results for IT governance and Green IT structures

IT GOVERNANCE and GREEN IT STRUCTURES

Subject to variable ratio: 9:1; **KMO:** 0.733; **p** < 0.001

Structure items	Item code	Factor loadings STRU1	STRU2	STRU3	Communalities
IT executive committee includes both business and IT executives/ Heads.	STRUC5	.834			.702
IT executive committee oversees strategic IT decisions.	STRUC3	.815			.720
IT steering committee includes both business and IT executives/ Heads.	STRUC6	.802			.731
Organisational board has at least one IT executive as member.	STRUC1	.623			.408
IT steering committee oversees strategic IT decisions.	STRUC4	.565			.570
IT project steering committees oversee IT projects.	STRUC7	.437			.405
A dedicated structure (e.g. Corporate Social Responsibility Office) is responsible for coordinating Green IT.	STRUC12		.812		.716
A dedicated person (e.g. Chief Sustainability Officer) is responsible for coordinating Green IT.	STRUC13		.786		.651
Business executives play a leading role in all Green IT initiatives.	STRUC11		.784		.635
IT executives/Heads play a leading role in all Green IT initiatives.	STRUC10		.710		.520
Audit/risk committees oversee IT audits.	STRUC8			.935	.900
Audit/risk committees oversee IT risks management.	STRUC9			.889	.837
IT executives/Heads report to a CxO (e.g. CEO, COO or CFO).	STRUC2			.537	.378
Cronbach α		0.844	0.875	0.895	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	4.826	1.5782	Accept
2	1.852	1.4310	Accept
3	1.493	1.3116	Accept
4	1.093	1.2119	Reject

EFA results were then fed to LISREL 8.80 to run CFA using polychoric correlations with WLS and under parallel mode. Following goodness-of-fit, modification index and standardised residual analysis for model fit and validity, unidimensional validity was ensured by deleting items with MI > 5 and standardised residuals > 2.58 (Gefen 2003). Latent variables also had to be merged so as to ensure model fit and avoid one-item factors. In this way, the structure mechanism was reduced to one latent variable (STRU) clustering three items, as shown in Figure 6.6. Model fit and internal consistency were confirmed by favourable goodness-of-fit indices and reliable Cronbach α respectively, as reported in Table 6.7. Convergent validity was established by a non-significant χ^2 ($p > 0.05$) and factor loadings of 0.86. Since only one factor remained, discriminant and factorial validity did not have to be established.

Figure 6.6: CFA path diagram for structure mechanism

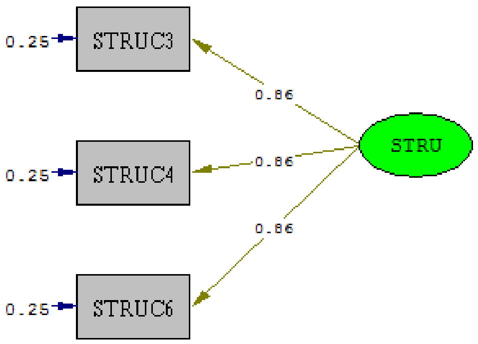


Table 6.7: Summary of model fit and convergent validity results for IT governance structure mechanism

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Structures	STRU	IT executive committee oversees strategic IT decisions. IT steering committee oversees strategic IT decisions. IT steering committee includes both business and IT executives/ Heads.	STRUC3 STRUC4 STRUC6	**λ**: 0.86 **α**: 0.82 **X^2**:3.10; ***df***: 2; ***p***:0.21 **RMSEA**: 0.06 **SRMR**: 0.06 **NNFI**: 0.99 **CFI**: 0.99 **PNFI**: 0.65

In addition to triangulating IT and steering committees as structure mechanisms, survey analysis also established the presence of both business and IT Heads on IT steering committees as a new structure. As highlighted in orange in Figure 6.7, this new structure (shown in orange) was added to the IT governance structure section of the final ITGM.

IT Governance Structures:

- Short reporting lines between business & IT
- Committees
    - IT
    - Executive
    - Steering / project steering
    - Audit/risk
- Green IT structure
- **IT steering committee consists of both business & IT Heads**

Figure 6.7: IT governance structures in the final ITGM

6.7.3 IT governance mechanisms - processes

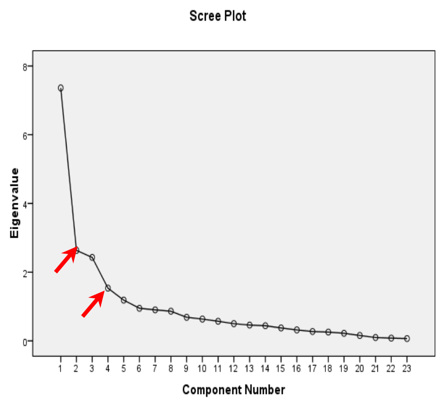
Following favourable factorability conditions (subject to variable ratio: 5:1; KMO: 0.798; $p < 0.001$ and factor item correlations mostly > 0.3), 23 items under the IT Governance and Green IT process mechanism were subjected to EFA using PCA and varimax. EFA identified 5 factors accounting for 66% of the total variance. However, as shown in Table 6.8, both parallel analysis and scree plot suggested a three-factor solution. EFA was therefore repeated to force three factors. This solution explained 54.2% of the total variance with factors PRO1, PRO2 and PRO3 contributing 32.1%, 11.5% and 10.6% of the total variance respectively. The resulting solution is summarised in Table 6.8. 6 items were removed from the list (shown in red in Table 6.8). All had low communalities (0.397, 0.236, 0.254, 0.434, 0.272 and 0.204) as defined by MacCallum et al. (1999). PROC5 and PROC6 also had poor factor loadings (0.332 and 0.411 respectively). All retained factor items were found to demonstrate strong internal consistency (α = 0.882; 0.847; 0.787 for PRO1, PRO2 and PRO3 respectively).

Table 6.8: Summary of three-factor EFA, Cronbach αand PA results for IT governance and Green IT processes

IT GOVERNANCE and GREEN IT PROCESSES

Subject to variable ratio: 5:1; **KMO:** 0.798; **p** < 0.001

Process items	Item Code	Factor loadings			Commu-nalities
		PRO1	PRO2	PRO3	
Organisation has defined Green IT targets.	PROC21	.917			.865
Organisational Green IT performance is measured.	PROC22	.909			.831
Organisational Green IT performance is reported.	PROC23	.855			.744
Organisation uses IT Governance frameworks.	PROC14	.652			.532
Business executives look out for useful technological innovations.	PROC18	.611			.485
Organisation uses formal project management methodologies.	PROC15	.606			.527
IT budget is assigned yearly.	PROC2		.783		.640
IT budget is monitored and reported regularly.	PROC4		.780		.627
SLAs formalised between organisation and external IT providers.	PROC12		.703		.494
Organisational strategic IT defined in line with business strategy	PROC1		.681		.494
Organisational IT is based on an assessment of best practice.	PROC20		.613		.550
IT budget is managed centrally by the IT department.	PROC3		.596		.397
IT policies and processes are formalized.	PROC19		.596		.586
IT executives/Heads scan for useful technological innovations.	PROC17		.562		.538
Critical IT solutions are bespoke (not off-the-shelf).	PROC7		.481		.236
Business cases are used to select and prioritise IT projects.	PROC6		.411		.254
Departmental IT costs are charged back.	PROC10			.905	.826
Business unit IT costs are charged back.	PROC11			.894	.812
SLAs formalised between organisation and its IT department.	PROC13			.566	.434
Organisational IT investment value is assessed and reported back.	PROC9			.547	.560
IT risk management follows company risk management framework.	PROC16			.494	.556
Critical IT systems are developed internally (not outsourced).	PROC8			.476	.272
IT budget includes Green IT initiatives.	PROC5			.332	.204
Cronbach α		0.882	0.847	0.787	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	7.384	1.9062	Accept
2	2.634	1.7341	Accept
3	2.427	1.6114	Accept
4	1.506	1.5120	Reject
5	1.117	1.4221	Reject

CFA was then conducted using polychoric correlations with WLS and under parallel mode. Unfavourable goodness-of-fit indices led to MI and standardised residual analysis which resulted in the removal of several items to ensure unidimensional validity. The process mechanism was reduced to one latent variable (PRO), grouping four items shown in Figure 6.8. As reported in Table 6.9, goodness-of-fit indices and Cronbach α confirmed model fit and reliability. Convergent validity was established by a non-significant χ^2 ($p > 0.05$) and factor loadings of 0.77. Since only one process factor was identified, discriminant and factorial validity were not required.

Figure 6.8: CFA path diagram for process mechanism

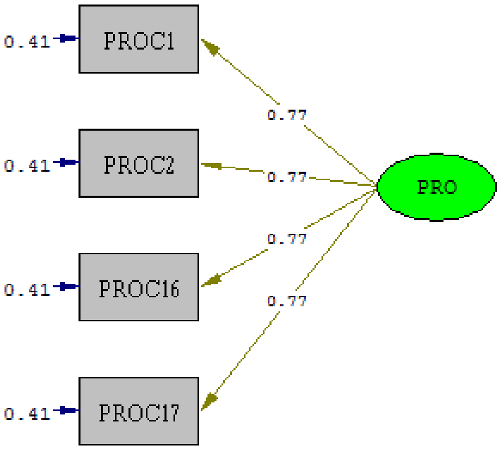


Table 6.9: Summary of model fit and convergent validity results for IT governance process mechanism

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Processes	PRO	Organisational strategic IT defined to align with business strategy.	PROC1	**λ**: 0.77 **α**: 0.76 **X²**:7.24; ***df***: 5; ***p***:0.20 **RMSEA**: 0.06 **SRMR**: 0.06 **NNFI**: 0.98 **CFI**: 0.98 **PNFI**: 0.78
		IT budget is assigned yearly.	PROC2	
		IT risk management follows company risk management framework.	PROC16	
		IT executives/Heads scan for useful technological innovations.	PROC1	

Survey findings triangulated numerous previously identified practices including strategic IT planning, yearly IT budgets, risk management frameworks and the need for IT Heads to remain abreast with technological innovations. As survey results did not reveal new processes, the section for IT governance processes in the final ITGM remained unchanged.

6.7.4 IT governance mechanisms - relational mechanisms

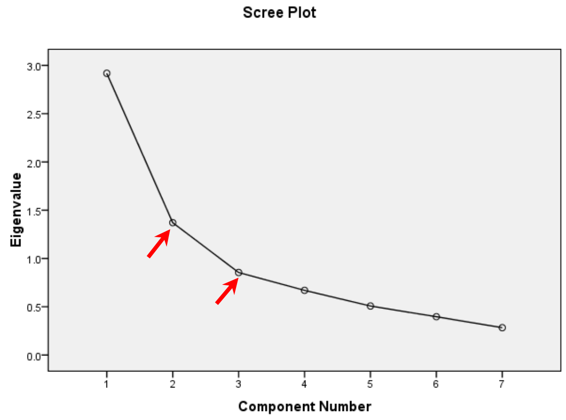
Once factorability of relational mechanisms had been established (subject to variable ratio: 17:1; KMO: 0.706; $p < 0.001$ and factor item correlations mostly > 0.3), the EFA of the seven items under relational mechanisms identified two factors (RM1 and RM2) contributing 41.8% and 19.5% of the total variance respectively (cumulative total of 61.3%). This was supported by both parallel and scree plot analysis. Results are summarised in Table 6.10. No items were removed since all factor loadings exceeded 0.55, thus fitting under the "good" category of Comrey and Lee (1992, quoted in DiStefano 2005, 227) and all communalities were around 0.5 as prescribed by MacCallum et al. (1999). Cronbach α values for RM1 (0.771) and RM2 (0.794) demonstrated factor reliability.

Table 6.10: Summary of EFA, Cronbach αand PA results for IT governance and Green IT relational mechanisms

IT GOVERNANCE and GREEN IT RELATIONAL MECHANISMS

Subject to variable ratio: 17:1**; KMO:** 0.706**; p** < 0.001

Relational Mechanism Items	Item Code	Factor loadings		Commu-nalities
		RM1	RM2	
Regular meetings are conducted between business & IT executives/management for IT decision-making.	REM1	.719		.583
Informal communication is common between business & IT executives/ management for IT decision-making.	REM2	.703		.517
Business and IT people are physically located close to each other.	REM3	.689		.477
Processes to distribute IT Governance knowledge are established.	REM5	.611		.580
Systems to distribute IT Governance knowledge are established.	REM4	.579		.626
Systems to spread Green IT awareness among employees are established.	REM6		.870	.761
Processes to spread Green IT awareness among employees are established.	REM7		.864	.746
Cronbach α		.771	.794	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	2.918	1.3514	Accept
2	1.371	1.1968	Accept
3	.854	1.0829	Reject

CFA using polychoric correlations with WLS under parallel mode established the presence of both factors. However, as shown in Figure 6.9, while both RM2 items were confirmed by CFA, two items were removed from RM1 following goodness-of-fit, MI and standardised residual analysis for model fit and convergent validity. As presented in Table 6.11, goodness-of-fit indices and Cronbach α confirmed model fit and reliability. Convergent validity was established by non-significant χ^2 ($p > 0.05$) and factor loadings of 0.79 and 0.82 for RM1 and RM2 respectively.

Figure 6.9: CFA path diagrams for relational mechanisms

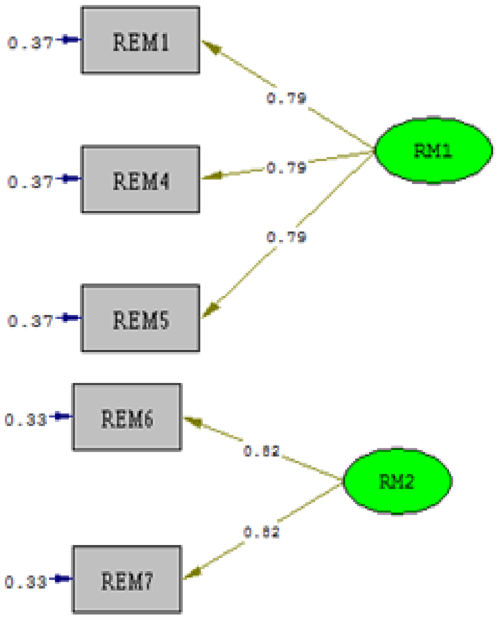


Table 6.11: Summary of model fit and convergent validity results for IT governance relational mechanisms

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Relational Mechanisms	RM1	Regular meetings unite business & IT Heads for IT decisions. Systems to distribute IT Governance knowledge are established. Processes to distribute IT Governance knowledge are established.	REM1 REM4 REM5	**λ**: 0.79 **α**: 0.77 **X^2**:0.04; ***df***: 2; ***p***:0.98 **RMSEA**: 0.00 **SRMR**: 0.01 **NNFI**: 1.03 **CFI**: 1.00 **PNFI**: 0.67
	RM2	Systems spreading Green IT awareness among employees are established. Processes for Green IT employee awareness are established.	REM6 REM7	**λ**: 0.82 **α**: 0.79 **X^2**:0; ***df***: 0; ***p***:1 **RMSEA**: 0.00 **SRMR**: 0.00 **NNFI**: 1 **CFI**: 1 **PNFI**: 1

Since relational mechanisms were clustered under two factors, it was important to confirm that factors were not the same by establishing their discriminant validity. As shown in Table 6.12, a χ^2 test of difference between constrained (correlation between factors set to 1) and unconstrained (free) factor pairs led to the unconstrained model with a statistically significant ($p < 0.001$) smaller value, thereby demonstrating discriminant validity.

Table 6.12: Summary of discriminant validity results for relational mechanism factors

Construct	Factor pairs		χ2			*df*	*p*
			Constrained	Unconstrained	Difference		
Relational Mechanisms	RM1	RM2	20.93	5.65	15.28	1	0.000

Both factors were also shown to represent the relational mechanism construct by demonstrating their factorial validity. The resulting path diagram and valid goodness-of-fit indices are illustrated in Figure 6.10 and Table 6.13 respectively.

Figure 6.10: CFA path diagram for relational mechanism construct with both its factors

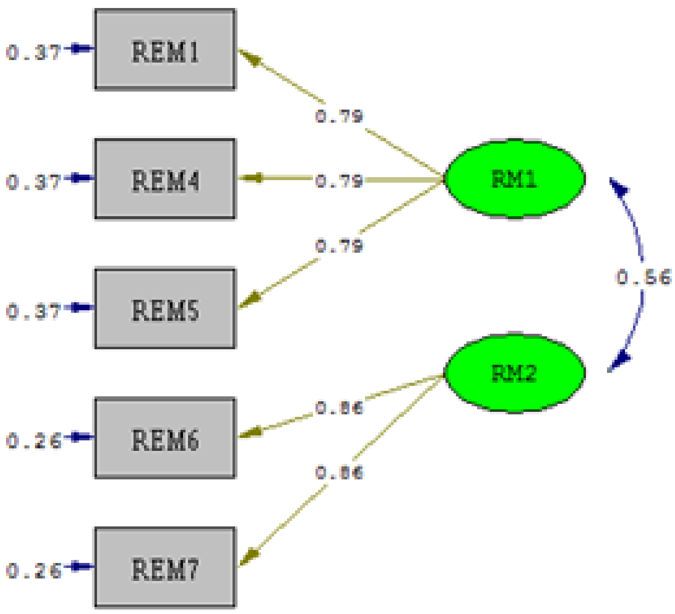


Table 6.13: Summary of factorial validity results for relational mechanism factors

Construct	Factor	Items	Item code	Factorial validity goodness-of-fit indices
Relational Mechanisms	RM1	Regular meetings unite business & IT Heads for IT decisions.	REM1	**X**^{2}:5.65; ***df***: 7, ***p***:0.58 **RMSEA**: 0.00 **SRMR**: 0.06 **NNFI**: 1.01 **CFI**: 1.00 **PNFI**: 0.68
		Systems to distribute IT Governance knowledge are established.	REM4	
		Processes to distribute IT Governance knowledge are established.	REM5	
	RM2	Systems spreading Green IT awareness among employees are established.	REM6	
		Processes for Green IT employee awareness are established.	REM7	

Therefore, survey findings triangulated two previously identified relational mechanisms. These included business & IT communication and IT governance knowledge management (systems and processes to distribute IT Governance knowledge). In addition, the implementation of systems and processes for Green IT employee awareness emerged as a new relational mechanism. This was added to the final ITGM, as illustrated in orange in Figure 6.11.

IT Governance Relational Mechanisms:

- Business & IT communication
- Co-location or centralised business & IT meetings
- IT governance knowledge management
- **Systems & processes for Green IT employee awareness**

Figure 6.11: IT governance relational mechanisms in the final ITGM

6.7.5 Green IT mechanisms - Green IT attitude

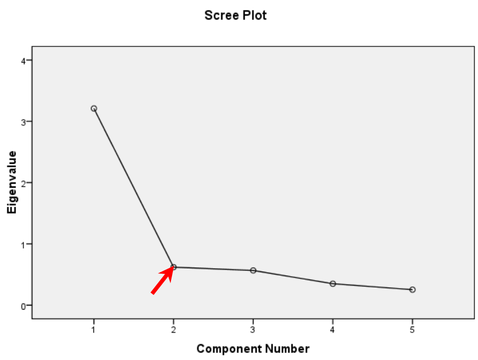
With factorability confirmed for Green IT attitudes (subject to variable ratio: 24:1; KMO: 0.811; p < 0.001 and factor item correlations mostly > 0.3), the EFA of its five items resulted in one factor, GAT, accounting for 64.2% of the total variance. This solution was supported by both parallel and scree plot analysis as summarised in Table 6.14. All factor loadings were found to exceed 0.7, which is "excellent" according to Comrey and Lee's (1992, quoted in DiStefano 2005, 227) categorisations. Communalities were also in the range of 0.5 or more, thereby supporting the reliability of all construct items (MacCallum et al. 1999). The strong internal consistency of items was indicated by the Cronbach α value (0.860) which exceeded 0.7.

Table 6.14: Summary of EFA, Cronbach αand PA results for Green IT attitude

GREEN IT ATTITUDE

Subject to variable ratio: 24:1; **KMO:** 0.811; **p** < 0.001

Green IT Attitude Items	Item code	Factor loadings GAT	Commu-nalities
Organisational concern about its IT energy consumption.	GATT3	.878	.770
Green IT initiatives are driven by organisational leader(s).	GATT5	.848	.719
Organisational concern about the environmental impact of its IT suppliers.	GATT2	.776	.602
Organisational concern about its environmental impact upon IT disposal.	GATT4	.770	.593
Organisational drive for environmental sustainability.	GATT1	.725	.526
Cronbach α		.860	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	3.211	1.2562	Accept
2	.621	1.1156	Reject

Parallel model CFA using polychoric correlations with WLS was then conducted. Following unfavourable goodness-of-fit indices, MI and standardised residuals were analysed. Two items (GATT1 and GATT2) were then removed before model fit was achieved with three items, as shown in Figure 6.12. Goodness-of-fit indices and Cronbach α confirmed model fit and internal consistency. Convergent validity was established by a non-significant χ^2 ($p > 0.05$) and factor loadings of 0.84. These are reported in Table 6.15. Since CFA resulted in only one factor, discriminant and factorial validity were not required.

Figure 6.12: CFA path diagram for Green IT attitudes

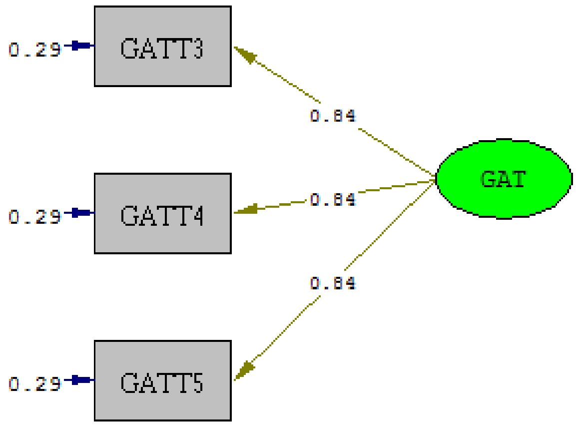


Table 6.15: Summary of model fit and convergent validity results for Green IT attitudes

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Green IT Attitude	GAT	Organisational concern about its IT energy consumption. Organisational concern about its environmental impact on IT disposal. Green IT initiatives are driven by organisational leader(s).	GATT3 GATT4 GATT5	**λ**: 0.84 **α**: 0.83 **X^2**:1.32; ***df***: 2; ***p***:0.52 **RMSEA**: 0.00 **SRMR**: 0.05 **NNFI**: 1.01 **CFI**: 1.00 **PNFI**: 0.66

Survey findings therefore validated executive leadership as Green IT attitude and identified two new factors reflecting a concern for IT energy consumption and ecologically responsible disposal of IT waste. According to Molla and Abareshi (2012), internal sources of Green IT motivation include the need to be resource (including energy) efficient for both environmental and economic reasons, and the desire to demonstrate sustainable behaviour (such as ecological IT disposal) based on top management and employee commitment to environmental sustainability. Therefore, concern about IT energy efficiency and environmentally responsible IT disposal were moved from the Green IT attitude CFA cluster to be classified as internal Green IT drivers in the final ITGM. This is discussed in more detail in section 6.7.10.

6.7.6 Green IT mechanisms - Green IT policy

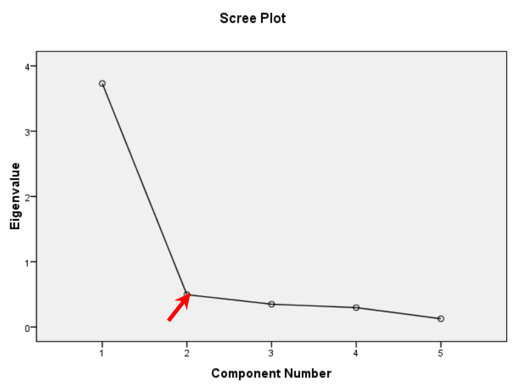
Once factorability was established (subject to variable ratio = 24:1; KMO = 0.835; p < 0.001 and factor item correlations mostly > 0.3), in line with both parallel and scree plot analysis, the EFA of the five Green IT policy items identified one factor (GPO) contributing 74.6% of the total variance. All items were retained since, according to Comrey and Lee (1992, quoted in DiStefano 2005, 227), they all had excellent loadings (> 0.7) and as per MacCallum et al.'s (1999) recommendation, their communalities well exceeded 0.5. Cronbach α (0.914) demonstrated a strong internal consistency of factor items. Results are summarised in Table 6.16.

Table 6.16: Summary of EFA, Cronbach α and PA results for Green IT policy

GREEN IT POLICY

Subject to variable ratio: 24:1; **KMO:** 0.835; **p** < 0.001

Green IT Policy Items	**Item code**	**Factor loadings GPO**	**Commu-nalities**
Organisation has a policy for environmentally friendly IT use.	GPOL3	.924	.854
Organisation has a purchasing policy which includes Green IT acquisition.	GPOL2	.904	.817
Organisation has an overall Green IT policy.	GPOL5	.848	.719
Organisation has a policy for e-waste management.	GPOL4	.835	.697
Organisation has an environmental sustainability policy.	GPOL1	.803	.645
Cronbach α		.914	



Parallel Analysis

Factor #	**Actual Eigenvalue from EFA**	**Critical value from PA**	**Decision**
1	3.731	1.2617	Accept
2	.496	1.1069	Reject

CFA using polychoric correlations with WLS in parallel mode initially produced unfavourable goodness-of-fit indices. MI and standardised residual analysis resulted in the elimination of GPOL4 and GPOL5 for model fit as shown in Figure 6.13. Non-significant χ^2 ($p > 0.05$) and factor loadings of 0.91 demonstrate good convergent validity. Goodness-of-fit indices demonstrate model fit and Cronbach α confirms internal consistency. These are reported in Table 6.17. Discriminant and factorial validity did not have to be established due to the identification of only one factor.

Figure 6.13: CFA path diagram for Green IT policies

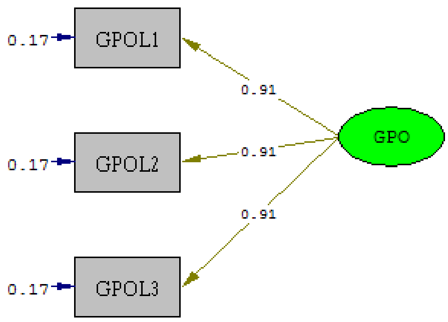


Table 6.17: Summary of model fit and convergent validity results for Green IT policies

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Green IT Policy	GPO	Organisation has an environmental sustainability policy. Organisation has a purchasing policy including Green IT acquisition. Organisation has a policy for environmentally friendly IT use.	GPOL1 GPOL2 GPOL3	**λ**: 0.91 **α**: 0.89 **X^2**:1.29; ***df***: 2; ***p***:0.52 **RMSEA**: 0.00 **SRMR**: 0.07 **NNFI**: 1.00 **CFI**: 1.00 **PNFI**: 0.66

Policies formalising environmental sustainability, Green IT purchase and environmentally friendly IT usage emerged as new items from the survey. These were grouped under the “Green IT policy” mechanism and were added to the final ITGM, as shown in orange in Figure 6.14.

Green IT Policy:

- Ecological IT use policy
- Green IT acquisition in purchasing policy
- Environmental sustainability policy

Figure 6.14: Green IT policy items in the final ITGM

6.7.7 Green IT mechanisms - Green IT practice

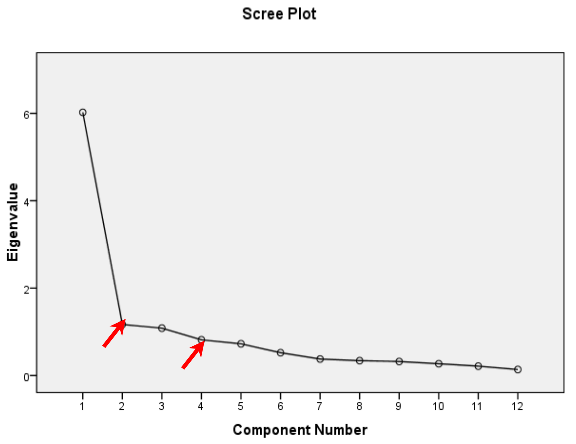
Following confirmation of factorability (subject to variable ratio: 10:1; KMO: 0.842; $p < 0.001$ and factor item correlations mostly > 0.3), EFA of the 12 Green IT practice items identified three factors contributing 50.2%, 9.8% and 9.0% respectively of the total variance (69%). The scree plot showed marked elbows after one and three components, whereas PA suggested one factor. EFA was therefore repeated to force one factor (GPR), with a variance of 50.2%. As shown in Table 6.18, except for GPRAC12, all items had excellent (> 0.7) to fair (> 0.45) factor loadings (Comrey and Lee 1992, quoted in DiStefano 2005, 227). Three items (including GPRAC12) had communalities below the 0.5 range (MacCallum et al. 1999). These are highlighted in red in Table 6.18 and were removed from the list. Remaining items demonstrated internal consistency ($\alpha = 0.913$).

Table 6.18: Summary of EFA, Cronbach αand PA results for Green IT practice

GREEN IT PRACTICE

Subject to variable ratio: 10:1; **KMO:** 0.842; **p** < 0.001

Green IT Practice Items	Item code	Factor loadings GPR	Communalities
Organisation prefers environmentally responsible IT suppliers	GPRAC1	.821	.674
Environmental factors are considered in the design of IT infrastructure.	GPRAC5	.819	.671
Environmental factors are considered in IT procurement.	GPRAC4	.806	.650
Organisation encourages the use of technology-related alternatives to travel.	GPRAC8	.776	.602
Organisation encourages Green printing.	GPRAC7	.749	.561
Organisation encourages Green IT behaviour.	GPRAC6	.749	.561
Technology is upgraded for improved energy efficiency.	GPRAC2	.736	.541
Organisation provides e-transaction facilities.	GPRAC3	.703	.498
IT solutions are used to increase production efficiency.	GPRAC9	.701	.491
Old IT equipment are recycled.	GPRAC11	.545	.297
Old IT equipment are re-used where possible.	GPRAC10	.503	.253
E-waste is responsibly disposed of.	GPRAC12	.472	.222
Cronbach α		.913	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	6.023	1.5429	Accept
2	1.169	1.3849	Reject
3	1.084	1.2727	Reject

EFA results then constituted the input to parallel model CFA using polychoric correlations with WLS. Following goodness-of-fit, MI and standardised residual analysis, several items were removed as shown in Figure 6.15. Non-significant χ^2 ($p > 0.05$) and factor loadings of 0.84 demonstrated good convergent validity. As reported in Table 6.19, goodness-of-fit indices demonstrated model fit and Cronbach α confirmed internal consistency. Since Green IT practices were grouped under only one factor, discriminant and factorial validity did not have to be established.

Figure 6.15: CFA path diagram for Green IT practices

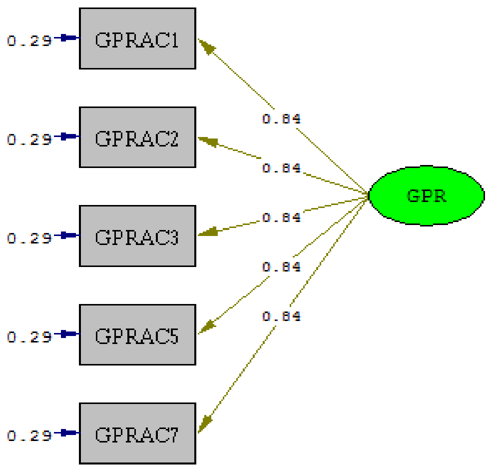


Table 6.19: Summary of model fit and convergent validity results for Green IT practices

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Green IT Practice	GPR	Organisation prefers environmentally responsible IT suppliers.	GPRAC1	**λ**: 0.84 **α**: 0.86 **X^2**:7.26; ***df***: 9; ***p***:0.61 **RMSEA**: 0.00 **SRMR**: 0.04 **NNFI**: 1.00 **CFI**: 1.00 **PNFI**: 0.88
		Technology is upgraded for improved energy efficiency.	GPRAC2	
		Organisation provides e-transaction facilities.	GPRAC3	
		Environmental factors are considered in the design of IT infrastructure.	GPRAC5	
		Organisation encourages Green printing.	GPRAC7	

Survey findings therefore triangulated multiple Green IT practices (a preference for environmentally sustainable IT suppliers as a Green IT purchase criterion, regular technological updates, e-transactions and Green printing). In addition, surveys enabled the inclusion of environmental factors in the design of IT infrastructure for “greening” IT to be discovered. This was added to the final ITGM, as highlighted in orange in Figure 6.16.

Green IT Practice:

- Greening IT

- Regular technological upgrades
- Green criteria in IT purchase
- **Green IT infrastructure design**

- Green IT disposal

- Hiring ‘green’ disposal company
- Re-use/donations
- Recycling

- Greening by IT

- IT to optimise production
- Video-conferencing
- E-transactions
- Green printing
- Regular review of processes for energy efficiency through IT

Figure 6.16: Green IT practice items in the final ITGM

6.7.8 Green IT mechanisms - Green technology

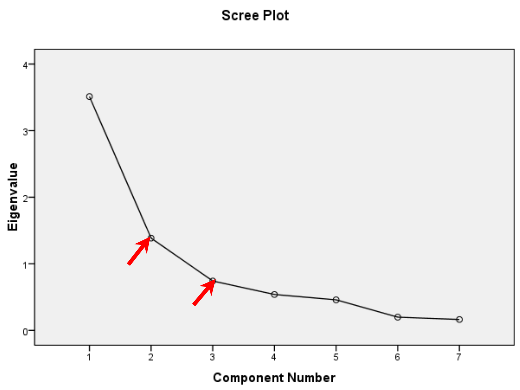
Factorability was confirmed for the seven Green technology items (subject to variable ratio: 17:1; KMO: 0.696; $p < 0.001$, factor item correlations mostly > 0.3). EFA generated two factors (GTE1 and GTE2) explaining 70% (49.9% by GTE1 and 20.1% by GTE2) of the total variance. This two-factor solution was retained following scree plot and parallel analysis. Results are summarised in Table 6.20. As shown in the table, all items showed excellent (> 0.7) to good (> 0.55) factor loadings as per categorisations of Comrey and Lee (1992, quoted in DiStefano 2005, 227). Communalities were also well above the 0.5 range suggested by MacCallum et al. (1999). Consequently, no items were removed. This was further supported by Cronbach α values which demonstrated the strong internal consistency of all factor items (α = 0.888 and 0.821 for GTE1 and GTE2 respectively).

Table 6.20: Summary of EFA, Cronbach αand PA results for Green technology

GREEN TECHNOLOGY

Subject to variable ratio: 17:1; **KMO:** 0.696; **p** < 0.001

Green Technology Items	Item code	Factor loadings GTE1	Factor loadings GTE2	Commu-nalities
Storage virtualisation.	GTECH2	.926		.893
Server consolidation and virtualisation.	GTECH1	.923		.858
Data centre energy efficiency and cooling.	GTECH6		.796	.796
Energy efficient lighting.	GTECH4		.774	.721
Building management systems for energy efficiency.	GTECH5		.770	.594
Use of collaborative software (e.g. document management systems).	GTECH7		.726	.675
Desktop virtualisation.	GTECH3		.615	.517
Cronbach α		.888	.821	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	3.491	1.3508	Accept
2	1.408	1.1987	Accept
3	.734	1.0877	Reject

CFA using polychoric correlations with WLS and in parallel mode generated goodness-of-fit indices which indicated model unfit. MI and standardised residual analysis then followed, resulting in only three items fitting the model. These are shown in Figure 6.17. χ^2 non-significance ($p > 0.05$) and factor loadings of 0.75 demonstrated convergent validity. As reported in Table 6.21, goodness-of-fit indices confirmed model fit and Cronbach α showed internal consistency. With only one factor categorising Green technology, discriminant and factorial validity were not required.

Figure 6.17: CFA path diagram for Green technology

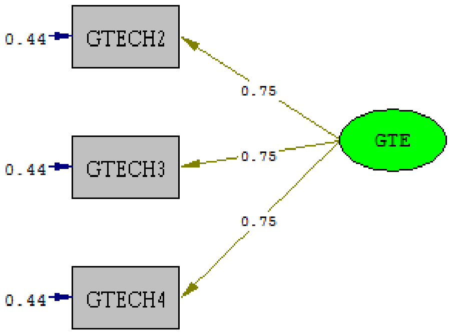


Table 6.21: Summary of model fit and convergent validity results for Green technology

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Green technology	GTE	Storage virtualisation Desktop virtualisation Energy-efficient lighting	GTECH2 GTECH3 GTECH4	**λ**: 0.75 **α**: 0.72 **X^2**:1.05; ***df***: 2; ***p***:0.59 **RMSEA**: 0.00 **SRMR**: 0.04 **NNFI**: 1.02 **CFI**: 1.00 **PNFI**: 0.66

In addition to triangulating virtualisation (storage and desktop) as Green IT technology, survey results also revealed the use of energy-efficient lighting as a new item. This was added to the final ITGM, as highlighted in orange in Figure 6.18.

<u>Green Technology:</u>

- Energy efficient hardware
- Virtualisation
- Software promoting energy & resource efficiency
- **Energy-efficient lighting**

Figure 6.18: Green technology items in the final ITGM

6.7.9 IT Governance and Green IT influencers - IT Governance drivers

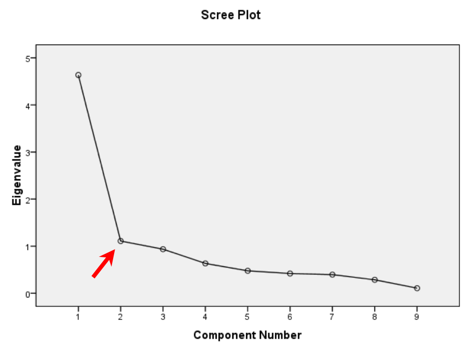
Once factorability established (subject to variable ratio: 13:1; KMO: 0.835; $p < 0.001$ and factor item correlations mostly > 0.3), EFA of IT governance drivers classified its nine items under two components, each contributing 51.2% and 12% respectively of the total variance (63.2%). Both scree plot and parallel analysis supported a one factor solution (as shown in Table 6.22). EFA was therefore repeated to force one factor, IGD, which explained 51.2% of the total variance. As highlighted in red in Table 6.22 , two items were not retained since their communality values did not satisfy the 0.5 range suggested by MacCallum et al. (1999). In addition to its low communality, ITGD9 also loaded poorly on its factor as per Comrey and Lee's (1992, quoted in DiStefano 2005, 227) categorisation, thus further supporting its removal. The remaining items demonstrated strong internal consistency (α = 0.886).

Table 6.22: Summary of EFA, Cronbach αand PA results for IT governance drivers

IT GOVERNANCE DRIVERS

Subject to variable ratio: 13:1; **KMO:** 0.835; **p** < 0.001

IT Governance Driver Items	Item code	Factor loadings IGD	Commu-nalities
Industry resilience.	ITGD2	.867	.752
The acquisition of certifications or accreditation endorsing effective IT use.	ITGD1	.851	.724
Political strategy of turning Mauritius into an ICT hub.	ITGD5	.790	.624
Organisational strategy to increase its presence in the African region.	ITGD8	.768	.589
Client expectations.	ITGD6	.748	.559
Suggested amendments to the Mauritian Regulatory Framework.	ITGD4	.710	.504
Current Mauritian legislation.	ITGD3	.660	.495
The level of IT governance of competitors.	ITGD7	.567	.321
Organisation's (or its Group's) value on the Stock Exchange of Mauritius.	ITGD9	.321	.103
Cronbach α		.886	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	4.611	1.4237	Accept
2	1.084	1.2755	Reject

CFA using polychoric correlations with WLS and in parallel mode showed model unfit. MI and residual analysis resulted in the removal of several more items, until only four IT governance drivers demonstrated model fit. Their corresponding path diagram is shown in Figure 6.19. χ^2 non-significance ($p > 0.05$) and factor loadings of 0.79 demonstrated convergent validity. As reported in Table 6.23, goodness-of-fit indices confirmed model fit and Cronbach α showed internal consistency. Discriminant and factorial validity tests were not required, since only one factor was identified.

Figure 6.19: CFA path diagram for IT governance drivers

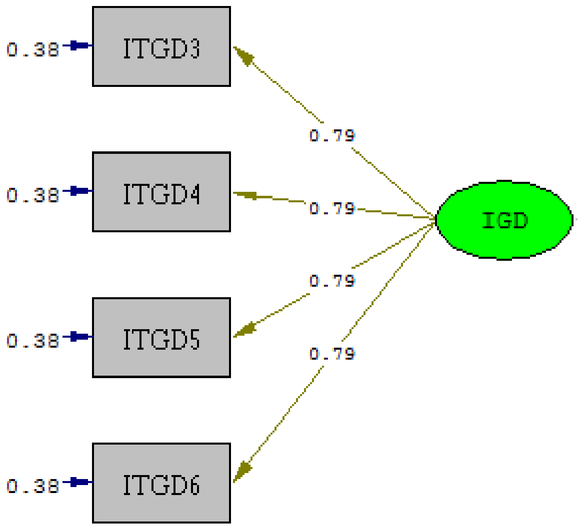


Table 6.23: Summary of model fit and convergent validity results for IT governance drivers

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
IT governance drivers	IGD	Current Mauritian legislation.	ITGD3	**λ**: 0.79 **α**: 0.79 **X^2**:2.66; ***df***: 5; ***p***:0.75 **RMSEA**: 0.00 **SRMR**: 0.05 **NNFI**: 1.02 **CFI**: 1.00 **PNFI**: 0.82
		Suggested amendments to the Mauritian Regulatory Framework.	ITGD4	
		Political strategy of turning Mauritius into an ICT hub.	ITGD5	
		Client expectations.	ITGD6	

In addition to validating current and proposed changes to the Mauritian legal framework, survey results identified client expectations and the political strategy of turning Mauritius into an ICT hub as two new IT governance drivers. These new findings were categorised as external IT governance drivers together with industry resilience and certifications (identified from document analysis), since they either aim at satisfying external business stakeholders such as customers and the government or are based on industry turbulences which are external to the organisation. The remaining IT governance drivers (cost and value optimisation, IT strategic alignment and IT risk management) were classified as internal, since they relate to the achievement of business needs and are internal to the company. Changes made to the IT governance drivers' section of the final ITGM are shown in orange in Figure 6.20.

IT Governance Drivers

- Internal

- IT cost & value optimisation
- IT risk management
- Strategic IT alignment

- External

- Certifications & accreditations
- Industry resilience
- Mauritian legal framework
  - Current
  - Proposed amendments
- Client expectations
- Political strategy

Figure 6.20: IT governance drivers in the final ITGM

6.7.10 IT Governance and Green IT influencers - Green IT drivers

Green IT drivers also demonstrated factorability (subject to variable ratio: 12:1; KMO: 0.830; $p < 0.001$ and factor item correlations > 0.3). As shown in Table 6.24, EFA of its ten items clustered those under two factors (GID1 and GID2), each capturing 46.9% and 16% of the overall variance respectively (total of 62.9%). Table 6.24 further illustrates results of scree plot and parallel analysis, both validating the two-factor solution. Factor loadings under GID1 were good (> 0.55) or better and those under GID2 were all excellent (> 0.7), as per Comrey and Lee's (1992, quoted in DiStefano 2005, 227) classifications. However, two items (shown in red in Table 6.24) were removed from the list, as their communalities were below MacCallum et al.'s (1999)

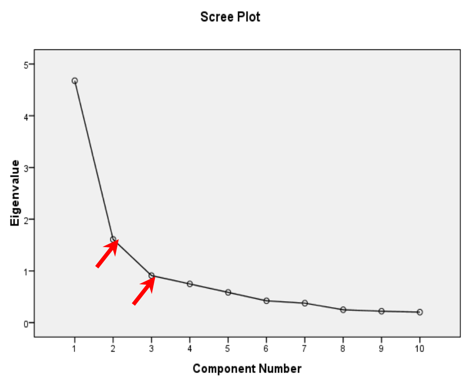
0.5 range. As seen in Table 6.24, all remaining items showed good internal consistency (α = 0.817 and 0.906 for GID1 and GID2 respectively).

Table 6.24: Summary of EFA, Cronbach αand PA results for Green IT drivers

GREEN IT DRIVERS

Subject to variable ratio: 12:1; **KMO:** 0.830; **p** < 0.001

Green IT Driver Items	**Item Code**	**Factor loadings**		**Commu-nalities**
		GID1	**GID2**	
Society's environmental concern.	GIGD8		.907	.835
Competitor's environmental concern.	GIGD7		.888	.807
Client's environmental concern.	GIGD6		.879	.829
Industry resilience.	GIGD2	.824		.702
The acquisition of certifications or accreditations endorsing environmental responsibility	GIGD1	.749		.613
Suggested amendments to the Mauritian Regulatory Framework.	GIGD4	.731		.534
Current Mauritian Legislation.	GIGD3	.617		.396
Organisational strategy to increase its presence in the African region.	GIGD9	.597		.662
Organisation's (or it's Group's) value on the Stock Exchange of Mauritius	GIGD10	.556		.411
Political strategy of turning Mauritius into a sustainable island.	GIGD5	.548		.497
Cronbach α		.817	.906	



Parallel Analysis

Factor #	**Actual Eigenvalue from EFA**	**Critical value from PA**	**Decision**
1	4.688	1.4753	Accept
2	1.598	1.3254	Accept
3	.893	1.2068	Reject

The CFA using polychoric correlations with WLS in parallel mode indicated model fit for GID2 only. Goodness-of-fit indices were unfavourable for GID1, resulting in the removal of several items following MI and standardised residual analysis. This is shown in Figure 6.21. Convergent validity was established by non-significant χ^2 (p >

0.05) and factor loadings of 0.85 and 0.91 for GID1 and GID2 respectively. Goodness-of-fit indices and Cronbach α confirmed model fit and reliability. These results are reported in Table 6.25.

Figure 6.21: CFA path diagram for Green IT drivers

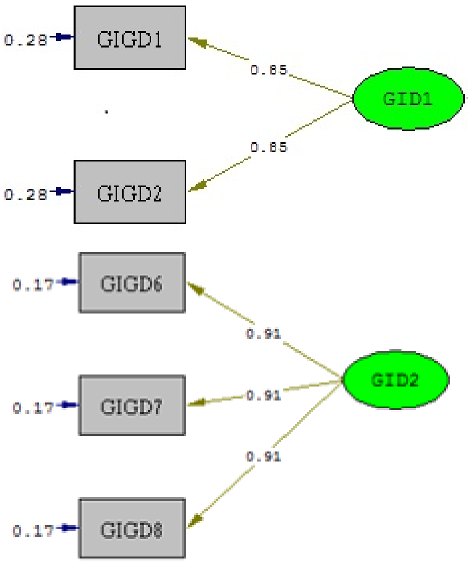


Table 6.25: Summary of model fit and convergent validity results for Green IT drivers

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Green IT drivers	GID1	The acquisition of certifications or accreditations endorsing environmental responsibility Industry resilience.	GIGD1 GIGD2	**λ**: 0.85 **α**: 0.79 **X^2**:0.00; ***df***: 0; ***p***:1 **RMSEA**: 0.00 **SRMR**: 0.00 **NNFI**: 1 **CFI**: 1 **PNFI**: 1
	GID2	Clients' environmental concern. Competitors' environmental concern. Society's environmental concern.	GIGD6 GIGD7 GIGD8	**λ**: 0.91 **α**: 0.91 **X^2**:0.31; ***df***: 2; ***p***:0.85 **RMSEA**: 0.00 **SRMR**: 0.01 **NNFI**: 1.02 **CFI**: 1.00 **PNFI**: 0.67

With Green IT drivers clustered under two factors, discriminant validity needed to be determined. This was demonstrated by a $\chi 2$ test of difference between constrained and unconstrained (free) factor pairs which resulted in the unconstrained model having a statistically significant ($p < 0.05$) smaller value. Discriminant validity results are reported in Table 6.26.

Table 6.26: Summary of discriminant validity results for Green IT driver factors

Construct	Factor pairs		χ2			*df*	*p*
			Constrained	Unconstrained	Difference		
Green IT Drivers	GID1	GID2	48.72	41.74	6.98	1	0.008

Both factors were also shown to represent the Green IT driver construct through their factorial validity. The resulting path diagram and valid goodness-of-fit indices are illustrated in Figure 6.22 and Table 6.27 respectively.

Figure 6.22: CFA path diagram for Green IT driver construct with both its factors

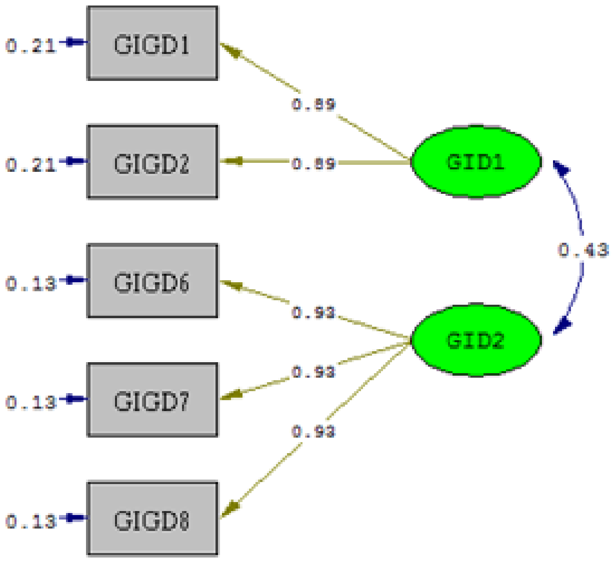


Table 6.27: Summary of factorial validity results for Green IT driver factors

Construct	Factor	Items	Item code	Factorial validity goodness-of-fit indices
Green IT drivers	GID1	The acquisition of certifications or accreditations endorsing environmental responsibility	GIGD1	**X^2**: 3.73; ***df***: 7; ***p***: 0.81 **RMSEA**: 0.00 **SRMR**: 0.04 **NNFI**: 1.01 **CFI**: 1.00 **PNFI**: 0.69
		Industry resilience.	GIGD2	
	GID2	Clients' environmental concern.	GIGD6	
		Competitors' environmental concern.	GIGD7	
		Society's environmental concern.	GIGD8	

Survey findings were found to triangulate the acquisition of certifications or accreditations endorsing environmental responsibility, as well as industry resilience. Three new Green IT drivers (clients', competitors' and society's environmental concerns) also emerged. These were grouped as "stakeholder environmental concern". Prior to adding the latter to the final ITGM, it was decided to categorise Green IT drivers as internal and external. This categorisation was based on Molla and Abareshi's (2012) internal and external loci of Green IT motivation. As mentioned in section 6.7.5, resource (and its resulting economic) efficiency as well as sustainable practices (such as ecological IT disposal) emanating from top management and employee beliefs are strong internal Green IT motivators (Molla and Abareshi 2012). Concern for IT energy efficiency and environmental IT disposal were thus moved from the Green IT attitude factor to be classified as internal Green IT drivers. On the other hand, external Green IT sources of motivation include market forces (e.g. client expectations and competitiveness) and the need for legitimacy fuelled by political (e.g. regulations) and normative (e.g. Green IT guidelines and codes of conducts) pressures (Molla and Abareshi 2012). Environmental certifications and accreditations along with industry resilience, current and proposed legal framework as well as stakeholder environmental concerns were therefore classified as external Green IT drivers. The amended Green IT drivers' section of the final ITGM is illustrated in Figure 6.23, with new survey findings highlighted in orange.

Green IT Drivers

- Internal
- Concern for IT energy consumption
- Concern for environmental impact of IT disposal

- External
- Certifications & accreditations
- Industry resilience
- Mauritian legal framework
  - Current
  - Proposed amendments
- Stakeholder environmental concern

Figure 6.23: Green IT drivers in the final ITGM

6.7.11 IT Governance and Green IT influencers - IT Governance and Green IT Incentives & Support

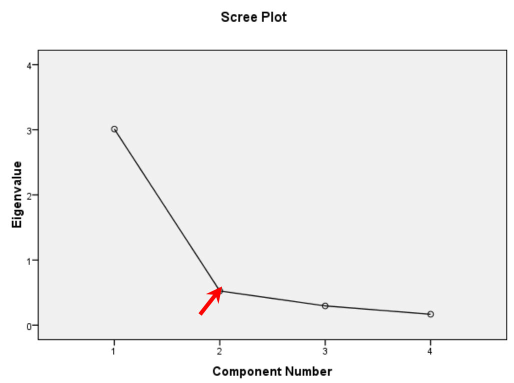
Once factorability was established (subject to variable ratio: 30:1; KMO: 0.773; $p < 0.001$ and factor item correlations > 0.3), EFA of the four items under IT Governance and Green IT Incentives and Support identified one factor (GGI) which explained 75.2% of the total variance and had strong internal consistency ($\alpha = 0.889$). The one-factor solution was supported by both scree plot and parallel analysis. No items were removed since they all loaded excellently (> 0.7) on GGI, based on Comrey and Lee's (1992, quoted in DiStefano 2005, 227) categorisation and had communalities above the 0.5 range as suggested by MacCallum et al. (1999). EFA results are illustrated in Table 6.28.

Table 6.28: Summary of EFA, Cronbach αand PA results for IT governance & Green IT incentives and support mechanisms

IT GOVERNANCE & GREEN IT INCENTIVES and SUPPORT MECHANISMS

Subject to variable ratio: 30:1**; KMO:** 0.773**; p** < 0.001

Incentives and Support Mechanism Items	Item code	Factor loadings GGI	Commu-nalities
Government-provided Green IT support units.	IGGI3	.902	.814
Government-provided IT Governance support units.	IGG4	.872	.761
Green IT governance awards	IGG2	.861	.741
Tax benefits on Green IT equipment.	IGGI1	.832	.692
Cronbach α		.889	



Parallel Analysis

Factor #	Actual Eigenvalue from EFA	Critical value from PA	Decision
1	3.009	1.2002	Accept
2	.524	1.0597	Reject

CFA using polychoric correlations with WLS and in parallel mode initially revealed model unfit. This was followed by MI and residual analysis which resulted in the removal of one item. The ensuing path diagram is shown in Figure 6.24. χ^2 non-significance ($p > 0.05$) and factor loadings of 0.87 demonstrated convergent validity. As reported in Table 6.29, goodness-of-fit indices confirmed model fit and Cronbach α showed internal consistency. Discriminant and factorial validity tests were not conducted due to the identification of only one factor.

Figure 6.24: CFA path diagram for IT governance and Green IT incentives and support mechanisms

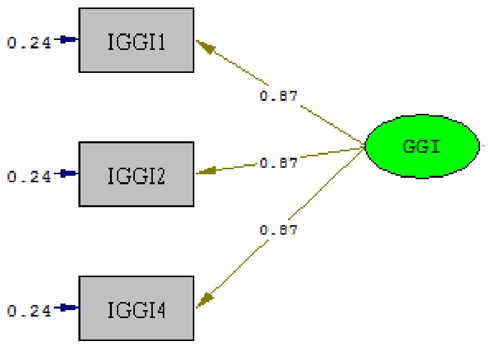


Table 6.29: Summary of model fit and convergent validity results for IT governance and Green IT incentives and support mechanisms

Construct	Factor	Items	Item Code	Factor loading, Cronbach α and goodness-of-fit indices
Incentives & Support Mechanisms	GGI	Tax benefits on Green IT equipment. Green IT governance awards Government-provided IT Governance support units.	IGGI1 IGGI2 IGGI4	**λ**: 0.87 **α**: 0.84 **X^2**:2.62; ***df***: 2; ***p***:0.27 **RMSEA**: 0.05 **SRMR**: 0.04 **NNFI**: 1.00 **CFI**: 1.00 **PNFI**: 0.66

Survey findings validated tax benefits for Green technology, the recognition of Green IT efforts through Green IT governance awards, and IT governance support from government units. No new incentive or support items were discovered.

6.8 Chapter summary

This chapter discusses the survey conducted among key companies of Mauritius to refine the draft IT governance and Green IT model resulting from interview and document analysis. Firstly, the questionnaire design was described. The target population was then justified before analysing the response rates. The demographic profile of respondents were presented next. It was found that the majority of respondents were IT managers from private companies primarily belonging to the Mauritian finance and IT industries. Techniques for survey data analysis were then discussed. These include the analysis of central tendencies for IT decision accountabilities as well as exploratory and confirmatory factor analysis used to establish the validity and reliability of the remaining survey data.

The rest of the chapter presented results of survey data analysis for each IT governance and Green IT mechanism and influencer. It explained why several items had to be removed from the initial model due to their low factor loadings, communalities or goodness-of-fit indices. Modification index and standardised residual analysis were conducted to remove items preventing model fit or unidimensional validity. Convergent validity was also demonstrated by non-significant χ^2 and factor loadings exceeding 0.707. Internal consistency was established by Cronbach α values exceeding 0.7. In cases where items under a mechanism or influencer contained more than one factor, factor difference or discriminant validity was demonstrated by a statistically significant, lower χ^2 value for an unconstrained model as opposed to a constrained one. Where applicable, factorial validity was also confirmed by valid goodness-of-fit indices generated by the confirmatory factor analysis of all factors identified under a construct.

Survey findings were then used to triangulate previous results and newly emerged items were added to the IT governance and Green IT model to produce its final version. The latter is discussed in detail in the next chapter.

Chapter 7: The Final IT Governance and Green IT Model

7.1 Introduction

Results from this study enhance the overall understanding of organisational IT governance in Mauritius. The final IT governance and Green IT model (ITGM) generated from interviews, document analysis and surveys shows that large companies from the key economic sectors in Mauritius do have an IT governance and Green IT agenda. It is envisioned that the final ITGM derived from this research will play a pivotal role in supporting large businesses from the core economic sectors of Mauritius in managing their IT Governance and Green IT.

This chapter presents the final ITGM, discusses each accountability, mechanism and influencer documented in the model and links them to best practice applied world-wide.

7.2 The final IT governance and Green IT model

The final ITGM groups findings from ten company interviews across the five main pillars of the Mauritian economy (discussed in Chapter 4), analysis of company and government documents (discussed in Chapter 5) and survey of large companies from key economic sectors of the island (discussed in Chapter 6). IT decision accountabilities, IT governance mechanisms, Green IT mechanisms as well as IT governance and Green IT (ITG) influencers resulting from all three methods were collated to generate the final IT governance and Green IT model shown in Figure 7.1. The arrows moving from IT governance and Green IT mechanisms to IT decision accountabilities indicate that the mechanisms assist in IT decision making while the arrow from ITG influencers to IT decision accountabilities represents the influence of ITG drivers, incentives and support on IT decision taking. Each section of the model is discussed next.

IT GOVERNANCE MECHANISMS

IT Governance Structures:
- Short reporting lines between business & IT
- **Committees**
  - IT
  - Executive
  - Steering / project steering
  - Audit/risk
- Green IT structure
- IT steering committee consists of both business & IT Heads

IT Governance Processes:
- **IT cost & value control**
  - Centralised, yearly IT budget
  - IT budget monitoring & reporting
  - Business case
  - IT performance value assessment
  - IT charge-back
  - SLAs
- IT acquisition & development strategy
- Risk management framework
- **Strategic IT use**
  - Best practice evaluation
  - IT Heads scan for technological innovations
  - Strategic IT direction
  - IT policies & processes

IT Governance Relational Mechanisms:
- Business & IT communication
- Co-location or centralised business & IT meetings
- IT governance knowledge management
- Systems & processes for Green IT employee awareness

IT DECISION ACCOUNTABILITIES

IT decision types	Accountabilities
IT Investment and Prioritisation	Business monarchy or IT duopoly
Business Application Needs	Business monarchy or IT duopoly (both with BU Head input) or federal or IT monarchy
IT Infrastructure IT Architecture	Business or IT monarchy or IT duopoly
IT Principles	Business or IT monarchy or IT duopoly or federal
Green IT	Business or IT monarchy

GREEN IT MECHANISMS

Green IT Attitude:
- Green IT executive leadership

Green IT Policy:
- Ecological IT use policy
- Green IT acquisition in purchasing policy
- Environmental sustainability policy

Green IT Practice:
- **Greening IT**
  - Regular technological upgrades.
  - Green criteria in IT purchase
  - Green IT infrastructure design
- **Green IT disposal**
  - Hiring 'green' disposal company
  - Re-use/donations
  - Recycling
- **Greening by IT**
  - IT to optimise production
  - Video-conferencing
  - E-transactions
  - Green printing
  - Regular review of processes for energy efficiency through IT

Green Technology:
- Energy efficient hardware
- Virtualisation
- Software promoting energy & resource efficiency
- Energy efficient lighting

ITG INFLUENCERS

IT Governance Drivers
- **Internal**
  - IT cost & value optimisation
  - IT risk management
  - Strategic IT alignment
- **External**
  - Certifications & accreditations
  - Industry resilience
  - Mauritian legal framework
    - Current
    - Proposed amendments
  - Client expectations
  - Political strategy

Green IT Drivers
- **Internal**
  - Concern for IT energy consumption
  - Concern for environmental impact of IT disposal
- **External**
  - Certifications & accreditations
  - Industry resilience
  - Mauritian legal framework
    - Current
    - Proposed amendments
  - Stakeholder environmental concern

ITG Incentives & support
- Green IT tax benefits
- Green IT awards
- Green IT government support mechanisms
- IT governance government support mechanisms

Figure 7.1: The final IT governance and Green IT model (ITGM)

7.3 Discussing IT decision accountabilities

A number of observations can be made from the accountabilities documented in the final ITGM. For example, the responsibility for IT investment and prioritisation decisions, defined through either a business monarchy or an IT duopoly (collective responsibility of IT and business executives), demonstrates the interest of Mauritian business executives in such decisions. This aligns with Weill's (2004) research which surveyed 250 companies from 23 different countries from America, Europe and Asia Pacific to demonstrate rising business executives' awareness of strategic IT investments. The finding also corroborates IT governance best practice identified in the top IT governance enterprises in Belgium (De Haes and Van Grembergen 2009a). Likewise, in their study of Australian companies, Ali, Green and Robb (2015) found that top management needs to be involved in IT investment decisions in order to improve business/IT alignment and value. Large Mauritian enterprises are no exception. The ITGM shows that IT investment decisions are not isolated from business strategy, and executives from large Mauritian companies in key economic sectors are concerned about making wise IT choices for business benefits.

Despite different modes of accountability for IT "make or buy" (business application needs) decisions, the responsibility of business executives and IT executives or Heads is noted in the Mauritian companies. Business unit (BU) Heads appear to often have an active role in this decision by either providing their input or being part of the decision. This view is reflected by Weill (2004) who found that the joint decisions made by IT, business and BU Heads regarding business application needs help to integrate enterprise strategies in business unit requirements. However, this approach has also been found to be less efficient and time consuming, particularly due to complications arising from the number of parties involved (Van Grembergen and De Haes 2008). This could explain the identification of IT monarchy as an equally common form of accountability for this type of decision. It would therefore appear that accountabilities for business application in large Mauritian companies from major economic sectors are driven by either enterprise-wide standards or, simply, efficient decision-making.

Whether it be a business monarchy, IT duopoly or IT monarchy, the strong presence of IT executives/Heads in infrastructural and architectural decisions is also seen in the final ITGM. This could be explained by the fact that IT architecture and infrastructure decisions are often considered to be too technical for business executive involvement (Weill 2004). Interviews also revealed a preference for the IT monarchy mode of accountability in cases where IT infrastructural and architectural decisions are purely technical, as opposed to a business monarchy (including IT executive) when the decision is more strategic. This aligns with the views of Xue, Liang and Boulton (2008) who, following a study of IT governance in Chinese hospitals, suggest an IT monarchy responsibility when deciding on IT infrastructure and architecture with little strategic influence, but recommend considerable business executive involvement when such decisions are strongly business-related in order to enhance IT and business alignment. Large Mauritian companies from the island's economic pillars have adopted a similar pattern whereby they tend to opt for IT monarchies for technical IT decisions as opposed to joint IT and business executive ownership when decisions are of a more strategic nature.

Several modes of accountability were found to govern business IT usage or IT principles decisions among the Mauritian companies investigated. Whether business monarchy, IT duopoly or federal, business executives were often found to share ownership of this decision. Such involvement is recommended for strategic IT alignment when planning business IT use (Trites 2004). In addition, federal configurations to guide IT usage focusses on IT that best addresses individual business unit requirements (Weill and Ross 2005). On the other hand, a strong penchant for the IT monarchy mode of accountability is also seen among the Mauritian companies explored, thereby indicating a more enterprise-wide approach.

In line with findings of Molla and Cooper's (2009) study of Australian companies, the final ITGM reflects the key role of IT leaders, such as the CIO, in Green IT decisions. When implemented as a business monarchy, IT and business executive commitment to champion sustainable ICT projects is seen. Such top management support is recommended in literature to promote Green IT endeavours in enterprises (Bose and Luo 2011; Donnellan, Sheridan, and Curry 2011; Akman and Mishra 2015). On the other hand, the popularity of IT monarchies can be explained by the Green IT knowledge of IT leaders and the pervasiveness of the IT department, thereby making it best suited for making decisions on Green IT endeavours affecting the entire enterprise (Dutta and Mia 2010).

Monarchies were found to be commonly implemented in large key Mauritian companies across all IT decision types. This shows a tendency to centralise IT (including Green IT) decisions for standardisation of processes (Weill and Ross 2005). The ensued reduced costs and enterprise-wide synergy lead to higher profits and the company benefits from greater executive control (Sohal and Fitzpatrick 2002). The popularity of IT duopolies among large Mauritian enterprises from the island's prime economic sectors also demonstrates a cost-saving strategy which is based on the optimisation of IT assets (Weill and Ross 2005). This hybrid approach straddles between centralised (enterprise-wide control) and decentralised (BU independence) to get the best of both (Sohal and Fitzpatrick 2002). It is also supported by Bermejo, Tonelli and Zambalde (2014) in their study of Brazilian companies. The latter prefer duopolies for greater business and IT alignment in IT decision-making (Bermejo, Tonelli, and Zambalde 2014). Collaboration of business and IT (whether in business monarchies, IT duopolies or in a federal configuration) is also apparent in all IT decisions. This partnership is widely recommended for strategic IT use (Peterson 2004; Weill and Ross 2004; Chan, Sabherwal, and Thatcher 2006; Bowen, Cheung and Rohde 2007; Willson and Pollard 2009; De Haes and Van Grembergen 2009b; Heart, Maoz, and Pliskin 2010). Cost savings, increased control and strategic IT alignment appear to be strong determinants underlying the choice of IT decision accountability in key Mauritian enterprises.

In addition to IT decision accountabilities, the Mauritian companies explored were found to implement several IT governance and Green IT mechanisms to facilitate strategic IT decision-making. The latter is also influenced by numerous factors documented in the ITGM. IT governance and Green IT mechanisms as well as their influencers are discussed next in more detail.

7.4 Discussing IT governance structure mechanisms

Monarchy, federal or duopoly modes of accountability require structures that are conducive to "enterprise-wide synergies" (Weill and Ross 2004, 7). Several such structures have been established in the Mauritian companies explored. However, the absence of Green IT structures in most of them is conspicuous. Final ITGM structures are discussed in the subsections which follow.

7.4.1 Short IT reporting lines between business and IT

IT Heads/CIOs were found to report to CEO, Managing Director, COO and, in some cases, even the CFO, thus demonstrating short reporting lines between IT and business in large companies belonging to the major sectors of the Mauritian economy. This practice aligns well with theory, since numerous research findings encourage short IT reporting relationships for improved strategic business and IT alignment (Luftman and Brier 1999; Sohal and Fitzpatrick 2002; Law and Ngai 2007; Raghupathi 2007). Short IT reporting lines were also highlighted as a key governance structure by De Haes and Van Grembergen (2009b) in their study of Belgian financial companies, as well as Karahanna and Preston (2013) who explored matched pairs of CIO and top management teams in the United States.

The CIO-CFO reporting relationship is supported by Schobel and Denford (2013) who, in their Canadian study, identify the CFO as not only being usually involved in strategic IT decisions, but also as being responsible for IT in many organisations. This reporting arrangement is further acknowledged by Ferguson et al. (2013) whose analysis of Australian companies suggests that IT Heads indirectly report to the CEO through a direct reporting line to the CFO for improved IT cost control. Banker et al. (2011), who studied U.S firms, contend that the CIO reporting line should depend on the organisational strategy for maximum value. For example, a cost leadership strategy would be best supported by a CIO-CFO reporting line. This would enable the CIO to work closely with the organisational financial executive to ensure IT use for business efficiency. On the other hand, a CIO-CEO reporting relationship brings greater value when the company strategy is to use IT for differentiation. Short reporting lines between business and IT in the Mauritian businesses explored therefore help to decrease IT costs and optimise strategic use.

7.4.2 IT governance committees

Several committees were found to be commonly implemented by the companies explored in Mauritius. These include IT, executive, steering and project steering as well as audit/risk committees. This finding is supported by IT governance best practice from across the world. For example, in their study involving Australian ISACA members, Ferguson et al. (2013) found that an IT steering committee is a key component of effective IT governance. Following their research involving Canadian companies, Turel and Bart (2014) recommend the setting up of a board IT committee for superior IT performance. Elagha's (2014) study of Emirati enterprises advocates the implementation of IT strategic and steering committees for effective IT governance. Ali and Green (2012) studied Australian companies to deduce that firms having strategic level IT committees govern IT more effectively. De Haes and Van Grembergen (2009b) identify IT steering committees amongst IT governance structures adopted by high IT governance performing organisations in Belgium. In addition, following their study of companies in the United Arab Emirates, Majdalawieh and Zaghloul (2009) contend that as businesses become increasingly IT-dependent, an IT audit serves to inform business executives of organisational IT efficiency and provides an assessment of the business impact of IT decisions for effective IT governance. The presence of board-level audit/risk committees responsible for IT audits demonstrates a commitment to good governance of enterprise IT. Large Mauritian companies from major industry sectors appear to align with international best practice as far as IT governance committees are concerned.

7.4.3 Green IT structure

Green IT structures were found to be implemented in many of the companies explored. For example, some companies have sustainability and energy officers who take responsibility for Green IT measures. This aligns with the view of Murugesan (2008) who recommends that, as part of a large organisation's Green IT strategy, a sustainability officer be employed to oversee the implementation, monitoring and control of Green IT. Green IT governance structures for collaborative business and IT buy-in need to be established for Green IT commitment. According to Melville (2010), organisational structures related to environmental sustainability help to foster a positive attitude towards the environment. Molla, Cooper and Abareshi (2014) also suggest that organisational Green IT structures reinforce Green IT values and belief among IT professionals. The presence of Green IT governance structures in many large Mauritian companies thus indicate an organisational commitment towards Green IT and environmental protection.

7.4.4 IT steering committee consisting of both business and IT Heads

IT steering committees were also found to include both business and IT Heads. This is good IT governance practice adopted by large enterprises from the main segments of the Mauritian economy since such committees formally bring together business and IT executives for the purpose of making strategic IT decisions. For example, Huang, Zmud and Price (2010) who explored companies in USA encourage the setting up of IT steering committees with both business and IT representatives to encourage a more efficient use of IT. Ferguson et al.'s (2013) analysis of Australian ISACA and Institute of Internal Auditors (IIA) members, support the implementation of active steering committees involving senior managers for improved business and IT alignment. This structure encourages business executive level involvement in IT decisions which is considered to be one of the key conditions for good enterprise governance of IT (Bowen, Cheung and Rohde 2007).

7.5 Discussing IT governance process mechanisms

Along with IT governance structures, multiple IT governance processes were a common feature of the large Mauritian organisations explored. However, there was little evidence of the adoption of IT governance and project management methodologies. Green IT processes including Green IT targets, monitoring and reporting were also found to be uncommon. Processes identified in the final ITGM are discussed in the subsections below.

7.5.1 IT budget (yearly, centralised, monitored and reported)

The allocation of a yearly IT budget was a common IT governance process which emerged in this research. This budget was found to be centrally managed, monitored and reported. This aligns with Ali, Green and Robb's (2015) findings from an Australian survey which revealed that IT budgeting based on well-planned IT projects is a crucial process for businesses. In their exploration of IT governance in Thailand, Jairak, Praneetpolgrand and Subsermsri (2015) also identify the management of IT budgets including annual IT budgets and their control as a key IT governance practice. Large Mauritian businesses from key economic pillars appear to have realised this, since they establish yearly IT budgets based on well-justified IT projects. Aligning with recommendations from De Haes and Van Grembergen (2009b), IT budgets are monitored and reported to validate the judiciousness of IT investments. A centralised approach to IT budget management also demonstrates sound IT governance, since centralised IT decisions result in improved budget control (Ferguson et al. 2013), process standardisation, and cost reduction (Weill and Ross 2005).

7.5.2 Business case and IT performance value assessment

The implementation of business case and IT value assessment processes indicate that large Mauritian businesses from key economic sectors recognise the need for valuable returns on IT investments. Business cases supporting IT investment decisions and IT performance measurements are prominent IT governance processes for strategic IT investments and assurance of business value as reflected in studies of Belgian (De Haes and Van Grembergen 2009b) and Australian (Ali, Green, and Robb 2015) companies. The business case process supports effective IT project investment decisions since they include financial, non-financial and in-depth risk analysis (Bowen, Cheung and Rohde 2007).

Once the IT investment made, it is important to measure its performance both to evaluate its business value (Tallon, Kraemer, and Gurbaxani 2000) and continuously improve (Sohal and Fitzpatrick 2002). In their study of companies from Germany, Austria and Netherlands, Buckwald, Urbach and Ahlemann (2014) identify an understanding of IT value in the organisation as an important criterion for IT governance success. Studies from other parts of the world such as Australia (Willson and Pollard 2009), Bahrain (Elagha 2014), Tanzania (Nfuka and Rusu 2011) and Saudi Arabia (Abu-Musa 2010) also consider the measurement of IT performance and business value as a prime IT governance mechanism. Large Mauritian companies from key economic sectors therefore appear to align with international best practice for IT investment support and value measurement.

7.5.3 Service level agreements and IT charge-back

Service level agreements (SLAs) and IT charge-back were also found to be processes commonly used to improve IT governance in Mauritian businesses with a high reliance on IT systems. This is supported by a number of other studies. For example, Nolan and Mc Farlan (2005) recommend that SLAs with clearly defined deliverables, responsibilities and the right trade-off between maintenance and replacement be defined for IT services to deliver business value. Similarly, following their study of 256 companies from around the world, Weill and Ross (2005) posit that SLAs should be formalised and IT costs charged-back to maximise IT asset utilisation. Both processes are further supported by De Haes and Van Grembergen (2009b) who in their study of Belgian companies, identify charge-back of IT costs and SLAs as critical IT governance processes.

7.5.4 IT acquisition and development strategy

Most large companies from the island’s prime sectors were found to adopt IT acquisition and development strategies for their IT governance process. A preference for in-house development or customisation of critical IT systems was seen, although outsourcing is not uncommon when internal expertise is lacking and cost effectiveness prioritised. This aligns with the views of Ali and Green (2012) who, following a study of Australian companies, suggest that organisations with critical IT dependency prefer in-house strategies to outsourcing. However, they also contend that as IT requirements escalate in complexity, organisations with insufficient resources may need to outsource even vital IT systems (Ali and Green 2012), thereby explaining the need for some companies to contract out the development of critical IT systems such as ERPs. On the other hand, Cragg, Caldeira and Ward's (2010) research based in Portugal, UK and New Zealand, found that off-the-shelf strategies provide an easy solution for non-critical IT processes due to their availability, low price or when founded on best practice. This was also found to be the case for Mauritan IT companies which use the same off-the-shelf strategies which they sell as a means of showcasing their own products.

7.5.5 Risk management framework

IT risk management included in the overall company risk management framework was another common process documented in the ITGM. This aligns with literature which recognises IT risk management as a critical component of IT governance (ChePa et al. 2015) and a risk management framework as an essential process for businesses to protect themselves from IT security threats (Khan 2006). Risk management frameworks require top management oversight in order to be effective (Marks 2009), hence their prominence as an IT governance process. Large, key Mauritian companies appear to adopt world-wide IT governance best practice with regard to risk management, particularly since studies in several countries including Bahrain (Elagha 2014), the United States (Bradley et al. 2012) and Saudi Arabia (Abu-Musa 2010) have reinforced the importance of risk management processes for effective IT governance.

7.5.6 IT best practice evaluation and IT Heads scan for technological innovations

This finding shows that companies studied not only look at best practices to determine organisational IT use, but IT Heads are also expected to explore IT innovations for business opportunities. Business can no longer expect exclusivity in terms of IT since, sooner or later, competition catches up. As a result, businesses need to keep a watchful eye on IT innovations that offer a competitive edge, even if they might entail a change in business processes (Peppard and Ward 2004). In their study of Australian companies, Ali, Green and Robb (2013) refer to this practice as "knowledge scanning". In large businesses in major Mauritian industries, IT Heads (as opposed to business executives) appear to shoulder most of this responsibility. This proactivity from IT management is essential to capture new technological advancements for business strategic achievements, including a competitive advantage (Peppard and Ward 2004; Ali, Green, and Robb 2013).

7.5.7 Strategic IT direction, IT policies and processes

By setting their strategic IT direction, large Mauritian companies from the island's main industries establish their IT vision for business value. Several studies have identified the need for a similar strategic IT vision as a step towards good IT governance. For example, in his analysis of more than 200 Austrian firms, Bernroider (2008) concludes that IT projects are more likely to succeed when IT governance is driven by strategic IT direction. Likewise, Willson and Pollard's (2009) Australia-based study stresses on the importance of a strategic IT vision for effective IT governance. From their investigation in Taiwan, Tsai et al. (2011) contend that Enterprise Resource Planning (ERP) systems are most successful when a technological investment strategy is established in alignment with business strategy.

Many of the Mauritian companies studied were found to formalise their IT path in a Strategic Information Systems Plan (SISP) for enhanced IT and business alignment. This facilitates good governance of IT as supported by research from across the world such as Weill's (2004) study of 256 organisations from 23 countries of America, Europe and Asia Pacific as well as Bowen, Cheung and Rohde's (2007) case study of a company based in Australia and New Zealand, and De Haes and Van Grembergen's (2009) exploration of Belgian companies.

Business and IT synergy was found to be further fostered in key Mauritian companies through the establishment of IT policies and processes, which primarily document business IT usage, IT security and IT department responsibilities. IT policies and processes clarify organisational IT use and its expected outcomes for improved IT governance (Weill 2004; Raghupathi 2007; De Haes and Van Grembergen 2009b; Bin-Abbas and Bakry 2014). This is further supported by conclusions from other studies from different parts of the world such as Bowen, Cheung and Rohde's (2007)

Australian case study, Lee, Lee and Jeong's (2008) exploration of 96 leading Korean companies and Huang, Zmud and Price's (2010) analysis of three U.S.A-based companies.

7.6 Discussing relational mechanisms of IT governance

To further enhance understanding of IT governance in large companies from core economic sectors of Mauritius, the final ITGM identifies their commonly adopted relational mechanisms. These shape a culture of shared business and IT understanding, as well as Green IT use. Such business and IT partnership is imperative to maximise organisational IT value (Luftman 2000; Sohal and Fitzpatrick 2002; Peterson 2004; Bowen, Cheung, and Rohde 2007; Willson and Pollard 2009). Final ITGM relational mechanisms are discussed in more details in the next sections.

7.6.1 Business and IT communication, co-location, and centralised business meetings

Effective communication is a key requirement for business and IT alignment (Roses, Brito, and Lucena 2015). Both formal (e.g. meetings) and informal business and IT communication were found to be commonly adopted in the Mauritian organisations explored. These mechanisms improve communication between business and IT executives, for clear understanding and achievement of corporate IT direction (Tallon, Kraemer, and Gurbaxani 2000; Law and Ngai 2007). In their analysis of three companies based in the U.S.A, Huang, Zmud and Price (2010) recognise the importance of less formal interactions between business and IT managers and claim that a combination of both formal and informal communication leads to improved IT decision-making.

Such communication in large, key Mauritian organisations was also found to be catalysed by co-locating business and IT or, when faced with geographical distance, by conducting regular, centralised meetings. With business and IT working in close proximity, communication is facilitated, thereby fostering a shared business/IT understanding and constructive collaboration (Reich and Benbasat 2000; Van

Grembergen and De Haes 2008). The importance of regular meetings to enhance shared business and IT understanding and partnership is also highlighted by Schlosser (2015) in his study of 132 banks in the United States. Likewise, following their study of Brazilian companies, Bermejo, Tonelli and Zambalde (2014) contend that such mechanisms facilitate business and IT synergy for improved IT decisions. Lee, Lee and Jeong (2008) also identify lack of clear communication mechanisms between business and IT as one of the main inhibitors of effective IT governance in Korean companies. It appears then, that large enterprises from the major industries in Mauritius align with international best practice for a strong business/IT partnership.

7.6.2 IT governance knowledge management and Green IT employee awareness

Mauritian companies explored were also found to commonly implement systems (e.g. policies and procedures located on the company Intranet) and processes (e.g. employees to sign hard copies of policies as part of their induction) to disseminate knowledge about IT governance. This aligns with Elagha's (2014) investigation of 20 Emirati organisations which concludes that communication systems (such as an Intranet setup) to share IT governance decisions and processes are critical for effective IT governance. These enable IT governance practices, policies and processes to be shared so as to improve understanding and implementation (Bin-Abbas and Bakry 2014).

Systems (e.g. Green IT policies available on the company Intranet) and processes (e.g. awareness campaigns) for spreading Green IT awareness among employees were also found to be commonly adopted. This mechanism demonstrates the interest of many large, key Mauritian companies in developing an organisational culture which values ecologically responsible utilisation of IT. This practice is supported by several other studies. For example, in their analysis of Turkish companies, Akman and Mishra (2015) found that employee Green IT commitment rests on their awareness of sustainable IT use and its benefits. This view is also shared by Molla, Abareshi and Cooper (2014) who, following an investigation of Australian companies, conclude that access to Green IT knowledge results in the right beliefs and attitudes required to drive

Green IT behaviour. Chuang and Huang's (2014) research based on Taiwanese companies suggests that the degree of business environmental sustainability relates positively to staff awareness and understanding of Green IT.

7.7 Discussing Green IT attitude

It appears that large companies from key Mauritian industries realise that the development of a Green IT culture is impossible without Green IT executive leadership. This favourable Green IT attitude from organisational leaders shows top level commitment to effecting the behavioural changes warranted by a Green IT culture and is crucial for Green IT success (Bose and Luo 2011; Donnellan, Sheridan, and Curry 2011; Mishra, Akman, and Mishra 2014). This is supported by Chuang and Huang (2014) who, in their study of Taiwanese enterprises, identified top management prioritisation of Green IT as an important factor for business sustainability. Likewise, in their investigation of Malaysian business, Gholami et al. (2013) conclude that managers with a positive Green IT attitude are more likely to adopt and achieve success in their Green IT endeavours. Similarly, Molla, Abareshi and Cooper (2014) contend that organisational structures which reflect senior management commitment to ecologically responsible utilisation of IT contribute to the enforcement of Green IT beliefs among Australian IT professionals.

7.8 Discussing Green IT policies

Top managements' commitment to Green IT initiatives in prominent Mauritian companies from major economic sectors was also found to be translated into policies for environmental IT usage, Green IT purchase and overall environmental sustainability. As part of organisation-wide greening strategies, Murugesan (2008) recommends the development of Green IT policies that clearly spell out a company's Green IT vision, objectives and initiatives. From their survey of CIOs and IT managers in Australia, Molla and Abareshi (2011) conclude that Green IT policies guiding Green IT procurement and ecologically responsible IT disposal are popular. However, although policies for ecological IT purchase were found to be common amongst the Mauritian companies surveyed, the lack of sustainable IT disposal policies was conspicuous, particularly since a concern for environmentally friendly IT disposal was identified when analysing Green IT attitudes from the survey. Nonetheless, the fact that most organisations explored also have an environmental sustainability policy demonstrates that Green IT policies align with an overall company vision so as to be ecologically viable. This aligns with Bohas and Poussing's (2016) investigation of companies based in Luxembourg which concludes that Corporate Social Responsibility policies, including company environmental responsibility, encourage the adoption of Green IT.

7.9 Discussing Green IT practice

Green IT policies would not serve much purpose if they did not lead to the implementation of sustainable IT practices. Several Green IT practices (many of them supporting previously identified Green IT policies) were found to be implemented by large companies from the major Mauritian industries. These were grouped under "Greening IT" which includes ways of supporting Green IT production and use, "Green IT disposal" which clusters methods used for ecological IT disposal and "Greening by IT" which includes ways of using IT for increased environmental respect. These three categories align with Molla and Abareshi's (2012) classifications of Green IT practice: the first order effect which includes ways of greening IT production, usage and disposal and the second order effect where IT is used to make business more environmentally sustainable. Each category of Green IT practice found in the ITGM is discussed next.

7.9.1 'Greening IT' practices

A preference for environmentally friendly IT suppliers, and other Green IT criteria for IT purchase (such as energy efficiency and green labels) demonstrate that Mauritian companies explored generally support ecologically responsible IT vendors. These practices align with sustainable IT purchasing principles recommended in literature (Erek et al. 2009) in addition to supporting Green IT considerations in purchasing policies identified in section 7.8. Some 'Greening IT' usage practices were also identified. These include regular technological upgrades as a means of making IT more ecologically friendly and the inclusion of environmental factors in the design of IT infrastructures (including data centres). Both methods align with environmentally responsible IT usage policies previously identified in section 7.8. They also concur with best practice from literature. For example, Gu et al.'s (2013) study of Dutch data centres present data centre design and cooling as examples of Greening of IT practice. Ardito and Morisio (2014) encourage environmental considerations in IT infrastructure design, including environmentally friendly data centre designs. Chuang and Huang (2014) conclude that Taiwanese companies that are regularly investing in IT infrastructure for improved energy efficiency bring greater business sustainability. Hedman and Henningson (2011) identify the use of energy efficient hardware as a Green IT strategy used in Danish companies. Bose and Luo (2012) recommend that technology be regularly upgraded for energy efficiency. "Greening IT" practices found to be implemented in key Mauritian companies therefore appear to align with international best practice and demonstrate a concern for energy efficiency.

7.9.2 Green IT disposal practices

Despite the general absence of a formal policy for e-waste management, it was found that many Green IT disposal mechanisms were being implemented in the Mauritian companies investigated. These include the services of Green disposal companies for sustainable e-waste management, re-use of equipment or spare parts and recycling of IT equipment (such as toners and cartridges). This implementation of Green IT disposal methods is encouraged in literature in order to curb the increasing generation of electronic waste (Aronson 2008; Murugesan 2008; Shevlin 2008). Molla and Abareshi's (2011) study identifies eco-effectiveness motives which include e-waste management strategies as a driver of Green IT in Australian organisations. Chuang and Huang (2014) state that a concern about IT recycling is important for improved business environmental sustainability in Taiwan. It would therefore appear that the concern about ecologically responsible disposal of IT waste in key Mauritian companies transcends Green IT e-waste policies to translate directly into Green IT best practice.

7.9.3 'Greening by IT' practices

IT was also found to be a helpful tool in the promotion of ecologically sound behaviour among the Mauritian companies explored. For example, the use of IT to optimise production efficiency and regular reviews of IT-driven processes for energy efficiency were common practices. Other 'Greening by IT' practices comprise of e-transactions, resource-efficient or green printing and video-conferencing as a substitute for air travel. These indicate that policies for environmentally friendly IT use, as well as organisational concern for energy efficiency, are backed by practice.

'Greening by IT' practices are also well grounded in literature. For example, Hedman and Henningson (2011) identify the redesign of business processes to better harness Green IT potential as a Green IT strategy used by companies in Denmark. Efficient printing using methods such as centralised and/or double-sided printing (Erek et al. 2009; Unhelkar 2011) and the adoption of eco-friendly technologies such as video-conferencing mentioned in Cai, Chen and Bose's (2013) study of Chinese companies, are also highly recommended. Based on their analysis of Iranian companies, Ainin, Naqshbandi and Dezdar (2015) encourage the use of video-conferencing as a good way of reducing the need for travel. They also support the review of production processes for increased efficiency not only to reduce environmental impacts but also to decrease both cost of inputs and waste (Ainin, Naqshbandi, and Dezdar 2015).

7.10 Discussing Green Technology

To support Green IT practice, companies explored were found to adopt Green technology such as (1) virtualisation, (2) energy efficient hardware, (3) software promoting energy and resource efficiency and (4) the adoption of energy efficient lighting. Implementation of such Green IT technology mechanisms are highly encouraged in literature. For example, Hedman and Henningson (2011) identify server virtualisation as good common practice among companies in Denmark. In their analysis of press releases from U.S-based and other companies, Jain, Benbunan-fich and Mohan (2011) identify virtualisation as one of the most commonly cited Green IT technology. Companies in Taiwan adopt Green IT technology such as server virtualisation and energy-efficient hardware for improved business environmental responsibility (Chuang and Huang 2014). Several other authors also recommend virtualisation for energy and resource efficiency, and energy-efficient hardware for improved business greening (Murugesan 2008; Berl et al. 2009; Beloglazov, Abawajy, and Buyya 2011). Following their analysis of Australian companies, Molla, Cooper and Pittayachawan (2011) identify energy efficient lighting as a Green IT technology. Faucheux and Nicolaï (2011) support eco-innovations such as Building Management Systems for the promotion of energy-efficient buildings. Software promoting resource efficiency such as collaborative software commonly used in Chinese companies (Cai, Chen, and Bose 2013) have also been cited as effective means of using IT for environmental sustainability.

7.11 Discussing IT governance drivers

Enterprise IT governance in key Mauritian companies was found to be fuelled by numerous factors. These were classified as internal and external for greater clarity and are discussed in detail below.

7.11.1 Internal IT governance drivers

In its survey of 21 countries, the IT Governance Institute (2011) reported that 94% of its respondents classify IT as being either very important or important for strategic business and vision delivery. It is therefore not surprising that one of the driving forces behind the implementation of IT governance in key Mauritian businesses was found to be strategic business and IT alignment. This driver is widely cited in literature as one of the main catalysers of IT governance implementation (ITGI 2003a; Weill 2004; Peterson 2004; Robinson 2005). It also appears to be an important driver of IT governance in companies across the world. For example, in their study of business firms from the United States and Canada, Chan, Sabherwal and Thatcher (2006) contend that strategic IS alignment improves organisational performance. Ali and Green's (2007) study of Australian organisations infers that a drive for strategic business/IT alignment translates into the implementation of board level strategic IT committees for more effective IT governance. Bernroider's (2008) analysis of Austrian companies concludes that ERP projects are more successful when their governance is driven by strategic business alignment. De Haes and Van Grembergen's (2009b) study of Belgian financial companies shows a strong link between implementation of IT governance mechanisms and business/IT alignment. Following their interview of IT managers from British companies, Sharma, Stone and Ekinci (2009) conclude that a culture of IT governance brings strategic alignment. Tsai et al.'s (2011) study based in Taiwan identifies strategic alignment as a predominant driver for the governance of IT. Likewise, from their investigation of Thai universities, Jairak, Praneetpolgrang and Subsermsri (2015) conclude that IT/business strategy alignment is one of the main functions of IT governance.

IT cost and value optimisation was found to be another internal IT governance driver encouraging IT governance in large companies from Mauritian economic pillars. Cost reductions and business performance improvements resulting from effective IT governance mechanisms have also been well supported by research. For example, Weill's (2004) study of 256 enterprises in 23 different countries concluded that firms with above average IT governance achieve more that 20% more profits than their counterparts with less effective governance strategies. Weill (2004) also contends that organisations which succeed in optimising their IT business value through IT governance perform better. Likewise, in their review of IT governance literature, Wilkin and Chenhall (2010) emphasise that cost savings and business value (e.g. improved business performance through the generation and management of information) are important benefits of IT governance. Kanapathy and Khan (2012) conclude that the adoption of ITIL as an IT governance framework improves annual turnover in Malaysian multimedia firms. Lunardi et al.'s (2014) study of Brazilian firms confirms that IT governances enhances profitability. The IT Governance Institute (2011) also identifies the management of costs as one of the main drivers of IT governance.

IT risk management was identified as another internal driver of IT governance for the Mauritian firms investigated. This can be justified by the increasing need for businesses to minimise IT security breaches (Khan 2006) and because effective risk management is one of the most significant benefits of IT governance as cited in literature (Raghupathi 2007; Marks 2009). For example, in their study of European companies, Buchwald, Urbach and Ahlemann (2014) conclude that effective IT governance leads to greater IT strategic control thereby improving the mitigation of IT risks. Likewise, from their review of 25 studies from literature, ChePa et al. (2015) identify the mitigation of risks as one of the main concerns driving the governance of IT. The IT Governance Institute (2011) also highlights improved IT risk management as one of the main outcomes of effective IT governance.

7.11.2 External IT governance drivers

The acquisition of certifications (such as ISO 17799 and ISO 27001 which endorse organisational IT security) were found to externally drive IT governance in large businesses from the main economic sectors of Mauritius. This not only aligns with IT governance best practice (Mohamed and Kaur 2012), but it also shows the need for businesses to showcase their IT legitimacy which, according to Wright (2010), is enhanced through data protection and privacy. The finding aligns with Spremić, Žmirak, and Kraljević's (2008) study of large Croatian firms which concludes that companies with information-intensive requirements commonly use ISO 27001 as a standard of IT governance. Client expectations were also found to externally motivate the implementation of IT governance in the companies analysed. The fact that IT governance provides better customer service (Van Grembergen and De Haes 2008) further confirms the importance of including this driver in the final ITGM.

Industry resilience was identified as another external motivator of IT governance. This is because large Mauritian businesses appear to recognise IT as a powerful and strategic enabler for the achievement of their goals, especially in troubled environments and against harsh competition. This need for business agility as an influencer of IT governance has been acknowledged by Hutton (2012). Other drivers include the current Mauritian legal framework and its proposed future amendments such as propositions for mandatory IT security audits as well as the Mauritian government's strategy for turning Mauritius into an ICT hub. In their study of U.S hospitals, Xue, Liang and Boulton (2008) identify institutional pressures such as regulations and government encouragement as having a high external influence on their governance of IT. Likewise, in their analysis of European companies, Buchwald, Urbach and Ahlemann (2014) highlight both market pressures and regulatory compliance as strong external IT governance triggers. It was found that large companies in the main Mauritian economic sectors were experiencing similar drivers.

7.12 Discussing Green IT drivers

In addition to IT governance motivators, several factors were found to drive Green IT decisions and mechanisms in the companies explored. These were classified as internal and external. Each category is discussed in the sections which follow.

7.12.1 Internal Green IT drivers

The first internal Green IT driver which emerged from this research is an organisational concern regarding IT energy consumption. This focus on energy efficiency is consistent with the findings of Sayeed and Gill (2010) who posit that the adoption of Green IT initiatives is primarily driven by energy saving motives and their resulting cost savings. This is supported by Cai, Chen and Bose (2013) who, in their study of Chinese companies, identify IT energy reductions and their associated cost benefits as being a key driver of Green IT. The findings also align with those of Haanaes et al. (2011) who, after surveying 3,100 top managers from across the world, contend that cost reductions from energy efficiency are among the top drivers of sustainability in businesses.

Despite the dearth of e-waste management policies in the Mauritian companies explored, the need for environmentally responsible IT disposal was also found to drive their Green IT initiatives. This driver is shared by companies following the Green IT route (Murugesan and Laplante 2011) and reflects the island’s concern for the reponsible disposal of its fast growing electronic waste (The Mauritius Chamber of Commerce and Industry 2016) spurred by the short lifespan of IT equipment (e.g. a maximum of four years for a laptop) (Jenkin, Webster, and McShane 2011). It also justifies the Green IT disposal practices included in the ITGM.

7.12.2 External Green IT drivers

External Green IT drivers included in the ITGM emanate mostly from market pressures. Resilience to industry turbulences to motivate Green IT practice is one of them. This is supported in literature by Vykoukal, Wolf and Beck (2009) who highlight resilience and increased competitiveness as benefits of Green IT implementation. Another external Green IT driver reported in the ITGM is the acquisition of certifications accrediting business commitment to environmental sustainability including Green IT. As stated by Bohas and Poussing (2016) in their study of Luxembourg-based firms, certifications such as ISO 14000 enable firms to better evaluate, report and improve their contribution to environmental sustainability. They also serve to satisfy customers who are increasingly searching for proof of sustainability (Molla and Abareshi 2012; Soma, Termeer, and Opdam 2016) as they include environmental stewardship in their criteria for purchase (Sen, Bhattacharya, and Korschun 2006). This is further corroborated by the identification of clients' environmental concern as another external Green IT driver.

Competitors' and society's concern for ecological sustainability were also found to motivate Green IT implementation. Together with clients' concern for the environment, these were grouped and documented in the ITGM as "stakeholder environmental concern." Based on data collected from 53 companies in the UK and Japan, Bansal and Roth (2000) identify both competitiveness and society's increasing expectations of environmental sustainability as external catalysers of environmental sustainability in business. Watson, Boudreau and Chen (2010) document Green IT endeavours of competitors as a driver of ecologically responsible IT use in enterprises.

The Mauritian legal framework is also included as one of the ITGM's external Green IT drivers. This shows that, although current Mauritian legislation does not specifically include Green IT, it does attempt to regulate numerous environmental issues such as energy efficiency which are facilitated by environmentally sustainable IT use. Such behaviour is not always demonstrated. For example, in their research, Cai, Chen and Bose (2013) conclude that regulations and political influence do not have any effect on Green IT implementation in Chinese firms because there is no reference to Green

IT in Chinese environmental regulations. Nevertheless, legislations as a driver of business Green IT implementation is well supported in literature (Murugesan 2008; Bose and Luo 2012; Molla and Abareshi 2011). From their Malaysian study, Gholami et al. (2013) posit that coercive pressures arising from regulations encourage senior managers to promote Green IT in their firms. Consequently, Mauritian firms appear to be following this trend.

The identification of proposed amendments to the current legal framework as an external Green IT driver also demonstrates that organisations foresee the enforcement of Green IT practices in Mauritius. Changes are already occurring. For example, the Mauritian government joined forces with industry in February 2016 to work on a national policy for sustainable e-waste management (The Mauritius Chamber of Commerce and Industry 2016). Once formalised, this policy together with the forthcoming national Green IT policy would mandate organisational Green IT practice. Large Mauritian companies from key economic sectors therefore appear to be pro-active with respect to their Green IT implementation.

7.13 Discussing IT governance and Green IT incentives and support mechanisms

Tax concessions for energy efficient technology, coupled with awards acknowledging Green IT behaviour and IT governance and Green IT government-provided, support mechanisms were identified as effective means of encouraging IT Governance and Green IT. These appear to follow similar practices in other parts of the world. For example, company tax benefits and rewards for Green IT best practice are common in China as a means of lowering their carbon emission (Wang and Chang 2014). The United Kingdom also provides business tax reductions (GOV.UK 2014), Green IT awards (Green IT Awards 2013), as well as IT Governance and Green IT support mechanisms (IT Governance Ltd. 2015) for the sustainable use of IT.

7.14 Chapter summary

This chapter discusses the main deliverable of this study - the IT Governance and Green IT model based on large, key businesses in Mauritius. IT decision accountabilities, IT governance and Green IT mechanisms as well as their influencers identified in the final ITGM are highlighted and compared with world-wide best practice from literature.

Several IT decision accountability archetypes were found to underlie the governance of IT decisions in the large Mauritian firms investigated. Aligning with findings from world-wide studies, the Mauritian companies explored were found to show a preference for business or IT monarchies (including business executives) when it comes to IT investment decisions. Decisions regarding business application needs are the responsibility of both the executive (business and IT) and the BU Head. While such collaborative responsibility was supported in some studies, it was also found to be inefficient; hence there is a case for the IT monarchy alternative which was equally common among the companies explored. IT executives from key Mauritian companies were also found to be highly involved in IT infrastructural and architectural decisions. This finding was supported by studies involving businesses from different continents. Aligning with a study involving Chinese companies, a preference for IT monarchy was identified for technical architectural and infrastructural decisions among the Mauritian companies, whereas an inclination towards a business monarchy was seen when such decisions are of a more strategic nature. While archetypes varied in terms of IT usage decisions, business executives from the Mauritian companies explored were often found to share responsibility for such decisions, thereby supporting a drive for business/IT strategic alignment.

Monarchies and IT duopoly emerged as the most commonly adopted IT decision governance archetypes in the Mauritian companies investigated. The popularity of monarchies was also reported in Weill’s (2004) study involving countries from America, Europe and Asia. This indicates a preference for a centralised IT governance and Green IT approach. Literature also points towards a hybrid strategy of IT duopolies as another preferred governance archetype. Whether centralised or hybrid, both approaches favour strategic IT alignment and cost control. Key Mauritian enterprises therefore appear to be strongly driven by business and IT alignment as well as cost control in their choice of IT governance archetype.

IT governance mechanisms, including IT governance structures, processes and relational mechanisms, reported in the ITGM were found to stem from best practice and encourage strategic IT decisions for business IT alignment. Common structures identified include short business and IT reporting lines, IT governance committees, Green IT structures and the presence of both business and IT Heads in IT steering committees. These were supported by studies based in countries including Belgium, the United States, Canada, Australia and the Emirates.

Several IT governance processes have also been implemented. These include centralised and monitored yearly IT budgets, business case to justify IT investments, IT performance value assessment, SLAs, IT charge-back, IT acquisition and development strategies, risk management framework, IT best practice, IT Heads on the look-out for technological innovations, and strategic IT planning and policies. Many of these practices were common to several countries world-wide such as Australia, Belgium, Thailand, Taiwan, Korea, Germany, Austria, the Netherlands, Bahrain, Tanzania, Saudi Arabia, Portugal, UK, New Zealand and the United States.

Many IT governance relational mechanisms have been adopted by the Mauritian companies studied. For example, business/IT communication facilitated by co-location or centralised business/IT meetings were found to catalyse a common understanding and collaboration between business and IT. IT governance knowledge management and Green IT employee awareness also emerged as commonly implemented relational mechanisms amongst large Mauritian companies. Many of these relational mechanisms are used by companies from other countries such as the United States, Brazil, Korea, Taiwan, the Emirates, Turkey and Australia.

Several Green IT mechanisms were identified in the Mauritian companies explored. These include Green IT executive leadership, Green IT policies (ecological IT use, Green IT acquisition and environmental sustainability), practices (including ‘Greening

IT', 'Greening by IT' and Green IT disposal) and technology. The importance of executive leadership for Green IT success is highlighted in several other studies from countries such as Taiwan, Malaysia and Australia. Likewise, the need for Green IT policies to guide Green IT practice was emphasised in research based on companies in Australia and Luxembourg. Greening IT practices such as Green IT criteria in IT purchase, regular IT upgrades and Green IT infrastructure are also supported by studies based in countries such as the Netherlands, Taiwan and Denmark. Green IT disposal mechanisms such as sustainable disposal by a specialised company, IT reuse and recycling used by large Mauritian companies have also been highlighted in literature from countries such as Australia and Taiwan. Similarly, 'Greening by IT' practices such as IT for production efficiency, video-conferencing, e-transactions and green printing adopted by the Mauritian companies analysed are the focus of some literature from countries such as China, Iran and Denmark. Large Mauritian companies from prime sectors of the economy were also found to adopt a number of Green IT technologies including virtualisation as well as lighting, hardware and software for the promotion of energy efficiency. These are commonly implemented across the world in countries such as U.S.A, China and Australia.

Both IT governance and Green IT mechanisms applied by large Mauritian companies were found to be driven by internal and external drivers. Aligning with literature from different parts of the world (such as Australia, Austria, United States, Canada, Belgium, UK, Taiwan, Malaysia and Thailand), IT governance was found to be internally driven by IT cost and value optimisation, strategic IT/business alignment and IT risk management. On the other hand, a concern for IT energy consumption and the environmental impact of IT disposal underlie the implementation of Green IT in the Mauritian firms studied. Certifications, industry resilience as well as the Mauritian regulatory framework were found to externally drive both IT governance and Green IT implementation. Client expectations and political strategy (such as government vision for the country) also externally drive IT governance, whereas stakeholder environmental concern was found to be an additional external driver for Green IT implementation. Such drivers are supported by studies from European countries, the United States, Japan and China.

The ITGM also includes incentives and support mechanisms encouraging the adoption of IT governance and Green IT in Mauritian companies. These include tax rebates on energy efficient technology, Green IT awards and support mechanisms from the government. Similar practices have been implemented in other countries such as China and UK.

Large companies from the island's key economic sectors are therefore no different from their global counterparts in the adoption of several IT governance and Green IT practices. However, several IT governance and Green IT mechanisms founded in best practice were found to be missing among large Mauritian firms. The ensuing objective of this research is to provide recommendations for improvement. This is discussed in the next chapter which also concludes the thesis, discusses research limitations and identifies avenues for future research.

Chapter 8: Conclusions and Recommendations

8.1 Introduction

This chapter concludes the thesis. It begins with a review of research questions to summarise the main findings of this study. The theoretical and practical contributions of this research are then discussed to establish its relevance. Following an analysis of findings and research contributions, recommendations for improved IT governance and Green IT implementation are proposed. Limitations of the study are then identified. These form the basis for future work discussed in the final section of the chapter.

8.2 Answering the research questions

Two research questions framed the scope of this research. These are as follows:

RQ1: What IT governance and Green IT measures are practised in large organisations from the five pillars of the Mauritian economy?

RQ2: How can IT governance and Green IT measures be applied in large Mauritian organisations to maximise their IT use?

Following data collection and analysis described in Chapters 4, 5 and 6, the most common factors affecting IT governance and Green IT implementation across large Mauritian companies from key economic sectors were compiled to produce the final IT Governance and Green IT Model (ITGM) shown in Figure 7.1. The model answers both research questions. It identifies IT governance and Green IT practices to address the first research question. During this process, internal and external ITG influencers emerged and were added to the model for a more comprehensive picture of ITG in Mauritius. The model also answers the second research question by providing a baseline for IT governance and Green IT implementation as well as improvement. These are explained in more detail next.

To answer the first research question, interviews and a survey of IT executives and managers as well as an analysis of government and company documents identified the most commonly used modes of IT decision accountability as well as IT governance and Green IT mechanisms practised in key Mauritian companies. Accountabilities were found to vary depending on the type of IT decision. For example, business executives were found to take a lot more responsibility for IT investment decisions as opposed to technical IT infrastructural decisions for which IT executives/Heads are more accountable. Several IT governance structures (e.g. IT committees and short IT/business reporting lines) were also found to be anchored in most of the large Mauritian businesses explored. Processes such as yearly IT budgets and their monitoring as well as IT service level agreements and cost chargeback are commonly implemented. Relational mechanisms such as regular formal and informal communication between IT and business are also valued. Green IT mechanisms implemented were found to range from (1) strong Green IT leadership to (2) Green IT policies (e.g. Green IT purchasing policies and environmental sustainability policies), (3) practices (including green technology, use of technology for environmentally sustainable business processes and ecological disposal of technology) and (4) technology (e.g. virtualisation).

To further address the first research question, it was found that large companies from the key economic pillars appear to prefer a centralised or hybrid IT governance and Green IT approach, as opposed to a decentralised one. The presence of mechanisms such as centralised committees, enterprise-wide processes (such as centralised IT budgets), IT governance knowledge management (via standardised systems and processes) as well as Green IT central leadership in the final ITGM demonstrate that IT governance and Green IT are both driven by a centralised approach which aims at enterprise synergy, greater IT executive control and cost reductions. This is supported by a tendency to adopt monarchies as a mode of IT decision accountability. However, mechanisms such as SLAs and IT charge-back support a hybrid IT governance approach which balances centralised, enterprise-wide control with BU autonomy (Weill and Ross 2005). The popularity of IT duopolies akin to that of monarchies aligns with a hybrid strategy.

When answering the first research question, IT governance and Green IT influencers including IT governance and Green IT drivers, incentives and support mechanisms emerged from company data and the government documents analysed. Drivers were found to be both internal and external to the enterprise. For example, cost benefits, IT risk management and strategic IT alignment internally motivate IT governance practices, whereas energy efficiency and responsible IT disposal drive Green IT within the company. At an external level, the implementation of IT governance and Green IT measures are influenced by the need to acquire certifications, comply with legislations and build industry resilience. Political strategies and client expectations also drive IT governance, whereas competitors' and society's environmental concern adds to the list of Green IT external drivers. Government-provided support mechanisms (e.g. National Computer Board, tax benefits and awards) also encourage the implementation of IT governance and Green IT practices.

To answer the second research question, IT governance and Green IT measures as well as motivating factors were presented in the final ITGM (Figure 7.1). From the ITGM, it can be deduced that IT governance and Green IT do figure on the agenda of large, key Mauritian companies. These are both internally and externally driven to define accountabilities and implement best practice mechanisms for the governance and sustainability of their IT. As shown in Table 8.1, 6 out of the 7 minimum, key IT governance practices recommended by De Haes and Van Grembergen (2009b) appear in the final ITGM. This shows promise in the IT governance arena of large Mauritian companies, although there remains room for improvement.

Table 8.1: Key IT governance mechanisms implemented by large companies from Mauritian economic pillars

Key minimum baseline for IT governance mechanisms (De Haes and Van Grembergen 2009b, 135)	**ITGM presence**
IT steering committee (IT investment evaluation/ prioritisation at executive/ senior management level)	✓
Portfolio management (including business cases)	✓
IT budget control and reporting	✓
IT leadership	✓ (particularly for Green IT)
IT project steering committee	✓
CIO reporting to CEO or COO	✓
Project governance/management methodologies	**X**

Green IT mechanisms, such as leadership interest in Green IT, its inclusion in some organisational policies, Green IT practices as well as their enabling technology also show interest in the implementation of sustainable IT. The latter appear to stem from a concern for energy efficiency and sustainable IT disposal as well as external pressures to be environmentally sustainable. Nonetheless, the lack of Green IT targets along with their monitoring and control as well as scarcity of structures to oversee organisational Green IT demonstrate that Green IT governance still needs improvement.

The ITGM therefore provides guidance in the implementation of IT governance and Green IT even though Mauritian businesses can do much more for efficient and sustainable IT use. These are discussed in the recommendations which follow.

8.3 Recommendations

Based on the ITGM, a number of recommendations can be made to large businesses from prime Mauritian industries to improve their governance of IT including Green IT. These are discussed in the subsections which follow.

8.3.1 At least one IT representative on organisational board

Although the ITGM shows that there are short reporting lines between IT and business executives, IT representation on the board of directors was found to be mostly lacking among the Mauritian companies explored. This is important to champion the governance of IT at the topmost level of an organisation and better convince the board to commit to IT investments for optimal business and IT alignment (Ali and Green 2007; Buchwald, Urbach, and Ahlemann 2014; Schlosser et al. 2015). An IT executive on the board could also challenge traditional practices and identify opportunities for innovation while having a good understanding of the business (Nolan and McFarlan 2005). It is therefore recommended that Mauritian enterprises include at least one IT executive on their board of directors to better establish their IT governance tone.

8.3.2 Adoption of IT governance frameworks/standards

From this research, it was seen that IT governance frameworks were severely lacking in large Mauritian businesses. As discussed in Chapter 2, highly recognised IT governance frameworks exist to assist organisations with the governance of their IT. These provide a roadmap on how to ease an IT governance structure into the organisation for efficient business IT use and IT risk minimisation. Well-established ones (including COBIT and ITIL) lead to more successful IT governance (Robinson 2005). COBIT also includes a component for the management of projects to facilitate project stakeholder participation, progress and monitoring of risks (Simonsson, Johnson, and Ekstedt 2010). This is particularly useful since project management is an important area of IT decision-making (Sambamurthy and Zmud 1999). Other more specific project management methodologies (e.g. PRINCE2 and Project Management Body of Knowledge referred to as PMBOK) have been identified as important for the good governance of IT projects, particularly for the allocation of accountabilities (Sharma, Stone, and Ekinci 2009). IT governance standards such ISO 38500 also provide IT governance guidance without giving details of the process (ITGI 2009). Since such practices are lacking in most Mauritian companies explored, the adoption of IT governance frameworks and standards as additional ITGM process mechanisms is recommended to facilitate the implementation of enterprise IT governance.

8.3.3 Formalising and communicating an integrated Green IT policy

Green IT policies enable the ‘right’ attitude from executives to cascade to all levels of the organisation and provide guidance to support IT sustainable behaviours across the company (Raghupathi 2007). This helps to promote a Green IT culture across the organisation (Molla, Cooper, and Pittayachawan 2011). Yet, most of the Mauritian companies explored were found to have disjointed Green IT-related policies such as ecological IT purchase and Green IT usage policies. Green IT disposal policies were considerably lacking even though Green IT disposal is common practice. It is therefore recommended that Mauritian companies formalise a unified (as opposed to haphazard) Green IT policy which includes Green IT disposal. This policy should also officialise executive Green IT accountabilities and act as a company guide for standardised, ecological IT sourcing, use and disposal. The policy should then be communicated to and made easily available for employee perusal to ensure that it is followed. Its implementation also needs to be audited as recommended in the next section.

8.3.4 Green IT auditing and planning

To implement Green IT in organisations, Murugesan (2008) suggests an environmental audit of organisational IT use from which the enterprise should formulate and implement a Green IT plan. Although all Mauritian companies explored were found to have audit committees responsible for IT audit, Green IT auditing appeared sadly lacking. For environmentally responsible IT use, it is therefore recommended that current Green IT potential be audited in Mauritian firms before they establish their future Green IT trajectory. Areas of Green IT audit would include Green IT policies, practices (such as Green IT sourcing, IT use for sustainability and Green IT disposal), Green IT infrastructure and technology as well as IT energy consumption (Wabwoba et al. 2013). For successful Green IT audits, the monitoring and reporting of Green IT undertakings are essential. These are recommended in the next section.

8.3.5 Green IT monitoring and reporting

Metrics for Green IT monitoring need to be identified to assess the success of Green IT endeavours (Molla, Cooper, and Pittayachawan 2011). This was not found to be common practice across most of the Mauritian organisations explored. It is therefore recommended that Green IT metrics be identified, measured and reported. Such Green IT reporting would promote stakeholder engagement for increased trust in the enterprise, particularly since society is now increasingly aware of the strategic role of business for sustainability (Harmon and Demirkan 2011).

Several Green IT metrics exist. For example, Mauritian organisations could adopt the European Union Code of Conduct on Data Centre Energy Efficiencies (European Commission Joint Research Centre Institute for Energy and Transport 2014) to identify metrics such as Data Centre Infrastructure Efficiency (DCiE). The International Telecommunication Union (ITU) also defines Power Usage

Effectiveness (PUE) as a key sustainability metric for data centres (International Telecommunications Union 2015). Other Green IT metrics include the weight of e-waste generated per year and the IT carbon footprint. This could be facilitated through associations with expert third party firms for the acquisition of Carbon Certifications. For example, Txt_Org2, one of the textile companies which participated in the interview phase of this research, hires the services of a third party company for the achievement of its Blue Carbon certification. This includes the calculation of its carbon footprint as well as the setting of carbon reduction objectives. Mauritian companies could also decide to adopt an Environmental Management Information System such as a Decision Support System (DSS) to determine their carbon emissions including their IT carbon footprint (Angeles 2014). For more structured Green IT reporting, companies on the island could use sustainability reporting guidelines provided by reputable organisations in the field such as the Global Reporting Initiative (GRI).

8.3.6 Implementation of IT balanced scorecard

IT value performance assessment was identified as an IT governance process in the ITGM. However, the IT balanced scorecard as a process mechanism was found to be lacking in large Mauritian companies. This tool provides a structured means of evaluating IT performance from both financial and non-financial perspectives for improved governance of IT (Ferguson et al. 2013). Financial metrics include IT expenses, whereas non-financial areas of performance assessment pertain to measures of customer satisfaction, efficiency of IT processes, IT staff and innovation capacities (Van Grembergen and De Haes 2008). Jain, Benbunan-Fich and Mohan (2011) also recommend that a Green IT dimension be added to the company balanced scorecard (BSC) for Green IT performance measures. They suggest that Green IT be evaluated using BSC components (financial, operations, customer and innovation) as well as from an environmental and social sustainability perspective (Jain, Benbunan-fich, and Mohan 2011). It is therefore recommended that Mauritian companies implement the IT balanced scorecard, include Green IT metrics across each component of the scorecard, and include environmental and social sustainability as an additional dimension for improved IT performance evaluation.

8.3.7 IT governance and Green IT training and guidance

Training is essential to improve enterprise IT governance (Nfuka and Rusu 2011). To assist companies with the implementation of IT governance, it is recommended that enterprises join the local ISACA chapter for more guidance and that company IT professionals undertake specific IT governance training. These could include the acquisition of ISACA-driven IT governance certifications such as CGEIT (Certified in the Governance of Enterprise IT) and CRISC (Certified in Risk and Information Systems Control). IT professional training on IT security standards is also provided by the Computer Emergency Team of Mauritius (CERT-MU). Such training would help IT professionals from Mauritian companies to better understand the different aspects of IT governance so as to provide more strategic IT input into business decisions.

In addition, Wabwoba et al. (2013) contend that the understanding of Green IT by ICT personnel positively affects organisational Green IT attitudes, policies, practices and technology, and plays a key role in the Green IT readiness of enterprises. While Green IT employee awareness through Green IT policies and campaigns was identified as a relational mechanism in the ITGM, it is recommended that Mauritian companies invest in Green IT training pertaining to areas of improvement such as Green IT monitoring. Training in the field of Green IT could also provide significant insight into new Green IT practices and technology. Such training is often offered by local bodies such as the National Computer Board of Mauritius (National Computer Board 2015).

8.4 Research contributions

This research makes several contributions to the field of IT governance (ITG) including Green IT. Its overarching contribution lies in the development of a model which merges IT governance and Green IT accountabilities, mechanisms and drivers in the context of large, essentially private businesses from the main economic pillars of Mauritius. By addressing IT governance in the context of large Mauritian businesses, the ITGM also responds to the call from literature to better explore IT governance in practice (e.g. Wilkin and Chenhall (2010); Ferguson et al. (2013); Smits and van Hillegersberg (2014)).

The model is also the first to be developed in the context of a small island developing nation with high IT dependency and environmental vulnerabilities, namely Mauritius. The Mauritian government is determined to turn the island both into a leading ICT hub and a prime example of environmental sustainability. This cannot be achieved without business partnership; hence the need for businesses to optimise both IT use and sustainable development. The ITGM assists key Mauritian businesses to use IT strategically (including environmentally sustainable practices) and provides grounds for areas of improvement discussed in section 8.3. It is also envisioned that the ITGM and its resulting recommendations will both guide businesses from other Small Island Developing States (SIDS) in their implementation of IT governance and Green IT and lay the foundation for further IT governance and Green IT research into other IT-dependent SIDS.

The ITGM addresses four main areas of IT governance and Green IT, namely: (1) IT decision accountabilities, (2) IT governance mechanisms, (3) Green IT mechanisms and (4) IT governance and Green IT influencers. The next subsections discuss the significance of each ITGM area from both theoretical and practical perspectives.

8.4.1 IT decision accountabilities

The first contribution of this research in the domain of IT decision accountabilities is the addition of Green IT as a strategic IT decision area along with IT principles, architecture, infrastructure, business application needs and investments. With environmental sustainability turning into an increasingly important concern for businesses, strategic IT decisions need to include the ecologically responsible use of IT. Such Green IT accountability is also important for practitioners both to promote green technology and to maximise the use of technology for environmental sustainability.

The second contribution of this research in the decision accountabilities section of the ITGM is that it provides common accountability archetypes adopted for different strategic IT decisions in the context of large Mauritian businesses. While archetypes were found to differ across IT decision types, monarchies and IT duopolies were commonly found to have a tendency to maintain executive control, contain costs and ensure strategic IT alignment. A better insight into IT decision accountabilities within large Mauritian organisations was therefore obtained.

8.4.2 IT governance mechanisms

Several IT governance structures, processes and relational mechanisms commonly adopted by large businesses from the main Mauritian industries were unearthed. This provides a better understanding of frequently implemented IT governance mechanisms within key Mauritian companies. It also enables the identification of areas for improvement such as the adoption of IT governance frameworks. From a practitioner's perspective, this section of the ITGM provides a view of IT governance current best practice on the island and can be used as a starting point to improve organisational IT strategic (including environmentally sustainable) contributions. Areas for improvement also need to be addressed through the recommendations provided.

8.4.3 Green IT mechanisms

The Green IT mechanisms section provides an insight into Green IT attitudes, policies, practices and technology adopted by key Mauritian organisations. It identifies Green IT beliefs and measures currently applied in large Mauritian businesses. Green IT practices were found to encompass both environmentally sustainable IT ("Greening IT") and IT use for environmental sustainability ("Greening by IT") as well as ecologically responsible IT disposal. Nevertheless, the research identifies that Green IT disposal policies are uncommon. Other Green IT governance measures such as the implementation of structures, targets and monitoring mechanisms for greater control over Green IT endeavours were also found to be lacking. The ITGM can therefore be used as a starting point and the lack of Green IT measures should be addressed by practitioners wishing to pursue a Green IT agenda.

8.4.4 IT governance and Green IT influencers

The ITGM identifies internal and external drivers as well as incentives and support systems for both IT governance and Green IT. This finding contributes to better understand the factors motivating the implementation of IT governance and Green IT accountabilities and mechanisms within key Mauritian enterprises. It also demonstrates awareness of some of the benefits brought to companies by IT governance and Green IT implementation as well as existing incentives and support mechanisms. This should encourage other businesses to implement IT Governance and Green IT mechanisms. Such businesses also need to benefit from government-provided support to best implement their IT (including Green IT) governance.

8.5 Limitations

Although this research provides significant contributions from both a theoretical and practical perspective, it has several limitations. These are discussed in more detail below.

Some limitations were identified for the case study approach used in this research. Firstly, interviews could be secured only from either business or IT executives within each selected company. The ability to interview executives from both business and IT realms within each company would have brought a dual perspective to the research for added insight into the governance of IT and Green IT. The researcher was also unable to have access to IT policies for several companies explored and none of them was willing to share their Strategic Information Systems Plan owing to confidentiality reasons. Analysis of more IT policies and company Strategic Information Systems Plans would have added greater depth to the investigation. In addition, the National Green IT Strategy, Policy and Action Plan examined during the document analysis phase was mandated by the previous government of Mauritius (2010 – 2014) and remains to be officialised by the current government (elected in December 2014). While environmental sustainability remains a priority for the current government as well (“Mauritius Budget Speech 2015-2016” 2015), the National Green IT Strategy, Policy and Action Plan could be subject to change.

The survey method used in this research also has some limitations. An important one is linked to the survey population of large businesses pertaining to the five main sectors of the Mauritian economy. The population was primarily identified from the Mauritius

Central Statistics Office data of 2007 as this was the latest set of data available during the survey phase. An attempt was made to refine the data obtained by investigating the emergence of new companies, mergers and closures. The population of IT companies was also updated using the 2012 IT Directory for Mauritius. However, a more accurate picture of the population of large companies from each of the economic sectors explored would have helped to better collect data and make inferences from the findings. Secondly, the majority of survey respondents comprised of IT managers as opposed to executives. A better participation rate from both business and IT executives would have provided a wider perspective on the governance of IT and Green IT. Some companies also had more than one respondent. An analysis of these to determine the extent of consistency among such respondents would have provided a better insight into the IT governance and Green IT understanding of managers and executives from the same organisation. Finally, while the response rate for the survey (56%) was above Baruch and Holtom's (2008) accepted level for organisations (35% - 40%), participation from the Mauritian textile sector was very low. Only 13 out of the 50 textile companies identified responded to the survey.

Other limitations lie in the ITGM itself. Firstly, this research focusses on large businesses (essentially private) from the five main pillars of the Mauritian economy. The ITGM may therefore not be applicable to businesses outside the research scope such as large businesses from other sectors, smaller businesses from either the five prime economic pillars or from other industries as well as business from the Mauritian public and parastatal realms. Secondly, even though the ITGM was generated by analysing data from Mauritian economic pillars, it is not industry-specific. The limitations provide grounds for future work as discussed next.

8.6 Future work

The limitations of this study provide several avenues for future research. Firstly, a wider perspective on IT Governance and Green IT from both business and IT top managers and executives of companies in Mauritius would add more depth to the ITGM. This would establish grounds for comparing business and IT understanding of IT governance (including Green IT). The same idea could be extended to a comparison between the business executive's view of IT and Green IT governance and that of the the IT manager. This would enable the ITGM to be enhanced. Discrepancies picked up between each group would then need to be addressed through recommendations to maximise business/IT alignment.

A larger sample derived from a recent population of companies and representing each of the key pillars of the Mauritian economy would also provide a more accurate picture of IT governance and Green IT. The sample should include more respondents from the business and IT executive category as well as from different industries, particularly the textile industry. This would help to further refine the ITGM.

This research could be extended to small and medium enterprises (SMEs) as well as large companies from sectors other than the main economic pillars of Mauritius. While small and medium organisations are often characterised by a lack of IT capacity, many of them also have an IT strategy for optimal IT use (Cragg, Caldeira, and Ward 2010). Such SMEs could be included in the research scope to enhance the ITGM. In addition, several large companies of Mauritius figure in the 2015 Top 100 Mauritian Companies report (DCDM Research 2015a) but are not part of the island's key industries. Future investigations with an extended scope of companies would therefore assist in better understanding the governance of IT and Green IT in Mauritian enterprises for an improved ITGM. The model could also be better investigated in Mauritian public and parastatal domains.

This study could be further refined to compare IT governance and Green IT among industries for more industry-specific conclusions. It could also be extended to compare IT governance and Green IT between multinationals in Mauritius and local companies. A comparison of IT governance and Green IT among public, parastatal and private Mauritian enterprises would also provide a more comprehensive picture of enterprise IT governance and sustainable IT use on the island. This could help to better identify best practice as well as areas of IT governance and Green IT improvement in Mauritius.

Another future extension of this research would be to investigate IT governance and Green IT in companies following their implementation of the ITGM and its recommendations. This would enable improvements in IT use as well as any resulting challenges to be gauged. The model could then be further improved by allowing companies to filter off sections which they have already implemented to generate a customised version which meets their specific needs.

The ITGM identifies some incentive and support mechanisms provided by the government. Future research could be conducted on the extent to which those mechanisms are used by Mauritian companies to identify room for improvement. Avenues for public-private partnership in the enhancement of IT governance and Green IT in the country could also be explored.

This research could be extended to other SIDS with high IT dependency and developing countries. Not only would this help in evaluating the ITGM in the context of other SIDS and developing countries, but it would also provide a basis for comparing IT governance and Green IT in Mauritius with other similar countries. This should enable SIDS to learn from each other and adopt best practice to optimise the sustainable use of IT in their development.

8.7 Chapter summary

The concluding chapter of this thesis begins with a review of answers provided to research questions. The ITGM is the primary outcome of this research and comprises both IT governance and Green IT measures commonly practised among key Mauritian companies and their drivers. Recommendations were then derived from the ITGM to further assist businesses with the sound implementation of IT governance and Green IT. These include the presence of an IT executive on the board as well as the implementation of IT governance frameworks, Green IT structures, integrated Green IT policy, Green IT auditing and planning, Green IT monitoring and reporting, IT balanced scorecard as well as IT governance and Green IT training. Contributions of this research are discussed next. Theoretically, the ITGM fills a literature gap by combining both IT governance and Green IT accountabilities, mechanisms and drivers under one model for sustainable IT use among large businesses, particularly those from the private sector. The model is also the first to be developed for a Small Island Developing State with high IT dependency. In terms of its practical significance, the ITGM provides guidance to Mauritian businesses with an IT governance and Green IT agenda.

Limitations of the study were also acknowledged. Prominent ones include IT (as opposed to business) perspective dominance and the restricted scope of the research. These formed the basis of recommendations for future work such as comparisons between IT and business input, extension of the study to businesses from other areas of the Mauritian economy and of varied sizes as well as replication of the study in other IT-dependent SIDS to improve the sustainable use of IT in business both in Mauritius and other islands of its kind.

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Appendix A Interview Questions

Organisational Structure

1. How many people are employed by your company?
2. Could you please describe the structure of your organisation?

IT Governance (Decisions, Accountabilities and Mechanisms)

1. **IT Principles**
    1.1 What is IT used for in your organisation?
    1.2 What are the steps/processes that need to be followed before finalising decisions regarding organisational IT use? At what organisational level(s) are these steps/processes executed?
    1.3 Who is/are accountable for decisions on what to use IT for in your organisation?
2. **IT Architecture**
    2.1 What rules/policies govern technical choices for the use of IT in your organisation?
    2.2 What are the steps/processes that need to be followed before finalising decisions regarding organisational architecture? At what organisational level(s) are these steps/processes executed?
    2.3 Who is/are accountable for decisions regarding the organisation's IT architecture?
3. **IT Infrastructure**
    3.1 What factors/criteria need to be considered when determining the organisation's IT hardware/software as well as IT human-resource requirements?
    3.2 What are the steps/processes that need to be followed before finalising decisions regarding IT hardware/software and human resources? At what organisational level(s) are these steps/processes executed?
    3.3 Who is/are accountable for these decisions?

4. **Business Application Needs**
    4.1 Do you buy software applications off-the-shelf and/or develop them in-house?
    4.2 What are the steps/processes that need to be followed before finalising decisions regarding software acquisition and/or development? At what organisational level(s) are these steps/processes executed?
    4.3 Who is/are accountable for these decisions?
5. **IT Investment and Prioritisation**
    5.1 What decisions need to be made when choosing IT projects and allocating IT budgets?
    5.2 What are the steps/processes that need to be followed to enable decision-making regarding IT project choice and investment? At what organisational level(s) are these steps/processes executed?
    5.3 Who is/are accountable for these decisions?
6. **IT Governance Mechanisms**
    6.1 Has your organisation appointed specific people or groups of people (not discussed previously) to align IT decisions with business strategies? If yes, could you describe their role in IT decision-making?
    6.2 Has your organisation adopted specific tools/methodologies/processes (not discussed previously) to assist in IT decision-making? If yes, could you describe them?
    6.3 Does your organisation encourage active involvement and collaboration among executives, IT personnel and business management for the realisation of IT and business goals? If yes, how?

Green IT Mechanisms

1. In what way is environmental sustainability taken into consideration when buying, using and disposing of IT equipment?
2. Has your organisation acquired/developed green Information Technology? If yes, could you give some examples?

3. Are members of the board and senior management of your organisation concerned about the use of IT for environmental sustainability? If yes, does your organisation have a green IT policy?
4. Who is accountable/responsible for driving Green IT initiatives (if any) in your organisation?
5. Does your organisation monitor the contribution of its Green IT initiatives (if any)? If yes, what are the metrics used for Green IT monitoring?

Documents

1. Does your organisation have any documentation on IT policy/strategy/governance and/or Green IT? If yes, would it be possible to obtain a copy of the documentation available?

Appendix B Participant Information Sheet

Curtin University

School of Information Systems

Participant Information Sheet

My name is Sarita Hardin-Ramanan. I am currently completing a PhD research titled "Development and Evaluation of IT Governance and Green IT Model to Support Large Mauritian Organisations", at Curtin University, Australia.

Purpose of Research

I am investigating IT Governance and Green IT measures in large Mauritian companies in order to develop a conceptual IT Governance and 'green' model (ITGM) for large Mauritian companies belonging to the four pillars of the Mauritian economy.

Consent to Participate

Your involvement in the research is entirely voluntary. You have the right to withdraw at any stage without it affecting your rights or my responsibilities. When you have signed the consent form I will assume that you have agreed to participate and allow me to use your data in this research.

Participant Requirements

This research carries no risks, although you shall be asked questions on your company. Interview questions shall pertain to your organisational size, structure, company IT strategies/policies/governance/Green IT practices and documents, if any. The interview should not last more than an hour.

Confidentiality

The information you provide will be kept separate from your personal details, and only my supervisors and I shall have access to this. The interview transcript will not have your name or any other identifying information on it and in adherence to university policy, the interview tapes and transcribed information will be kept in a locked cabinet for five years, before it is destroyed.

Ethics

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number IS_12_36). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21). For further information on this study, contact the researcher named above or the Curtin University Human Research Ethics Committee. c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845 or by telephoning + 61 8 9266 9223 or by emailing hrec@curtin.edu.au

Further Information

If you would like further information about the study, please feel free to contact me on 724 9145 or by email on sarita.ramanan@telfair.ac.mu. Alternatively, you can contact my supervisors Vanessa Chang on +61 8 9266 1388 or by email on Vanessa.Chang@cbs.curtin.edu.au and Tomayess Issa on +61 8 9266 7682 **or by email on** Tomayess.Issa@cbs.curtin.edu.au.

Thank you very much for your involvement in this research. Your participation is greatly appreciated.

Appendix C Interview Consent Form

Research Title: Development and Evaluation of IT Governance and Green IT Model to Support Large Mauritian Organisations.

Name and position of researcher: Sarita Hardin-Ramanan, Senior Lecturer at Charles Telfair Institute and PhD Student at Curtin University.

Statements:

1. I confirm that I have read and understood the information sheet provided for this research and have been given the opportunity to ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving reason.

	Please Tick Box	
	Yes	*No*
3. I agree to participate in the study as outlined to me.	☐	☐
4. I agree to the interview being audio recorded.	☐	☐
5. I agree to the use of anonymised quotes in publications.	☐	☐

Name of participant:	Date:	Signature:
Sarita Hardin-Ramanan (researcher)	Date:	Signature:
Prof. Vanessa Chang (Supervisor)	Date:	Signature:
Dr. Tomayess Issa (Co-Supervisor)	Date:	Signature:

Appendix D Interview Content Analysis IT Governance and Green IT Matrices

Table D.1: IT governance and Green IT archetypes across IT decisions for each company explored during interview phase

Company	Green IT	IT decisions: IT Investment & Prioritisation	Business Application Needs	IT Infrastructure	IT Architecture	IT Principles
S_Org1	Business monarchy • CEO • CSO	Business monarchy • CEO • CFO • Board of directors	Federal • IT manager • BU Heads • CFO • CEO	IT duopoly (enterprise-wide decision/strategic IT decision) • IT manager • CFO • CEO	IT duopoly (enterprise-wide decision/ strategic IT decision) • IT manager • CFO • CEO	Federal • IT manager • BU Heads • CFO • CEO
S_Org2	Business monarchy • CSR office driven by CEO • CIO	Federal • Executive committee (Business executives, CIO, BU Heads) • Board of directors	Federal • Executive committee (Business executives, CIO, BU Heads)	Federal (enterprise-wide decision/ strategic IT decision) • Executive committee (Business executives, CIO, BU Heads)	Federal (enterprise-wide decision/ strategic IT decision) • Executive committee (Business executives, CIO, BU Heads)	Federal • Executive committee (Business executives, CIO, BU Heads)
Txt_Org1	Business monarchy • Executive Director	Business monarchy • Executive Director • Board of directors	IT duopoly • Executive Director • IT manager (input from factory Heads)	IT duopoly • Executive Director • IT manager	IT duopoly • Executive Director • IT manager	IT duopoly • Executive Director • IT manager
Txt_Org2	Business monarchy • CEO	Business monarchy • CEO • Board of directors	IT duopoly • CEO • IT manager (input from factory Heads)	IT duopoly • CEO • IT manager	IT duopoly • CEO • IT manager	IT duopoly • CEO • IT manager
IT_Org1	Feudal • BU Heads	Business monarchy • CEO • Board of directors	Business monarchy • CFO or any other business executive	Business monarchy • CFO • CEO	Business monarchy • IT (Data Centre) Executive • CEO	Business monarchy • Executive team led by CEO
IT_Org2	Business monarchy	Business monarchy • Managing director	IT duopoly	IT duopoly • IT Project Coordinator	Business monarchy • Managing Director	Business monarchy • Managing director

	• Managing director	• Technology operational board • Cluster board • Group board	• IT Project Coordinator • Managing director • Group IT Coordinator (input from BU Heads)	• Managing Director	• Group IT Coordinator	• Group IT Coordinator • Technology operational board • Cluster board • Group board
T_Org1	IT monarchy • CIO	Business monarchy • IT Steering Committee (CEO, CIO, COO) • Board of directors	Business monarchy • IT Steering Committee (CEO, CIO, COO) (input from BU Heads)	Business monarchy • IT Steering Committee (CEO, CIO, COO)	Business monarchy • IT Steering Committee (CEO, CIO, COO)	Business monarchy • IT Steering Committee (CEO, CIO, COO)
T_Org2	Business monarchy • CFO	Business monarchy • CFO • CEO • Board of directors	Business monarchy • CFO (based on input from IT manager, hotel GMs, residential managers & departmental Heads)	IT duopoly • CFO • Group IT senior manager	IT duopoly • CFO • Group IT senior manager	IT duopoly • CFO • Group IT senior manager
F_Org1	IT monarchy • CIO	Business monarchy • Executive committee (CEO, CIO and Senior Managers) • Board of directors	Business monarchy • Executive committee (including CEO, CIO and other executives) (input from BU Heads)	Business monarchy • Executive committee (CEO, CIO and other executives) • Board of directors	Business monarchy • Executive committee (CEO, CIO and other executives) • Board of directors	Business monarchy • Executive committee (CEO, CIO and other executives)
F_Org2	Business monarchy • IT executive committee (CEO, DCEO, COO)	Business monarchy • IT executive committee (CEO, DCEO, COO) • Executive committee (all company executives) • Board of directors	Business monarchy • IT executive committee (CEO, DCEO, COO) • Executive committee (all company executives) • Board of directors (input from BU Heads)	Business monarchy • IT executive committee (CEO, DCEO, COO) • Executive committee (all company executives) • Board of directors	Business monarchy • IT executive committee (CEO, DCEO, COO) • Executive committee (all company executives) • Board of directors	Business monarchy • IT executive committee (CEO, DCEO, COO) • Executive committee (all company executives) • Board of directors

Table D.2: IT governance and Green IT structures across IT decisions for each company explored during interview phase

<table>
<tr><th></th><th colspan="6">IT decisions</th></tr>
<tr><th>Company</th><th>Green IT</th><th>IT Investment & Prioritisation</th><th>Business Application Needs</th><th>IT Infrastructure</th><th>IT Architecture</th><th>IT Principles</th></tr>
<tr><td rowspan="2">S_Org1</td><td colspan="6">IT manager reports directly to CFO.
CEO, CFO and IT manager meet regularly to discuss IT decisions and projects.
CEO is IT board representative.
Audit & Risk Committee to oversee IT risks.</td></tr>
<tr><td>Chief Sustainability Officer works with IT manager and CFO to drive Green IT projects.</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">S_Org2</td><td colspan="6">CIO reports directly to CEO.
CIO is a member of executive committee which consists of directors, BU Heads, CEO, CIO and other business executives.
CEO is the board IT liaison.
IT audit committee (includes external auditors and company directors) to review business processes supported by IT (including IT risks)
IT steering committee monitors and controls IT projects.</td></tr>
<tr><td>CIO works with CSR office on Green IT projects.</td><td>Executive committee (directors, BU Heads, CEO, CIO and other business executives) oversees IT project and budget and liaises with board for approval.</td><td>CIO liaises with executive committee.</td><td>Executive committee decides for enterprise-wide, strategic decisions.</td><td>Executive committee approval for enterprise-wide, strategic decisions (including IT policies)</td><td>CIO liaises with executive committee.</td></tr>
<tr><td>Txt_Org1</td><td colspan="6">IT manager reports directly to Executive Director.
Executive Director represents IT on the board.
Centralised Risk & Audit committee at Group board level to oversee IT risks.
IT steering committee headed by Executive Director and including IT manager is set up to oversee IT projects.</td></tr>
<tr><td rowspan="2">Txt_Org2</td><td colspan="6">IT manager reports directly to CEO.
CEO represents IT at board level.
Risk & Audit committee to oversee IT risks.</td></tr>
<tr><td>IT manager works with Energy officer to drive energy efficient IT projects.</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
</table>

Appendix D – Interview Content Analysis IT Governance and Green IT Matrices

<table>
<tr><td>IT_Org1</td><td colspan="6">Executives and managers driving IT projects report directly to CEO.
CEO represents IT at board level.
Risk & Audit Committee at Group board for regular IT auditing (including IT security audit).
Executive team led by CEO responsible for setting IT strategy in line with business strategy.</td></tr>
<tr><td rowspan="2">IT_Org2</td><td colspan="6">IT Project Coordinator reports to managing director. Together, they sit on the Technology Operational Board.
Managing director represents IT at Cluster Board and Group board.
Group IT Coordinator is responsible for aligning company IT use with the rest of the group and sits on Technology Cluster and Group Board.
Group Board Audit Committee responsible for overseeing IT risks.
Group IT Coordinator working on setting up a Group IT Audit Structure to oversee IT activities.</td></tr>
<tr><td>Green IT projects are driven by IT Project Coordinator and MD at Technology Operational Board level. MD then liaises with Technology Cluster and Group board members.</td><td>IT investments/budget approved and prioritised by Technology Operational Board (IT Project Coordinator, managing director, financial manager and representatives from the Group Board) before decision is ratified by the Technology Cluster Board and Group Board.</td><td>MD and Group IT liaise with technology Cluster Board and Group Board for approval.</td><td>IT Project Coordinator and MD seek approval at Technology Operational Board level.
MD then requests Technology Cluster Board approval.</td><td>Group IT Coordinator validates IT architectural decisions.
MD and Group IT liaise with Technology Cluster Board and Group Board for approval.</td><td>Technology Operational, Technology Cluster and Group Board approval required via MD and Group IT.</td></tr>
<tr><td rowspan="2">T_Org1</td><td colspan="6">CIO is part of the corporate management team and reports directly to CEO.
CEO acts as board/IT liaison.
Audit and Risk Management committee at board level responsible for overseeing IT audits and risks.</td></tr>
<tr><td>CIO works with Quality manager on Green IT initiatives</td><td>IT steering committee (consisting of CEO, COO and CIO) validates IT project/budget decisions and liaises with board for approval where required.</td><td>IT steering committee is responsible following consultation with business users, owners and providers.</td><td>CIO reports to IT steering committee which liaises with board where infrastructure requirement has not been budgeted for.</td><td>Security sub-committee reports to IT steering committee and is responsible for business IT security.</td><td>IT Steering committee sets IT principles and liaises with board for approval.</td></tr>
<tr><td>T_Org2</td><td colspan="6">Group IT manager reports directly to CFO.
CEO is IT board representative.
Group IT manager, CFO and CEO meet regularly to discuss IT decisions and projects.
Risk & Audit committee at board level to oversee IT risks</td></tr>
<tr><td>F_Org1</td><td colspan="6">CIO reports directly to CEO.
CIO is a member of executive committee.
CEO is the IT liaison with the board.
Board Audit and Risk Committee responsible for overseeing IT risks.
IT steering committee (BU Heads concerned, CEO and CIO) oversee IT projects.</td></tr>
</table>

		For IT investment, executive committee (consisting of CEO, CIO and Senior Managers) approval is required – may need board approval.	For strategic decisions (e.g. off the shelf strategy), executive committee approval is required.	For strategic IT infrastructural decisions, executive committee and board approval may be required.	For strategic IT architectural decisions, executive committee and board approval may be required.	CIO liaises with Executive Committee.
F_Org2	Head of IT reports directly to COO. COO is a member of the IT executive committee (sub-committee of Executive committee) also consisting of CEO and DCEO. CEO is the IT liaison with board. IT executive committee nominates project owner from senior management for high risk, costly projects and from middle management for smaller projects. Project Steering Committee formed for big IT projects. Project steering committee often chaired by CEO, DCEO or COO to facilitate project progress board report back. Project owner reports to Project Steering Committee and liaises with board via IT executive committee Management Operational Risk Committee responsible for overseeing IT risks meets monthly and reports on a quarterly basis to Board Risk Management Committee.					
	IT executive committee (CEO, DCEO and COO) drive Green IT projects.	IT executive committee approval required – may need executive committee and board approval depending on investment size.	IT executive committee approval required for strategic projects - may need executive committee and board approval depending on requirement.	IT executive committee approval required for strategic projects.	IT executive committee approval required for strategic projects - may need executive committee and board approval (e.g. for IT security policies).	IT executive committee liaises with Head of IT, executive committee and board.

Table D.3: IT governance and Green IT processes across IT decisions for each company explored during interview phase

		IT decisions				
Company	**Green IT**	**IT Investment & Prioritisation**	**Business Application Needs**	**IT Infrastructure**	**IT Architecture**	**IT Principles**
S_Org1	IT baseline survey to set quantifiable targets for green IT measures as part of EMS. GRI Sustainability reporting including measurement and reporting of e-waste. Software for monitoring power consumption in server room. Monitoring and reporting of printer use.	Centrally managed, yearly IT budget. Business case to evaluate IT projects (financial appraisals including ROI, impact on people and existing systems and processes). Assessment and reporting of IT investment value via regular meetings for feedback (no specific metrics/tools for measurement). IT budget monitoring and reporting (IT manager reports to CFO at least quarterly before presenting report to CEO).	Outsourced development of major bespoke applications e.g. ERP due to lack of resources.	IT asset management tool. Informal policy for regular replacement of PCs (every 3-5 years) and servers (every 3 years). SLAs with hardware and software providers. IT charge-back for shared IT services based on number of users.	No specific IT policy document, but some IT rules (e.g. use of computers) are specified in HR policy document. Risk assessment framework to identify vulnerabilities in system security and availability. Access control processes.	Evaluation of best practice. Vendor presentations and Group IT manager's participation in conferences help to identify new technology for more efficient business processes. IT strategic direction derived from yearly risk assessment.
S_Org2	N/A	Centrally managed, yearly IT budget. Business case to evaluate IT projects (proof of concept, impact on people, existing systems and processes, financial appraisals including cost/benefit analysis). Assessment and reporting of IT investment value using pre-defined	Outsourced development of major bespoke applications e.g. ERP due to lack of resources.	SLAs with external service providers. Training plan when required for updates/upgrades. IT charge-back based on service and invoices.	IT policy document. Prince 2 project management methodology for ERP project ITIL inspired IT governance methodology for IT services.	IT strategic document. Evaluation of best practice. Network Systems Administrator to remain abreast with latest versions of standard software for required updates.

		performance indicators e.g. cost reduction, process cycle-time reduction, measurement of downtimes. IT budget monitoring and reporting.				
Txt_Org1	Measurement of IT carbon footprint using Blue Carbon Eco-Label software.	Centrally managed, yearly IT budget. Business case (including ROI and cost/benefit analysis). Assessment and reporting of IT investment value by monitoring set targets. IT budget monitoring and reporting.	Hardware outsourced. Customisation/ Development of software done in-house.	SLAs with external service providers. IT charge-back based on a system of cost apportionment.	Standard Operating Procedures (SOPs) validated by Executive Director before being translated by IT manager into IT solution. IT policies.	No IT strategic document, but IT objectives in line with Executive Director's vision embedded in IT manager's job objectives every 6 months. Evaluation of best practice. IT manager tuned in to latest technology.
Txt_Org2	Energy monitoring system	Business case (project analysis and assessment in terms of man power requirements, costs, downtime in business activities). Assessment and reporting of IT investment value by measuring and monitoring set targets.	Customisation/Development of software done in-house. No outsourcing of IT systems.	SLAs with external service providers. .	IT policies.	Evaluation of best practice. IT team responsible to keep in touch with latest IT.

IT_Org1	N/A	Centrally managed, yearly IT budget. Business case (cost/benefit analysis, risk assessment). Assessment and reporting of benefits by measuring and monitoring fundamental IT capability KPIs. No IT balanced scorecard but IT performance tied to organisational scorecard. IT budget monitoring and reporting.	Off-the-shelf packages with minimal customisation No outsourcing of IT systems	Employees constantly on look-out for best practices . IT charge-back SLAs with external service providers.	IT policies Own project management methodology based on Prince 2 and PMBOK guidelines IT risk assessment framework.	IS Strategic Plan reviewed every 3 years, following review of business strategy and evaluation of best practice. Up-to-date technology driven by vendors, often through enhancement plans
IT_Org2	N/A	Centrally managed, yearly IT budget. Business case (includes cost/benefit analysis). Assessment and reporting of benefits by measuring and monitoring fundamental financial and performance based IT capability KPIs. IT budget monitoring and reporting.	Off the shelf packages with some customisation. IT infrastructure outsourced to Group subsidiary.	SLAs for outsourced services. IT charge-back (payment per user, per department basis).	IT policies. Own project management methodology based on standard project management methodologies and PMBOK guidelines. IT Administration and Project Management Unit to oversee IT projects.	IS Strategic Plan being developed. Evaluation of best practice. Employees expected to keep abreast with latest technology (sometimes through being sent to international forums).

T_Org1	Energy monitoring system	Centrally managed, yearly IT budget. Business case (includes cost/benefit analysis, ROI, SWOT analysis). Assessment and reporting of benefits through internal and external customer satisfaction surveys and helpdesk monitoring. No IT balanced scorecard but IT performance tied to organisational scorecard. IT budget monitoring and reporting.	Feasibility study to determine if software should be off-the-shelf or developed in-house.	Competency matrix to identify IT training gaps. SLAs with service providers. IT charge-back.	IT policies. Standard Operating Procedures.	Strategic IS Plan Evaluation of best practice. IT team responsible to stay in tune with latest technology. Vendor presentations for latest technology.
T_Org2	Monitoring of IT energy consumption in server room.	Centrally managed, yearly IT budget. IT Budget monitoring and reporting. Business case (includes NPV assessment) Assessment and reporting of benefits through IT surveys and during strategic meetings between CFO and financial controller.	Off-the-shelf strategy (based on best practice) with in-house customisation.	SLAs with external service providers IT charge-back	IT policies	IT strategies formulated yearly as an IT requirements list from CFO. Evaluation of best practice. IT team responsible to stay in tune with latest technology. Vendor presentations for latest technology. Formulation of Strategic IS Plan being worked on following IT requirements survey conducted by external consultant.
F_Org1	N/A	Centrally managed, yearly IT budget.	Off-the-shelf strategy with minimal customisation	IT charge-back on a per user basis.	IT policies.	Strategic IS Plan based on evaluation of IT use with respect to business

		IT Budget monitoring and reporting. Business case (includes cost/benefit analysis). Assessment and reporting of benefits by measuring and monitoring IT KPIs.	based on current industry best practices. Software support is outsourced.	SLAs with external service providers.	Risk Management Framework to monitor IT performance.	strategies, organisational objectives and current best practices. IT team responsible to stay in tune with latest technology.
F_Org2	N/A	Centrally managed, yearly IT budget. IT Budget monitoring and reporting. Business case (includes cost/benefit analysis, ROI). Assessment and reporting of IT investment value by measuring and monitoring IT metrics identified for the project.	Maintenance/Support is in-house for fast response. Critical activities are not outsourced. Few less critical systems are outsourced for cost-effectiveness. Most applications are customised from off-the-shelf. Few less critical applications developed in-house	IT charge-back on a per user basis SLAs with external service providers	IT policies Business Continuity Plan Risk Assessment Framework and IT issue log to monitor IT performance.	5 year Strategic IS Plan based on evaluation of IT use with respect to current industry best practices. Head of IT and his team responsible to keep abreast with latest technology.

Table D.4: IT governance and Green IT relational mechanisms across IT decisions for each company explored during interview phase

<table>
<tr><th rowspan="2">Company</th><th colspan="6">IT decisions</th></tr>
<tr><th>Green IT</th><th>IT Investment & Prioritisation</th><th>Business Application Needs</th><th>IT Infrastructure</th><th>IT Architecture</th><th>IT Principles</th></tr>
<tr><td rowspan="2">S_Org1</td><td>Toner/cartridge disposal policies placed on company intranet.</td><td>N/A</td><td>N/A</td><td>N/A</td><td>IT processes and HR policy including use of technology are available on company Intranet.</td><td>N/A</td></tr>
<tr><td colspan="6">Constant formal and informal communication between IT and users, HODs, and business executives to discuss business IT needs, solutions, risks and facilitate business/IT understanding.
IT manager close to business executives and end users (co-location). IT manager spends 3 days at Head office with business executives and 2 days on factory site to be close to factory end-users.</td></tr>
<tr><td rowspan="2">S_Org2</td><td>Communication of Green IT policy through Intranet, noticeboards, and posters.

Employee awareness campaigns on environmental sustainability including green IT.</td><td>N/A</td><td>N/A</td><td>N/A</td><td>IT policies included in "employee handbook" and important points highlighted in company Ethics Code manual.</td><td>N/A</td></tr>
<tr><td colspan="6">CIO in constant formal and informal communication with HODs, users and business executives to discuss business IT needs, solutions, risks and facilitate business/IT understanding.
CIO close to business executives and users (co-location) to better understand needs.</td></tr>
<tr><td rowspan="2">Txt_Org1</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>IT policies are handed over to employees to be signed and filed.</td><td>N/A</td></tr>
<tr><td colspan="6">IT team close to both users and Executive Director (co-location).
Regular formal/informal communication between IT manager, Executive Director, BU Heads and users to discuss business IT needs, solutions, risks for business/IT understanding.</td></tr>
<tr><td rowspan="2">Txt_Org2</td><td>IT manager promotes business green IT awareness through regular emails.</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="6">Regular formal/informal communication between IT manager, CEO, Factory Head, departmental managers and users to discuss business IT needs, solutions, risks and facilitate business/IT understanding.
IT team close to users (co-location) and CEO.</td></tr>
<tr><td rowspan="2">IT_Org1</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>IT policies available on Intranet.</td><td>N/A</td></tr>
<tr><td colspan="6">Constant formal and informal communication amongst business/IT executives and BU Heads to discuss business IT needs, solutions, risks and facilitate business/IT understanding.
Business/IT executives, BU Heads and users are co-located.</td></tr>
<tr><td>IT_Org2</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td><td>IT policies placed on a system of employee shared folders.</td><td>N/A</td></tr>
</table>

	Constant formal and informal communication amongst business/IT executives, IT managers, BU Heads and users to discuss business IT needs, solutions, risks and facilitate business/IT understanding. Business/IT executives, BU Heads and users are co-located.					
T_Org1	N/A	N/A	N/A	N/A	IT security sub-committee newsletters. IT policies placed on local portal.	N/A
	Formal/informal communication between CIO, IT managers, business executives, BU Heads and users to discuss business IT needs, solutions, risks and facilitate business/IT understanding.					
T_Org2	N/A	N/A	N/A	N/A	IT policies placed on system of shared folders.	N/A
	Formal/informal communication between Group IT manager, IT managers, business executives, hotel GMs, Resident Managers and users to discuss business IT needs, solutions, risks and facilitate business/IT understanding.					
F_Org1	N/A	N/A	N/A	N/A	IT policies are handed over to employees to be signed and filed.	N/A
	Formal/informal communication between CIO, IT committee, business executives, BU Heads and users to discuss business IT needs, solutions, risks, and facilitate business/IT understanding.					
F_Org2	Promotion of user Green IT awareness	N/A	N/A	N/A	IT policy document available on company Intranet.	N/A
	Formal/informal communication between IT, executive committee, BU Heads and users to discuss business IT needs, solutions, risks, and facilitate business/IT understanding. IT and business and co-located.					

Table D.5: Green IT mechanisms (excluding governance) for each company explored during interview phase

Company	Green IT Mechanisms (excluding governance)			
	Attitude	**Policy**	**Practice**	**Technology**
S_Org1	Green Vision (including Green IT) driven by CEO.	Purchasing policy includes green factors for IT purchase such as energy consumption considerations. Policy for environmentally friendly disposal of toners and cartridges.	Toner and Cartridge recycling. Reuse of IT spare parts where possible. Ecological disposal of IT waste via IT disposal company. Scan to email. Print to fax. Regular replacement of PCs for more energy efficient models.	Virtualisation. Reduction in printing and paper use through easy filing system and use of intranet. Use of automated systems (e.g. Building Management System) for efficient energy consumption.
S_Org2	Green Vision (including Green IT) driven by CEO.	Green IT policy.	Selection of IT equipment with Green labels. Centralisation of printing. Ecological disposal of IT waste via IT disposal company.	Virtualisation. Collaborative Software Applications e.g. messaging servers to reduce paper use.
Txt_Org1	Executive leadership for greening by IT.	No Green IT policy.	Eco-Label registered. Double-sided printing. Improving energy efficiency using IT by producing more in less time. Ecological disposal of IT waste via IT disposal company.	Virtualisation.
Txt_Org2	CEO encourages energy efficient use of technology.	No Green IT policy.	Printer Cartridge recycling/refill. Old IT equipment recycling. Scanning to email. Centralisation of printing. Double-sided printing. Technology upgrade for power consumption decrease	Virtualisation. Switch from tower to rack servers).
IT_Org1	No Green IT drive from top management.	No Green IT policy but green IT considerations included in overall group green policy.	Ecological disposal of IT waste via IT disposal company. Use of environmentally friendly technology.	Virtualisation Implementation of document management system.
IT_Org2	Executive leadership to promote Green IT.	Green IT policy being developed as part of IT policy revamping project and Group environmental policy.	Ecological disposal of IT waste via IT disposal company. Green IT project initiated by employees for efficient printing (includes print assessment report, efficient printing plan, and execution, monitoring & reporting of benefits). Adoption of latest, environmentally friendly technology	Virtualisation. Infrastructure services on cloud.
T_Org1	IT leadership for green IT measures	No Green IT policy	Videoconferencing and telepresence. Recycling of IT equipment through IT recycling company. Double-sided printing. Regular upgrade for environmentally friendly technology.	Virtualisation. Cloud services.

T_Org2	Executive leadership towards green IT for energy consumption reduction.	No Green IT policy.	Unused IT equipment is donated or stocked awaiting ecological disposal. Upgrade, removal and centralisation of printers for efficient printing. Preference for vendors with a 'green' strategy.	Preference for low energy consumption hardware. Virtualisation. Switch to blade servers. Building Management Software for energy efficiency.
F_Org1	IT leadership for Green IT measures.	No Green IT policy.	Ecological disposal of IT waste via IT disposal company. Centralised printing to reduce number of printers. E-commerce strategies. Greater email use to reduce printing. Regular technological upgrades for environmental friendliness.	Minimisation of number of servers (e.g. through virtualisation).
F_Org2	Executive leadership towards Green IT projects.	No Green IT policy.	Ecological disposal of IT waste via IT disposal company. Energy consumption considered during IT purchase. Double sided printing; E-commerce Secured server with dedicated management access to reduce printing during management meetings.	Virtualisation. Implementation of document management system.

Appendix E Mauritian Legislations Relevant to IT Governance and Green IT

Table E: Mauritian laws supporting enterprise governance of IT (Attorney General Office 2014)

Act	Sections relevant to IT governance and/or Green IT
The Electronics Transaction Act 2000	Regulates secure e-commerce transactions.
BOM Guidelines on Internet Banking 2001 (issued under *Bank of Mauritius Act* and *Banking Act 1988*)	Mandates: ➢ Risk Management Framework overseen by bank board of directors and senior management (Section 8). ➢ written security policies for Internet Banking System (Sections 9 & 10). ➢ outsourcing of Internet Banking Systems if integrity and security requirements are met (Section 11).
Mauritius Companies Act 2001	Mandates the preparation of annual reports (section 218) to be disclosed to shareholders (Section 219).
The Computer Misuse and Cybercrime Act 2003	Defines unauthorised access to and manipulation of computer data/service as a crime (Part II Sections 3-10).
Data Protection Act 2004	Mandates the privacy of any data relating to an individual.
Financial Reporting Act 2004	Establishes National Committee on Corporate Governance responsible for setting up the Code of Corporate Governance (Part V Sections 63-69). Establishes Financial Reporting Council (Part II, section 3) responsible for monitoring (Part II Section 5): ➢ compliance with reporting requirements in National Code of Corporate Governance and National Committee of Corporate Governance guidelines. ➢ auditors for maintenance of high standards of professional conduct.
Insurance Act 2005	Specifies the setting up of: ➢ strategies, policies, and processes for risk management including IT(Section 31 part 1(b)). ➢ sub-committees including audit Section 46) and risk management (Section 38 part 2). ➢ internal control systems for information systems security (Section 39).

Appendix E – Mauritian Legislations Relevant to IT Governance and Green IT

BOM Guideline on Operational Risk Management 2008 (issued under section 50 of *Bank of Mauritius Act 2004* and section 100 of *Banking Act 2004*)	Enunciates: ➢ operational risk management framework for banks (Section 4). ➢ contingency and disaster recovery (Section 9).
BOM Guideline on Public Disclosure of Information 2009 (issued under section 50 of *Bank of Mauritius Act 2004* and section 100 of *Banking Act 2004*)	Establishes minimum standards for financial institutions' annual reports information disclosure including ➢ risk management and controls (Sections 21-23). ➢ corporate governance practices (Sections 30 – 31). ➢ financial reporting including reporting on software licensing, other IT costs and. impairment loss on software (Section 53).
BOM Guidelines for Corporate Governance 2012 (issued under section 50 of *Bank of Mauritius Act 2004* and section 100 of *Banking Act 2004*)	The board of financial institutions should ensure the set-up of: ➢ robust risk management framework including management of technology risks (Section 7). ➢ adequate and effective information systems, audited for data and information integrity (Section 9)
The Environmental Protection Act 2002 (last amended in 2008)	Establishes National Environment Commission chaired by the Prime Minister to set national goals, and determine policies and priorities to protect the environment (Section 5)
Environment Protection (Industrial Waste Audit) Regulations 2008	Establishes requirement for industrial waste audit for areas including sugar and textile industries (Sections 3 and 4).

Income Tax Act 1995 (last amended in 2013)	➢ Provides for accelerated annual allowance of 50% in respect of investments made in 2013 and 2014 in green technology equipment including:
	    ➢ energy efficient equipment,
	    ➢ pollution control equipment, and
	    ➢ equipment for shredding, sorting, compacting paper for recycling
	➢ Application of Alternative Minimum Tax waived for manufacturing and hotel companies to encourage innovation and investment in energy efficient equipment.

Energy Efficiency Act 2011	➢ Commissions energy audits where deemed necessary (Part IV Section 19). ➢ Mandates the Energy Efficiency Management office (EEMO) responsible for effecting energy audits and promoting energy efficiency awareness for carbon footprint reduction and environmental protection (Section 4).
Building Control Act 2012	➢ Embeds sustainability considerations including energy savings and optimum energy consumption for the running of buildings.

Appendix F National Code of Corporate Governance

Table F: Summary of IT governance and Green IT guidelines from the National Code of Corporate Governance (Committee on Corporate Governance 2004)

	Guidelines from National Code of Corporate Governance
IT Governance	➢ Board to ensure that technology systems used are adequate and subject to regular risk assessment. ➢ All companies should have corporate governance and audit committees. Risk committees are optional and risks can be handled by audit committee. ➢ Board/risk committee responsible for risk management process including risk identification, evaluation, response and reporting in areas such as technology. ➢ Board/audit committee is responsible for effective internal control systems and policies. ➢ Directors have to enforce IT audits to evaluate effectiveness of IT controls and processes. ➢ Responsibility of the board to disclose processes used to implement, monitor and prove the effectiveness of internal control systems and risk management. ➢ Responsibility of management to have pertinent knowledge of IT systems and internal controls. ➢ Responsibility of management to evaluate the cost/value relationship of IT strategies.
Green IT	➢ Companies should be wary of their environmental effects. ➢ Companies should be actively involved in minimising the environmental impact of their activities. ➢ Company policies and activities regarding environmental citizenship should be disclosed in Corporate Governance Report. ➢ Where possible, companies should promote environmental awareness in regions where they operate. ➢ Companies should demonstrate environmental stewardship to operate in an international context which is increasingly concerned about environmental issues. ➢ Companies should aspire to produce Integrated Sustainability Reports.

Appendix G National Green IT Strategy, Policy and Action Plan

Table G: Summary of IT sustainability pillars and their corresponding proposed initiatives from forthcoming National Green IT Strategy, Policy and Action Plan (Ministry of Information and Communication Technology 2013)

IT Sustainability Pillar	Proposed Initiatives
Sustainable equipment lifecycle	➢ Initiative 1 – Define set of Green IT standards (based on international standards such as ENERGY STAR ®) to encourage sustainable procurement of IT equipment. ➢ Initiative 2 – Enforce Green IT standards in bidding documents. ➢ Initiative 3 – Lengthen the life cycle of IT equipment. ➢ Initiative 4 – Re-use of existing IT equipment ➢ Initiative 5 – Define and implement a procedure for e-waste
Improving end-user computing	➢ Initiative 6 – Define and implement procedure for Green end-user computing. ➢ Initiative 7 – Optimise end-user computing infrastructure. ➢ Initiative 8 – Rationalise and consolidate physical departmental servers. ➢ Initiative 9 – Optimise usage of printers and its consumables.
Building sustainable enterprise and data centre	➢ Initiative 10 – Adopt Green IT practices for data centre ICT equipment as per EU Code of Conduct. ➢ Initiative 11 – Adopt Green IT practices for data centre environment as per EU Code of Conduct. ➢ Initiative 12 – Effective network and communication equipment usage. ➢ Initiative 13 – Maximise utilisation of software applications.
ICT as a low carbon enabler	➢ Initiative 14 – Establish Green IT governance and compliance structure. ➢ Initiative 15 – Measure and baseline IT energy consumption. ➢ Initiative 16 – Undertake business process improvement. ➢ Initiative 17 – Use of business applications to reduce carbon emissions. ➢ Initiative 18 – Establish carbon management processes to measure actual carbon emissions and set carbon reduction targets.

Appendix H IT Governance and Green IT Survey Questionnaire Items

Table H: IT governance and Green IT questionnaire items and their sources

Construct	Questionnaire item	References
IT decision accountabilities – IT decisions	1. IT investments including IT project justification and prioritisation.	Weill 2004
	2. Principles guiding organisational IT usage.	
	3. Business need for purchasing or developing IT applications.	
	4. Enterprise-wide IT infrastructure (technology and people) strategies.	
	5. IT architecture, including policies and rules guiding organisational IT use.	
	6. IT use to promote environmental responsibility.	Chen, Boudreauand Watson 2008; Molla and Cooper 2009
IT decision accountabilities – IT accountabilities	Possible combinations of business executives, IT executives/Heads and Business Unit leaders for IT decision accountabilities	Weill 2004
IT governance mechanisms - structures	1. Organisational board has at least one IT executive as member.	Tallon, Kraemerand Gurbaxani 2000; De Haes and Van Grembergen 2009
	2. IT executives/Heads report to a CxO (e.g. CEO, COO or CFO).	Sohal and Fitzpatrick 2002; Law and Ngai 2007; Raghupathi 2007; De Haes and Van Grembergen 2009; Banker et al. 2011; Ferguson et al. 2013
	3. IT executive committee oversees strategic IT decisions.	Weill and Ross 2005
	4. IT steering committee oversees strategic IT decisions.	Sohal and Fitzpatrick 2002; Weill and Ross 2005; De Haes and Van Grembergen 2009; Huang, Zmudand Price 2010
	5. IT executive committee includes both business and IT executives/Heads.	Weill and Ross 2005
	6. IT steering committee includes both business and IT executives/Heads.	Sohal and Fitzpatrick 2002; Peterson 2004; Weill and Ross 2005; Bowen, Cheungand Rohde 2007; De Haes and Van Grembergen 2009; Huang, Zmudand Price 2010
	7. IT project steering committees oversee IT projects.	De Haes and Van Grembergen 2009; Hartley 2009
	8. Audit/risk committees oversee IT audits.	De Haes and Van Grembergen 2009

	9. Audit/risk committees oversee IT risks management.	De Haes and Van Grembergen 2009
	10. IT executives/Heads play a leading role in all Green IT initiatives.	Bose and Luo 2012; Donnellan, Sheridanand Curry 2011; Molla, Cooperand Pittayachawan 2011
	11. Business executives play a leading role in all Green IT initiatives.	Bose and Luo 2012; Donnellan, Sheridanand Curry 2011
	12. A dedicated structure (e.g. Corporate Social Responsibility Office) is responsible for coordinating environmentally sustainable IT use.	Gartner 2008; CFO Research Services 2009
	13. A dedicated person (e.g. Chief Sustainability Officer) is responsible for coordinating environmentally sustainable IT use.	Gartner 2008; Murugesan 2008; CFO Research Services 2009
IT governance mechanisms - processes	1. Organisational strategic IT decision is defined in line with business strategy (e.g. in a strategic information systems plan).	Weill 2004; Bowen, Cheungand Rohde 2007; Raghupathi 2007; De Haes and Van Grembergen 2009
	2. IT budget is assigned yearly.	Luftman and Brier 1999
	3. IT budget is managed centrally by the IT department.	Interview findings
	4. IT budget is monitored and reported regularly.	De Haes and Van Grembergen 2009
	5. IT budget includes Green IT initiatives.	CFO Research Services 2009
	6. Business cases are used to select and prioritise IT projects.	Bowen, Cheungand Rohde 2007; De Haes and Van Grembergen 2009
	7. Critical IT solutions are bespoke (not off-the-shelf).	Cragg, Caldeiraand Ward 2011
	8. Critical IT systems are developed internally (not outsourced).	Ali and Green 2012
	9. Organisational value derived from each IT investment is assessed and reported back.	Tallon, Kraemerand Gurbaxani 2000; De Haes and Van Grembergen 2009
	10. Departmental IT costs are charged back.	Weill and Ross 2004; De Haes and Van Grembergen 2009
	11. Business unit IT costs are charged back.	Weill and Ross 2004; De Haes and Van Grembergen 2009
	12. Service level agreements are formalised between your organisation and external IT providers.	Nolan and McFarlan 2005; Weill and Ross 2004; De Haes and Van Grembergen 2009
	13. Service level agreements are formalised between your organisation and its IT department.	De Haes and Van Grembergen 2009
	14. Your organisation uses IT Governance frameworks (e.g. COBIT or ITIL).	De Haes and Van Grembergen 2009; ITGI 2011
	15. Your organisation uses formal project management methodologies (e.g. Prince2 or PMP).	Sharma, Stoneand Ekinci 2009; ITGI 2011

	16. IT risks management is based on a company risk management framework.	Khan 2006; Marks 2009
	17. IT executives/Heads constantly look out for technological innovations useful to the company.	Peppard and Ward 2004; Ali, Greenand Robb 2013
	18. Business executives constantly look out for technological innovations useful to the company.	Cragg, Caldeiraand Ward 2011; Ali, Greenand Robb 2013
	19. IT policies and processes are formalised.	Weill 2004; Bowen, Cheungand Rohde 2007; Raghupathi 2007; De Haes and Van Grembergen 2009
	20. Organisational IT is based on an assessment of best practice.	Raghupathi 2007
	21. Your organisation has defined Green IT targets.	CFO Research Services 2009; Erek et al. 2009
	22. Organisational Green IT performance is measured.	CFO Research Services 2009; Erek et al. 2009
	23. Organisational Green IT performance is reported.	CFO Research Services 2009; Erek et al. 2009
IT governance mechanisms – business and IT collaborative relationship (relational mechanisms)	1. Regular meetings are conducted between business and IT executives/management for IT decision-making.	Tallon, Kraemerand Gurbaxani 2000; Law and Ngai 2007
	2. Informal communication is common between business and IT executives/management for IT decision-making.	Huang, Zmudand Price 2010; De Haes and Van Grembergen 2009
	3. Business and IT people are physically located close to each other.	Reich and Benbasat 2000; Van Grembergen and De Haes 2008
	4. Systems (e.g. Intranet) to distribute IT Governance knowledge (e.g. IT policies, IT responsibilities) are established.	De Haes and Van Grembergen 2009; Bin-Abbas and Bakry 2014
	5. Processes (e.g. employee signed hard copied) to distribute IT Governance knowledge (e.g. IT policies, IT responsibilities) are established.	De Haes and Van Grembergen 2009; Bin-Abbas and Bakry 2014
	6. Systems (e.g. emails, Intranet) to spread Green IT awareness among employees are established.	Harmon and Demirkan 2011
	7. Processes to spread Green IT awareness among employees (e.g. Green IT employee awareness campaigns) are established.	Harmon and Demirkan 2011
Green IT mechanisms - attitudes	1. Organisation is concerned about environmental sustainability.	Chen, Boudreauand Watson 2008; Murugesan 2008; CFO Research Services 2009; Jain, Benbunan-fichand Mohan 2011; Molla, Cooperand Pittayachawan 2011
	2. Organisation is concerned about the environmental impact of its IT suppliers.	Molla, Cooperand Pittayachawan 2011
	3. Organisation is concerned about the energy consumption of its IT.	CFO Research Services 2009; Sayeed and Gill 2010; Molla, Cooperand Pittayachawan 2011

	4. Organisation shows concern for its environmental impact upon IT disposal.	CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011; Murugesan and Laplante 2011
	5. Green IT initiatives are driven by organisational leader(s).	Bose and Luo 2011; Donnellan, Sheridanand Curry 2011
Green IT mechanisms - policies	1. Organisation has an environmental sustainability policy.	CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011
	2. Organisation has a purchasing policy which includes environmental considerations for IT acquisition.	Chen, Boudreauand Watson 2008; Molla and Abareshi 2011
	3. Organisation has a policy for environmentally friendly IT use.	CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011
	4. Organisation has a policy for e-waste management.	Murugesan 2008; Chen, Boudreauand Watson 2008; Molla and Abareshi 2011
	5. Organisation has an overall Green IT policy.	Murugesan 2008; Molla, Cooperand Pittayachawan 2011
Green IT mechanisms - practices	1. Organisation prefers environmentally responsible IT suppliers.	Murugesan 2008; CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011
	2. Organisation upgrades technology for improved energy efficiency.	Kurp 2008; CFO Research Services 2009; Bose and Luo 2012
	3. Organisation provides e-transaction facilities.	Interview findings
	4. Organisation considers environmental factors (e.g. energy efficiency or environmental IT endorsements such as EPEAT) in IT procurement.	Erek et al. 2009
	5. Organisation considers environmental factors such as lighting and cooling in the design of IT infrastructure (e.g. data centres).	Elliot and Binney 2008; CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011; Ardito and Morisio 2014
	6. Organisation encourages Green IT behaviour (e.g. switching off lights and equipment when not required).	Murugesan 2008; CFO Research Services 2009
	7. Organisation encourages Green printing (e.g. virtualisation of printing, double sided printing).	Murugesan 2008; Molla, Cooperand Pittayachawan 2011; Unhelkar 2011
	8. Organisation encourages the use of technology related alternatives to travel (e.g. videoconferencing).	Cai, Chenand Bose 2013
	9. Organisation uses IT solutions to increase production efficiency (e.g. to produce more in less time).	Faucheux and Nicolaï 2011

	10. Organisation re-uses old IT equipment where possible.	Murugesan 2008; Shevlin 2008; Vykoukal, Wolfand Beck 2009
	11. Organisation recycles old IT equipment.	Murugesan 2008; CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011; Vykoukal, Wolfand Beck 2009
	12. Organisation disposes of e-waste responsibly.	Elliot and Binney 2008; Murugesan 2008; Molla, Cooperand Pittayachawan 2011
Green IT mechanisms - technology	1. Server consolidation and virtualisation	Elliot and Binney 2008; Molla, Cooperand Pittayachawan 2011
	2. Storage virtualisation	CFO Research Services 2009; Molla, Cooperand Pittayachawan 2011
	3. Desktop virtualisation	Molla, Cooperand Pittayachawan 2011
	4. Energy efficient lighting	Molla, Cooperand Pittayachawan 2011
	5. Building management systems for energy efficiency	Faucheux and Nicolaï 2011
	6. Data centre energy efficiency and cooling (e.g. using hot aisle/cool aisle data centre layout)	Molla, Cooperand Pittayachawan 2011
	7. Collaborative software (e.g. document management systems)	Cai, Chenand Bose 2013
IT governance and Green IT influencers – IT governance drivers	1. The acquisition of certifications or accreditation endorsing effective IT use	Mohamed and Kaur 2011
	2. Industry resilience	Document analysis findings
	3. Current Mauritian legislation	Document analysis findings
	4. Suggested amendments to the Mauritian Regulatory Framework (e.g. mandatory IT security audits)	Document analysis findings
	5. Political strategy of turning Mauritius into an ICT hub	Ministry of Information and Communication Technology 2011
	6. Client expectations	De Haes and Van Grembergen 2008
	7. The level of IT governance of its competitors	Nolan and McFarlan 2005
	8. Company strategy to increase its presence in the African region	Mauritius Africa Club 2013
	9. Company (or its Group's) value on the Stock Exchange of Mauritius	Vykoukal, Wolf, and Beck 2009; Ministry of Information and Communication Technology 2013
IT governance and Green IT influencers – Green IT drivers	1. The acquisition of certifications or accreditation endorsing environmental responsibility	Erek et al. 2009
	2. Industry resilience	Vykoukal, Wolfand Beck 2009
	3. Current Mauritian Legislation	Document analysis findings

	4. Suggested amendments to the Mauritian Regulatory Framework (e.g. e-waste recycling tax and disposal fee)	Document analysis findings
	5. Political strategy of turning Mauritius into a sustainable island	Elahee 2009
	6. Client environmental concern	Molla and Abareshi 2012
	7. Competitor environmental concern	Watson et al. 2011
	8. Society's environmental concern	Bansal and Roth 2000
	9. Company strategy to increase its presence in the African region	Mauritius Africa Club 2013
	10. Company (or it's Group's) value on the Stock Exchange of Mauritius	Vykoukal, Wolf, and Beck 2009; Ministry of Information and Communication Technology 2013
IT governance and Green IT influencers – IT governance & Green IT incentives and support mechanisms	1. Takes advantage of tax benefits on Green IT equipment	Document analysis findings
	2. Is motivated by Green IT governance awards to adopt Green IT measures	Document analysis findings
	3. Benefits from government-provided Green IT support units (e.g. National Computer Board, Energy Efficiency Management Office)	Document analysis findings
	4. Benefits from government-provided IT Governance support units (e.g. CERT-MU)	Document analysis findings

Appendix I Survey questionnaire

PARTICIPANT INFORMATION

Purpose of Research

This questionnaire is part of my PhD research on the "***Development and Evaluation of IT Governance and Green IT Model to Support Large Mauritian Organisations***", at Curtin University, Australia. The purpose of this research is to investigate and model the governance of IT and Green IT in large Mauritian organisations across the five pillars of the Mauritian economy. Your responses are important in enabling me to obtain a comprehensive picture of IT governance and Green IT in your enterprise.

Consent to Participate

Participation in this research is completely voluntary and your responses will be completely anonymous. Participants may withdraw at any time without prejudice or negative consequences, and do not need to provide a reason. By completing the survey, you are consenting to participate.

Participant Requirements

This research carries no risks, although you shall be asked questions about your company. Questions shall pertain to your company's IT strategies, policies, governance and Green IT practices. The questionnaire should not take you more than 20 minutes to complete.

Confidentiality

The information you provide will be kept in strictest confidence, and shall be accessible only to my supervisors and I. The questionnaire does not require that you enter your name or address, and in accordance with university policy, filled questionnaires shall be kept in a locked cabinet for five years, before they are destroyed.

Ethics

This study has been approved under Curtin University's process for lower-risk Studies (Approval Number – IS_14_20). This process complies with the National Statement on Ethical Conduct in Human Research (Chapter 5.1.7 and Chapters 5.1.18-5.1.21). For further information on this study, you may contact the researcher (contact details below) or the Curtin University Human Research Ethics Committee. c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth 6845; telephone number: + 61 8 9266 9223; email address: hrec@curtin.edu.au.

Further Information

If you would like further information about the study, please feel free to contact me on 5724 9145 or by email on sarita.ramanan@telfair.ac.mu. Alternatively, you can contact my supervisors Vanessa Chang on +61 8 9266 1388 or by email on Vanessa.Chang@cbs.curtin.edu.au and Tomayess Issa on +61 8 9266 7682 or by email **on** Tomayess.Issa@cbs.curtin.edu.au.

Thank you very much for your involvement in this research. Your participation is greatly appreciated.

This section identifies your organisational position and the industry your company belongs to.

Q1 What is your Job Title?

Q2 Please tick your company industry(s)

- ❑ Finance
- ❑ Tourism
- ❑ Information and Communication Technology
- ❑ Sugar/Cane
- ❑ Textile
- ❑ Other

Q3 Please tick the most appropriate category which describes your organisation.

- ❑ Private listed
- ❑ Private unlisted
- ❑ State enterprise
- ❑ Parastatal

This section identifies IT decision accountabilities. These refer to people or groups of people taking ownership of your company's IT decisions.

Q4 IT decision accountabilities

Please tick the group or groups of people responsible for taking each IT decision below. You may tick more than one category for each IT decision.

	Business executives	IT executives/ Heads	Business Unit leaders
IT investments including IT project justification and prioritisation.	❑	❑	❑
Principles guiding organisational IT usage.	❑	❑	❑
Business need for purchasing or developing IT applications.	❑	❑	❑
Enterprise-wide IT infrastructure (technology and people) strategies.	❑	❑	❑
IT architecture, including policies and rules guiding organisational IT use.	❑	❑	❑
IT use to promote environmental responsibility.	❑	❑	❑

This section identifies company IT structures connecting business and IT for their alignment. These include specific people or committees acting as liaison between business and IT.

Q5 IT structure to connect business and IT

Please indicate your level of agreement with each statement:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Organisational board has at least one IT executive as member.	❑	❑	❑	❑	❑
IT executives/Heads report to a CxO (e.g. CEO, COO or CFO).	❑	❑	❑	❑	❑
IT executive committee oversees strategic IT decisions.	❑	❑	❑	❑	❑
IT steering committee oversees strategic IT decisions.	❑	❑	❑	❑	❑
IT executive committee includes both business and IT executives/Heads.	❑	❑	❑	❑	❑
IT steering committee includes both business and IT executives/Heads.	❑	❑	❑	❑	❑
IT project steering committees oversee IT projects.	❑	❑	❑	❑	❑
Audit/risk committees oversee IT audits.	❑	❑	❑	❑	❑
Audit/risk committees oversee IT risks management.	❑	❑	❑	❑	❑
IT executives/Heads play a leading role in all Green IT initiatives.	❑	❑	❑	❑	❑
Business executives play a leading role in all Green IT initiatives.	❑	❑	❑	❑	❑
A dedicated structure (e.g. Corporate Social Responsibility Office) is responsible for coordinating environmentally sustainable IT use.	❑	❑	❑	❑	❑
A dedicated person (e.g. Chief Sustainability Officer) is responsible for coordinating environmentally sustainable IT use.	❑	❑	❑	❑	❑

This section identifies company IT processes. These refer to IT-related company practices facilitating the implementation and monitoring of company IT decisions.

Q6 IT processes for the implementation and monitoring of IT decisions

Please indicate your level of agreement with each statement:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Organisational strategic IT direction is defined in line with business strategy (e.g. in a Strategic Information Systems Plan).	❑	❑	❑	❑	❑
IT budget is assigned yearly.	❑	❑	❑	❑	❑
IT budget is managed centrally by the IT department.	❑	❑	❑	❑	❑
IT budget is monitored and reported regularly.	❑	❑	❑	❑	❑
IT budget includes Green IT initiatives.	❑	❑	❑	❑	❑
Business cases are used to select and prioritise IT projects.	❑	❑	❑	❑	❑
Critical IT solutions are bespoke (not off-the-shelf).	❑	❑	❑	❑	❑
Critical IT systems are developed internally (not outsourced).	❑	❑	❑	❑	❑
Organisational value derived from each IT investment is assessed and reported back.	❑	❑	❑	❑	❑
Departmental IT costs are charged back.	❑	❑	❑	❑	❑
Business unit IT costs are charged back.	❑	❑	❑	❑	❑

Service Level Agreements are formalised between your organisation and external IT providers.	❑	❑	❑	❑	❑
Service Level Agreements are formalised between your company and its IT department.	❑	❑	❑	❑	❑
Your organisation uses IT governance frameworks (e.g. COBIT or ITIL).	❑	❑	❑	❑	❑
Your organisation uses formal project management methodologies (e.g. Prince2 or PMP).	❑	❑	❑	❑	❑
IT risks management is based on a company risk management framework.	❑	❑	❑	❑	❑
IT executives/Heads constantly look out for technological innovations useful to the company.	❑	❑	❑	❑	❑
Business executives constantly look out for technological innovations useful to the company.	❑	❑	❑	❑	❑
IT policies and processes are formalised.	❑	❑	❑	❑	❑
Organisational IT usage is based on an assessment of best practice.	❑	❑	❑	❑	❑
Your organisation has defined Green IT targets.	❑	❑	❑	❑	❑
Organisational Green IT performance is measured.	❑	❑	❑	❑	❑
Organisational Green IT performance is reported.	❑	❑	❑	❑	❑

This section identifies company mechanisms supporting a collaborative relationship between business and IT for their alignment. This relationship is built on organisational practices encouraging business and IT to work together.

Q7 Collaborative relationship between business and IT

Please indicate your level of agreement with each statement:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Regular meetings are conducted between business and IT executives/management for IT decision-making.	❑	❑	❑	❑	❑
Informal communication is common between business and IT executives/management for IT decision-making.	❑	❑	❑	❑	❑
Business and IT people are physically located close to each other.	❑	❑	❑	❑	❑
Systems (e.g. Intranet) to distribute IT governance knowledge (e.g. IT policies, IT responsibilities) are established.	❑	❑	❑	❑	❑
Processes (e.g. employee signed hard copies) to distribute IT governance knowledge are established.	❑	❑	❑	❑	❑
Systems (e.g. emails, Intranet) to spread Green IT awareness among employees are established.	❑	❑	❑	❑	❑
Processes to spread Green IT awareness among employees (e.g. Green IT employee awareness campaigns) are established.	❑	❑	❑	❑	❑

This section identifies Green IT attitudes. These refer to company concerns about environmentally sustainable IT use.

Q8 Green IT attitudes

Please indicate your level of agreement with each statement:
Your organisation is concerned about:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
environmental sustainability.	❑	❑	❑	❑	❑
environmental impact of its IT suppliers.	❑	❑	❑	❑	❑
its IT energy consumption.	❑	❑	❑	❑	❑
its environmental impact upon IT disposal.	❑	❑	❑	❑	❑
Green IT initiatives, since your organisational leader(s) drives this aspect	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's **Green IT attitude.**

This section identifies Green IT policies. These consist of guidelines formalising environmentally sustainable company IT use.

Q9 Your organisation's state with respect to Green IT policies

Please indicate your level of agreement with each statement:

Your organisation has:

	Strongly agree	Disagree	Neither agree nor disagree	Agree	Strongly agree
an environmental sustainability policy.	❑	❑	❑	❑	❑
a purchasing policy including environmental considerations for IT acquisition.	❑	❑	❑	❑	❑
a policy for environmentally friendly IT use.	❑	❑	❑	❑	❑
a policy for e-waste management.	❑	❑	❑	❑	❑
an overall Green IT policy.	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's **Green IT policies.**

This section identifies Green IT practices. These refer to company measures for environmentally sustainable IT procurement, use and disposal.

Q10 Your organisation's Green IT practices

Please indicate your level of agreement with each statement:
Your organisation:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
prefers environmentally responsible IT suppliers.	❑	❑	❑	❑	❑
upgrades technology for improved energy efficiency.	❑	❑	❑	❑	❑
provides e-transaction facilities.	❑	❑	❑	❑	❑
considers environmental factors (e.g. energy efficiency or environmental IT endorsements such as Electronic Product Environmental Assessment Tool – EPEAT) in IT procurement.	❑	❑	❑	❑	❑
considers environmental factors such as lighting and cooling in the design of IT infrastructure (e.g. data centres).	❑	❑	❑	❑	❑
encourages Green IT behaviour (e.g. switching off lights and equipment when not required).	❑	❑	❑	❑	❑
encourages Green printing (e.g. virtualisation of printing, double-sided printing)	❑	❑	❑	❑	❑
encourages the use of technology-related alternatives to travel (e.g. videoconferencing).	❑	❑	❑	❑	❑
uses IT solutions to increase production efficiency (e.g. to produce more in less time).	❑	❑	❑	❑	❑
re-uses old IT equipment where possible.	❑	❑	❑	❑	❑
recycles old IT equipment.	❑	❑	❑	❑	❑
disposes of e-waste responsibly.	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's **Green IT practices.**

This section identifies use of Green technology. This refers to company technology adopted to promote environmental sustainability.

Q11 Green technology

Please indicate your level of agreement with each statement:
Your organisation uses the following technology:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
server consolidation and virtualisation.	❑	❑	❑	❑	❑
storage virtualisation.	❑	❑	❑	❑	❑
desktop virtualisation.	❑	❑	❑	❑	❑
energy efficient lighting.	❑	❑	❑	❑	❑
Building Management Systems for energy efficiency.	❑	❑	❑	❑	❑
data centre energy efficiency and cooling (e.g. using hot aisle/cool aisle data centre layout).	❑	❑	❑	❑	❑
collaborative software (e.g. document management systems).	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's use of **Green technology.**

This section identifies IT governance drivers. These refer to external factors encouraging organisations to optimise IT use for the achievement of organisational objectives.

Q12 IT governance drivers

Please indicate your level of agreement with each statement:
Your organisation's IT governance measures are driven by:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
the acquisition of certifications or accreditation endorsing effective IT use.	❑	❑	❑	❑	❑
industry resilience.	❑	❑	❑	❑	❑
current Mauritian legislation.	❑	❑	❑	❑	❑
suggested amendments to the Mauritian Regulatory Framework (e.g. mandatory IT security audits).	❑	❑	❑	❑	❑
political strategy of turning Mauritius into an ICT hub.	❑	❑	❑	❑	❑
client expectations.	❑	❑	❑	❑	❑
the level of IT governance of its competitors.	❑	❑	❑	❑	❑
its strategy to increase its presence in the African region.	❑	❑	❑	❑	❑
its (or its Group's) value on the Stock Exchange of Mauritius.	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's external **IT governance drivers.**

This section identifies Green IT drivers. These refer to external factors encouraging organisations to implement environmentally sustainable IT measures.

Q13 Green IT governance drivers

Please indicate your level of agreement with each statement:
Your organisation's Green IT measures are driven by:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
the acquisition of certifications or accreditation endorsing environmental responsibility.	❑	❑	❑	❑	❑
industry resilience.	❑	❑	❑	❑	❑
current Mauritian legislation.	❑	❑	❑	❑	❑
suggested amendments to the Mauritian Regulatory Framework (e.g. e-waste recycling tax and disposal fee).	❑	❑	❑	❑	❑
political strategy of turning Mauritius into a sustainable island.	❑	❑	❑	❑	❑
its clients' environmental concern.	❑	❑	❑	❑	❑
its competitors' environmental concern.	❑	❑	❑	❑	❑
society's environmental concern.	❑	❑	❑	❑	❑
its strategy to increase its presence in the African region.	❑	❑	❑	❑	❑
its (or its Group's) value on the Stock Exchange of Mauritius.	❑	❑	❑	❑	❑

Comments

Please add other comments on your company's external **Green IT drivers.**

This section identifies the extent of enterprise IT governance and Green IT influence by externally-provided encouragements. These include incentives and units supporting organisational strategic and environmentally sustainable IT use.

Q14 IT governance and Green IT incentives and support mechanisms

Please indicate your level of agreement with each statement:
Your organisation:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
takes advantage of tax benefits on Green IT equipment.	❑	❑	❑	❑	❑
is motivated by Green IT governance awards to adopt Green IT measures.	❑	❑	❑	❑	❑
benefits from government-provided **Green IT** support units (e.g. National Computer Board, Energy Efficiency Management Office).	❑	❑	❑	❑	❑
benefits from government-provided **IT governance** support units (e.g. CERT_MU).	❑	❑	❑	❑	❑

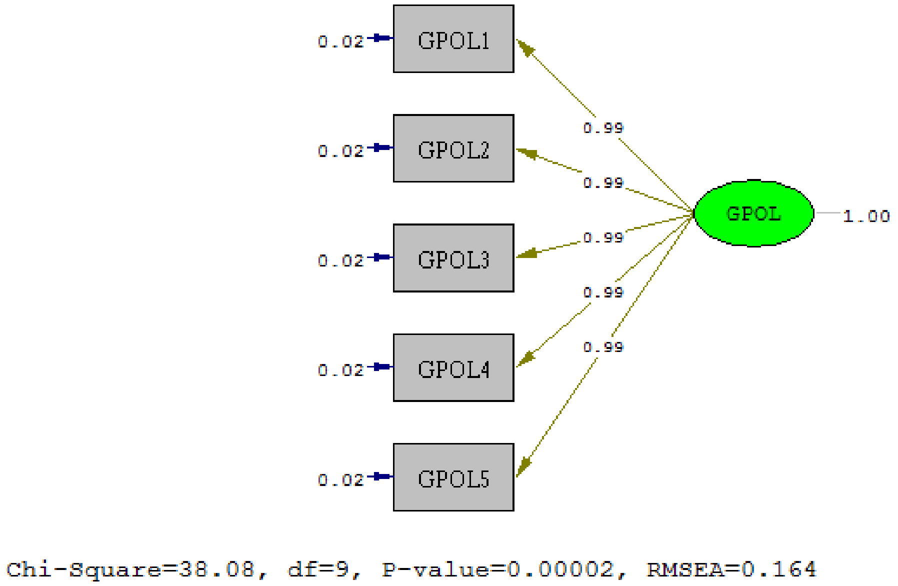
Comments

Please add other comments on **IT governance and Green IT incentives and support mechanisms.**

Appendix J Sample EFA to CFA conversion

ITERATION 1 - CFA MODEL WITH GPOL1, GPOL2, GPOL3, GPOL4, GPOL5

Results of first CFA run for Green IT policies (GPOL) using LISREL 8.80:



Goodness of Fit Statistics

```
Degrees of Freedom = 9
Minimum Fit Function Chi-Square = 38.077 (P = 0.000)
Estimated Non-centrality Parameter (NCP) = 29.077
90 Percent Confidence Interval for NCP = (13.655 ; 52.044)
Minimum Fit Function Value = 0.317
Population Discrepancy Function Value (F0) = 0.242
90 Percent Confidence Interval for F0 = (0.114 ; 0.434)
Root Mean Square Error of Approximation (RMSEA) = 0.164
90 Percent Confidence Interval for RMSEA = (0.112 ; 0.220)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.000375
Expected Cross-Validation Index (ECVI) = 0.417
```

90 Percent Confidence Interval for ECVI = (0.289 ; 0.609)

ECVI for Saturated Model = 0.250

ECVI for Independence Model = 21.519

Chi-Square for Independence Model with 10 Degrees of Freedom = 2572.288

Independence AIC = 2582.288

Model AIC = 50.077

Saturated AIC = 30.000

Independence CAIC = 2601.267

Model CAIC = 72.851

Saturated CAIC = 86.937

Normed Fit Index (NFI) = 0.985

Non-Normed Fit Index (NNFI) = 0.987

Parsimony Normed Fit Index (PNFI) = 0.887

Comparative Fit Index (CFI) = 0.989

Incremental Fit Index (IFI) = 0.989

Relative Fit Index (RFI) = 0.984

Critical N (CN) = 69.283

Root Mean Square Residual (RMR) = 0.203

Standardized RMR = 0.203

Goodness of Fit Index (GFI) = 0.988

Adjusted Goodness of Fit Index (AGFI) = 0.980

Parsimony Goodness of Fit Index (PGFI) = 0.593

Standardized Residuals

	GPOL1	GPOL2	GPOL3	GPOL4	GPOL5
	--------	--------	--------	--------	--------
GPOL1	- -				

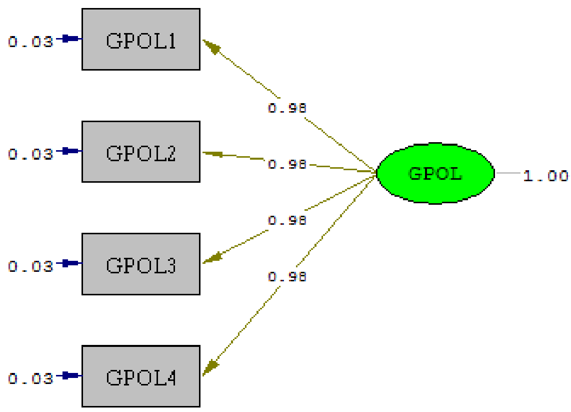
GPOL2	-2.029	- -			
GPOL3	-2.171	-1.432	- -		
GPOL4	-3.222	-3.484	-3.067	- -	
GPOL5	-3.102	-2.925	-3.660	-3.485	- -

Modification Indices for THETA-DELTA

	GPOL1	GPOL2	GPOL3	GPOL4	GPOL5
	--------	--------	--------	--------	--------
GPOL1	- -				
GPOL2	0.120	- -			
GPOL3	0.337	20.561	- -		
GPOL4	1.535	20.697	5.894	- -	
GPOL5	2.812	3.493	2.546	0.433	- -

Model fit was not achieved due to goodness of fit indices highlighted in red (valid ones are highlighted in yellow). The p-value was less than 0.05 and standardised RMR and RMSEA exceeded 0.08 and 0.06 respectively. Based on standardised residuals (absolute values) above 2.58 and modification indices greater than 5 (highlighted in red), GPOL4 and GPOL5 were identified for removal. GPOL 5 was removed from the model first and CFA run again as follows:

ITERATION 2 - CFA MODEL WITH GPOL1, GPOL2, GPOL3, GPOL4



Chi-Square=25.22, df=5, P-value=0.00013, RMSEA=0.184

Goodness of Fit Statistics

Degrees of Freedom = 5

Minimum Fit Function Chi-Square = 25.225 (P = 0.000126)

Estimated Non-centrality Parameter (NCP) = 20.225

90 Percent Confidence Interval for NCP = (8.134 ; 39.825)

Minimum Fit Function Value = 0.210

Population Discrepancy Function Value (F0) = 0.169

90 Percent Confidence Interval for F0 = (0.0678 ; 0.332)

Root Mean Square Error of Approximation (RMSEA) = 0.184

90 Percent Confidence Interval for RMSEA = (0.116 ; 0.258)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00114

Expected Cross-Validation Index (ECVI) = 0.294

90 Percent Confidence Interval for ECVI = (0.193 ; 0.457)

ECVI for Saturated Model = 0.167

ECVI for Independence Model = 15.088

Chi-Square for Independence Model with 6 Degrees of Freedom = 1802.530

Independence AIC = 1810.530

Model AIC = 35.225

Saturated AIC = 20.000

Independence CAIC = 1825.713

Model CAIC = 54.204

Saturated CAIC = 57.958

Normed Fit Index (NFI) = 0.986

Non-Normed Fit Index (NNFI) = 0.986

Parsimony Normed Fit Index (PNFI) = 0.822

```
Comparative Fit Index (CFI) = 0.989

Incremental Fit Index (IFI) = 0.989

Relative Fit Index (RFI) = 0.983

Critical N (CN) = 72.780

Root Mean Square Residual (RMR) = 0.192

Standardized RMR = 0.192

Goodness of Fit Index (GFI) = 0.989

Adjusted Goodness of Fit Index (AGFI) = 0.978

Parsimony Goodness of Fit Index (PGFI) = 0.494
```

Standardized Residuals

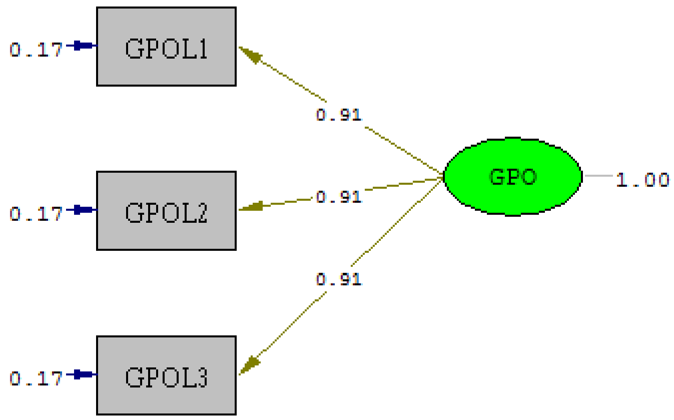
	GPOL1	GPOL2	GPOL3	GPOL4
GPOL1	- -			
GPOL2	-1.987	- -		
GPOL3	-2.126	-1.363	- -	
GPOL4	-3.182	-3.440	-3.064	- -

Modification Indices for THETA-DELTA

	GPOL1	GPOL2	GPOL3	GPOL4
GPOL1	- -			
GPOL2	0.083	- -		
GPOL3	1.804	11.175	- -	
GPOL4	0.183	16.446	13.471	- -

Model fit was not achieved as per goodness of fit indices highlighted in red. Again, the p-value was less than 0.05, SRMR greater than 0.08 and RMSEA above 0.06. Following analysis of standardised residuals and modification indices (highlighted in red), GPOL4 was removed from the model next. CFA was then run as follows:

ITERATION 3 - CFA MODEL WITH GPOL1, GPOL2, GPOL3



Chi-Square=1.29, df=2, P-value=0.52423, RMSEA=0.000

Goodness of Fit Statistics

Degrees of Freedom = 2

Minimum Fit Function Chi-Square = 1.292 (P = 0.524)

Estimated Non-centrality Parameter (NCP) = 0.0

90 Percent Confidence Interval for NCP = (0.0 ; 6.077)

Minimum Fit Function Value = 0.0108

Population Discrepancy Function Value (F0) = 0.0

90 Percent Confidence Interval for F0 = (0.0 ; 0.0506)

Root Mean Square Error of Approximation (RMSEA) = 0.0

90 Percent Confidence Interval for RMSEA = (0.0 ; 0.159)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.616

Expected Cross-Validation Index (ECVI) = 0.0833

90 Percent Confidence Interval for ECVI = (0.0833 ; 0.134)

ECVI for Saturated Model = 0.1000

ECVI for Independence Model = 1.482

Chi-Square for Independence Model with 3 Degrees of Freedom = 171.813

Independence AIC = 177.813

Model AIC = 9.292

Saturated AIC = 12.000

Independence CAIC = 189.200

Model CAIC = 24.475

Saturated CAIC = 34.775

Normed Fit Index (NFI) = 0.992

Non-Normed Fit Index (NNFI) = 1.006

Parsimony Normed Fit Index (PNFI) = 0.662

Comparative Fit Index (CFI) = 1.000

Incremental Fit Index (IFI) = 1.004

Relative Fit Index (RFI) = 0.989

Critical N (CN) = 856.750

Root Mean Square Residual (RMR) = 0.0710

Standardized RMR = 0.0710

Goodness of Fit Index (GFI) = 0.998

Adjusted Goodness of Fit Index (AGFI) = 0.993

Parsimony Goodness of Fit Index (PGFI) = 0.333

Standardized Residuals

	GPOL1	GPOL2	GPOL3
GPOL1	- -		
GPOL2	-1.054	- -	
GPOL3	-1.115	0.643	- -

Modification Indices for THETA-DELTA

	GPOL1	GPOL2	GPOL3
	--------	--------	--------
GPOL1	- -		
GPOL2	0.237	- -	
GPOL3	0.001	1.272	- -

As indicated by goodness of fit indices highlighted in yellow, absolute standardised residuals' values less than 2.58 and modification indices less than 5, model fit was achieved with the three variables GPOL1, GPOL2 and GPOL3.