THE UNIVERSITY OF NAIROBI

SCHOOL OF COMPUTING AND INFORMATICS

MSc. INFORMATION TECHNOLOGY MANAGEMENT

A FRAMEWORK FOR ADOPTING GREEN IT IN TELECOMMUNICATION COMPANIES: A CASE STUDY OF MAJOR TELECOMMUNICATION COMPANIES IN KENYA

BY

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DECLARATION

This research proposal is my original work and has not been presented for an award of a degree in any other University.

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REGISTRATION NO. P54/85899/2016

This research proposal has been submitted for examination with my approval as the University Supervisor.

Signature …… Date ……

DR. STEPHEN MBURU

DEDICATION

This project is dedicated to my family for the unending support they have always given me. I also dedicate this research to my friends and classmates who gave me support throughout the process. Not forgetting future researchers in the area of Green IT.

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ABSTRACT

Green IT adoption is the effort in an organization to tackle the current ecological challenges facing the universe. The goal of this paper is to propose a framework to assist organizations' and practitioners in the adoption of green IT. Existing green IT literature were reviewed. Findings from this paper show the attributes and components that stand to be considered in adopting Green IT in IT Governance; consequently the framework can also be used as a guide for forthcoming research in this area.

The study used cross-sectional descriptive survey design which will be deemed fit to establish the framework for adoption of green IT in telecommunication companies in Kenya. This focused on examining out who, what, where, when and how much of an existing phenomenon under the study. This research sort to establish a framework for adoption green IT in telecommunication companies in Kenya.

The results revealed that telecommunication companies engages the service of professionals, operates existing IT systems in an efficient manner, undertook Auditing of the energy efficiency of current IT technologies existing IT technologies and that companies were giving weight to eco-friendly considerations in sourcing .Generally, the result of this study has several implications for the adoption of Green IT within Organizations in Kenya. First the result indicates all the six factors have significant impact on adoption of Green IT within Organizations in Kenya. Particularly, the factors as discussed should aggressively develop and pay more emphasis on such variables in the whole process of Green IT adoption.

This research contributes to the emergence of a cumulative tradition in Green IT research. By proposing a green IT adoption framework customized to telecommunication organizations in Kenya.

Keywords: Green IT, adoption of Green IT, Information Technology (IT)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The planet earth faces new and different problems every day that regrettably can be resolved. Utmost of these problems have been caused by computing, this has led to society, organizations, and government and institutions to increasingly rethink the effectiveness, efficiency, and consumption of their activities in the quest to mitigate and /or create awareness of their harmful impacts on the environment. Sustainable development and green growth on the other hand being recognized by the same; in order to develop an important strategy initiative while many are under increased regulatory, social and economic pressure to far-reaching in the world market. Thus most of the organizations are searching for a tool(s) that will deliver support for a corporate strategy that incorporates economic, social and environmental objectives. Green IT, because of its significant role in power consumption and in monitoring and managing business activities, has become a developing subject and has received worldwide attention.

World Commission on Environment and Development (WCED) an organization formed in 1983, by then UN Secretary-General Javier Pérez de Cuéllar to focus on ecological and developing problems and solutions; defined justifiable development as: growth which "meets the requirements of the current generation without conceding the ability of future generations to meet their own needs". This delineation, regrettably, opens numerous interpretations (Rusinko, 2005). Delyse Springett in her article Business Conceptions Of Sustainable Development (2017) explores the concerns related to the various shades which the practice of sustainability conveys about such as the change between cultural understandings and socio-structural of the concept and as well empowerment of the public to handle justifiable undertakings. Hutchinson (1992) likewise, emphases on Peter Drucker' references about the three dimensional encounters faced by trades which comprise of making running trades effective; realizing potential and identification, and observance with the changing environs and adapting into a different business to ensure a future.(Hutchinson, 1992)

Green IT, also identified as green computing, is a brolly term referring to ecologically sound information technology and systems, applications, and practices. In the Journal Harnessing Green IT: Practices and Principles, San Murugesan describes the field of green IT as "the practice and study of , manufacturing, using, and disposing of computers, and associated subsystems such as storage devices, monitors, printers, networking and communications systems efficiently and effectively with minimal/no impact on the environment.

Furthermore, green IT refers to supporting businesses critical information technology needs with minimum possible amount of energy. Accordingly Carbon offset is a reduction in the emissions of CO2 or greenhouse gases applied to compensate for or to offset an emission made somewhere else. Therefore, Green IT initiatives should also be geared to counterweigh carbon emissions in a holistic approach to sustain environmental needs. In summary, green computing encompasses three comprehensive information technology (IT) allowed methods to improving ecological sustainability:

a) Efficient design, effective design, production, use, and disposal of information technology systems with no or slight effect on the environment.
b) Using IT to empower, assists, support, and controls other conservational initiatives.
c) The use of information technology to create awareness amongst shareholders and stimulate the green program & green initiatives in line with strategic business models

Worldwide, the computing industry has started to rival aviation in contribution to global warming. Computing area has come under increased scrutiny over energy consumption and the carbon discharges in its data centres, particularly, as the discussion over emissions broadens outside the traditional targets alike coal plants, planes and heavy industry. The information technology industry influence global warming similar to aviation and this is growing fast as the industry grows. According to Michele Marius on her journal “Making the world a greener place” I deduced the below facts that is production and use of IT account for about 2% of worldwide carbon emissions – which was same to aviation industry, energy consumption charges for a personal computer surpasses its purchase price over its lifetime, PCs contribute 40% to ICT’s global carbon

emissions, while heavy computing equipment's contribute approximately 23% and fixed and mobile telecoms contribute approximately 24% to ICT's global carbon emissions.

The carbon emissions from information technology use is anticipated to pass that of aviation industry. By 2021, approximations are that it will emit about 1.54 metric Gigatonnes of greenhouse gas discharges yearly (McKinsey). Key contributors to this continuous increase in of emissions are; rapid distribution and use of IT, especially PCs, in third world, the global take-up of mobile phones, number and size data centres and computing systems that are being recognized, which most meaningfully affects power consumption.

Personal computer (PC) ownership will multiply to four billion devices by 2020, with emissions increasing, according to a 2015 report by The Climate Group. According to a report CO2 Emissions from Fuel Combustion Highlights 2011, Kenya had a total of 10,000,000 tons of CO2 emissions in the year 2009. Additionally, per capita emissions with power and heat allocated to consuming sectors in 2009, Kenya had 252 kg CO2/ capita from CO2 Emissions from Fuel Combustion.

Similarly, with the developed countries like China, and Kenya driving industrial uptake and rising demand for smart phones, laptops and internet, the division's carbon footprint is set to increase radically. The Climate Group approximates broadband users will increase to around 900 million by 2020, with emissions increasing over the entire Telco's infrastructure. Organizations can reduce their carbon footprint and lessen their impact on the environment through implementing environmentally friendly IT practices. As mentioned earlier, most IT operations have harmful effect to environment. IT equipment consume large amounts of energy, which in turn contribute to greenhouse emissions, there is also the aspect of IT hardware disposal, if the hardware is not disposed in an environmentally friendly manner, this can lead to harmful pollution and toxic materials e g Lead (affects central peripheral nervous system), mercury (methylated if mixed with water), cadmium (toxic if accumulates in the body).

Green IT practices will diminish the environmental impact of IT equipment by improving power efficiency, lowering carbon emissions, using less hazardous material during the manufacturing of IT equipment and implementing recycling and refurbishment initiatives (Murugesan, 2008). This research intends to localize the study of application of green technologies with a keen interest into

the impact, derived reimbursements and flaws of green computing. The context of this research covers two major Telco's in Kenya. It will inspect the belief and behavior of Kenyan organizations and propose a suitable framework that will guide in attaining a sustainable greener IT roadmap in a holistic approach.

1.2 Problem Statement

Computing operations have momentous impact on the environment, and organizations have an obligation of reducing the negative ecological impact of their IT operations. However, Green IT acceptance requires an all-rounded style in order to benefit from Green IT initiatives and practices. Most of Kenyan telco establishments lack the understanding of having a holistic and sustainable approach in providing their services while being environmentally amicable as they perform their business models and strategies. This has led them to have keen interest on their bottom lines while neglecting their environmental obligations in a bid to build a sustainable future by embracing green computing initiatives in the core of their business models and strategies.

The pressure to become more and more environmentally friendly in the IT industry is becoming a major challenge for many organizations (O'Donnell & Leslie, 2009). The concept of green IT is being increasingly adopted primarily in developing countries, as a research topic, promotion and practice. Though the developing countries are slow to acknowledge the issues and also slow to take action to promote green IT.

1.3 Research Objectives

i. To propose a suitable and sustainable green computing framework to be adopted by Telecommunication companies.
ii. To study existing green computing frameworks and determine their level of adoptation.
iii. Identify an appropriate framework for adopting green IT from reviewed framework.
iv. To use the proposed framework to measure the level of green IT adoptation in major telecommunication in Kenya.

1.4 Research significance

Organizations within the country are pretty more environmentally conscious and setting that responsiveness into practice is suddenly common among the businesses. Campaigners believe it saves money and benefits the world in reducing global warming.

The following are among other reasons for the research study in this area of study:-

1.4.1 Cost Effectiveness

The capital expenditure for going green is averagely high. This is because Solar cells which are more efficient over the last years in Kenya, take around four years to pay back the initial costs in the form of lower energy bills, hence cost effectiveness.

1.4.2 Customer Preferences

Several organizations/businesses make a virtue of their ecological awareness; do advertising operations around it in response to the increasing number of customers that prefer dealing with socially responsible business.

1.4.3 Market Size

The latest article in Harvard Business Review argued that "brands that truly appeal to the ecologist consumer can reach the mainstream." It cites research showing that protecting the environment is really the key motive why people choose to purchase a product in some markets. Hence, the study enables businesses to build green strategies to tap into the increasing market share which are inclined to this paradigm and school of thought.

1.4.4 Tax Benefits

Increasingly, governments are in the front with the tax benefits given to greener service providers. Some of the motivations are; tax cuts for businesses that can reduce their building's power consumption by even up to 50%. This shows how the study is relevant in dealing with the emerging government regulations and practices that have incorporated green practices that builds sustainable future development.

1.5 Scope

The Scope of the study will concentrate on Telkom Kenya and Safaricom PLC since they have established communication infrastructure and practices that have huge impact on the environment in everyday operations for me to come up with the true picture of the situation at hand.

1.6 Limitations of the study

The study is primarily aimed for proposed audience such as and IT executives, IT Managers and IT Professionals of various establishments within Kenya who are involved in assessing the level of Green IT process and practices at their particular organizations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Green IT or green computing has been appearing more and more on the agenda of organizations, the media and internet publications. The central idea of green IT is use of computing resources more efficiently, reduction of the greenhouse gas emission of data centers, developing better power management strategies, handling the increasing demand of data storage, reducing the use of toxin for producing IT equipment, or changing the organizational culture towards a more ecological way of thinking. In the context of an enterprise, the following definition of green IT seems appropriate (Mingay, 2007); *"Green IT is the optimal use of information and communication technology (ICT) for managing the environmental sustainability of enterprise operations and the supply chain, as well as that of its products, services and resources, throughout their life cycles."*

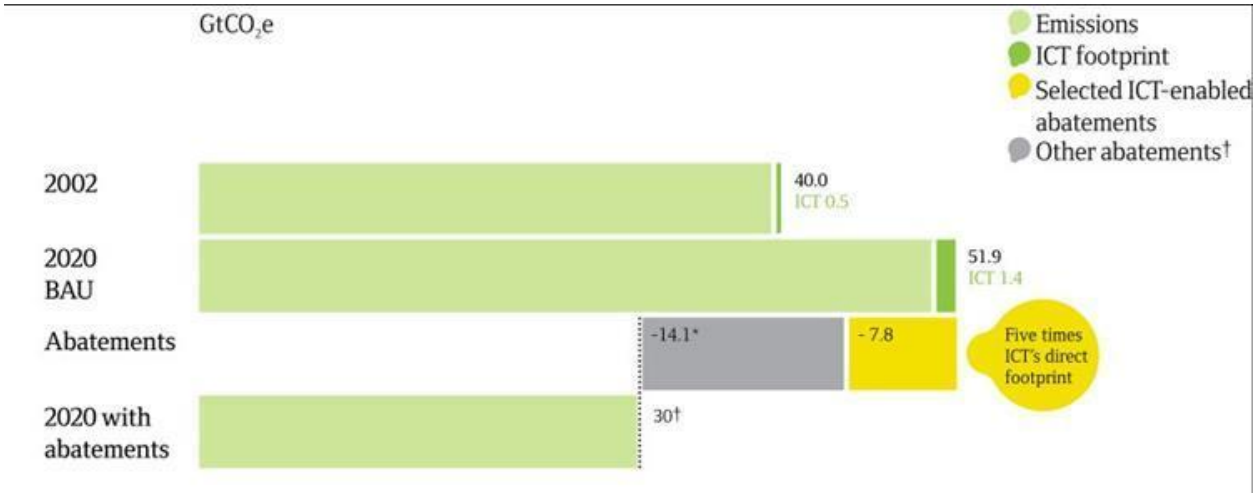
In an American survey of 280 IT executives (CIO Staff, 2008) the primary factors that are leading companies to adopt this new concept of green IT are mainly cost reduction efforts related to energy efficiency and more socially responsible corporate citizen. Some of the practices organizations are adopting to green their IT include; reducing IT equipment's power consumption, educating users to switch off equipment at night and when not in use, configuration of desktops to enter sleep mode while not in use, and improvement in data Centre cooling system for improved efficiency. The goal of green IT initiatives is to reduce the carbon dioxide (CO2) emissions, maximize energy efficiency and promote sustainability.

2.2 IT and the environment

The connection between communication systems and environment is intricate and multidimensional, as IT can equally play both negative and positive roles. The positive impacts come from the benefits of IT applications, online processing systems, remote applications, and travel substitution, online delivery, monitoring and management applications, increased energy efficiency in production & use, and product recycling. Negative impacts arise from energy consumption in data centres and the materials used in the production and distribution of IT equipment, short product life cycles and disposal of IT products. The impacts of IT on the

ecosystem can be direct or indirect (i.e. the effects of IT themselves), or indirect (i.e. the impacts of IT applications) or third-order and rebound (i.e. the impacts enabled by the direct or indirect use of IT, such as better use of more energy efficient transport and substitute sources of energy.

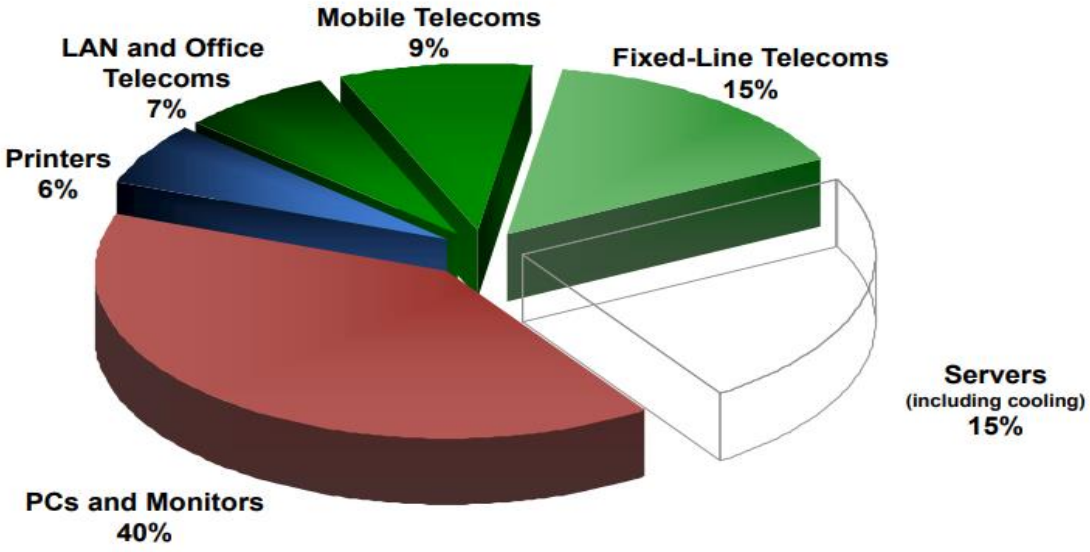
Approximations of the direct effects of the IT industry vary with the definition of the industry and coverage of IT-related power uses, but the production and use of IT equipment is estimated to be equal to 1% to 3% of global carbon dioxide emissions and growing share of energy consumption. In 2010, Gartner projected that IT equipment (excluding broadcasting) contributed between 2% and 2.5% of global Greenhouse Gas (GHG) emissions of which 40% of this was reported to be due to the energy requirements of personal computers and monitors, 23% to data centers, 24% to mobile and fixed telecommunications, and 6% to printers (Kumar and Mieritz 2007).



(Source: The Climate Group (2008) SMART 2020)

Figure 2.1: ICT Impact: The Global Footprint and the Enabling Effects

Rather than looking at individual initiatives, my research takes a all-inclusive view of the ecological footprint across an organization's IT and highlight areas where accomplishment may be taken.



(Source: Rakesh Kumar, Lars Mieritz.Gartner (2007)

Figure 2. 1: Estimated Distribution of Global Carbon Dioxide Emissions From ICT

However, the indirect, permitting impacts of ITs are more significant and most of the research have identified potentially substantial net positive effects from IT. For instance, The Climate Group (2008) acknowledged key areas of aiding impacts potentially leading to worldwide emissions drops by 2020 that were five times the IT sector's direct footprint.

IT and the broadband are aiding in an increased number of services and products to be conveyed online, this comprises of academic and scientific journals, film and videos, books, software, etc., with fewer appealing a physical form and possibly fewer resources being used in their production hence less energy consumption, storage and delivery. E-commerce can save time in searching for products and pricing, centralized fulfillment and delivery can replace many thousands of individual tours, this will save energy directly and also through possible reductions in traffic congestion. E-mail has substituted letters written on paper worldwide, with almost sudden communication that has a very small environmental footprint (Schmidt and Kloverpris 2009). IT offer telecommuting, which states the act of working from a remote location, or virtual office. With this there is the reduction of transport and commuting time which is substantial and has considerable benefits that can accrue for institutions and individuals.

Though, there are numerous studies pointing the problems in evading negative effects and grasping

the potential benefits. Its notable that the virtual office has not yet eventuated, e-commerce may not save energy if it encourages long distance delivery, 360 degree working has increased power use at home and demand for IT equipment's, such as routers and printers, and so on (Plepys 2002). The key is not the technology, but how it's implemented and later used. This research study aims to develop a framework for Green IT adoption which will assist organizations within Kenya and the region in implementing Green IT practices which in turn will impact our environment in a positive way.

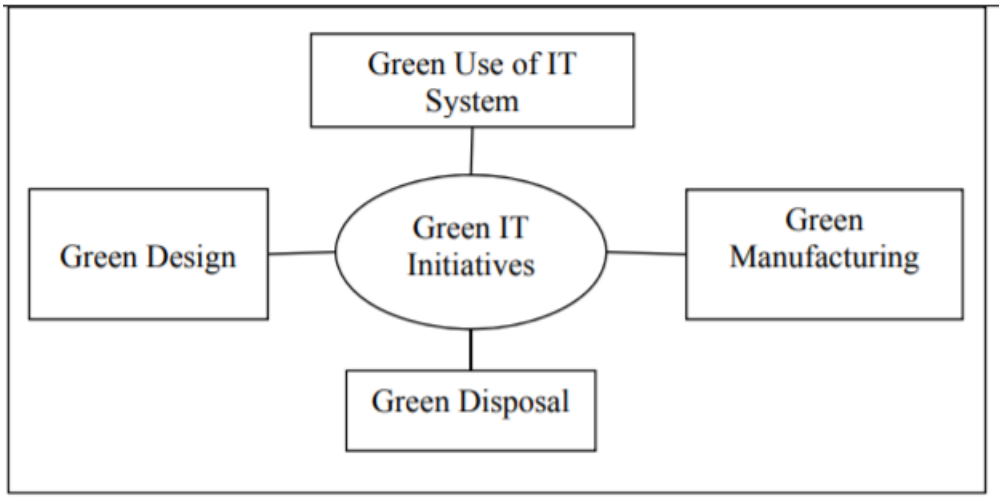
2.3 Green computing Management

Institutions are progressively going green and putting more intensely on information technology to shrink corporate power consumption thus become more ecologically responsible. Institutions are being pressured to go green and hence discovering growing openings to improve on sustainability practices and on the flip side responding by building capacity, setting their resources to capture mindshare and wallet share of user companies putting green IT in place. Also the government regulators and environmental watchdogs are also pushing the organizations to align their operations with environmentally sustainable practices. Eg The Kyoto protocol agreement. Consequently, management of green IT infrastructure needs strong commitment from the echelons of corporate leadership (Sarkar and Young, 2009, p.2).

The focus of many firms has changed from purely enriching the shareholders to an approach for sustainable and responsible business. This is often stated to as "the triple bottom line" (Willard, 2002). The notion of a triple bottom-line implies that businesses should measure their financial performance and their environmental and social impact. These three bottom-lines are often referred to as: "people", "planet" and "profit" (Willard, 2002). The impact of IT operations on the environment has previously been discussed. By embracing green IT practices, establishments can minimize the effect of their IT operation to the environment, and thus contribute towards their environmental benchmark. Such contributions towards the environmental bottom-line would almost certainly improve the financial bottom-line, by mitigating risks and building competitive advantage.

2.4 Concept of green IT

The concept of green IT in not well defined or uniformly accepted set of practice (M. Alemayehu, 2009).Green IT is a crucial topic in Information technology or information systems study, thus scholars have derived several definitions of Green IT. Green IT or Green Computing, (Mata Toledo and Gupta 2011), is the practice of implementing procedures and policies that increase the efficiency of computing resources in such a way as to decrease the power consumption and ecological impact in their operation. Trimi and Park (2013) states 'green' is compound noun that refers the information technology and the environment, deals with issues such as pollution, power consumption, disposal and recycling of resources etc. One of the most referred articles that combined the concept of Green IT is (Murugesan 2008) author proposed four domains of Green IT which are Green design, Green use, Green manufacturing and Green disposal of IT Systems



Source: Murugesan (2008)

Figure 2. 2: Domains of Green IT

Green use emphasizes on reduction of energy consumption of computer hardware and other systems hence their use in an eco-friendly way. On green disposal it discusses the recycling of electronic equipment. Green design on the other hand defines the design of energy efficient computer systems. Green manufacturing defines the way of manufacturing electronics hardware systems with minimal impact on environment (Murugesan 2008).

Green IT to different departments (Davis, 2007)

Department	**what green IT means**
CIO and IT organization	Reduce environmental impact of computing Apply IT to other green initiatives, eg travel reductions Source and deploy environmental management information system
Procurement and sourcing	Choose green suppliers Choose electricity source and associated carbon impact
Facilities	Plan, monitor, and manage electricity consumption
CSR office	Set corporate policies and guidance on use of assests; set carbon reduction goals
Marketing Office	Use CSR to differentiate firm and products
Manufacturing and distribution	Reduce process, packaging and transport waster: eliminate hazardous materials
All business leaders	Reduce environmental impact of corporate travel, commuting, etc
R&D and product design	Design product that minimize resource consumption in manufacturing, distribution and consumer use

Fig: what green IT means to different departments in an organization (Davis, 2007)

Green IT –Working definition

Molla (Molla, 2008) defined green IT as systematic and holistic method that address the following challenges

1. IT been a conspicuous consumer of energy, green IT infers to efficient design of IT architecture to decrease both cost and energy consumption
2. IT can support an organization s sustainable corporate practice by providing analytical tools
3. IT can also play a supplanting role in green IT by providing services such as video conferencing, tele conferencing etc that can reduce travel costs.

In this study, Green IT includes the ideas of Molla definition, but also includes the technology, the human resources aspect and organizational culture concerning green information systems as well.

The different undertakings that will help organizations to move towards green IT framework are:

a) The use of renewable energy
b) Ecofriendly disposal of IT equipment's and consumables
c) Maintain green IT Data centres by reduction through different initiatives.
d) Use of green technologies eg virtual office, automation etc.

These initiatives are determination by the establishments to reduce carbon footprints. For example presently, power converters with a rating of 70% efficiency waste 30 Watts of power which is a huge amount. Hence, the producers are sending higher efficiency adaptors with 80% to 90% efficiency scores. This helps in reduction of wastage. However, the cost sustained in designing energy efficient networking components is high which has caused slow improvements.

There are three main factors based on the review of the literature that will lead to green IT adoptation. These are motivational factors, organizational factors, and technological constraints (Kuo, 2010)

2.4.1 Motivational Factors

There are three motivations to make corporate environmentally conscious:- regulations, competition, and social responsibility. Competitiveness is related to organizations' success such as sinking cost and making more revenues. To avoid consequences and reduce risk, organizations

comply with regulations and norms. Social responsibility drivers are related to 'feel-good' reasons and are solely internal within the business and help in the embracing of Green IT.

2.4.2 Organizational Factors

The factor is associated to internal environment of the organizations eg hr. If the factors are not available in the appropriate quality and companies may be unable to act, so when senior management is strongly supportive of environmentally sustainable initiatives, the extent of green IT in organizations should be significantly higher.

Another organizational factor is on the procurement of IT equipment which are environmentally safe .i.e. purchasing of Energy Star equipment, if a company monitors their procurement processes to ensure that environmentally friendly equipment is procured, then the organization aim of practicing Green IT will be achieved. Other factors on People and Practice need to be monitored at an organizational level to ensure adoption of Green IT, this include efficient use of applications and mobile office environment.

2.4.3 Technological factors

These factors play a role in limiting business capacity to begin certain Green IT initiatives since some activities related to green IT depend on innovative technology, so if organizations don't have adequate technology, undertaking green IT initiatives may become challenging. This new innovations will lead to the adoption of more energy efficient hardware, and/or virtualization technologies (Mitchell, 2008).

2.5 Green IT in Kenya

The key concern of many conservational organizations active in Kenya is the rising cost of power and especially as related to the hydro power generation's and degradation of forests (as evidenced by Mau forest crisis 2010). Another major concern is the problem of used IT equipment's disposal (e-waste). the leading conservational groups in Kenya, the National Environmental Management Authority (NEMA), is currently working on an e-waste disposal framework (Nation Newspaper, September 8th 2015). The government of Kenya is interested in green IT issues, as evidenced in National Information & Communications Technology (ICT) policy formulated by the ministry of

information & communications in 2006. Under section 3.3.10 of the policy titled ―environmental issues the policy states; "*The Government will promote the use of environmentally-friendly IT products to address environmental and cost issues. This will include developing regulations for recycling and disposal facilities"*

2.6 Green IT Initiatives

Green IT is not only about being environmentally friendly; it is also about decreased cost and increased efficiency. There is a lot of literature on green IT initiatives to come up with a definitive list of the green IT practices. The aim of green IT is to reduce energy consumption, hence minimize the greenhouse gas emissions. There are certain strategies and initiatives to sustain the environment. One useful way this author found is to categorize the green IT initiatives the way The Info-tech research group categorizes them i.e. 4 major groups namely: Virtualization and Energy Efficiency, Consolidation, Asset Disposal and Travel Reduction (Info-Tech research group, 2009).

2.6.1 Virtualization and Consolidation to Support green IT

These technology allows organizations to have two or more standalone computers, running on different environments to run on one standalone machine. Virtualization decouples users and applications from the specific hardware of the systems they use. This area include server consolidation and virtualization, desktop virtualization and storage consolidation. These projects typically improve cost and power efficiency.

2.6.2 Server virtualization Storage consolidation

Virtualization is a technique utilized to share one set of physical hardware to several contemporary operating logical sessions or systems. This allows for lesser physical resources and consequently reduces the energy and cooling consumption. Storage consolidation involves putting data from multiple sources into a centralized system. In addition to the clear reductions in power use server virtualization and storage consolidation offer a host of other benefits in ease of management and cost efficiency. For example by use of server virtualization, IT system administrators can easily change server configurations, thus avoiding the time-consuming required by standalone servers.

2.6.3 Desktop Virtualization & Thin Clients

This is a network computer without a physical CPU, RAM, and hard disk drive, and connects to the virtual desktop environment. The idea of thin clients is to have terminals which do not have processing power locally but are connected to a powerful CPU where applications run. The terminals only display the information. A modern thin client consumes one twentieth the amount of power used by a relatively energy efficient machine (Nordin, 2008). Thin clients results in energy savings as well as cost avoidance.

2.6.4 Cloud Computing

Most of the organizations who wish to improve on efficiency of power consumption in data centers and its associated green credentials, we have three main and distinct options. Firstly to design and build a state-of-the-art data center, incorporating efficiency design and environmental standards and Secondly to improve the existing data center considering implementation of fairly low risk and low cost initiatives.

2.6.5 Energy Efficiency

This area include but not limited to new build server and room renovations and new builds, IT energy continuous measurement, printer consolidation, and PC power management. These initiatives have power efficiency or reduction as a key cost savings benefits.

2.7. Server room upgrades and new builds

The key reason for upgrades and new build are:

a) Increase effectiveness in ventilation and cooling systems hence cost reduction
b) Reduction of real estate costs, through up-to-date infrastructure that supports latest technologies

2.7.1 IT Energy Measurement

One cannot manage what cannot be measured. Organizations are increasingly under pressure to manage their energy costs. As a result they are beginning to measure the current level of energy

efficiency at which they are operating in, in order to begin how to improve. Programs in this group include sub-metering for the data centre, assessment of total IT energy use and PC power measurement.

2.7.2 Printer Consolidation

The decrease in consumables e.g. toner, paper, ink and energy are the driving forces behind print reduction and consolidation. In addition management costs and maintenance associated with dispersed printer fleets of different makes, hardware requirements and models is also achieved.

2.7.3 PC Power management

Power consumption on end-user devices management is easy way to reduce energy costs. Initiatives in this area include:

a) Using tools that centrally manage power settings in equipment's
b) Standardizing all power settings in equipment's
c) Buying energy-efficient equipment's ie Energy Star certified
d) Using self-optimizing software's in GSM networks for Telco's

2.7.4 Travel Reduction

Organizations are looking for ways to reduce travel, fuel and commuting costs including decrease the negative effect on the ecosystem caused by greenhouse gas emissions from the vehicles and airplanes. Initiatives in this area include telecommuting, collaboration and remote conferencing.

2.7.4.1.Collaboration & Remote Conferencing

a) Teleconferencing and Video-conferencing implementations between facilities and client sites.
b) Online collaboration tools.

2.7.4.2 Asset Disposal

IT assets disposal initiatives are mainly driven by combination of environmental responsibility and regulatory pressures rather that a business case with cost savings. Space is also playing factors in this issue as many departments are running out of space to store end of life equipment.

2.8 The Cost-benefit of Green IT Activities

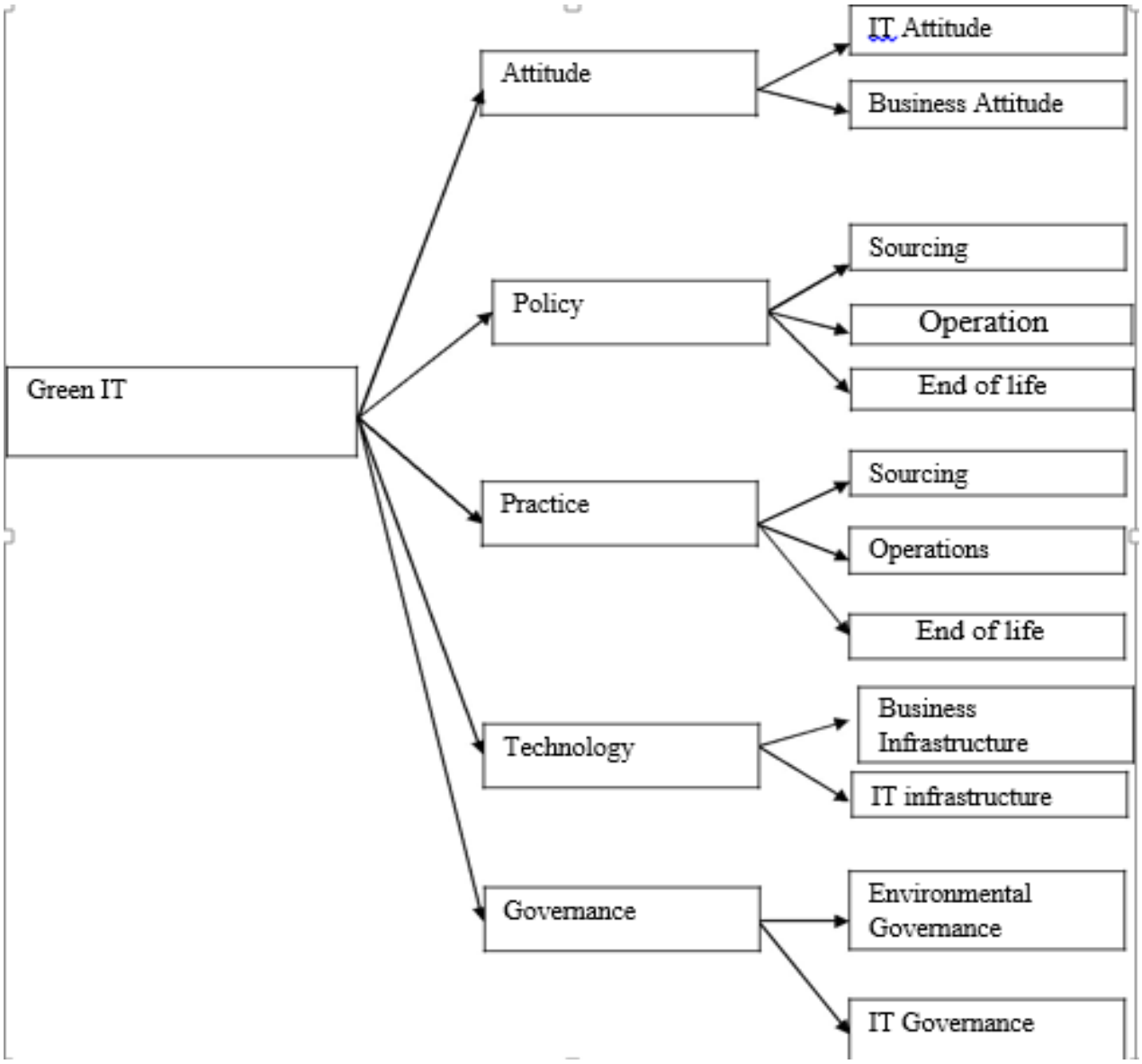
Due to the limited and competing IT budgets especially in the developing countries the need for cost effective green IT initiatives is an important factor in the adoption strategy. The importance of cost effective green IT initiatives has prominently featured in the green IT literature. In an empirical study, entitled *Managerial Attitudes Towards Green IT*; A study of policy drivers, Sarkar & Young, 2009 finds that the existence of an effective cost model and awareness programs surrounding green IT influence managerial attitudes towards green IT.

In other related study titled; *Organizational Green IT*; It seems the lowest line rules, Kuo, B & Dick found that those initiatives that have positive effect on the bottom line are the ones most likely to be executed. This focus on green IT initiatives that are cost effective is reflected in other studies (Info-Tech Research Group, 2008 & Molla et al., 2009). Sayeed and Gill (2008) also that found that the IT management is preoccupied with efficiency. This implies that those green IT initiatives that are easy and low cost to implement, and that have high benefits, the so called quick wins, have a high chance of success in the adoption strategy.

2.9 Green IT Frameworks, Model and Related works

2.9.1 Green IT Readiness Framework (Molla et. al, 2008)

The framework defines the main stakes of a G-readiness framework to aid establishments assess their green IT adoption readiness Green IT. The authors urge that unless there is a clear appreciative of g-readiness, organizations method of approach to green IT initiatives will be ad hoc and purely based on a reactive basis which is undesirable. There are five properties identified in greening IT – *technology, attitude, governance, policy, and practice;* this properties together make the critical quality which the authors call G-readiness. G-readiness is defined as the extent of a organizations IT readiness to support its resourcefulness in the low carbon landscape (Molla et. al, 2008). The framework is illustrated below.



SOURCE: E-READINESS TO G READINESS: DEVELOPING A GREEN INFORMATION TECHNOLOGY READINESS FRAMEWORK, ACIS 2008 PROCEEDINGS (MOLLA ET. AL, 2008)

Figure 2.4: Green it Readiness Framework

2.9.1.1 Attitude

Is a measure of the extent to which business and IT are engrossed in the regulatory, economic, environmental, strategic, and social concerns related to green IT.

2.9.1.2 Policy

Policy is the measure of degree to which green and sustainable policies are developed throughout an organization and infuse the value chain.

IT sourcing policy

This is the degree to which an organization has approved an ecologically preferable purchasing policy (EPP) and expressed clear green strategies for purchasing IT services and equipment's.

IT operations and services policy

This includes the level of services provided by the IT support issues captured in trade sustainability

IT end of life policy

This refers to the regulations and policies related to the disposal and settlement of IT equipment's in organizations.

2.9.1.3 Practice

Organizations vary in the actual carrying out of their policies. An organizations green practice along its value chain from inbound to reverse logistics influences g-readiness (Rao and Holt 2005).

2.9.1.4 Technology

This is about acquiring more ecologically effective technology. This may include IT infrastructure and power supplies (Brocade 2007; Rasmussen 2006). Rossi (2007), highlights that industries and nations spend a lot of money each year to power computers. This creates a bad image for IT as being power-consuming which is bad for the environment.

2.9.1.5 Governance

Governance describes the management of green IT undertakings. Gartner's (2008) case study reveals that Green IT requires "sound institute infrastructure to understand prioritize actions, impacts, and manage the enterprise's responses". Responsibilities, Roles, accountability and control for Green IT initiatives need to be clearly established.

2.9.2 Observations

This framework is not about green IT adoption, but more about green IT readiness which is only one aspect in green IT adoption albeit a very important one. This framework is good at representing the green IT readiness factors. However the framework does not cover the aspect of metrics in the green IT readiness construct factors. Green IT metrics are important since they provide a way of assessing the effectiveness of the green IT initiatives. The proposed study model will incorporate the aspect of metrics in the green IT readiness factors.

2.9.3 The RMIT green ict framework

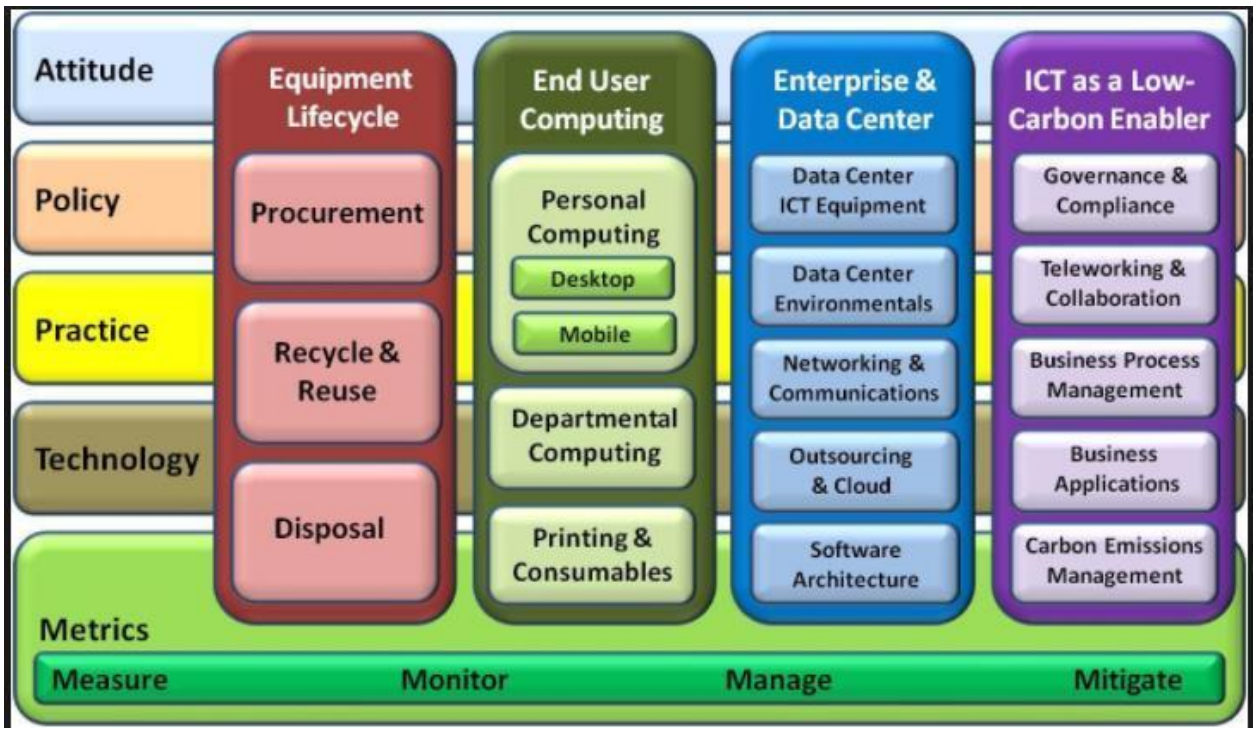


Figure 2. 5: The RMIT Green ICT Framework

The framework is used in organizations in categorization of Green IT. Commonly used by Connection Research and its commercial partners to conduct surveys into Green IT practice patterns and in steering Green IT benchmarking.

2.9.3.1 Equipment Lifecycle

This ranges from IT equipment acquisition to disposal/recycling in an environmentally friendly manner.

2.9.3.2 Procurement

Procurement is divided into two categories: the equipment and the supplier.

2.9.3.3 Recycle and Reuse

Organizations swap IT equipment occasionally either regularly or till end of life and others utilize some sort of nonstop update process for software.

2.9.3.4 Disposal of ICT Systems

Eco friendly practices for disposal predate Green IT concept, as many establishments have been aware for some time of the importance of reducing ecological damage by electronic waste.

2.9.3.5 End User Computing

This is the process in which the consumer who is the end user controls. This is divided into: personal computing (desktop), and consumables

2.9.3.6 ICT as a Low-Carbon Enabler

Research shows ICT contributes approximately two percent of the carbon emissions - by powering the equipment's, where the power comes from carbon emitting power stations. This is covered by the fourth pillar of the Framework.

2.9.3.7 Metrics

Effective Green IT strategy must identify reduction measures in order to achieve power savings, improving recycling efforts, carbon emissions reductions and water conservation. The choice of a tool to measure, monitor, manage and mitigate energy consumption, is crutual is ensuring success of green IT projects. Connection Research identifies four phases (the "Four Ms") of the metrics process: measure, monitor, manage and mitigate.

2.9.4 Observations

This framework is also not about green IT implementation. However the framework is useful in defining green IT and comprehending its components. Though the framework is good, especially in representing the ―pillars of green IT namely; Lifecycle, End User, Enterprise and datacenter, the author‘s area of interest is in the green IT actions, the horizontal aspects in the diagram, where governance is missing. Green IT governance is cited in literature as an importance aspect of green IT in organizations (Molla, 2008).

2.9.5 The green IT adoption model (Molla, 2008)

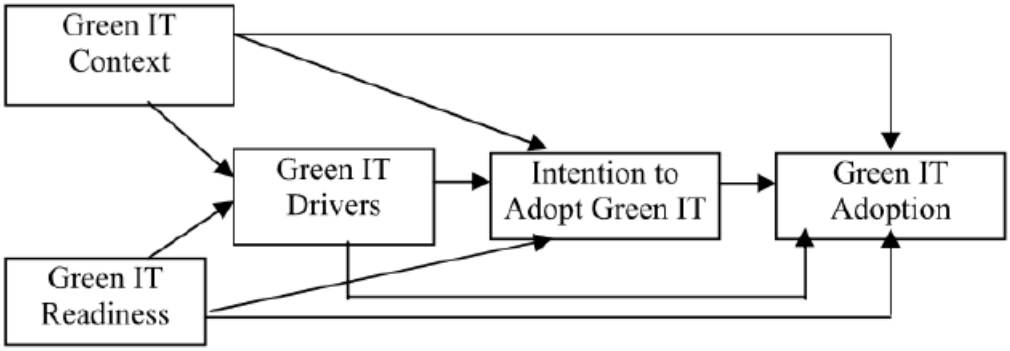


Figure 2. 6: The green IT adoption model –GITAM (Molla, 2008)

Green IT Adoption and Adoption Intention

Research has shown there is a gap between action and awareness and thus GITAM offers a scope to identify the specific Green IT context, driver dimensions and readiness which might convert intents to actions. It also explains the intention to adopt Green IT and the actual implementation are subjective to same set of factors. Moreover, GITAM offer 2 measures of Green IT adoption; depth and breadth.

2.9.5.1 Green IT Drivers

There are three green IT drivers namely regulatory, economical and ethical. These drivers are not mutually exclusive, the occurrence of a overriding driver can impact the content and course of Green IT initiatives and favor other Green IT practices.

Economic driver

This has been necessitated by the need for better IT efficiency and the quest of cost savings in IT processes. The growth rise of data storage brought about to increased global trade has led to need for high storage devices. The volume of company data has exceeded 1 million terabytes in 2013 and is anticipated to reach a zetabyte by 2018(IDC in Brocade, 2013). As businesses demand for additional data handling and storage ability continues to grow, the cost is becoming a challenge (Brocade, 2007). Thus the need to reduce power consumption through increase of data centre efficiency.

Ethical driver

Ethical drivers leads to Green IT preferences that associate a business to socially responsible commerce practices and good corporate citizenship. Socially accepted rules of standard green

IT practices are reduction of emission, reuse, recycling and good e-waste management (Mines and Davis, 2007; Sen et al, 2006).

2.9.5.2 Green IT Context

These are the primary features that are essentially in the adoption and can be evaluated relatively objectively.

Technological context

Organizations that run high density infrastructure are likely to feel the burden of rising power costs since the cooling and powering those technologies is still a challenge. This has led to the acceptance of high energy efficient technologies (Mitchell, 2008).

Organizational context.

This refers to descriptive properties of organizations such as department, corporate citizenship and size. Different areas are likely to respond to Green IT in a different way. Utility corporations such as electricity, oil and gas direct involvement in ecological policy, are expected to be early adopters of Green IT. Some information demanding businesses eg data storage providers, telecom and finance service providers can be expected to switch to Green IT early.

Environmental context

This is a key factor in generating the permissive and conducive surroundings for boosting Green IT use. Inter-governmental institutions could inspire the adoption of Green IT by law makers in order to build the framework for the low carbon economy. This include caps on greenhouse gas emissions, banning the use of some hazardous materials and institutionalizing emissions trading. Some of the existing legislations include: the Kyoto protocol, The European Commission has issued a document on the role of IT in tackling climate changes.

2.9.5.3 Green IT Readiness

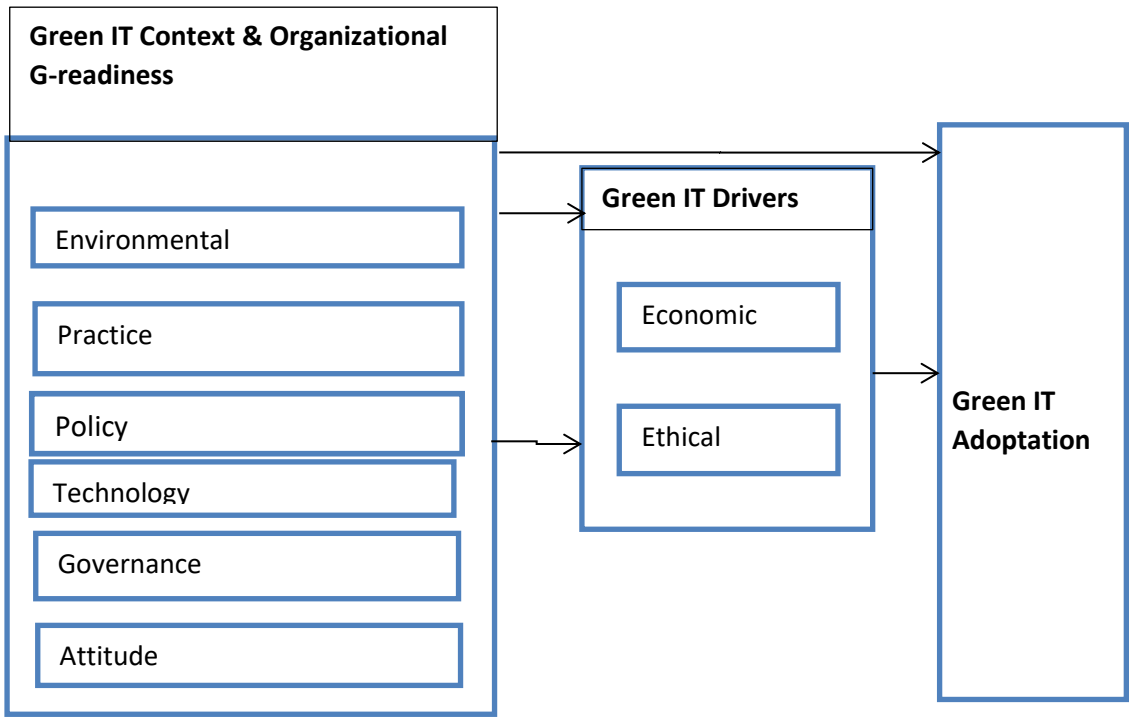
Green IT readiness captures a vibrant evaluation of an institutions own ecological preparation to agree to venture in Green IT practices. Kuan and Chau (2001) states that "as many features of innovation turn out to be minor, many organizational characteristics turn out to be secondary as well. Apparent Green IT readiness designates the awareness, resources and commitment of a firm relevant to Green IT. The extent to which business and IT leaders are concerned about the ecological and social effects of IT is a critical aspect for commencing Green IT.

2.13 Conceptual Framework

As discussed, green IT has different meaning to different people. There have been a lot of discussions on green IT in the industry and beyond leading to a lot of definitions on the topic. This lack of intelligibility make it hard to measure the effectiveness of an organizations execution of green IT (Connection Research, 2010)

The proposed conceptual framework encompasses of a number of multi-layered constructs of green IT adaptation recognized from the green IT adoptation model of Molla (Molla et al., 2008). The framework also identifies the main qualifications of green IT adoption recognized from the Green IT Readiness Framework (Molla et. al, 2008), and Connection Research – RMIT Green IT framework as discussed in the literature review.

This study seeks to identify an appropriate framework for Green IT and at the same time use the proposed framework to test the level of green IT adoptation. The model offers a significant contribution to the telecommunication field.



Source: ADAPTED FROM CONNECTION RESEARCH–RMIT GREEN IT FRAMEWORK, 2009, G-READINESS FRAMEWORK MOLLA ET.AL, 2008 & THE GREEN IT ADOPTION MODEL

Figure 2. 7: Proposed Conceptual Framework

This proposed framework is a combination of the Green IT adaptation model (Molla et.al, 2008) and other aspects from literature, specifically metrics aspect from connection Research-RMIT Green IT framework (connection research, 2010) described earlier. Green IT metrics are important as they provide ways an organization can use to measure the efficiency of its green IT initiatives.

The reason behind using this conceptual framework is to analyze the green IT readiness factors and at the same time have increased awareness of the other factors that influence green IT adoptation. So the green IT readiness factors, the green IT context factors, and the green IT drivers are three main constructs that influence green IT adoptation in organizations. According to Molla (2008) green IT readiness is a key to element in the ad0ption of green IT. The objective of this study is to enlighten on the green IT readiness factors as well as the green IT context and the green IT drivers in the adoptation of the green IT.

Green IT Context

Technological

This include aspects of IT that enable Green IT to be feasible within an organization, they include: Server consolidation, Power down systems, virtualization and Right sizing IT equipment's, print optimization, Storage tiering, among others. They can be broken down to the following areas

i. Green IT Technical Infrastructure
ii. Green IT Network Critical Physical Infrastructure
iii. Green IT Energy Efficient Practice

Environmental

Organizations follow several practices in pursuing based on the three phases of eco-friendly practices namely; product stewardship, sustainable development and pollution prevention which have impact on the environment and as such provide a foundation to explore and categorize organizational Green IT/IS practices

Pollution Prevention Practice

Mostly concerns the mitigation and control of contaminating emissions and wastes during and after development and procedures. In IT Governance pollution prevention practice involves innovation and use of IS to decrease pollution produced by business processes. In mitigating pollution, thus practitioners use IS technology such as innovative carbon and energy assessment and control application or telematics systems to reduce organization's carbon footprint.

Service Steward Practice

Requires environmental impacts to be considered all through IT Governance processes in the organization. Mainly involves Service for design and development in IT Governance. This practice is generally based on the ethics of the management and practitioners. In IT Governance, service stewardship practice involves innovation and use of information system such as innovative digital platforms, conference and collaboration system that improve the eco-friendly of product and service implementation.

Utilization of diagnostic applications such as the life cycle control program in the product and service policy can help practitioners attain product/service ethics strategy. Moreover, the development of product packaging supported by computer aided design system can also be categorized as the use of IS in the context of service stewardship.

Sustainable Development Practice

Involves the use of modern application or systems to change business processes by implementing and adopting practices that enhance and preserve resources, non-polluting, low waste and energy efficient processes. Sustainable development practice in IT Governance involves usage of information system such as sustainable data and education controlling systems that change business operations. Compliance software can be used by practitioners in product/service development for supporting organizational decision making and creation of knowledge for eco-sustainability. This can be seen as a Green sustainable development practice.

Hence this study proposes below hypotheses:

I. Organizations are highly compliant to environment driver tend to have higher intention to adopt Green IT.

II. Technology aspect contributes positively associated with intention to adopt Green IT.
III. Technology aspect contributes positively associated with Green IT economic drivers.
IV. Technology aspect contributes positively associated with Green IT ethical drivers.

Organizational G-readiness

Attitude

Refers to the overall organization thought or perception towards Green IT. Attitude is well-defined as "a multifarious mental state that involves beliefs, feelings, values and dispositions to act in certain ways" (word web). Green IT starts with corporate leaders' sentimentalities towards climate change, CSR, business and environmental sustainability. Attitude can either be IT attitude or business attitude.

Policies

Green IT Policy and Sustainable Environment Policy .i.e. Green data centers, CSR, Green IT policy, Green Supply Chain Management, among others. Green IT Policy defines the laws and regulations within an organization that promote Green IT Practices and Sustainable Environmental Policy that includes Government Laws and Regulations that promote the sustainable environment, implemented by NEMA. Organizations are supposed to abide by these regulations.

Practice

It is noted that not all practices can be effected smoothly and organizations vary in the actual execution of their policies. A industry's green practice along its value chain from inbound to inverse logistics effects to g-readiness (Rao and Holt 2005).

This study proposed the below hypothesis:

I. Organizations with stronger decision-making g-readiness tend to have upper intention to adopt Green IT.

Green IT Drivers

These are the propellants that stimulate green IT adoptation which are impacted simultneously by context and readiness

Economic Drivers

Williamson et al. pointed out that this economic drivers are mainly appealing to those

businesses who adopt Green IT since its direct and obvious benefit. According to Zhu et al. economic driver is the most influential element when corporations adopt Green IT.
Ethical

Organizations with sturdier conservational compliance driver incline to higher intention to adopt Green IT.
The study propose the hypothesis as below:

I. Economic and Ethical drivers confidently related with Green IT adoptation.
II. Economic and Ethical drivers positively associated with adoption of Green IT.
III. Establishments with sturdier economic drivers have greater intent to adopt green IT.

Green IT Adoptation

There is no Information Technology system can yield good outcomes unless it's effectively adopted and used (Sasovoca and Leenders, 2008). Corrales and Westhoff (2006) also stated that in the adoption theory the choices an individual examines makes to accept or deny a specific innovation and the degree to which that innovation is cohesive into the appropriate context.

This framework help in identifying the primary and static background variables for Green IT adoptation. Existing literature suggests that the Green IT context - environmental play an important role for determining organizational adoption decisions, while technological context, global scope, and regulatory environment have significant impact on e-business value as well; organization size is negatively related to online business value, which indicates that big institutions face more hindrances on creating online business value; innovation adoption is influenced more on internal resources (e.g., technological readiness) than external force (e.g., competitive pressure); from the business cycle perception, financial resources are significant for companies to adopt inventions in early stage. However, technological competences are far more significant when organizations step into progressive development; senior management support is a critical factor for determining organizational innovation adoption decisions; and on the other hand, posits that alleged organizational and environmental g-readiness are critical in a business's decision to adopt innovative technologies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the study's research methodology which is to be used for the purpose of determining the framework for the adoption of green IT in Telecommunication companies in Kenya. The chapter outline research methods, data collection and analysis of collected data in an effort to achieve research objectives. It explicitly comprises of the research design, data collection method & instruments, sampling design, Validity and reliability of the same and ethical considerations

3.2 Research Design

The research adopted a cross-sectional descriptive survey design. According to Cooper and Schindler (2009), cross sectional descriptive survey method is focuses on examining out who, what, where, when and how much of an existing phenomenon under the study. Mugenda (2008) contend that a cross-sectional descriptive survey allows the study to summarize and organize data in an effective and expressive way. This study seeks to establish framework for adoption green IT in telecommunication companies in Kenya. The research design was chosen because it involves planning, organizing, collection and analysis of data objectives or test a study hypotheses. This design also helped in collecting qualitative data to provide a great depth of reactions resulting in a better and elaborate understanding of the phenomenon under study that is framework for adoption of green IT in telecommunication companies in Kenya.

Cross-Sectional descriptive research survey design was most preferred since it will enable the collection of both quantitative and qualitative data. According to Cooper and Schindler (2011), descriptive designs aid in gathering quantitative and qualitative data in order to test hypothesis of the subject under study. The research design will be deemed fit to establish the framework for adoption of green IT in telecommunication companies in Kenya.

3.3 Target Population

Target population by definition is a precise population on which data is preferred. According to Kothari (2008), a population is best defined as a set of persons, services, elements, and events, group of things or households that are being examined. This explanation confirms that

population of interest is homogeneous. The unit of analysis of the study is the population and will consist of three telecommunication companies in Kenya .The study population will be the population which will consist of 1464 staff working in the telecommunication companies in Kenya.

The population characteristic will be as summarized in table 3.1 below.

Table 3. 1: Target Population

Population Category	Frequency
Managers	33
Operation Officers	370
Business Development officers	210
Financial Officers	240
IT Officers	365
Procurement Officers	246
Total	1464

Source: Researcher, 2018

3.4 Sampling Technique and Sample Size

Sampling frame is the device or source material from which a sample is drawn. It's a list of all those within a population who can be sampled, and may comprise of individuals, institutions or households (Cooper & Schindler, 2011). For the purpose of this study, a sample frame will constitute managers, financial officers, operation managers, and IT officers total of 1464 respondents. This study will use Slovin's formula to determine the sample size of the research.

The sample size of this study will be calculated from the Slovin's formula given as:

$n = N / [1 + N (e)^2]$

n = The sample size

N = Total population

e = Error tolerance

Since the study population (N) is 1464. Error of tolerance will be 0.05. Thus the sample size will be determined as shown below:

$n = 1464 / [1 + 1464(0.05)^2] = 314$

The study will adopt a sample size of 314 respondents working on the telecommunication companies in Kenya. This constituted approximate 21% of the study population and which form the sample proportion

The study will adopt a stratified random sampling and adopted a sample proportion of 21% as indicated by Kothari (2004) to determine a sample size of 314 respondents. A Simple random samplings will be adopted in selecting respondent in every level of management. This will minimize errors in selection of sample size and provide equal chance of the participation to all the respondents respectively.

Table 3.2: Target Population

Population Category	Frequency	Sample Proportion	Sample Size
Managers	33	0.21	7
Operation Officers	370	0.21	78
Business Development officers	210	0.21	44
Financial Officers	240	0.21	50
IT Officers	365	0.21	77
Procurement Officers	246	0.21	52
Total	1464		314

Source: Researcher, 2018

3.5 Data Collection Instruments

The research will use both primary and secondary data. The questionnaire will be used to gather primary data and will have both open and close-ended questions. The closed-ended questions will provide more organized responses to enable tangible recommendations (Cooper & Schindler, 2011). The closed ended questions will be used to test the rating of various features which will help in reduction of the number related responses in order to obtain more diverse responses.

The questionnaire will be developed and will contain two sections. Section A will focus on demographic information and section B will focus on green IT dimensions and the adoption of green IT in telecommunication companies in Kenya. A five point Likert-type scale will be

used to measure the responses ranging from (1) which is strongly disagree to (5) which is strongly agree. The respondents will be requested to evaluate Likert scales in the study variable opertionalization from a semi structured questionnaire containing direct measures and Likert type scales.

The open-ended questions will offer info that will not have been captured in the closed-ended questions. The questionnaire will be designed and tested with a few members of the population for further improvements. Secondary data will be useful for generating additional information for the study from already documented data or available reports. This essentially implies that the integration of treasured statistical data in the study.

3.6 Data Collection Procedure

Data collection procedures are critical as it enhance validity of the research process. The questionnaire set sent to potential respondents will comprise of an introduction letter to the respondents, detailing the purpose of the study and supporting identification documents.

The questionnaires will be hand delivered and sent by via emailed to ensure high rate of response. The questionnaires will be sent with an introduction letter outlining the objectives of the study, go along with with directions for filling out the survey. Also phone calls will be made to the firms to verify the contacts prior to sending the questionnaire. Some questionnaires will be completed in the presence of the researcher. After five weeks, i will make follow ups using phone calls, email and personal visits to the selected respondents who will have not yet responded to the survey.

The questionnaire will be administered using the drop and pick later method. The key advantage of using this method is that it is cheap and faster to conduct an investigation but also warns against prospects of low response rates unless the questions engages the respondents' interest or the examination is perceived as being of direct value to the respondents.

3.7 Pilot Testing

Before rolling out a questionnaire, at all times is advisable to run a pilot study (Kothari, 2008). A pilot study will first be piloted in order to assess the suitability of design of the research and questionnaire to be used eg to define whether the expected respondents comprehends the

questions asked in the instrument. Additionally, a test survey conveys to the light the flaws of the questionnaires and of the survey techniques.

A pilot group of 31 respondents will be selected from the target population of staff within the telecommunication companies. This pilot survey will seek to determine if the questions are easy to comprehend and if they will be able to elicit relevant info from the respondents. After the pilot survey any necessary adjustment will be made on the questionnaire to enhance its accuracy in data collection. The pilot data and respondents will not be included in the actual study

3.7.1 Validity of Research Instruments

Validity is apprehensive through the integrity of the assumptions that are made from part a research. Validity is the degree to which an instrument measures what it purports to measure. By estimating how accurately the data in the study signifies a given variable or construct in the study (Mugenda, 2008). During questionnaire construction, various validity checks will be conducted to ensure the instrument will measure what it is supposed to measure and perform as it will be designed to perform. The validity tests that will be conducted include construct validity and content validity.

The questionnaire will be operationalized and formulated as per the study variables to ensure representativeness and adequacy of the objects in each factor in relation to the objectives of the study. More so, content validity will be proved through expert opinions from practitioner's and supervisors.

Construct validity will be achieved through restricting the questions to the conceptualization of the variables and ensuring that the indicators of each variable fell with the same construct. The purpose of this will be to ensure that each measure sufficiently assessed the construct it will purport to assess. Furthermore, Kothari (2008) indicates that the quality of a research depends on the extent on which accuracy of the data collection procedure. The instrument used to collect data must yield the type of data the researcher can use to correctly answer his or her questions. The researcher will seek expert opinion in developing the instrument and especially the supervisors.

3.7.2 Reliability of Research Instruments

Reliability is defined as the tendency toward consistency hence, concept repeated over some time should produce the same results (Wood and Ross (2011). Alpha index will be attributed as the mean of correlations of all the variables, and it does not depend on the arrangement. With many similar items on a measure, by testing a varied sample of individuals and by using uniform testing procedures increases reliability. It is commonly used in relation to the question of whether the measures that are devised for concepts in business are consistent.

A Cronbach's alpha (Cronbach coefficient alpha), which is based on internal consistency, will be calculated using SPSS to establish the reliability of the survey instrument. This methodology measures the average of measurable items and its correlation. Field (2009) contends that Cronbach's alpha value that is at least 0.70 suffices for a reliable research instrument. The researcher shall ensure that the questionnaire is designed to enable reliability by providing consistent, stable and repeatable results.

3.8 Data Analysis and Presentation

Data collected was prepared for statistical analysis before processing the responses. Checking and validation was done after the receipt of questionnaires. Answers were checked for relevance, legibility, appropriateness and clarity. Coding was done on the basis of the locale of the respondents. Quantitative data analysed using Statistical Package for Social Sciences (SPSS Version 21) and analysis of a moment structures (AMOS) for Microsoft windows, which included descriptive analysis and inferential analysis.

Factor analysis KMO MSA (Kaiser-Meyer-Olkin Measure of Sampling) was also adopted. Principal Components Analysis factor analysis method were adopted to reduce the number of predictors to a smaller set of uncorrelated components. This helped in extracting the least number of factors that account for extreme variance in the data for use in subsequent multivariate analysis.

Inferential analysis was used to examine the relationship between Green IT dimensions and green IT adoption. This used correlation and multivariate analysis. Furthermore, the researcher made use of the correlation coefficient to test for the significance of the association amongst the researches variables. Pearson's correlation analysis indicate the direction, significance and

strength, of the bivariate relationship among all the variables that were measured at an interval or ratio level (Sekaran, 2003). A correlation coefficient (r) designates the direction and strength of the relationship. (r) Equals to zero means there is no relationship between two variables. While (r) ranges from 0.1 to 0.3 indicates a weak relationship and a (r) ranges from 0.4 to 0.6 represents a moderate relationship. Strong relationship is showed with a (r) above 0.7.

Multiple regression analysis was used to assess the degree of the relationship between the independent and dependent variables. Thus, the importance of using multiple regression analysis in this research study in order to evaluate the relative impact of the independent variables on the dependent variable. The research hypotheses were tested at 95% level of confidence in order to provide conclusions about the population from the study sample. Multiple regression analysis model that was adopted for this study is given as:

$$AGIT = \beta_0 + {}_+ \beta_1 EITC + \beta_2 OPO + \beta_3 OPR + \beta_4 OT + \beta_5 OGOV + \beta_6 OA + \varepsilon$$

Where;

AGIT = Adoption of Green IT

EITC = Environmental IT Context

OPO = Organizational Policy

OPR= Organizational Practices

OT = Organizational Technology

OGOV= Organizational Governance

OA= Organizational Attitude

β_1, β_2, β_3, β_4, β_5 and β_6 = Beta coefficients and

ε = Error term

3.8.1 Analysis of Variance (ANOVA)

ANOVA was used to decide if the means of the generations are equal. Equal variance between the clusters was determined by Homogeneity of variance test. Homogeneity of variance tests the following hypotheses: H0 = There are no differences between two or more variances and H1 there are differences between two or more variances. When significance level $p \leq .0.05$, H0 should be rejected and H1 is supported. Variance of analysis was used to test whether the overall is statistically significant through indication of whether or not R^2 could have occurred by chance alone. The F-ratio that was generated in ANOVA table will measure the likelihood

of chance to departure from a straight line. The P- value of the F-ratio generated ought to be less than 0.05 for the equation to be statistically significant at 95% confidence interval. If the P- value is more than that, then the equation is not statistically significant. For the individual variables, p values of their coefficients generated in the regression analysis must be less than 0.05 for their relationship to be concluded significant at 95% confidence interval.

3.8.2 Research Ethics

Respondents are likely to raise privacy issues as concerns of the information they will provide. They are also likely to seek the benefits of the research to them. Personal Identity will not be sought. The researcher embark on to keep confidentiality of data generated and will not in any way coerce a respondent into giving out information.

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents analysis and findings of the study as set out in the research methodology.

4.2 Response rate

From the study, out of 314 respondents who were staff working in the telecommunication companies selected for the study, 255 respondents filled and returned the questionnaires. Which constituted 81% response rate. Mugenda and Mugenda (2003) rated a respondent rate of 50% as adequate, while 60% as good and above 70% as very good, therefore a respondent rate of 96% for this study is very good.

4.3 Background of the Study

Table 4.1: Gender of the respondents

Responses Gender	Frequency	Percent
Female	65	25.5
Male	190	74.5
Total	255	100.0

The study revealed that most of the respondents were male 75% while 25% were female. This implies that the companies recruit both male and female in the companies' workforces

Table 4.2: Years Respondents Had Been in Company Kenya

	Frequency	Percentage
Between 1-3	112	43.9
Between 3-5	97	38.0
More than 5	46	18.0
Total	255	100.0

Results on years the respondents had been in the company, 44% of the respondents indicated 1-3 years, 38% indicated between 3-5 years while 18% of the respondents indicated more than

5 years. This inferred that the respondents had worked for more than three years and were experience on extent of adoption of framework for Green IT in telecommunication companies in Kenya.

Table 4.3: Level of education of the Respondents

Responses on Level of education of the Respondents	Frequency	Percent
Diploma	96	37.6
Degree	22	8.6
Masters	97	38.0
PhD	40	15.7
Total	255	100.0

The results indicated that 38% had attained master's level of education, 37% had attained diploma as highest level of education, 15% indicated had attained PhD as their highest level of education while 9% were degree level holders.

Table 4.4: Position of Respondent level in organization

Position of Respondent level in organization	Frequency	Percent
Operations	112	44
Lower management	54	21.2
Upper management	89	34.9
	255	100.0

The results above indicated that most of the staff were working in operation department as indicated by 44% of the respondents, 35% of the respondents were working top level management while 21% of the respondents were working as lower level management. This implied that data was collected from relevant officers who offer valid information on framework to measure the level of green IT adoption in major telecommunication in Kenya.

4.4 Reliability Test Results

Table 4. 5: Reliability Test Results

Variable	Cronbach's Alpha	No. of Items
Technological Context	0.7327	6
Environmental Context	0.8194	5
Organizational Policy	0.7159	5
Organizational Technology	0.7054	4
Organizational Governance	0.8092	5
Organizational Attitude	0.7621	6

Reliability in this study was ensured through a piloted questionnaire that was done to a sample of 31 employees (not included in the study). The Cronbach Alpha was used to measure the internal consistency. From the findings in Table 4.1, all measures of independent variables of Technological Context, Environmental Context, Organizational Policy, Organizational Technology, Organizational Governance, and Organizational Attitude. These alpha values fall within the acceptable limit thus making question items relating to these independent variables reliable and denoting a strong internal consistency among measures of variable items. Serekan (2010) asserted that the closer the Cronbach Alpha is to 1, the greater the reliability.

4.5 Total Variance Explained

The confirmatory factor analysis, total variance explained was determine to extract the number of Green IT determinants that have significance variance with adoption of Green IT in telecommunication companies. This is done through determining the Initial Eigenvalues of the operationalized determinants of Green IT with adoption of green IT (Factors).

Table 4.6: Total Variance Explained

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.041	37.757	37.757	6.041	37.757	37.757
2	4.300	26.876	64.634	4.300	26.876	64.634
3	2.612	16.328	80.961	2.612	16.328	80.961
4	1.545	9.658	90.619	1.545	7.576	85.698
5	.862	5.386	96.005	1.160	6.987	90.619
6	.503	3.143	99.149			
7	.136	.851	100.000			
8	1.241E-015	7.755E-015	100.000			
9	7.590E-016	4.744E-015	100.000			
10	3.398E-016	2.124E-015	100.000			
11	7.926E-017	4.954E-016	100.000			
12	-1.971E-017	-1.232E-016	100.000			
13	-1.260E-016	-7.874E-016	100.000			
14	-4.036E-016	-2.522E-015	100.000			
15	-6.092E-016	-3.808E-015	100.000			
16	-1.641E-015	-1.026E-014	100.000			

The researcher used Kaiser Normalization Criterion in the above table that permits for the extraction of components that have an Eigen value greater than 1. Factor (Determinant) 1 had Eigenvalue 6.041, Factor (Determinant) 2 had Eigenvalue 4.300, Factor (Determinant) 3 had Eigenvalue 2.612, factor determinant 4 Eigenvalue 1.545 had Factor 1 (Determinant) 5 had Eigenvalue of 1.160. The factors in the principal component analysis show discrete relationships, and same to the beta values in regression. Factor loadings here are the associations between the green IT factors and their linked variables. The Eigenvalue used to establish a cutoff of factors is a value like R in regression. As with regression, the Eigenvalue represents the strength of a factor. The Eigenvalue of the first factor is such that the sum of the squared factor loadings is the most for the model. The Eigenvalue is used as a cutoff because

it is the sum of the squared factor loadings of all variables (the sum divided by the number of variables in a factor equals the average proportion of variance explained by that factor). Subsequently the squared factor loadings are divided by the number of variables, an Eigenvalue of 1 simply means that the variables explain at least an average amount of the variance. A factor with an Eigenvalue of less than 1 means the variable is not even contributing an average amount to explaining the variance.

The principal component analysis was used and five factors were extracted. As the table shows, these five factors explain 61.35% of the total variation. Factor 1 contributed the highest variation of 37.757%, factor 2 contributed 26.877% of variation, and Factor 3 contributed a variation of 16.327%, green IT factor 4 contributed 4.737 while Factor Five contributed variation of 4.921%. The contributions decrease as one move from one factor to the other up to factor5.

4.5 Component Matrix (a)

Further confirmatory factors analysis, component Matrix was carried out to examine the Green IT factor matrix (Component matrix) to decide what variables could be combined (the ones that load together) and if some variables should be dropped. This is accomplished through the Factor Loading Value.

Table 4.7: Component Matrix (a)

Component Matrix[a]					
	Component				
	1	2	3	4	5
Server virtualization	-.949	.269	-.135	-.074	.-0 65
Desktop Virtualization	-.500	.227	.825	-.073	.029
Storage Virtualization	.513	.491	.680	-.133	.-177
Data duplication	.772	.611	.000	-.153	.325
Corporate Social Responsibility Policy	.861	.480	-.085	-.117	-.043
Preference to suppliers who are sensitive to green IT	-.695	.691	-.019	-.183	.139
Green data centers policy	.976	-.117	-.164	.039	.316
End of IT Life management/Environment friendly IT disposal Environment sustainability policy	.861	.480	-.085	-.117	-.295
Emerging regulations in greenhouse gas emissions	-.223	.487	-.835	-.116	.073
IT's energy consumption	.220	.912	-.247	-.231	.666
Energy consumption of cooling and lighting our data centers	-.500	.699	.460	-.190	-.054
The efficiency of powering our IT infrastructure (storage, servers, network)	.682	-.443	.570	.112	-.335
Gives preference to IT vendors with a green track record	-.097	.701	.146	.609	-.584
Gives weight to environmental considerations in sourcing	.424	.243	-.188	.598	.523
Audits the power efficiency of existing IT technologies existing IT technologies	-.232	.504	.094	.730	.721
Switches off data centre lights and equipment when not needed	.239	.226	.224	-.233	829

Extraction Method: Principal Component Analysis.

It is significant in the mining phase to scrutinize the communality. The communality is denoted by the sum of the squared loadings for a variable across factors. The communalities may range from 0 to 1. Where communality of 1 means that all of the variance in the model is explained by the factors (variables). This is shown in the "Initial" column of Table 4.24. The initial values are where all variables are included in the model. They have a communality of 1 because there are as many variables as there are factors. In the "Extraction" column, the communalities

are different and less than 1. This is because only the 5 factors used above (with Eigenvalues greater than 1) are taken into account. Here the communality for each variable as it relates to one of the four factors is taken into account. Although there are no 0 values; if there were, it would mean that variable (factor) contributed nothing to explaining the common variance of the model.

The correlation between a factor and variable where only a single factor is involved or multiple factors are orthogonal (in regression terms, it is the standardized regression coefficient between the observed values and common factors). Since the first five factors were the only ones that had eigenvalues > 1, the final factor solution only represented 61.8% of the variance in the data. The loadings listed under the "Factor" headings represent a correlation between that item and the overall factor. Like Pearson correlations, they range from -1 to 1. The five factors are the only significant with Eigenvalues values -1>0<1

4.7 Rotated Component Matrix (a)

Rotated Component Matrix was carried out to determine green IT determinants (Factors) that fall under the identified (factors). The initial component matrix was rotated using Varimax (Variance Maximization) with Kaiser Normalization. The above results allowed the researcher to identify what variables fall under each of the 5 major extracted factors.

Table 4.8: Rotated Component Matrix (a)

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
Server virtualization	-.514	.583	.623	.061	.163
Desktop Virtualization	-.119	.937	-.295	.089	.136
Storage Virtualization	.778	.399	-.446	.143	.884
Data duplication	.976	-.135	.024	.143	-.027
Corporate Social Responsibility Policy	.942	-.305	-.019	.108	.505
Preference to suppliers who are sensitive to green IT	-.030	.725	.664	.165	.712
Green data centers policy	.607	-.719	-.328	-.037	.553
End of IT Life management/Environment friendly IT disposal Environment sustainability policy	.942	-.305	-.019	.108	-.089
Emerging regulations in greenhouse gas emissions	.086	-.179	.976	.082	.669
IT's energy consumption	.759	.166	.591	.206	.823
Energy consumption of cooling and lighting our data centers	.167	.932	.233	.186	.732
The efficiency of powering our IT infrastructure (storage, servers, network)	.248	-.234	-.936	-.084	.372
Gives preference to IT vendors with a green track record	.175	.285	.139	.873	.063
Gives weight to environmental considerations in sourcing	.245	-.420	-.037	.628	.178
Audits the power efficiency of existing IT technologies existing IT technologies	-.086	.211	.109	.887	.832
Switches off data Centre lights and equipment when not needed	.406	.170	-.103	-.091	.884

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

4.8 Rotation converged in 16 iterations.

Each of the 16 variables placed in one of the 5 factors depending on the percentage of variability; it explained the total variability of each factor. From the findings, the study group

the factors based on the factors that loads to and identify common green IT determinants influencing green IT adoption in telecommunication companies. The variables that loads highly on Factor 1 are therefore label as technological IT context. The questions that relate highly on factor 2 all relates on environmental IT context so Factor 2 is therefore labeled Factor. The questions that relate to factors 3 relates organizational policy label Factor 3. The question relate to organizational policy therefore Factor 4 is label organizational policy which questions that relate to organizational governance hence factor 5 .From the above table, the individual variables instituting the four factors extracted are summarized and identified as follows:-

Factor1: Technological Context

Factor loading on Factor 1 related to technological IT context. These included Data duplication, Storage Virtualization, Corporate Social Responsibility Policy, and Green data centers policy.

Factor 2 Environmental Context

Under Factor 2, the following factor were extracted and related to environmental IT context, desktop Virtualization, Preference to suppliers who are sensitive to green IT, Energy consumption of cooling and lighting our data centers

Factor 3: Organizational Policy

Under Factor 3, the factor loading or correlating related to organizational policy which included Server virtualization, emerging regulations in greenhouse gas emissions

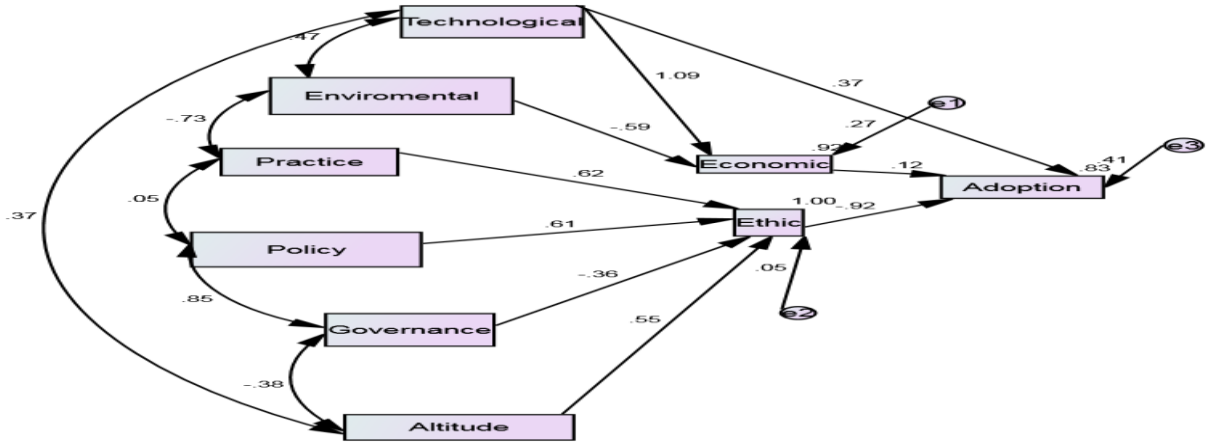
Factor 4: Organizational Attitude

Under Factor 4, the factor loading or correlating was modifying the organizational attitude, which include gives weight attitude considerations in sourcing and Audits the power efficiency of existing IT technologies existing IT technologies

Factors 5 Organizational Governance

From the factor analysis, the study reduced to four determinants of organizational governance which included power efficiency audit of existing IT technologies existing IT technologies

4.9 AMOS-path analysis



Source: Researcher, 2018

Figure 4.1: Standardized Graphic Output

Result in Figure indicates that Organizational technological capability has a significant direct and indirect effect on Green IT adoption with economic drivers as a mediating variable (β=0.37 for direct effect and β=0.1308 for the indirect effect, PV = 0.05)

Environmental has indirect negative effect on Green IT adoption with economic factor as a mediation variable (β=0.59 for the indirect negative, PV=0.05). This Organizational practices has indirect negative effect with Green IT Adoption with Organization ethic being a mediating variable (β=-0.5704, P < .05). This implied that existed significant negative mediation role in the relationship between organizational practices and Green IT adoption in the Organization.

Organizational Policy appear to have indirect positive effect with Green IT adoption with organization being mediating variable (β=0.61, P <.05). This implied that existed significant positive mediation role of organizational ethics in the correlation to organizational policy and Green IT adoption in the organization.

Organizational governance appear to have indirect negative and significant effect with Green IT adoption with organization ethics being mediating variable (β=0.3612, P < .05). This implied that existed significant negative mediation role of organizational governance in the relationship between organizational governance and Green IT adoption in the organization

Further Organizational attitude appear to have positive and significant indirect effect on green IT adoption (β=0.55, P > .05). This demonstrated that Organization ethics has a positive effect in the relationship between organizational attitude and adoption of Green IT in organization

4.10 Inferential analysis

The study carried out correlation and regression to establish the relationship between Green IT factors and adoption of green IT in telecommunication companies. The correlation coefficient was more so used to test if there existed correlation amongst the study variables. A correlation coefficient of r>0.9 denotes high multi-collinearity of which may lead to an unreliable regression model (Dancey & Reidy, 2011). A Multiple regression analysis was carried out to determine the influence of Green IT and adoption of Green IT in telecommunication

4.10.1 Correlation Analysis

Table 4.9: Correlation between Green IT and adoption of Green IT in telecommunication

Green IT factors		Adoption of Green
Environmental IT Context	Pearson Correlation	.819**
	Sig. (2-tailed)	.000
Organizational Policy	Pearson Correlation	.702**
	Sig. (2-tailed)	.000
Organizational Practices	Pearson Correlation	.634**
	Sig. (2-tailed)	.001
Organizational Technology	Pearson Correlation	0. 616*
	Sig. (2-tailed)	.001
Organizational Governance	Pearson Correlation	0.573*
	Sig. (2-tailed)	.001
Organizational Attitude	Pearson Correlation	-0.602
	Sig. (2-tailed)	.079

**-Correlation is significant at the 0.01 (2 tailed)

*- Correlation is significant at the 0.05 (2 tailed)

Correlation results indicated that there exists a strong, significant and positive correlation between Environmental IT Context and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=0.819, PV=0.000<0.01.

The results in table 4.13 Indicated that there exists a strong, significant and positive correlation between organizational policy and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=0.702, PV=0.000<0.05.

Correlation results indicated that there exists a strong, significant and positive correlation between Organizational Practices and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=0. 634, PV=0.001<0.05.

Also, Correlation results indicated that there exists a moderately strong, significant and positive correlation between organizational technology and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=0.616, PV=0.001<0.05.

Further correlation results revealed that there existed moderately strong, significant and positive correlation between organizational governance and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=0.573, PV=0.001<0.05.

Further correlation results revealed that there existed moderately strong, significant and negative correlation between organizational attitude and adoption of Framework for greet IT in telecommunication companies in Kenya as where r=-0.602, PV=0.079>0.05.This demonstrated that Organizational attitude have a negative correlation with adoption of framework for Green IT in telecommunication companies in Kenya.

4.10.2 Regression Analysis

Table 4. 10: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.776[a]	.602	.584	.36980

From the model summary results R2 is .602 and adjusted to .584. This indicates that the factors under the study contribute to 58.5% variation in adoption of framework for adopting green IT in telecommunication industry in Kenya. R^2 0.602 indicating that factors identified influence 60.2% of the adoption of framework for adopting green IT In telecommunication industry in Kenya.

4.10**.2.1 Analysis Of Variance**

Table 4. 11: Analysis Of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	121.355	5	24.271	0.0014
	Residual	183.523	249	.737	
	Total	304.878	254		

a. Dependent Variable: Adoption of Green IT

b. Predictors: (Constant), Environmental IT Context, Organizational Policy, Organizational Practices, Organizational Technology , Organizational Governance and Organizational Attitude

The study also established that there existed a significant goodness of fit of the model $AGIT = \beta_0 + \beta_1 EITC + \beta_2 OPO + \beta_3 PR + \beta_4 OT + \beta_5 OGOV + \beta_6 OA + \varepsilon$.

Based on the findings in Table 4.15, the F_{Cal} =24.271far exceeds F_{Cri} = 1.5122, P=0.0014<0.05 implying the model has goodness of fit.

4.10.2.2 Beta Coefficients Analysis

Table 4. 12: Beta Regression Coefficients

Model	Unstandardized Coefficients		Standardized	z	Sig.
			Coefficients		
	B	Std. Error	Beta		
(Constant)	2.7753	.308		9.011	.0011
Environmental IT Context	.426	.0404	.369	10.5403	.0027
Organizational Policy	.592	.0615	.542	9.624	.000
Organizational Practices	.469	.449	.365	1.045	. 105
Organizational Technology	0.572	.038	.484	15.053	.0017
Organizational Governance	0.438	.053	.398	8.264	.0012
Organizational Attitude	-0.416	.055	-.531	-7.563	.237

The study model was $AGIT = \beta_0 + \beta_1 EITC + \beta_2 OPO + \beta_3 PR + \beta_4 OT + \beta_5 OGOV + \beta_6 OA + \varepsilon$.

The resultant regression model took the form:

$AGIT = AGIT = \beta_0 + \beta_1 EITC + \beta_2 OPO + \beta_3 PR + \beta_4 OT + \beta_5 OGOV + \beta_6 OA + \varepsilon$.

From the regression analysis, the regression model had a constant = 2.7753 signifying that if all independent variables were rated zero, the adoption of Framework for IT would rate at .0011 at p=.05. The Adoption of Green IT of telecommunication companies in Kenya is significantly influenced by Environmental IT Context by 0.426, PV=..0027<0.05, z=10.5403. This demonstrated that Environmental IT Context significantly influence adoption of Green IT in telecommunication companies in Kenya.

The regression results indicated that there exist significant and positive relationship between Environmental IT Context and Adoption of framework Green IT of telecommunication companies in Kenya as indicated by 426, PV=..0027<0.05, z=10.5403. This demonstrated that Environmental IT Context significantly influence adoption of Green IT in telecommunication companies in Kenya.

The regression results indicated that there exist significant and positive relationship between organizational policy and Adoption Green IT of framework of telecommunication companies in Kenya as indicated by regression factor 0.592, PV=..0000<0.05, z=9.624. This demonstrated that organizational policy significantly influence adoption of Green IT in telecommunication companies in Kenya.

The findings in Table indicated that organizational practices have insignificant and positive influence on adoption of framework Green IT of telecommunication companies in Kenya as indicated by 469, PV=.105>0.05, z=1.045. This demonstrated that organizational practices significantly influence adoption of Green IT in telecommunication companies in Kenya.

The results in Table further indicated that organizational technology significant and positive influence Adoption of framework Green IT of telecommunication companies in Kenya as indicated by 426, PV=..0.572<0.0017, z=15.053. This demonstrated that Organization technology significantly influence adoption of Green IT in telecommunication companies in Kenya.

The results in Table indicated that organizational governance significant and positive influence Adoption of framework Green IT of telecommunication companies in Kenya as indicated by 0.438, PV=..0. 0012<0.05, z=8.264. This clearly indicated that Organization

governance significantly influence adoption of Green IT in telecommunication companies in Kenya.

The results in Table indicated that organizational attitude insignificant and negatively influence Adoption of framework Green IT of telecommunication companies in Kenya as indicated by -0.416, PV=..0. 237<0.05, z=-7.563. This clearly indicated that that Organization governance significantly influence adoption of Green IT in telecommunication companies in Kenya.

4.11 Testing Hypotheses

4.11.1 Hypotheses

The study sought to test the following research hypotheses:-

H1: Environmental IT Context has no significant influences on adoption of framework for adopting green IT.

H2: Organizational policy has no significant influences on adoption of framework for adopting green IT.

H3: Organizational Practices has no significant influences on adoption of framework for adopting green IT.

H4: Organizational Technological has no significant influences on adoption of framework for adopting green IT.

H5: Organizational governance has no significant influences on adoption of framework for adopting green IT.

H6: Organizational attitude has no significant influences on adoption of framework for adopting green IT.

H_7: Green IT drivers has no significant role in the relationship between Green IT factors and adoption of framework for adopting green IT

To test hypotheses, regression analysis was done by regressing green IT factors against adoption of framework for Green IT in telecommunication companies in Kenya. The study used P values (Sig.) to accept or reject the hypothesis and assessed against a level of 95% confidence level or significance value of 0.05. Interpretation for the beta value was based on unstandardized coefficients.

Hypothesis testing of Organizational Governance and Adoption of Green IT

The study sought to test the hypothesis, Organizational Governance has no significant influences on adoption of framework for adopting green IT

Table 4.13 Organizational Governance Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	Z	Sig.
(Constant)	2.153	.133		11.155	.0024
Organizational Governance for GIT (OGOVGIT)	.525	.018	.512	29.203	.000
R	. .878[a]				
R Square	.771				
Adjusted R Square	. 770				
F	52.787				
Sig	.0014[b]				

From the regression findings, R Square was 0.771 indicating that there is a significant variation 77.1% variation between organization governance and adoption of Green IT as indicated by the R-Squared .The results revealed that Organizational Governance has a significant and positive influence adoption of green IT in Telecommunication companies in Kenya as β_1 =0.525, PV= 0.000<0.05 and Z=29.203.

The alternative hypothesis was accepted and therefore a unit increase in Organizational Governance increase of 0.525 units in adoption of Green IT in telecommunication companies.

Hypothesis testing of Organizational Policy for Green IT and Adoption of Green IT

The study sought to test the hypothesis that organizational policy has no significant influences on adoption of framework for adopting green IT.

Table 4.14 Organizational Policy Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	z	Sig.
(Constant)	.840	.133		6.297	.000
Organizational Policy for GIT (OPOLICYGIT)	.828	.038	.807	21.698	.000
R	. 807 [a]				
R Square	.650				
Adjusted R Square	. 649				
F	70.790				
Sig	.000[b]				

From the regression findings, R Square was 0.650 indicating that there is a significant variation 65.0% variation between organization policy on Green IT and adoption of Green IT as indicated by the R-Squared .The results revealed that Organizational policy for Green IT has a significant and positive influence adoption of green IT in Telecommunication companies in Kenya as β_1 =0.828, PV= 0.000<0.05 and t=21.698. The alternative hypothesis is accepted that organizational policy has significant influences on adoption of framework for adopting of green IT. Therefore a unit increase in organizational policies IT Context increase of 0. 828 units in adoption of Green IT in telecommunication companies.

Hypothesis testing of Organizational Practices for Green IT and Adoption of Green IT

The study tested hypothesis that Organizational Practices for Green It has no significant influences on adoption of green IT in telecommunication companies.

Table 4.15 Organizational Practices Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	z	Sig.
(Constant)	.720	.133		10.287	.000
Organizational Practices for GIT (OGIT)	.390	.018	.256	23.698	.041
R	. 707 [a]				
R Square	.499				
Adjusted R Square	. 50				
F	70.790				
Sig	.000[b]				

From the regression findings, R Square was 0.499 indicating that there is a significant variation 50.0% variation between organization practices on Green IT and adoption of Green IT as indicated by the R-Squared .The results revealed that organization practices for Green IT has a significant and positive influence adoption of green IT in Telecommunication companies in Kenya as β_1 =.390, PV= 0.041<0.05 and z=23.698. The alternative hypothesis is accepted that organizational practices has significant influences on adoption of framework for adopting of green IT. Therefore a unit increase in organizational policies IT Context increase of .390 units in adoption of Green IT in telecommunication companies.

Hypothesis testing of environmental IT Context and Adoption of Green IT

The study sought to test the hypothesis, that environmental IT Context has significant influences on adoption of framework for adopting green IT

Table 4.15 Environmental Context Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	Z	Sig.
(Constant)	1.151	.114		10.132	.000
Environmental Context GIT (OGOVGIT)	.755	.033	.821	22.845	.001
R	. .821[a]				
R Square	.674				
Adjusted R Square	. 672				
F	121.907				
Sig	.001[b]				

From the regression findings, R Square was 0.674 indicating that there is a significant variation 67.4% variation between environmental IT Context for GIT and adoption of Green IT as indicated by the R-Squared .The findings revealed that environmental IT Context has a significant and positive influence adoption of green IT in Telecommunication companies in Kenya as β_1 =0.755, PV= 0.001<0.05 and z=22.845. The alternative hypothesis was accepted and it was concluded that environmental IT for GIT had a significant influence on adoption of green IT in telecommunication companies. This demonstrated that a unit increase in environmental IT context for GIT would lead to 0.755 increases in adoption of green IT in telecommunication companies.

Hypothesis testing of Organizational Attitude and Adoption of Green IT

The study sought to test the hypothesis, that organizational attitude has significant influences on adoption of framework for adopting green IT

Table 4.16 Organizational Governance Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	z	Sig.
(Constant)	1.746	.143		12.250	.000
Organizational Governance for GIT (OATTGIT)	.591	.042	559	13.944	.073
R	.659[a]				
R Square	.435				
Adjusted R Square	.432				
F	194.439				
Sig	.000[b]				

From the regression findings, R Square was 0.435 indicating that there is a significant variation 43.5% variation between organizational attitude for GIT and adoption of Green IT. The findings revealed that organizational attitude for GIT has a insignificant and positive influence adoption of Green IT in Telecommunication companies in Kenya as β_1 =0.591, PV= 0.073<0.05 and z=13.944. The alternative hypothesis was accepted and it was concluded that organizational attitude for GIT towards GIT had a significant influence on adoption of green IT in telecommunication companies. This demonstrated that a unit increase in organizational attitude for GIT towards GIT for instance allocation of resources would lead to 0.591 increases in adoption of green IT in telecommunication companies.

Hypothesis testing of Organizational technology and Adoption of Green IT

Table 4.17 Organizational technology Beta regression coefficient

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	z	Sig.
(Constant)	1.506	.130		11.584	.000
Organizational Governance for GIT (OGOVGIT)	.647	.038	.734	17.196	.000
R	. .734[a]				
R Square	.539				
Adjusted R Square	. .537				
F	295.712				
Sig	.000[b]				

Regression results indicated that there existed a significant 53.9% variation between technological for GIT and adoption of Green IT as indicated by the R-Squared .The regression results also indicated that organizational technology for Green IT has a significant and positive influence adoption of green IT in Telecommunication companies in Kenya as β_1 =0.647, PV= 0.000<0.05 and z=17.196. The alternative hypothesis was accepted and it was concluded that Organizational technology for GIT had a significant influence on adoption of green IT. This implied that a unit increase in organizational technology for GIT would lead to 0.647 increases in adoption of green IT.

Intervening Effects of Green IT Drivers on Green IT Factors and Adoption of Green IT

Table 4. 18: Beta Regression Coefficients

Model	Unstandardized Coefficients Beta	Std. Error	Standardized Coefficients Beta	z	Sig.
(Constant)	5.389	.133		11.438	.000
Environmental IT Context	.615	.0041	.587	15.006	.0003
Organizational Policy	.327	.0340	.309	9.602	.0001
Organizational Practices	.486	.0439	.542	11.074	. 008
Organizational Technology	.475	.0591	.453	8.052	.002
Organizational Governance	0.476	.038	.445	12.527	.0025
Organizational Attitude	0.599	.063	.557	9.509	.003
Combined GI Factors*GI Drivers	0.267	.0265	.398	10.074	.009
R	. 851 [a]				
R Square (After Introducing IV)	.7242				
Adjusted R Square	. 7169				
F	100.326				
Sig	.000[b]				

From the regression finding indicated that interaction variable, Green IT drivers explain 72.42% of variation in the relationship between Green IT factors and Adoption of Green IT in Telecommunication. The model that exists between Green IT factors, Green IT drivers and Adoption of Green IT in Telecommunication has a goodness of fit as F=100.326, PV=0.000.

The study results indicated that Green IT drivers has no significant intervening role in the relationship between organizational attitude and adoption of Green IT in telecommunication companies as Regression factors factor of 0.599 with PV=0.003. Green IT drivers was also found to have significant influence in the relationship between Organizational governance and adoption of green IT in telecommunication companies as Regression factor of 0.476,

PV=0.0025 and z=12.527. The results indicated that green IT drivers has no significant intervening role in the relationship between organizational practices and adoption of Green IT in telecommunication companies

The regression results also indicated that Green IT drivers has a significant and positive influence on the relationship between Green IT Factors and adoption of green IT in Telecommunication companies in Kenya as β_1 =0.267, PV= 0.009<0.05 and z=10.74. The hypothesis was accepted and that Green IT drivers had a significant interaction between Green IT factors and on adoption of green IT by. This implied that as telecommunication companies strive to adopt green it, significant efforts is deployed for green IT drivers to be consider as it has a significant influence on adoption the green IT.

Table 4. 29: Regression Weights

Iteration		Negative eigenvalues	Condition #	Smallest eigenvalue	Diameter	F	NTries	Ratio
0	e	6		-57.584	9999.000	412993.094	0	9999.000
1	e	6		-16.441	1.017	176270.205	8	1.118
2	e	6		-1.110	1.755	55318.532	6	.990
3	e	4		-.555	.631	27021.006	5	1.194
4	e	3		-.585	.459	14056.815	6	1.274
5	e*	4		-2.698	.750	7310.993	8	1.299
6	e*	4		-1.777	.303	3639.957	6	1.287
7	e	2		-.270	.124	1817.784	6	1.242
8	e	1		.000	.316	762.263	10	1.274
9	e	1		.000	.282	196.703	5	1.284
10	e	0	13030041479840.700		.310	-89.750	6	1.271
11	e	1		.000	.405	-229.050	1	1.252

Iteration		Negative eigenvalues	Condition #	Smallest eigenvalue	Diameter	F	NTries	Ratio
12	e	0	17515633 42436.320		.330	-304.775	3	1.241
13	e	1		.000	.117	-333.576	1	1.194
14	e	1		.000	.041	-341.579	2	1.236
15	e	0	34502495 3868.848		.032	-343.751	2	1.162
16	e	0	80084002 1466.160		.013	-344.018	1	1.087
17	e	0	91020438 1005.171		.003	-344.024	1	1.015
18	e	0	17591835 63512.770		.000	-344.024	1	1.000

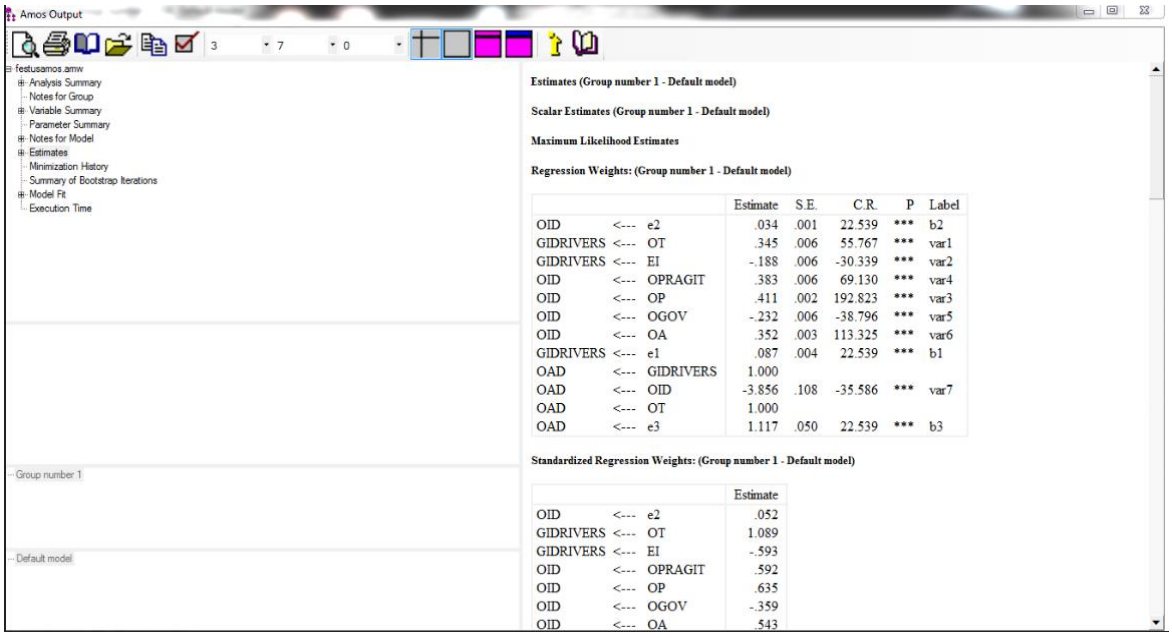
Minimization History (Default model)

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)



Source: AMOS output for an unstandardized maximum probability estimates

Fig 4.2: output for an unstandardized maximum probability estimates

The above table denotes AMOS output for an unstandardized maximum probability estimates of structural paths. The parameter estimate is significant at $p \leq 0.05$ and value of C.R is > 1.96. Critical ratio (CR) is the significance test which represents the parameter estimate divided by standard error.. The likelihood of attaining a CR is as large as 22.539, 55.767 and 30.339 in an absolute value is less than 0.005. In other words, the regression weight for Organization technological, Organizational, policy, Organization Environment, Organizational Governance and Organizational attitude that are Green IT adoption determinants are significant on predicting Adoption of Green IT estimate of Overall Gratification. It is significantly different from zero at the 0.005 level (two tailed).

Model Fit Summary

Chi-Square Value (CMIN)

Model	NPAR	CMIN
Default model	24	-462.114

Root mean square (RMR), Goodness of Fit Index (GFI)

Model	RMR	GFI	AGFI	PGFI
Default model	0.01856	.189		

Chi-square value in the model estimation output is significant at the $p<0.05$ level. The values of CMIN / DF of 344.024 absolute, GFI of 0.189 indicate the adequate fit between the structural model and sample data, AGFI of 0.816 and RMSEA of 0.01856 proposes a good model of fit which is designed and proposed

Model Goodness of Fit

Squared Multiple Correlations: (Group number 1 - Default model)

Table 4.17 Model Goodness of Fit

	RFI	IFI	TLI	CFI
Default	0.9214	0.9572	1.002	1.000
Saturated Model	1.000	1.000	1.000	1.000
Independent Model	0.000	0.000	0.000	0.000

The comparative fit index above (IFI, TLI, and RFI) compare the model of interest with the null or independence model ie the difference between the observed and predicted covariance matrices, as represented by the chi-square value. CFI represents the ratio between the discrepancies of this target model to the discrepancy of the independence model.

NFI values RFI is 0.9214, IFI the value is 0.9572, TLI the value is 1.002, and CFI has 1.000 and all the values close to 1 indicating a very good fit of the structural model.

4.9.2 Summary of Hypotheses

Null Hypothesis	Alternate	z	PV	Decision
H_1: Environmental IT Context has no significant influences on adoption of framework for adopting green IT	H_1: Environmental IT Context has significant influences on adoption of framework for adopting green IT	22.845	.001	Accepted
H_2:Organizational policy has no significant influences on adoption of framework for adopting green IT	H_2:Organizational policy has significant influences on adoption of framework for adopting green IT	21.698	.000	Accepted
H_3:Organizational Practices has no significant influences on adoption of framework for adopting green IT	H_3:Organizational Practices has significant influences on adoption of framework for adopting green IT	23.698	0.061	Accepted
H_4:Organizational governance has no significant influences on adoption of framework for adopting green IT	H4:Organizational governance has significant influences on adoption of framework for adopting green IT	29.203	0.000	.Accepted
H5: Organizational Technological has no significant influences on adoption of framework for adopting green IT	H4: Organizational Technological has significant influences on adoption of framework for adopting green IT	17.198	0.000	Accepted
H_6:Organizational attitude has no significant influences on adoption of framework for adopting green IT	H_5:Organizational attitude has significant influences on adoption of framework for adopting green IT	13.944	.073	Accepted
H_7: Green IT drivers has no significant role in the relationship between Green IT factors and adoption of framework for adopting green IT	H_7: Green IT drivers has no significant role in the relationship between Green IT factors and adoption of framework for adopting green IT	10.074	.009	Accepted

4.9.3 Validated model

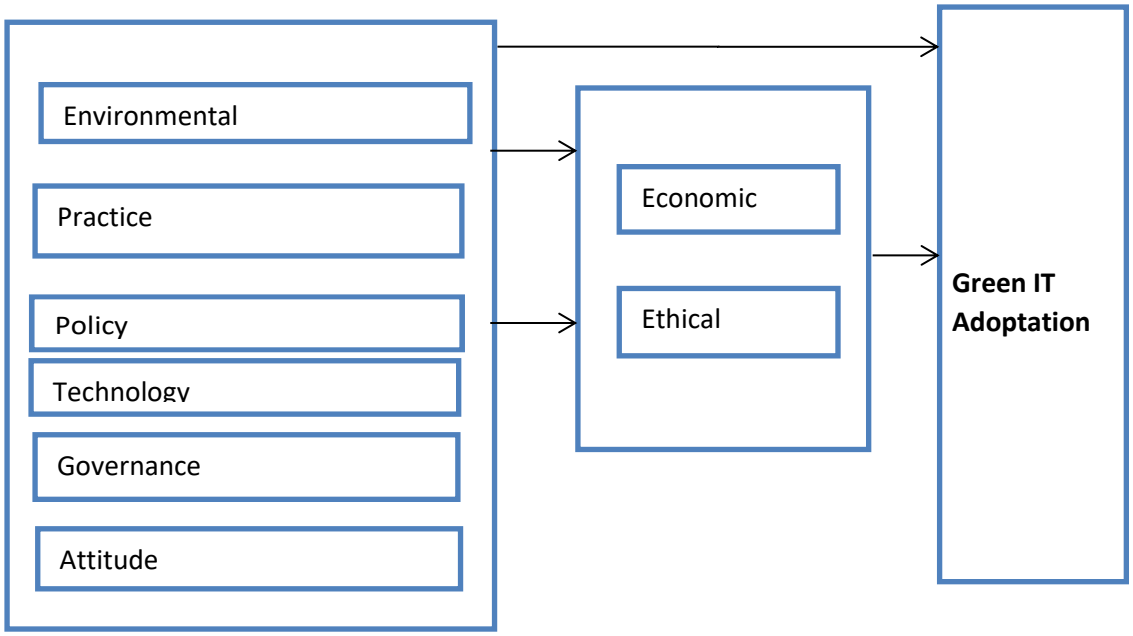


Fig 4.3: validated framework for adopting green it in telecommunication companies

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter builds from chapter four to provide a summary of finding from the study, to present the conclusions drawn from the results of the analysis of the questionnaires, and focus on discussions and then make recommendations for further research.

The validated framework creates a profounder understanding of how Green IT can support the sustainability of the organization and identify the factors of Green IT adoptation based on a comprehensive research. This framework consists of different factors; Policy, environmental, Practice, Technology, Governance, Attitude green IT drivers; Economic and Ethical. These components will affect the use of Green IT in green IT adoptation. It will also help close the gap in practices, issues related to implementing and using Green IT in organization, hence serving as a guide for practitioners in adopting Green IT.

This study investigated the influence of six independent variables (Policy, environmental, Practice, Technology, Governance, Attitude) and two dependent variables on the adoption of Green IT among telecommunication organizations in Kenya. In the result of the study, it shows that variables have significant relationship with the adoption of Green IT.

5.2 Summary

In summary, the study propose a framework for adopting green IT in IT Governance to overcome adoption challenges and increase the environmental orientation of practitioners in their organization.

5.2.1 Technology

The study revealed that technology had a significant, strong and positive correlation with adoption of Framework for greet IT where (0. 616*) Regression results indicated that technology influence adoption of Green IT of telecommunication companies in Kenya as β_1 =0.647, PV= 0.000<0.05 and z=17.196.

This demonstrated that companies' through deployment of IT infrastructure, deployed server virtualization, deployed data duplication system and deployed Desktop Virtualization have significant influence on adoption of framework for adoption of Green IT. The results further revealed that organization achieve technological readiness through departments deployment of storage virtualization, deployed DC powered IT Equipment, deployed Tiered storage for

information lifecycle management and deployed data center airflow management. Key areas to capitalize on are server/ desktop and storage virtualization, tiered storage, print optimization, data center airflow management, energy saver lights, high efficiency stand- by power equipment and deployment of data IT equipment

5.2.2 Policy

The results of the study revealed that there exists a strong, significant and positive correlation between organizational policy and adoption of green IT framework in telecommunication companies in Kenya (r=0.702**) .Regression results established that organizational policy has a positive and significant influence on Adoption Green IT of framework of telecommunication companies in Kenya as β_1 =0.828, PV= 0.000<0.05 and z=21.698).

Hence an improvement in policy would significantly influence adoption of Green IT in telecommunication companies in Kenya. This further revealed that policy on the use of IT to reduce the business's carbon emissions/footprint was addressed in company policy organizational policy on sensitization of green IT and organization as policy through corporate Social Responsibility Policy as well as policy on preference to suppliers who were sensitive to green IT influence adoption of Green IT framework to a great extent.

Therefore to adopt green IT some of the policies an organization should have include preference to suppliers who are sensitive to green IT, green data center policy, sensitization of green IT, electronic waste management policy and corporate social responsibility policy

5.2.3 Attitude

The study established that organizational attitude has moderately strong, significant and positive correlation with adoption of Framework for greet IT in telecommunication companies in Kenya (r=0.602*). The regression results confirm that organizational attitude has a positive relationship with adoption of framework for Green IT in telecommunication companies in Kenya as β_1 =0.591, PV= 0.073<0.05 and z=13.944.

The results demonstrated that companies were concerns on its energy consumption, efficiency of powering the firm IT infrastructure that is storage, servers, network, and moderately agreed that emerging regulations in greenhouse gas emissions raises concerns and energy consumption of cooling and lighting company's data centers raises concerns in an effort to adopt framework for adopting green IT.

Therefore an organization should be concerned on emerging regulations in greenhouse emissions, IT energy consumption and efficiency in powering IT infrastructure

5.2.4 Practice

The study revealed that Organizational Practices correlate significantly and positively with adoption of Framework for greet IT in telecommunication companies in Kenya (r=0.634*). Regression results depicts that organizational practices have significant and positive influence on adoption of framework Green IT of telecommunication companies in Kenya as as β_1 =.390, PV= 0.041<0.05 and z=23.698.

The results revealed that telecommunication companies engages the service of professionals, operates existing IT systems in an efficient manner , undertook Auditing of the energy efficiency of current IT technologies existing IT technologies and that companies were giving weight to eco-friendly considerations in sourcing .

The findings identified some of the practices practiced include switching off equipment's when not in use, printing double-sided on the paper as and firms Switching off data center lights when not needed .Other practices were executed to a moderate extent and influence adoption of framework for Green IT such as companies recycling consumable equipment that is batteries, ink cartridges, and paper, giving preference to IT vendors with a green track record

5.2.5 Governance

The results revealed that there existed moderately strong, significant and positive correlation between organizational governance and adoption of green IT framework in telecommunication companies in Kenya as as β1 =0.525, PV= 0.000<0.05 and Z=29.203. The regression results indicated that there existed a positive relationship between organizational governance and adoption of Framework for greet IT in telecommunication companies in Kenya.

This was supported by descriptive results that management responsibilities were clearly defined within each on Green IT initiative , management have budget and other resources for green IT and management have defined coordinating of the company's business green initiative . The findings also indicated that management demonstrates adequate readiness for Green IT , management have set carbon dioxide levels to reduce corporate carbon footprint and management have mechanisms for monitoring vendors green performance.

Therefore the organizations governance should undertake the following green IT aspects; set

carbon dioxide levels to reduce corporate carbon footprint, coordinate business green initiative, top management to consider Green IT issues as a priority and have budget and other resources for green IT adoptation.

5.2.6 Environment

The study found that Environmental IT Context correlate positively with adoption of Framework for greet IT in telecommunication companies in Kenya (r=0.819**), where regression results indicated that there exist significant and positive relationship between Environmental IT Context and Adoption of framework Green IT of telecommunication companies in Kenya as β_1 =0.755, PV= 0.001<0.05 and z=22.845.

This supported the views that companies business's was concerns about overall environmental footprint , companies were concerns on vendors environmental footprint end of its life for IT hardware and that companies were concerned about IT's contribution to greenhouse gas . Further results revealed that companies were concerns with competitor's actions toward green IT and that organizations were concerns with clients' environmental footprint.

5.2.7 Greet IT Drivers

From the regression finding indicated that interaction variable, Green IT drivers explain 72.42% of variation in the relationship between Green IT factors and Adoption of Green IT in Telecommunication. The study also indicated that Green IT drivers has a significant and positive influence on the relationship between Green IT Factors and adoption of green IT in Telecommunication companies in Kenya as β_1 =0.267, PV= 0.009<0.05 and Z=10.74

The results revealed that ethical drivers for green IT such as lack of government guidelines or political goodwill influence companies adoption for green IT, inadequacy of government regulations influence companies for green IT , inadequate support from top management drive the companies for green IT and inadequate knowledge on green computing influence companies for green IT .

5.3 Implications of the Study

Generally, the result of this study has several implications for the adoption of Green IT within Organizations in Kenya. First the result indicates all the six factors have significant impact on adoption of Green IT within Organizations in Kenya. Particularly, the factors as discussed

should aggressively develop and pay more emphasis on such variables in the whole process of Green IT adoption.

These may enhance the progress of Green IT adoptation within an organization and thus create more effectiveness toward the organization. The proposed frameworks would be used as references for those firms in the whole life cycle stages of Green IT. Practitioners may thus identify those essential issues and factors effectively in planning, developing and implementing Green IT.

For those firms who still lack initiatives to adopt Green IT paradigms, such research may provide better insights into the organizational factors for adopting Green IT. Secondly, the result of the study indicates that each of the proposed variables has significant interrelationship between each variables. This means that six critical factors are interdependent in determine the adoption of Green IT initiatives.

All stakeholders should understand the effect of correlation between each factor and take them into consideration before Green IT adoptation. Each of the factors needs to be equally emphasized in order to achieve desire outcome in the adoption of Green IT within an organization.

5.4 Recommendations for practice

This study has shed some light on some of the main factors which influence green IT adoption in the case study organizations. Findings from this research indicate that green IT knowledge is low and that staff do not commonly practice simple green IT actions that can significantly impact the success green IT in the organizations. Greening the employees can go a long way in increasing practices that support green IT. Educating the staff on green IT matters to raise their awareness and interest in green IT issues could be considered. It is vital that employees realize that they can positively reduce their IT impact on the environment by changing their use habits e.g. by practicing simple things like turning off or preferably plug out the computer and screen when leaving the office for the day or at lunchtime, printing or both sides of paper or only printing what is most relevant to be printed out, and so on.

5.5 Limitations of the research

While conducting the research I came up with some limitations which could have been a source of bias to the findings of the research.

a) Data collection only covered a two telecommunication organizations both of which are private companies
b) The generalization of my research may be affected because it was not possible to conduct interviews from all the staff at case study organizations.

5.6 Contribution to body of knowledge

This research contributes to the emergence of a cumulative tradition in Green IT research. By proposing a green IT adoption framework customized to telecommunication organizations in Kenya.

5.7 Future work

Further descriptive/explanatory studies might need to approve the proposed framework in this study and offer supplementary explanations and confirmation why these framework is best suited for the adoption of Green IT in telecommunication companies in Kenya; nonetheless every effort has been made to ensure the validity of my findings.

In addition, in this research, I studied two private telecommunication organizations. Hence, future research had better investigate more corporations in both private and public sectors in order to acquire a clearer and better picture of main areas of Green IT adoptation.

Further research can also be conducted in relation to green IT adoptation risks and risk mitigation in telecommunications organizations in Kenya.

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APPENDICES

Appendix I: Research Questionnaire

Please complete by putting X in the place where it closely matches with your view or by writing in the space provided.

The information obtained in this questionnaire will be treated with utmost confidentiality.

SECTION A: **GENERAL INFORMATION**

1.Respondents particulars: Gender

Male ☐

Female ☐

2. How many years have you been in your company ?

Less than 1 ☐

between 1-3 ☐

between 3-5 ☐

More than 5 ☐

3. What is your level of education level?

Diploma ☐

Degree ☐

Masters ☐

Phd ☐

Professional certification (ITIL) ☐

4 What is your level in your organization

Operations ☐

Planning ☐

Lower management ☐

Upper management ☐

SECTION TWO:

5.In this section, please tick appropriately based on the Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree,

Please give your honest opinion on the variables below.

Organizational G-readiness

Technological Readiness

Has your Department deployed the following infrastructure:	**(SD)**	**(D)**	**(N)**	**(A)**	**(SA)**
Server virtualization					
Desktop Virtualization					
Storage Virtualization					
Data duplication					
Tiered storage (information lifecycle management)					
Print Optimization					
Data center airflow management					
Management					
Free cooling in large scale data centers					
Liquid cooling for IT equipment					
Energy saver lights					
High efficiency stand- by power equipment					
DC powered IT Equipment					

policy

6.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate whether your department is govern by the given organizational policy

	(SD)	(D)	(N)	(A)	(SA)
Corporate Social Responsibility Policy					
Preference to suppliers who are sensitive to green IT					
Green data centers policy					
End of IT Life management/Environment friendly IT disposal Environment sustainability policy					
Policy on the use of IT to reduce the business's carbon emissions/footprint					
Policy on sensitization of green IT					
Electronic waste Management policy					

Attitude

7.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company experience the given attitudinal aspect

Is your organization concerned about	(SD)	(D)	(N)	(A)	(SA)
Emerging regulations in greenhouse gas emissions					
IT's energy consumption					
Energy consumption of cooling and lighting our data centers					
The efficiency of powering our IT infrastructure (storage, servers, network)					

Practice

8.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company undertake the given Green IT practices

My organization	(SD)	(D)	(N)	(A)	(SA)
Gives preference to IT vendors with a green track record					
Gives weight to environmental considerations in sourcing					
Audits the power efficiency of existing IT technologies existing IT technologies					
Switches off data centre lights and equipment when not needed					
Operates existing IT systems in an energy efficient manner					
Enforces PC power management eg switching off when not in use					
Prints double-sided on the paper					
Analyses IT energy's bill separately from the overall corporate bill					
Disposes of computing equipment in an environmentally friendly manner					
Engages the service of professional					
service provider regarding Green IT (i.e. batteries, ink cartridges, and					
Recycles consumable equipment (i.e. batteries, ink cartridges, and paper					

Governance

9.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company undertake the given Green IT governance aspects.

Our management:	(SD)	(D)	(N)	(A)	(SA)
Has set carbon dioxide levels to reduce our corporate carbon footprint					
Has defined coordinating of our business green initiative					
Top management consider Green IT issues as a priority					
Responsibilities are clearly defined within each on Green IT initiative					
Has a budget and other resources for green IT					
Has mechanisms for monitoring vendors green performance					
Demonstrates adequate readiness for Green IT					

Green IT drivers

Economic Drivers

10.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company is influence by Economic drivers for green IT

Rate the following reasons for pursuing Green IT:	(SD)	(D)	(N)	(A)	(SA)
Cost Reduction					
Environmental considerations					
Social Acceptance					
Government Regulations					
Government Incentives					
Vendor or client pressure					
Competition from other companies					

Ethical Driver

In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company is influence by ethical drivers for green IT

Rate the following reasons for not adopting green IT:	**(SD)**	**(D)**	**(N)**	**(A)**	**(SA)**
No clear business value in green IT					
Lack of government guidelines or political goodwill					
Inadequate knowledge on green computing					
Inadequacy of government regulation					
Inadequate support from top management					

Green IT context

Environmental

11.In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company concern about green IT environmental aspect.

Is your organization concerned about	**(SD)**	**(D)**	**(N)**	**(A)**	**(SA)**
IT's contribution to greenhouse gas					
Our business's overall environmental footprint					
Our clients' environmental footprint					
Our competitors actions toward green IT					
Our vendors environmental footprint end of its life for IT hardware					

Technological

12. In a Likert scale ranging from 1 to 5 where; 1–Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree, indicate the extent your company has the green IT technology

Does your organization have	**(SD)**	**(D)**	**(N)**	**(A)**	**(SA)**
sufficient experience with network based applications					
We have sufficient business resources to implement green IT					
Our existing systems are customizable to our customers' needs					
We thoroughly analyze the possible changes to be caused in our organization, suppliers, partners, and customers as a result of each green IT implementation					
Our vendors environmental footprint					
end of its life for IT hardware					