

FRAMEWORK FOR ASSESSING ENVIRONMENTAL, SOCIAL, AND ECONOMIC  
SUSTAINABILITY OF ICT ORGANIZATIONS

by

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## **DEDICATION**

I dedicate this work ...

To Huda Iskandar, the best friend ever, and the one who made me recycle for the first time and taught me the alphabets of sustainability.

To my mother Asma', my all times inspiration, role model and the one influenced my life the most. I learned from her that education (especially girls') is the best investment, and that the sky is the limit when you believe in yourself.

To my second mother Kawthar Iskandar for the love and care she provided me through this journey.

To the memory of two great fathers: Mustafa Odeh and Saed Iskandar.

To the ones who fill my life with hope of a better tomorrow, my nieces and nephews: Hanin, Shirin, Ramie, Hana, Fadi, Shadi, Raya, Yara, Farah, Dana, Dalia, Saed, Mustafa, Mohamad, Mustafa, Furat, and Fathi.

And to the memory of my beloved friend, Behnaz Morshed.

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## LIST OF ABBREVIATIONS

Information and Communication Technology.....	ICT
United Nations .....	UN
World Commission on Environment and Development.....	WCED
Electronic Product Environmental Assessment Tool .....	EPEAT
World Business Council on Sustainable Development .....	WBCSD
Sustainable Development .....	SD
International Institute for Sustainable Development .....	IISD
Integrative Sustainability Triangle .....	IST
Corporate Social Responsibility .....	CSR
Triple Bottom Line .....	TBL
Framework for Strategic Sustainable Development .....	FSSD
The Natural Step .....	TNS
Zero Emissions Research and Initiatives .....	ZERI
Intergovernmental Panel on Climate Change .....	IPCC
Greenhouse Gas .....	GHG
Environmental Protection Agency.....	EPA
The Climate Group .....	TCG
World Wildlife Fund .....	WWF
Global eSustainability Initiative .....	GeSI
Electronic Waste .....	e-Waste
Geographic Information System .....	GIS
Organization for Economic Co-operation and Development .....	OECD
Information and Communication Technology for Development .....	ICT4D
European Commission .....	EUC
Science, Engineering, and Education for Sustainability .....	SEES
Sustainability Impact Assessment .....	SIA
Integrated Sustainability Assessment .....	ISA
Multi-Criteria Decision Making .....	MCDM
United States Green Building Council .....	USGBC
Institution of Chemical Engineers .....	ICHEME
Global Reporting Initiative .....	GRI
Dow Jones Sustainability Index .....	DJSI
Waste Electrical and Electronic Equipment .....	WEEE
Restriction of Hazardous Substances .....	RoHS
Federal Electronic Challenge .....	FEC
Federal Energy Management Program .....	FEMP

Recycling Electronics and Asset Disposition .....	READ
State Electronic Challenge .....	SEC
The Green Grid .....	TGG
Data Center Maturity Model .....	DCMM
Climate Savers Computing Initiative .....	CSCI
Intra-Class Correlation Coefficient .....	ICC
National Electrical Manufacturers Association .....	NEMA
American Society of Heating and, Refrigerating, and Air Conditioning .....	ASHRAE
Power Usage Effectiveness .....	PUE
Carbon Usage Effectiveness .....	CUE
Water Usage Effectiveness .....	WUE
Rack Cooling Index .....	RCI
Social Life Cycle Assessment .....	SLCA

## **ABSTRACT**

### **FRAMEWORK FOR ASSESSING ENVIRONMENTAL, SOCIAL, AND ECONOMIC SUSTAINABILITY OF ICT ORGANIZATIONS**

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George Mason University, 2013

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Key challenges that confront the Information and Communication Technology (ICT) industry today in defining and achieving social, environmental, and economic sustainability goals include identifying sustainable operating standards and best practices and measuring and assessing performance against those practices. The industry lacks a framework for assessing sustainability that is consistent, reliable, and applicable to ICT organizations' practices beyond the data center operation and purchasing of electronic products. Without an industry accepted framework, the burden of defining sustainable practices lies with each organization or company. This has resulted in inconsistencies and a general lack of baseline information regarding sustainable practice in the sector. To address this gap, an ICT sustainability assessment framework was developed. The framework took a balanced approach in accounting for the environmental, economic and social sustainability issues in ICT and recognized contributions of innovation to

sustainable ICT. The rating method was based on a weighted and aggregated set of criteria that were validated by ICT sustainability experts. An expert focus group validated the model ratings against their professional judgment. Practical application of the model was also demonstrated for a leading North American Telecommunication company.

## **1. INTRODUCTION**

### **1.1 Motivation and Background**

Unsustainable development and growth beyond the capacity of the planet's resources are major challenges facing our civilization. These challenges lead to problems such as climate change, pollution, resource depletion, poverty, and increased conflict.

In 1987, the UN World Commission on Environment and Development (WCED)'s Brundtland report defined the concept of sustainable development (sustainability) to the international community. This report introduced a new paradigm for economic growth, social equality, and environmental protection. It advocated for a sustainable future through balancing all three objectives (WCED and Brundtland 1987). According to the report, sustainability demands solutions and practices that make financial sense, increase the bottom line, and increase business efficiency. It also demands that such solutions have minimal to no environmental impact and utilize scarce natural resources intelligently. Finally, sustainability means that solutions and practices bring benefit to local communities and society at large; satisfying the triple bottom line (economic, social, and environmental sustainability).

Since the release of the Brundtland report, sustainability has become a global priority. Although twenty five years have passed since this report, the UN concluded in a recent report that “the world is still not on the path of sustainable development” (UN 2012). This conclusion was attributed to sustainability remaining an agreed upon concept

rather than a practical reality. Sustainability has not been incorporated into mainstream policies and practices. To address the need to incorporate sustainability into day-to-day decision-making, the report provided 56 recommendations. One of the recommendations included establishing trusted rating and labeling schemes to enable sustainable choices. In particular, recommendation number 11 encouraged organizations and governments to “promote open, transparent, balanced and science-based processes for developing labeling schemes and other mechanisms that fully reflect the impact of production and consumption, and work with the private sector to ensure that labeling, corporate reporting and advocacy are accurate, cost effective and trustworthy so as to enable consumers to make informed choices.” (UN 2012, P81)

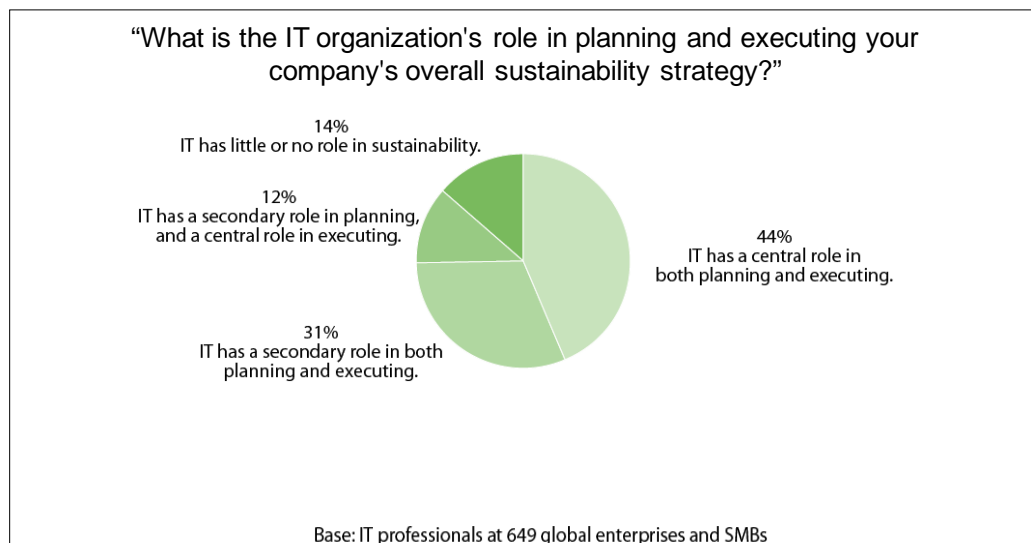
Sustainability performance assessments and rating schemes benefit both the rated entity (a product or a practice) and the decision maker (consumer). The rated entity benefits through recognition of achievements, having clear targets for improvement, and benchmarking against peers. The decision maker is provided with trusted guidance and a reference in making sustainable choices (Bratt et al. 2011). Sustainability rating schemes tend to be indicator-based with values derived from collected environmental, social and economic data (Wu and Wu 2012).

The Information and Communication Technology (ICT) sector is fast growing and contributes significantly to global economy. Reported estimates (2-3%) of the sector’s contributions to the global carbon footprint have raised concerns about the sustainability of ICT organizations. How can an ICT organization assess the

sustainability of its practices? How should a framework be structured to guide this assessment? This is the premise of my thesis.

## 1.2 Scope and Research Problem

The buildings, energy and transportation sectors have witnessed an increase in the development of sustainability rating systems over the past decade. Having sector-accepted rating methods have contributed to significant enhancements in overall sustainability. By providing industry-specific guidance, more sustainable practices have been adopted by these sectors. Tools to guide sustainability of other sectors like the ICT sector remain at various maturity levels. The ICT organization has a significant role to play in sustainability as shown in Figure 1. In Forrester's 2009 Global Green IT Survey, 86% of 649 professionals agreed that the ICT organization plays an important role in the planning or execution of their corporate sustainability strategy (Forrester 2009).



**Figure 1 Role of the ICT Organization in Planning and Executing Corporate Sustainability Strategy (Forrester 2009)**

Within the ICT sector, sustainability assessment tools are limited to specific areas like electronic products stewardship, energy efficiency and hazardous materials management. Unfortunately, assessment tools that address the three pillars of sustainability similar to the Leadership in Energy and Environmental Design (LEED) within the building sector are lacking within the ICT sector. Except for EnergyStar and the Electronic Product Environmental Assessment Tool (EPEAT), ICT sustainability assessment initiatives are immature. Without an industry accepted framework, the burden of defining sustainable practices rests with each ICT organization; this has created inconsistencies and an inability to compare between organizations. ICT leaders struggle to make sustainable choices. Therefore, the focus of my research is to address this need. The scope of my work involves the establishment of criteria that define the sustainability performance of ICT organizations. In my research I explore existing sustainability rating and labeling schemes, and develop a framework to evaluate environmental, social and economic contributions to the ICT sector.

### **1.3 Goals and Objectives**

The primary objective of my research is to develop a sustainability rating model that can assess the environmental, social, and economic sustainability of ICT organizations. Specific research goals are to:

1. Establish a set of key social, economic, and environmental sustainability assessment criteria that should be considered when rating and assessing the practices of the ICT organization.

2. Develop a quantitative model that will provide a meaningful and informing sustainability score/rating for an ICT organization.
3. Incorporate ICT and sustainability experts' viewpoints regarding the level of relevance, practicality, reliability, and significance of the rating model.

#### **1.4 Research Statement and Questions**

I hypothesize that a simple linear weighted multi-criteria model can be developed that will be useful to ICT sustainability experts. The following research questions are explored:

1. What form should the proposed sustainability assessment model take?
2. What are the set of criteria that defines a sustainable ICT organization?
3. How should the contributions to social, economic, and environmental sustainability be weighted?
4. How can innovation in ICT sustainability be incorporated in the model?
5. Will the model predict the level of sustainability for an ICT organization that is consistent with the opinions of a panel of sustainability experts?

#### **1.5 Contributions**

The main contributions of my research are:

1. The establishment of a baseline (version 1.0) of the ICT sustainability assessment criteria that should be considered for ICT organizations' transition towards sustainable practices.

2. The development of a model for ICT sustainability evaluation that represent the body of knowledge and views of sustainability experts and leaders within the sector.
3. Creating an approach that can be used in the development of sector-specific sustainability rating frameworks.

## **1.6 Organization of the Dissertation**

This dissertation is organized in six main chapters. This first chapter provided an overview of the research scope and objectives, in addition to research statements and questions. Chapter 2 provides a review of related work and literature on sustainability, Sustainable/ Green IT, and sustainability rating and assessment models and systems. Chapter 3 details the research methodology steps followed to achieve the primary goal of the research. The results of the research steps are detailed in Chapter 4, followed by validation and results analysis in Chapter 5. Finally, a summary of the conclusions and future research direction are presented in Chapter 6.

## **2. LITERATURE REVIEW**

### **2.1 Sustainability**

According to the World Business Council on Sustainable Development (WBCSD), sustainability involves “the simultaneous pursuit of economic prosperity, environmental quality and social equity. Companies aiming for sustainability need to perform not against a single, financial bottom line but against the triple bottom line” (WBCSD 2000).

“Sustainability” and “Sustainable Development” are used interchangeably in literature to define the relationship between human society and the natural systems. The concept was born out of the concern for the patterns of growth and development of human activities. It evolved around recognizing that unlimited growth is impossible in a world with finite limits and resources. The Club of Rome project in the early 1970s called for a steady state economy with a halt to unbridled growth (Club of Rome 1972; Daly 1996). However, the recommendation was disputed because it did not recognize the economic consequences associated with the opportunity to invest in replacement of resources. It also did not recognize the true cost of environmental exploitation, leading to considerably rapid acceptance of the sustainability argument over the limits of growth (Meadows, Randers, and Meadows 2004).

The concept of sustainable development received major international recognition in 1972 at the UN Conference on the Human Environment held in Stockholm, where it

was decided that both development and the environment could be managed in a mutually beneficial way (UNEP 1972). The term “Sustainable Development” (SD) was popularized in the 1987 UN report “Our Common Future”, also known as the “Brundtland Report”, of the UN World Commission on Environment and Development. It provided what later became the most cited definition of sustainable development in literature:

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (WCED 1987)

This definition encompasses major concepts related to SD including:

- *Time*: present and future;
- *People*: generations of today and tomorrow;
- *Needs and Resources*: meeting the needs of generations of today and tomorrow;
- *Strategy*: thinking of tomorrow while living today and the balance between today's needs and resources and those of tomorrow;

This definition established the need for integrated decision making that is capable of balancing the economic and social needs of the people with the regenerative capacity of the natural environment. Since its popularization in the Brundtland report, the concept continued to evolve around the following common principles of sustainability (See Figure 2):

- a) Living within the limits of the natural system,

- b) Understanding the interconnections between economy, society, and the environment, and
- c) Distribution of resources and opportunities equally.

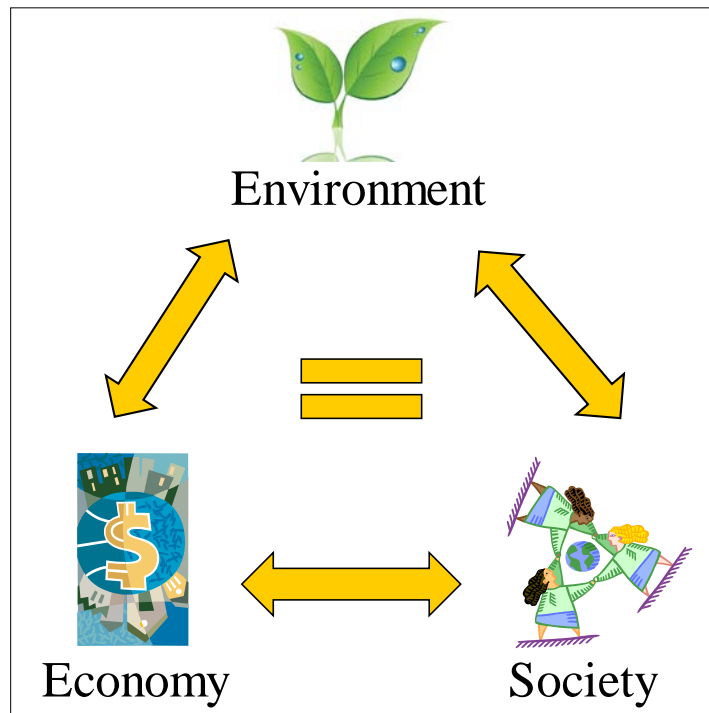


Figure 2 Pillars of Sustainability

Haughton and Hunter deduced three major principles for SD from the above definition (Haughton and Hunter 2003, 17):

1. Inter-generational equity (sometimes referred to as the principle of “futuraity”), addresses the needs of future generations.
2. Intra-generational equity (also known as the social justice principle), addresses the needs of current generations.

3. Trans-frontier responsibility addresses the stewardship of the global environment.

Fifteen years after the Brundtland Report, at the 1992 Rio “Earth” Summit, attendants recognized sustainable development as the major challenge it remains today. They also declared SD principles and the action plan “Agenda 21” as movement towards achieving more sustainable patterns in development (UNCED 1992).

To assess the progress made since the Rio Summit, the World Summit on Sustainable Development was held in Johannesburg in 2002. It had three key outcomes: a supportive political declaration, the Johannesburg Plan of Implementation, and a range of partnership initiatives. Key commitments included those on sustainable consumption and production, water and sanitation, and energy (UN 2002).

The debate, research, policies, strategies, and actions on global and national levels related to sustainability and its challenges continue to grow in this century. The International Institute for Sustainable Development (IISD) maintains a timetable delineating the key milestones in the history of sustainability since its origination in the 1960s (IISD 2009).

In 2012, twenty-five years after the Brundtland Report, the UN released a new report on the global progress on sustainability called "Resilient People, Resilient Planet: A Future Worth Choosing" (UN 2012). The report highlighted the progress made in sustainable development in key areas by comparing the numbers of 2012 with those of 1987. The progress is summarized in Table 1.

**Table 1 The Global Track Record on Sustainable Development (UN 2012)**

<b>The Ozone Layer:</b> 50+ years until ozone layer will recover to pre-1980 levels	<b>Economic Growth and Inequality:</b> 75% of global GDP growth since 1992, but inequality is still high
<b>Poverty Eradication:</b> 27% of the world's population live in absolute poverty, down from 46% in 1990	<b>Hunger and undernourishment:</b> 20M increase of undernourished people since 2000
<b>Forests:</b> 5.2M hectares of net forest loss per year	<b>Education:</b> 67M children of primary school age are not in school
<b>Health:</b> 3.5 year increase in life expectancy	<b>The Oceans:</b> 85% of all fish stocks are overexploited, depleted, recovering, or fully exploited
<b>Water and sanitation:</b> 884M people lack access to clean water. 2.6B people without access to basic sanitation	<b>Energy:</b> 20% of the world's population lack access to electricity. 2.7B people still rely on traditional biomass use for their cooking needs
<b>Climate Change:</b> 38% increase in annual global carbon dioxide emissions between 1990 and 2009	<b>Biodiversity and Ecosystems:</b> 2/3 of the services provided by nature to humankind are in decline
<b>Gender:</b> 43% of those in the agriculture workforce in developing countries are women	

The report concluded that while progress has been made over the past 25 years, civilization is not on the path to sustainability, because:

- Sustainability remains a generally agreed concept, rather than a day-to-day, on-the-ground, practical reality.
- The concept has not yet been incorporated into mainstream policies and practices.

The report affirmed what researchers have argued regarding the importance of having a practical definition and approach to sustainability and provided 56 recommendations. Some of them directly linked to "practical" ways in enabling sustainable choices. Bell and Morse stated that sustainable development "embodies an ultimate practicality since it is literally meaningless unless we can 'do' it" (Bell and Morse 2008, 5). Understanding "what" needs to be sustained and "how" sustainability

should be approached are key concepts that need to be specified in practical terms (Kates, Parris, and Leiserowitz 2005).

## **2.2 Principles and Frameworks of Sustainability**

In literature, sustainability is often treated as the value or the end state and sustainable development as the process. According to Newman (2005), the distinction between the process and the goal of sustainable development is critical and much needed in shaping our understanding of the interactions between human society and the biosphere (Newman 2005). When the ability of human society to be innovative, and the inherent complexity and uncertainty of human and natural systems is taken into account, a dynamic process approach is required to understand and explain their complex interactions. Sustainable development must be treated and viewed as an ongoing process where feedback loops, new innovations, and precautionary principles play a key role in a continuous evaluation of the relationship between society and nature (Newman 2005).

There are various frameworks, models, and views of sustainability and its approach to the three fundamental elements: social, economic and environmental (people, profits and the planet).

### **2.2.1 The Three-Dimensional Model**

The “three-dimensional model” of sustainable development was introduced in the Rio Summit’s declaration as one of two main pillars (UN 1992). The concept rests on: (1) equity between and within generations, and (2) the equal status of *social*, *economic*, and *environmental* goals (IFRAS 2004). The combination of these two pillars is illustrated in Figure 3.

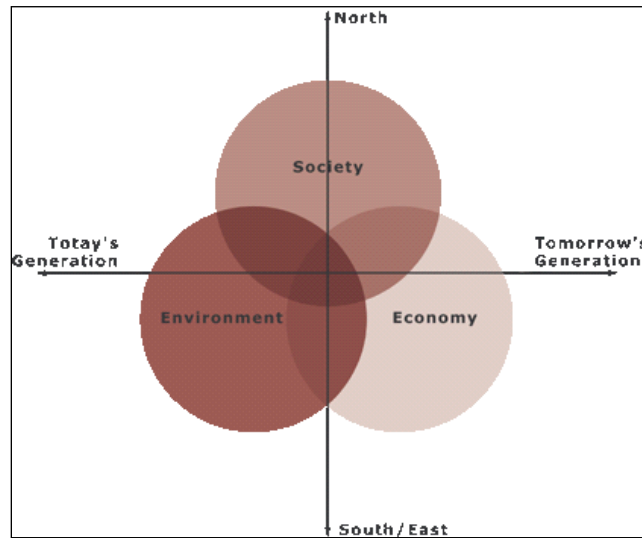


Figure 3 Equity between generations and three-dimensional model of sustainability (IFRAS 2004)

A number of interpretations of the inter-relational and boundary levels of the three-dimensional model have been developed in which sustainability is measured by the extent to which these boundaries are respected. See Figure 4.

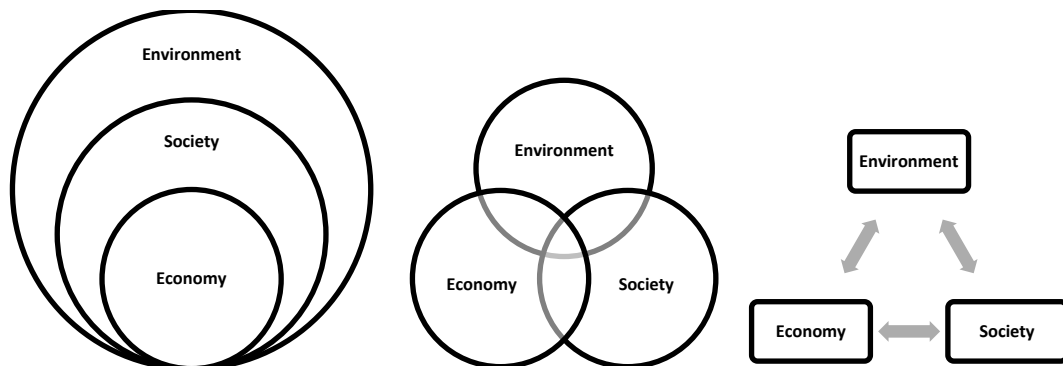


Figure 4 Views of the three-dimensional models of Sustainability. (Mann 2009)

### 2.2.2 Capital Stock Model

A complementing model to the three-dimensional one is called the Capital Stock Model, which was developed by the World Bank in 1994 (Cernea et al. 1994). The Capital Stock Model is based on the idea that there are three types of capital stock: environmental, economic, and social, in which sustainability capital consists of the sum of the three. According to this view, the Earth's *capital* should not simply be consumed, but constantly renewed. Sustainability is achieved when it is possible to live off the *interest* rather than off the *capital*. The question of how far environmental, economic, and social capital can be substituted for each other is addressed by the concepts of *strong* and *weak* sustainability. *Weak* sustainability regards natural environment capital as replicable with human-made capital stock as long as the overall level of capital in the system is maintained at a constant or growing level. Alternatively, the *strong* sustainability notion states that human-made capital stock and natural environment capital stocks are not always interchangeable due to the scarcity of certain natural environmental capital stock (Turner, Pearce, and Bateman 1993). An intermediate position between strong and weak sustainability is termed *sensible* sustainability or *weak sustainability plus*. This approach acknowledges that individual assets can be replaced, and that the various types of capital may be mutually complementary. Limited substitution is therefore permissible provided that for each type of capital there are critical limits below which the stock must not fall. Critical limits, such as environmental standards relevant to health of people (air pollutant levels), sociopolitical standards (equal opportunities, minimum income, decent living conditions, etc.), or guaranteed human rights, represent non-negotiable minimum requirements or threshold values.

### 2.2.3 Integrative Sustainability Triangle (IST)

Kleine and Hauff (2009) developed an Integrative Sustainability Triangle (IST) as a management tool that can help integrate sustainability into Corporate Social Responsibility (CSR). Their model combined the three-dimensional concept and the notion of strong, weak, and partial association of sustainability (Kleine and Hauff 2009). Figure 5 displays the model.

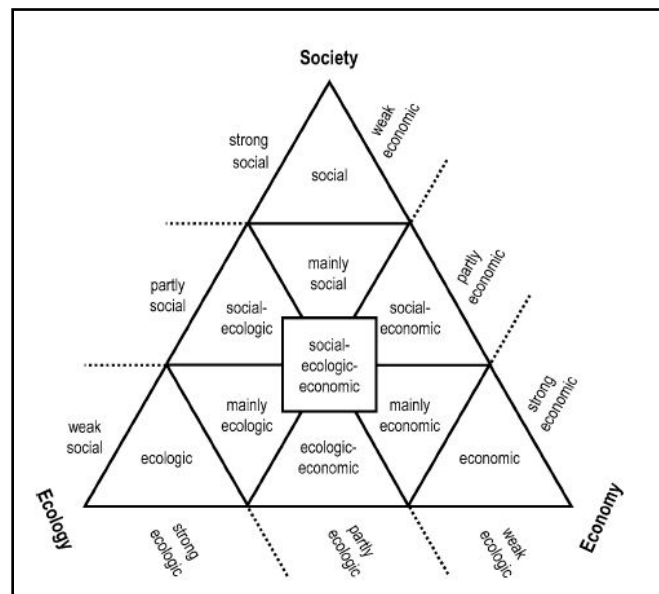


Figure 5 Integrative Sustainability Triangle, (Kleine and Hauff 2009)

### 2.2.4 The Triple Bottom Line (TBL)

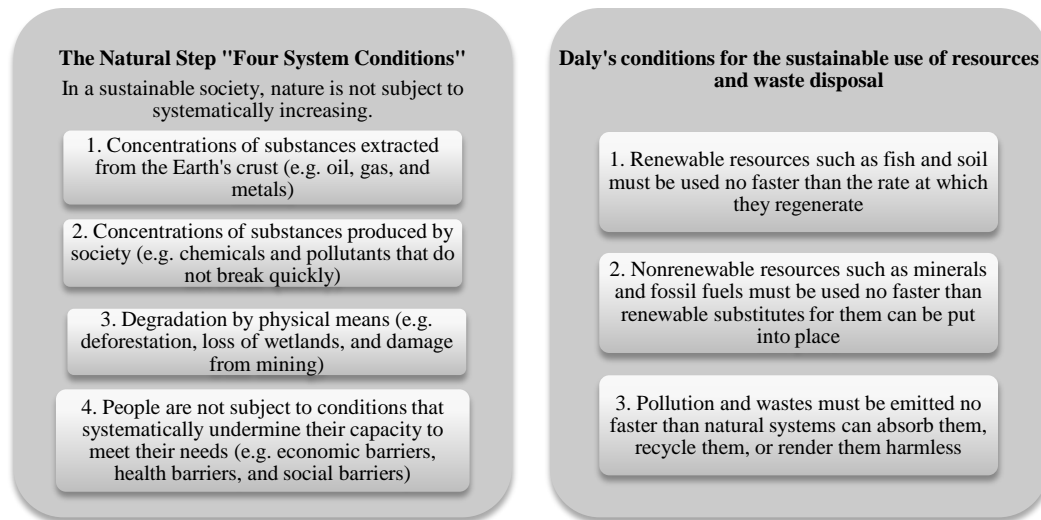
The “Triple Bottom Line” (TBL) is another three-dimensional model of sustainability (Elkington 2004). It builds on the common business term for financial sustainability: the bottom line. The model suggests that a sustainable business or organization considers the social and environmental sustainability equal to financial

sustainability. The TBL concept has been popular as an entry point for an organization in communicating and making a business case for sustainability. It is easy to grasp and utilizes a commonly understood business term: the bottom line. However, the model is also vague and does not have tools or methods to help an organization create a road map or implement sustainable solution (Elkington 2004; Elkington 1994). There are some extended versions of the TBL, one, the TBL *Plus*, includes culture, ethics, equality, equity, social responsibility, politics, and future generations in addition to economic, social and environmental bottom lines (Johnston 2007).

### **2.2.5 The Natural Step**

The Framework for Strategic Sustainable Development (FSSD), also known as The Natural Step (TNS), provides a conceptual holistic system framework for the establishment of a sustainable society (Karl-Henrik Robèrt et al. 2007; TNS 2008). The four system conditions advocated by the Natural Step, and Herman Daly's three conditions or strategies for sustainable use of resources and waste disposal, explain sustainability in terms of physical and ecological limits (Karl-Henrik Robèrt 2008; Daly 2004; RSBS 2006).

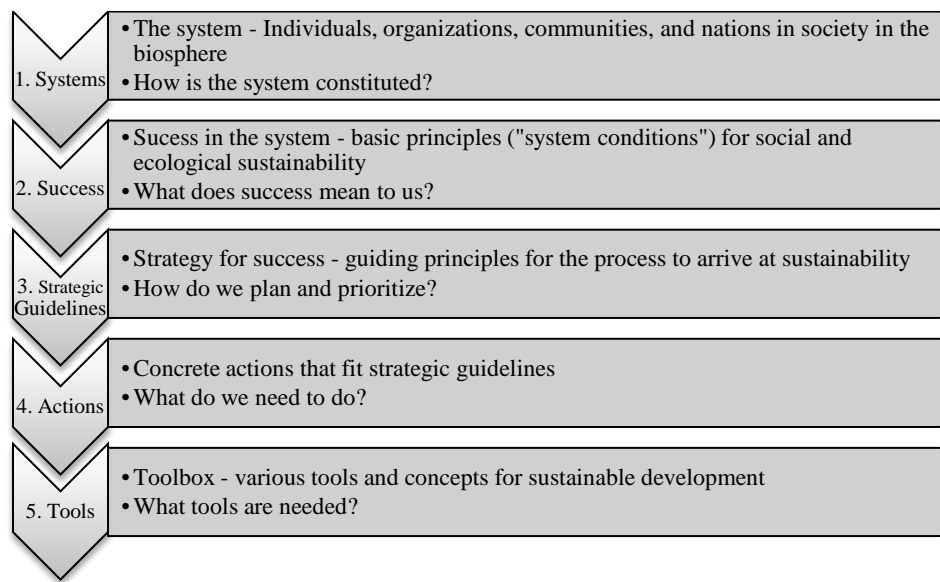
The Natural Step system conditions are a description of the boundaries of the ecosphere across which the sustainable society cannot be allowed to extend without seriously affecting the natural cycles bearing upon the world. The first three conditions deal with the ecosphere and the fourth deals with fundamental human needs (Holmberg and Robèrt 2000). See Figure 6 for a summary of these principles.



**Figure 6: System Conditions and Sustainability Principles (TNS 2008; Daly 2004)**

FSSD advocates a systems approach in the planning and decision making through the use of “Backcasting”. Backcasting is defined as the planning procedure by which a successful outcome is envisioned and the steps to accomplish the outcome are identified in reverse order. Basic principles for sustainability guide the backcasting process. The principles are scientifically based, necessary to achieve sustainability goals, sufficient, concrete, and non-overlapping (K-H Robèrt et al. 2005a).

The core concepts of this framework include: (1) taking a broad systems approach, (2) using a structured five-level decision making method, (3) applying principles of a sustainable society (called system conditions), (4) backcasting, (5) prioritizing actions strategically, and (6) selecting and informing the tools and methods needed for the transition to sustainability. Figure 7 illustrates the FSSD.



**Figure 7: Framework for Strategic Sustainable Development (FSSD). Adapted (Karl-Henrik Robèrt et al. 2007)**

### 2.2.6 The Natural Capitalism

The Natural Capitalism framework (Hawken, Lovins, and Lovins 2010) is based on four principles. It extends the concept of reinvestment in physical and financial capital (goods and money) to natural and human capital (nature, people, culture, and communities). Its four principles are:

1. Radical resource productivity.
2. Bio-mimetic production by turning waste to value and reducing/eliminating toxicity from the design phase.
3. Solutions economy: reduce what it takes to provide a service. Lease products and services instead of selling.
4. Reinvestment in nature: restoring nature and boosting the ecosystem's ability to provide and renew resources.

### **2.2.7 ZERI**

The Zero Emissions Research and Initiatives (ZERI) network, developed a framework that utilizes zero emissions as a strategic approach to resolving social, economic, and environmental challenges (ZERI 1994; Ruediger 2007). Zero emission is an eco-efficient approach to sustainability that reduces the negative impacts of processes in production and consumption. The science and methodology behind the framework includes guidelines/principles towards nature, society, and economic soundness. It is based on an understanding of when to integrate and when to separate major "kingdoms" of nature and promotes design principles that emulate nature.

### **2.2.8 Cradle-to-Cradle**

Eco-effective approaches like cradle-to-cradle incorporate social, economic, and environmental benefit and growth in the conceptualization and production of goods and services. Cradle-to-Cradle focuses on the design and development of products and systems that maintain high levels of quality and productivity of the materials and resources used through their life cycles (Braungart, McDonough, and Bollinger 2007).

## **2.3 Sustainability in the ICT Context**

### **2.3.1 Sustainable Computing**

The term Sustainable (or Green) computing emerged and gained the attention of the ICT sector in 2007 following a number of relevant studies. The Intergovernmental Panel on Climate Change (IPCC) released its report on greenhouse gas (GHG) emissions and projections and called for global action to mitigate the situation (IPCC 2007). Gartner (2007) and The Climate Group (2008) determined that the ICT sector's carbon

footprint accounts for 2% of the total global footprint. Figure 8 identifies the ICT global footprint and total GHG emissions estimates in 2007.

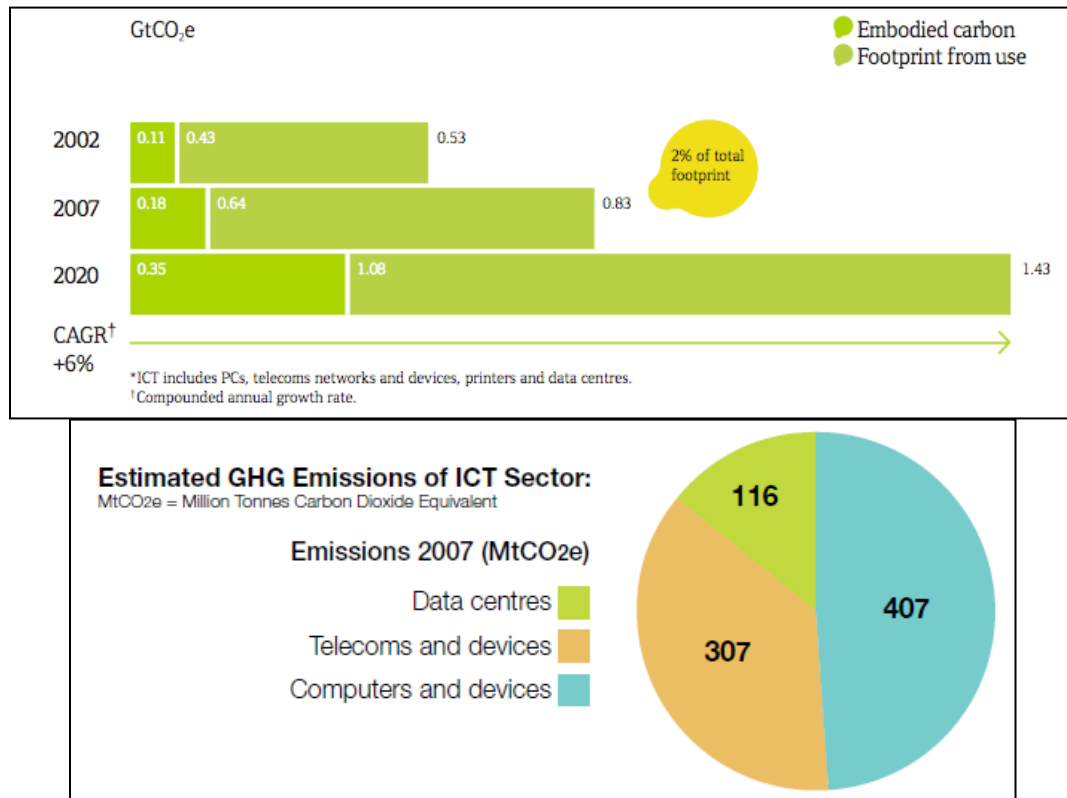


Figure 8: The Global ICT Footprint and its estimated GHG emissions, (TCG 2008)

The increased carbon footprint of ICT is largely attributed to high penetration rates of internet and mobile technologies. The number of computing devices in use worldwide today is substantial. Computing hardware causes significant environmental impact during production, use, and ultimate disposal. The Environmental Protection Agency (EPA) estimates that 1.5 percent of total U.S. electricity in 2006 was consumed

by data centers (61 billion kilowatt-hours (kWh) for a total electricity cost of about \$4.5 billion) and projected this amount to double by 2011 (EPA 2007). Data centers are costly to manage. Costs of \$500 Million to \$1 Billion are common for data centers and on average account for 25% of a corporation's IT budget. Data centers consume a large amount of power and, therefore, contribute the most to the overall corporate carbon footprint. However, recent studies indicate that data center power consumption rates did not double between 2006 and 2011 as projected by the EPA, but increased at a much slower rate. Consolidation of the infrastructure base through virtualization, advancements in power efficiency of servers, and an increased use of cloud computing, are believed to have contributed to slowing the power consumption growth (Koomey 2011) . It should be noted that IT solutions help to decrease the footprint of other sectors and sustainable development in general (Ruth 2009). A joint project between the World Wildlife Fund (WWF) and Hewlett Packard (HP) reported potential areas where applying IT solutions could reduce up to 1 billion tons of CO<sub>2</sub> emissions (WWF 2008). A recent report by the Global e-Sustainability Initiative (GeSI), estimated that ICT-enabled solutions have the potential to reduce the global carbon footprint by %16.5, amounting to \$1.9 trillion in energy savings (GeSI 2012).

Environmental pollution during the manufacturing and disposal of electronic products and electronic waste (e-Waste) is a growing problem. Disposal of this waste in developing countries, where most of this e-waste is shipped, exposes millions of people to toxic material (Greenpeace 2007). Table 2 summarizes ICT growth and resulting environmental impacts.

**Table 2 ICT Sector in Numbers**

ICT-related Numbers and Facts	Source
ICT sector accounts for 2.3 to 21% of the economy of member countries of the Organization for Economic Cooperation and Development (OECD), and for 3 to 4% of employment.	(OECD 2010a)
11.8 million computer servers were in use in the US in 2007, compared to 2.6 million in 1997	(IDC 2009)
More than 80% of households in OECD have access to at least one home computer	(OECD 2010a)
The number of personal computers in use in the most populous countries is projected to double to 2.25 billion by 2015	(Yates 2007)
Internet penetration rates have exceeded 25% worldwide, and exceeded 75% in OECD countries.	(InternetWorldStats 2009; OECD 2010a).
Telecommunication access penetration growth rates reached 986% in China and 654% in Mexico	(OECD 2010a).
Mobile Subscribers are projected to reach 5.9 billion by 2013, driven by China, India and Africa	(Cellular News 2009).
At least one ton of CO <sub>2</sub> per year is generated by operating a normal PC	(Murugesan 2008).
1.5 percent of total U.S. electricity in 2006 was consumed by data centers, and this amount was expected to double in 2011.	(EPA 2007)
Data centers account for 25% of the total IT budget.	(Harmon and Auseklis 2009)
Data centers account for 14% of the ICT sector's GHG emissions	(TCG 2008)
In 2010, 2.44 million tons of electronics were discarded in the US, with only 649,000 tons recovered for recycling	(Makower 2012).

In literature, the terms Green IT, Sustainable IT, Green Computing, and Sustainable Computing essentially represent the same concept. The Gartner Group defined the concept of Green IT within the context of an enterprise as 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." (Mingay 2007)

Murugesan (2008) extended the definition to include socio-economic aspects: "Green IT is the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems efficiently and effectively with minimal or no impact on the environment, and achieving economic viability and improved system

performance and use, while abiding by our social and ethical responsibilities."

(Murugesan 2008)

In recent literature, there is broader agreement on use of the term "Sustainable Computing". The editorial page of the first issue of "Sustainable Computing: Informatics and Systems" journal considered Sustainable Computing "an emerging research area spanning the fields of computer science and engineering, electrical engineering as well as other engineering disciplines" and defined it as "the study and practice of using computing resources efficiently, which in turn can impact a spectrum of economic, ecological, and social objectives." (Ahmad 2011)

Harmon and Auseklis noted that "Green Computing refers to the practice of using computing resources more efficiently while maintaining or increasing overall performance" (Harmon and Auseklis 2009). They discussed the emergence of green computing as a two wave process. The first wave is "Green Computing" and the second wave is "Sustainable IT Services and Operations". The first wave focused attention on key environmental aspects and IT infrastructure issues of computing, like power management, cooling, space utilization of data centers, and e-waste. The first wave was driven by the rapid growth of internet connectivity and services, increased cooling and energy needs, and low server utilization rates. The second wave's attention is directed towards the IT services value, aligning IT with business strategy, and the viability of the IT organization itself. The authors concluded in their study of sustainable IT services that there is a need for a model to guide the shift to sustainable IT services by the IT organization itself.

Harmon and Auseklis describe the role of computing in sustainability. The greening of other sectors was recognized and socio-economic dimensions of sustainability in computing began to surface and garner attention. The terms "computing for sustainability" or "IT for Greening" were coined to recognize the role of ICT in addressing sustainability challenges. For example, "smart" applications for buildings, the power grid, motors, and logistics and travel substitutions have the potential to reduce the US carbon footprint by 22 percent and save \$240 billion by 2020 (TCG 2008). Advancements in IT solutions, like sensor-rich mobile devices, Geographic Information Systems (GIS), and climate modeling software are making it possible to understand the climate science (ESG 2009; Mankoff, Kravets, and Blevis 2008). Cloud computing is another promising technology with potential for greening both ICT and other sectors that utilize the services (deMonsabert and Odeh 2010). It has potential for significant energy savings, along with a decrease in the associated carbon footprint, through maximum utilization of servers by eliminating the need for on-premises data centers (Berl et al. 2010).

### **2.3.2 ICT and Sustainability**

Recognition of the role of ICT and sustainable computing in driving the development processes and addressing global challenges has been on the rise. On an international level, the Green ICT Initiative started in 2008 upon the conclusions of the OECD Ministerial Meeting on "The Future of the Internet Economy". "Sustainability and an eco-conscious society driven and supported by innovative Information and Communication Technology (ICT) solutions" was a key component in the vision for the

Internet of 2018 (BIAC 2008). Accordingly, the green IT movement should flourish by 2018, including internet-based services such as community-based computing, distributed applications, modular web services, and portability of essential and user-centric information, intelligent devices, and mobility. According to OECD reports, the research and analysis of the environmental impact of ICT and the internet as well as ICT innovation are critical for the green growth of the global economy (OECD 2008a; OECD 2008b; OECD 2010b; OECD 2011). The ICT for Development (ICT4D) concept has been widely adopted by international development organizations and the United Nations to promote the innovative use of ICT as a powerful tool for economic and social development around the world (InfoDev 1995; Unwin 2009).

On a regional level, the European Commission on Information Society started the "ICT for Sustainable Growth" initiative in 2009 in an effort to recognize the key contribution of ICT in the development of a sustainable Europe, and the adaptation to climate change in the transition to an energy-efficient and low carbon economy (EUC 2009). In Japan, The Green IT Promotion Council was established in 2008 as "an industry-government-university partnership for promoting concrete actions" under the Japanese government's Green IT Initiative. The Initiative, the council, and a program called the "Cool Earth-Innovative Energy Technology Program" recognize the critical role of innovative technologies in achieving balanced economic, social, and environmental development (GreenITPC 2008). Despite the progress made on international, regional, national, and sector levels, a recent survey of 500 sustainability experts in 64 countries, revealed that 34% in the IT sector, and 41% in the

Telecommunication sector felt that their sector was not progressing effectively toward sustainability (SustainAbility 2011). Figure 9 shows a summary of the sustainability experts surveyed in over 17 industries including IT and Telecommunication.

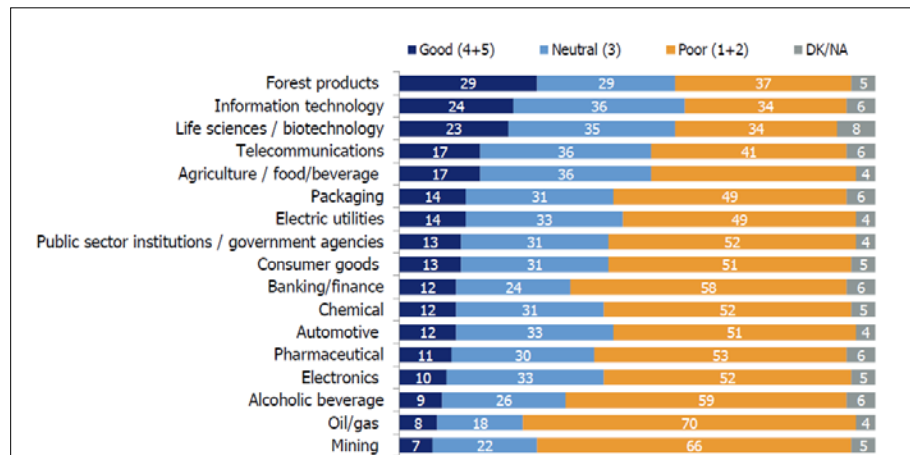


Figure 9 How well industry sectors are managing the transition to sustainability? (SustainAbility 2011)

In the research and development community, sustainable computing is expanding rapidly as a research area that spans across multiple research disciplines. The National Science Foundation (NSF) dedicated over \$650 million for the Science, Engineering, and Education for Sustainability (SEES) program. The SEES program focuses on climate change, energy science, and engineering "to inform societal actions that lead to environmental and economic sustainability". The establishment of The Institute for Computational Sustainability at Cornell University was sponsored with the intent to establish a new field for computational sustainability and inject computational thinking into sustainability (Fisher 2010; ICS 2009). A new IEEE Special Technical Community on Sustainable Computing was launched in 2011 (STC 2012). A peer review journal titled

*Sustainable Computing: Informatics and Systems* (SUSCOM) was launched in 2011 to publish research findings related to energy and thermal management issues of computing and research on applications of computing with ecological and societal impacts (Sustainable Computing 2011).

## **2. 4 Sustainability Assessment Approaches**

According to the OECD, global interest in methods and tools to assess the impact that policies, programs, projects, and products have on sustainability is on the rise, and the OECD sees that interest as a result of the growing acceptance of sustainable development as an overarching goal (OECD 2008c). The Sustainability Impact Assessment (SIA) is defined as:

"A systematic and iterative process for the assessment of the likely economic, social and environmental impacts of policies, plans, programs and strategic projects, which is undertaken during the preparation of them and where the stakeholders concerned participate pro-actively. The main aim is to improve the performance of the strategies by enhancing positive effects, mitigating negative ones and avoiding that negative impacts are transferred to future generations." (Arbter 2003)

Incorporating economic, environmental, and social considerations in a balanced manner is difficult from a practical and operational perspective. The large number of stakeholders coupled with the wide range of criteria to be considered in an assessment, contribute to this challenge and add to the complexity of sustainability assessments (Azapagic and Perdan 2005a; Phillis, Kouikoglou, and Andriantiatsaholainaina 2002). As a result, researchers agree on defining sustainability assessment as a complex decision

problem (Azapagic and Perdan 2005a; Azapagic and Perdan 2005b; Karl-Henrik Robèrt 2000).

There are various internationally, nationally, and industry-recognized conceptual frameworks for sustainability assessments; some are generic and can be applied to different sectors, and others are more sector-specific. Examples of frameworks developed for sustainability assessments are presented in the following subsections.

#### 2.4.1 The Swiss Sustainability Assessment Procedure

The Swiss Sustainability Assessment Procedure was developed by the Swiss Federal Operations Office (ARE) for sustainability assessment of all government policies. The procedural framework is based on integrated assessment methods in decision-making and is broken into three main phases (Figure 10): (1) sustainability relevance analysis, (2) sustainability impact analysis, and (3) sustainability assessment optimization (ARE 2004).

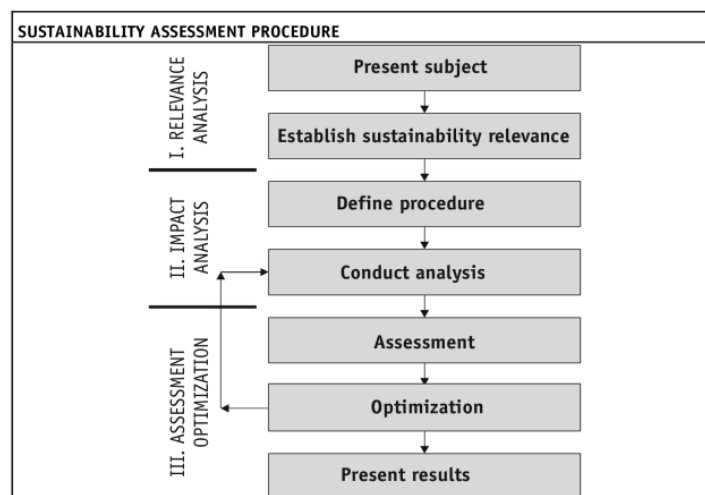


Figure 10: The Swiss Government Framework for Sustainability Impact Assessment Procedure, (ARE 2004)

#### **2.4.2 Integrated Sustainability Assessment (ISA)**

The Integrated Sustainability Assessment (ISA) method is defined as "a cyclical, participatory process of scoping, envisioning, experimenting, and learning through which a shared interpretation of sustainability for a specific context is developed and applied in an integrated manner in order to explore solutions to persistent problems" (Weaver and Rotmans 2006). The Integrated Sustainability Decision-Support Framework was implemented based on the ISA method (Azapagic and Perdan 2005a; Azapagic and Perdan 2005b). It approaches sustainability assessment as a complex problem where problem decision making takes place over the three major phases of problem structuring, problem analysis, and problem resolution. This framework is generic and can be applied to sustainability assessment of a policy, program, product, initiative, or technology. The framework is based on integrated assessment methods and the utilization of Multi-Criteria Decision Making (MCDM) techniques as the core of the analysis and assessment tool. It proposed 12 procedural steps for conducting the assessment as shown in Figure 11.

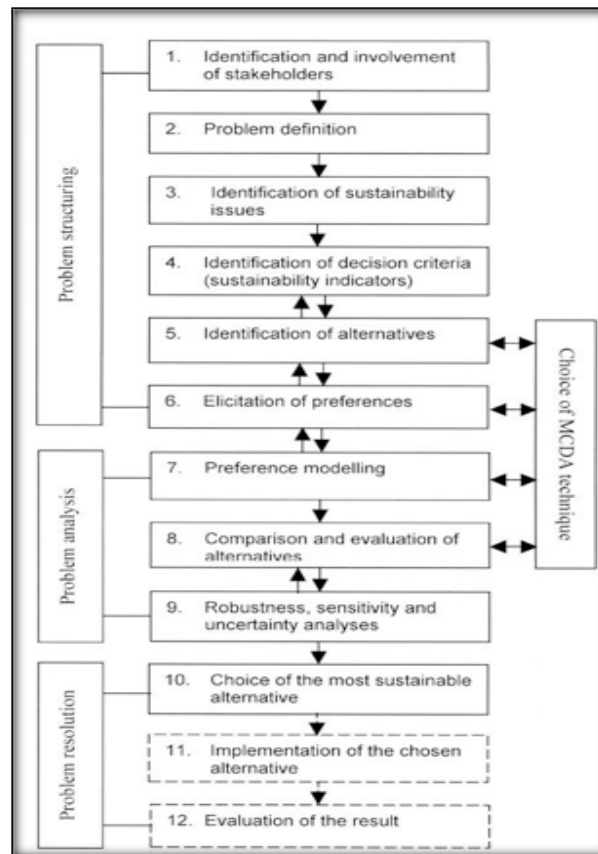


Figure 11 Integrated Sustainability Decision-Support Framework (Azapagic and Perdan 2005a)

### 2.4.3 Sustainability Assessment Tools Selection Framework

The Sustainability Assessment Tools Selection Framework (De Ridder et al. 2007) provides a guiding framework for selecting tools for a sustainability assessment. It divides the tools and methods into seven groups: (1) assessment frameworks, (2) participatory, (3) scenario analysis, (4) multi-criteria analysis, (5) cost-benefit and cost-effectiveness analysis, (6) accounting, physical analysis and indicator sets, and (7) model tools. Recommendations are provided for the selection suited to problem analysis, identifying options, analysis, and follow-up. The framework is depicted in Table 3. Shaded tools indicate leading (top used tools) under the particular assessment phase.

**Table 3 The Sustainability Assessment Tools Selection Framework (De Ridder et al. 2007)**

	Phase I Problem analysis	Phase II Finding options	Phase III Analysis	Phase IV Follow-up
Participatory tools	Problem framing (mobilising and integrating knowledge and values)	Supporting scenario building	Providing the context for and improve robustness of MCA, CBA and CEA	Evaluating the assessment process
Scenario tools	Providing the future perspectives to problem framing	Visioning futures, finding options and setting objectives	Providing references for the application of analytical tools	—
Multi-criteria analysis tools (MCA)	—	Definition of criteria	Comparing different alternatives	—
Cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA) tools	Providing the analytical basis for problem-framing	Supporting objective setting	Full analytical characterisation of options to enable comparison	Ex-post assessment
Accounting tools, physical analysis tools and indicator sets				
Model tools				

#### 2.4.4 Industry-Specific Frameworks

The building and chemical sectors, are significant contributors to greenhouse gas emissions. They were among the first industries to develop sustainability rating methods and frameworks. Green building rating systems share the principles of environmental protection, energy efficiency, and water conservation; they focus on areas related to the building lifecycle. The LEED rating system was developed by the US Green Building Council (USGBC) to evaluate new and retrofitted buildings based on green practices

related to the site, construction materials, water quality and quantity factors, energy efficiency, indoor environment quality, and innovation used in the design. LEED has emerged as a globally recognized rating for green buildings (USGBC 2011). The LEED certification is based on points that represent green performance measures and encourage innovation. A building is rated as certified, silver, gold, or platinum based on the total points earned as shown in Table 4 (USGBC 2009).

**Table 4 LEED Levels (USGBC 2009)**

<b>Total Points</b>	<b>LEED</b>
40-49	Certified
50-59	Silver
60-79	Gold
80 and above	Platinum

IchemE Sustainability Metrics Framework developed by the Institution of Chemical Engineers (IChemE 2002) provides guidance to the chemical production industry. Notable research related to sustainability assessment methods in other sectors include the Sustainable Energy Planning approach (Pohekar and Ramachandran 2004), a goal-programming methodology developed for water utilities to simultaneously balance sustainability objectives (Liner 2009), the Sustainability Assessment Model (SAM) for underground infrastructure projects (Koo, Ariaratnam, and Kavazanjian 2009), and a proposed framework for rating the sustainability of the residential construction practice (Mah 2011).

#### **2.4.5 Indicator-Based Frameworks**

Most sustainability assessment frameworks are indicator-based and display the following characteristics (Alfares and Duffuaa 2008; Pohekar and Ramachandran 2004):

- Help integrate sustainability in the decision process through the application of a procedural process.
- Subdivide the assessment process into procedural steps where multiple tools and techniques are used in each step (e.g. participatory or scenario analysis tools in problem structuring and defining, and multi criteria decision analysis techniques in analyzing options.
- Use types of value-based, weighting, or ranking techniques for preference modeling to decide the “value” of the different preferences (indicators in sustainability assessment criteria).
- Employ methods including weighted averages, priority setting, outranking, and fuzzy principles for aggregating the value of multiple indicators to handle large numbers of sustainability indicators.
- Apply methods to address uncertainty and sensitivity analysis.

According to Meadows (1998), indicators “arise from values (we measure what we care about) and they create values (we care about what we measure)” (Meadows 1998, 2). Therefore, indicator based frameworks are commonly used in sustainability assessments. Labuschagne et al.(2005) and Singh et al. (2009) provided an overview and analysis of key indicator-based frameworks (Labuschagne, Brent, and van Erck 2005; R. K. Singh et al. 2009). The researchers attempted to analyze how indicator based frameworks are structured, and how normalization, weighting, and aggregation methods

were approached to come up with a rating or index. Labuschagne et al. (2005) concluded from their review that most sustainability assessment frameworks are at national, regional or community levels instead of at an individual business or organizational level. Except for the Global Reporting Initiative GRI (GRI 2003), there is lack of frameworks that address the business or the entire organization, and if they exist, they are product focused, making such assessment frameworks less applicable and not practical for a business or organization to use.

Singh et al. (2009) concluded that subjectivity is a main characteristic of sustainability indices. While a limited set of sustainability indices integrate the three dimensions of sustainability, the majority are focused on one of the dimensions. Most importantly, it was concluded that the selection and definition of indicators must be developed and negotiated by the appropriate communities of interest and practice.

Indicator-based frameworks are structured in multiple hierarchal levels to reflect the key sustainability criteria addressed in assessments, and they vary in their assessment core purpose: reporting, monitoring, performance assessment, and inter-linkage (R. K. Singh et al. 2009):

1. Reporting: the Global Reporting Initiative GRI started in 1997 with the goal to improve sustainability reporting of organizations (GRI 2003).
2. Monitoring: The UN Commission on Sustainable Development Sustainability Indicator Framework for monitoring various indicators of government performance against sustainability (UNCSD 2001).
3. Performance Assessment:

- a. The Institution of Chemical Engineers Sustainability Indicators formulated indicators to assess the sustainability performance of a process industry (ICHEME 2002).
  - b. The Dow Jones Sustainability Index (DJSI) family – World, North America, AsiaPacific, Europe, Korea and Emerging Market (DJSI 1999). DJSI tracks the stock performance of the world's leading companies in terms of economic, environmental and social criteria.
4. Sector and Inter-linkage: The Wuppertal Sustainable Development Indicator Framework from the Wuppertal Institute (NRW 1998).

Figures 12-16 depict the structure of some of the above four examples of indicator-based frameworks.

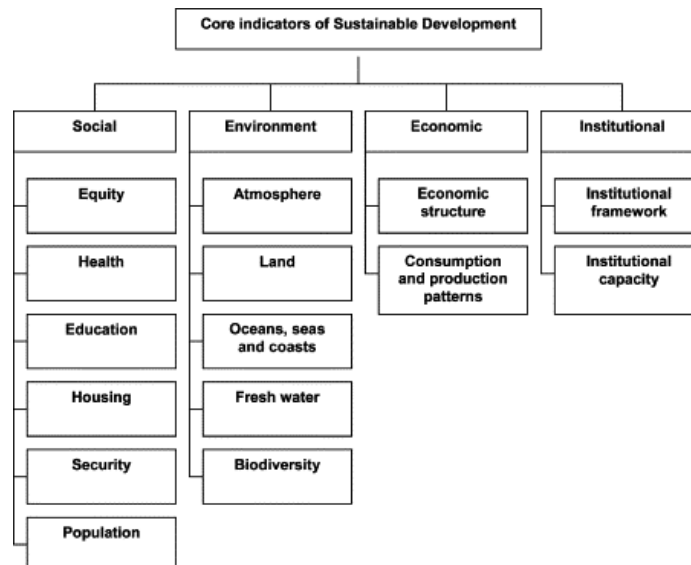


Figure 12 The UN Sustainable Development Indicator Framework, (R. K. Singh et al. 2009)

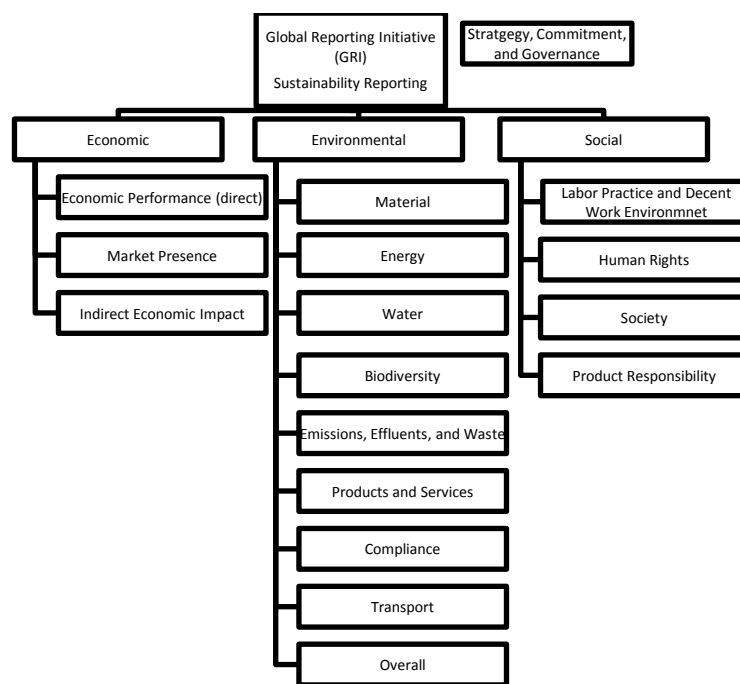


Figure 13 The Structure of the Global Reporting Initiative (GRI) Sustainability Reporting, Adapted from (GRI 2011)

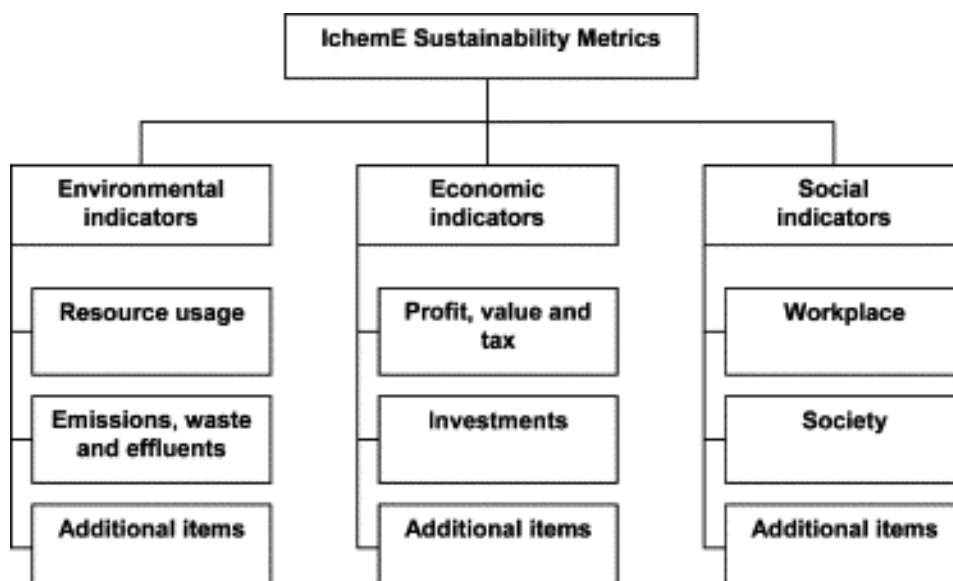
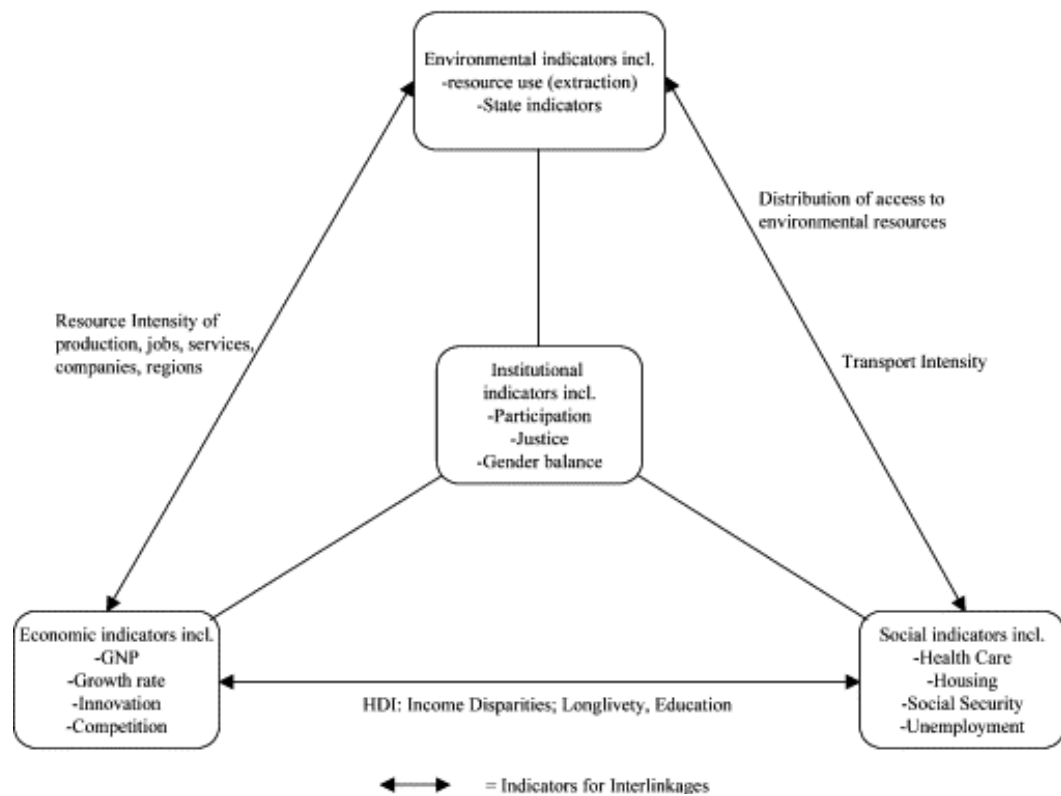


Figure 14 IchemE Sustainability Metrics, (R. K. Singh et al. 2009)



**Figure 15 Wuppertal Institute Sustainable development Indicator Framework, (R. K. Singh et al. 2009)**

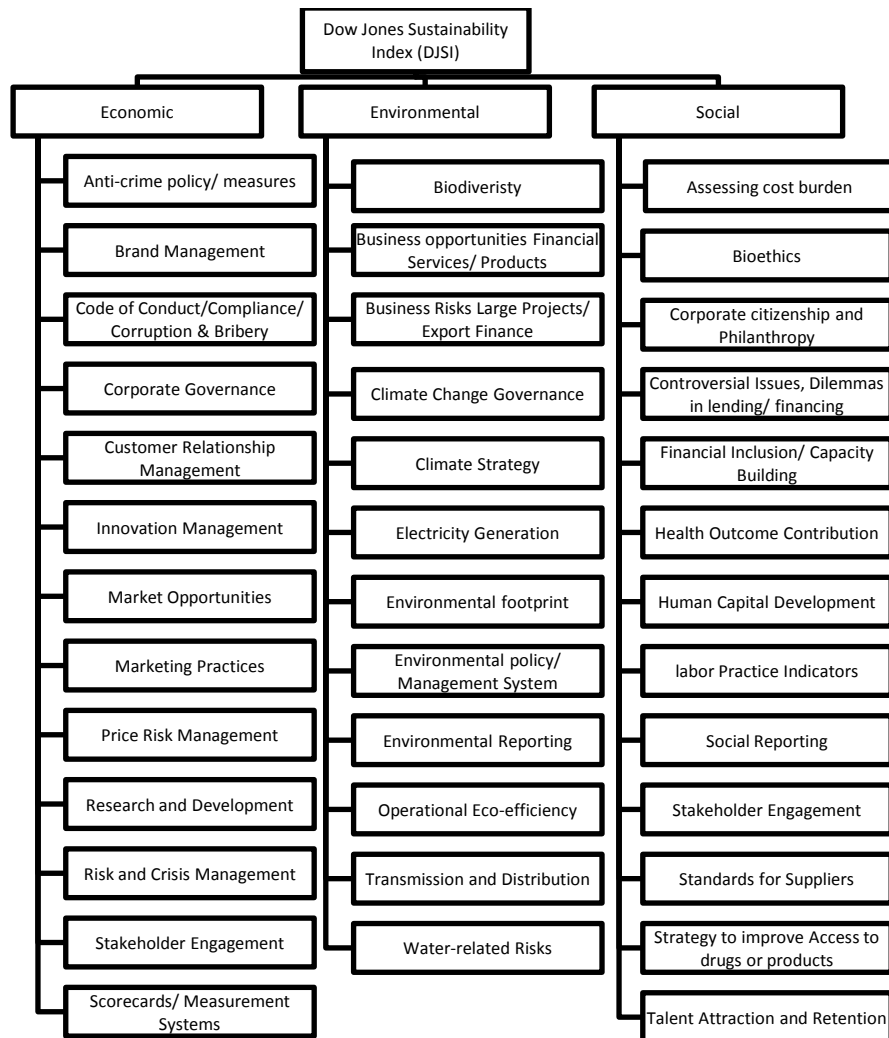


Figure 16 Dow Jones Sustainability World Index, (DJSI 2012)

#### 2.4.6 Eco-Labels

Eco-labels, certifications, ratings, and rankings are popular methods in publicizing sustainability related achievements and performance. In 1978, the first eco-label, Blue Angel, was developed to provide information to consumers wishing to purchase goods manufactured in an environmentally sound manner (EUC 2011). The last decade has witnessed a significant increase in the number and type of sustainability rating systems in

the form of eco-labels, indices, rankings, awards, and standard sustainability reporting systems. Many of the rating systems originated from the environmental sustainability assessment methods, and therefore tend to focus on environmental indicators.

SustainAbility, a sustainability think tank, completed a comprehensive four-phase research effort entitled “rate the rater” (SustainAbility 2010). This research program investigated the trends in rating systems, compared them in terms of methodology, and provided guidance on the construction of a successful sustainability rating system. Their conclusions are summarized in Table 5.

**Table 5 “Rate the Rater” Rating Methodology Recommendations**

<b>Area</b>	<b>Relevant Findings to the IT Sector</b>
Government and Transparency	<ol style="list-style-type: none"> <li>1. Make available the details of your methodology to the public, rated companies and other stakeholders.</li> <li>2. Provide a regular review of your methodology over time.</li> <li>3. Involve an independent advisory board in the review of the rating system.</li> <li>4. Incorporate feedback from stakeholders into the methodology.</li> </ol>
Quality of Inputs	<ol style="list-style-type: none"> <li>5. Incorporate feedback from rated companies into the methodology.</li> <li>6. Provide a means for data validation.</li> </ol>
Research Process	<ol style="list-style-type: none"> <li>7. Develop credential requirements for analysts based on sector specific experience.</li> <li>8. Certify research through a third party.</li> <li>9. Develop sector specific criteria.</li> </ol>
Outputs	<ol style="list-style-type: none"> <li>10. Provide summary results for the industry to stakeholders and companies.</li> </ol>

## **2.5 Accounting for Sustainability in the ICT sector**

In the article “Harnessing Green IT: Principles and Practices”, Murugesan highlighted focus areas and activities in Green IT that are still open to research and scientific investigation. The areas included: energy-efficient design and architecture, responsible e-waste management, regulatory compliance, eco-labeling of ICT products, and sustainability metrics, assessment tools, and methodologies (Murugesan 2008).

Sustainability metrics, indicators, and rating methods play a key role in the decision-support process regarding the sustainability performance of all alternatives available for a decision maker in the design, materials, or disposal of an IT product.

The current approach to account for sustainability and green efforts in ICT is dominated by environmental efficiency metrics of electronic products and infrastructure. A limited number of International, national, and sector-recognized efforts to account for sustainability issues in ICT can be found. Most efforts have been focused on environmental impact associated with the energy consumption and hazardous and toxic material in e-waste. Among the internationally recognized efforts are the European Waste Electrical and Electronic Equipment Directive (WEEE) and the Restriction of Hazardous Substances (RoHS). WEEE is for regulating the production of electronic waste and became law in 2003. RoHS is another European directive that restricts the use of hazardous substances like lead and mercury in electrical and electronic equipment (EUC 2003; BIS 2006). The IEEE standard for the Environmental Assessment of Personal Computers Products (IEEE 1680) is the only IEEE standard related to environmental impact (Omelchuck et al. 2006).

### **2.5.1 EnergyStar and EPEAT**

In the US, attention to energy efficiency issues of electronic products started in 1991 with the EPA's Green Lights program. A year later, the EnergyStar energy-efficiency labeling standard program for lights and electronic equipment began (EnergyStar 1992). The program has evolved and continued to expand its coverage of

electronic equipments. EnergyStar 5.0 today covers monitors, PCs, laptops, small scale servers, gaming consoles, printers, and other computing equipment.

In 2006, the first registry of EPEAT was released by the green electronic council (EPEAT 2006). With support and funding from the EPA, the development of EPEAT started in 2003 by the Zero Waste Alliance. EPEAT takes a life cycle approach to evaluating the environmental performance of electronic products based on compliance with the IEEE 1680 standard (Omelchuck et al. 2006). EPEAT takes a full life cycle approach in assessing electronic products and define three levels of EPEAT labels (See Figure 17). It includes a number of required and optional environmental criteria in the eight areas based on the IEEE 1680.1 PC and monitors standards:

1. Reduction/elimination of environmentally sensitive materials
2. Material selection
3. Design for end of life
4. Product longevity/life extension
5. Energy conservation
6. End-of-life management
7. Corporate performance
8. Packaging

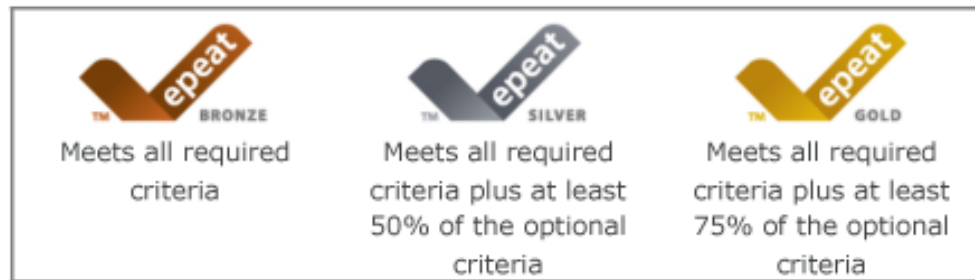


Figure 17 EPEAT Levels: Bronze, Silver and Gold: (EPEAT 2006)

The EPA projected that savings in energy costs could reach \$1.8 billion if all computers sold in the US met EnergyStar standards. Figure 18 delineates the trend since 2007 in total EnergyStar and EPEAT certification of computers. EnergyStar 5.0 and EPEAT are the two most recognized labels for computing equipment officially recognized by the government and standards organizations.

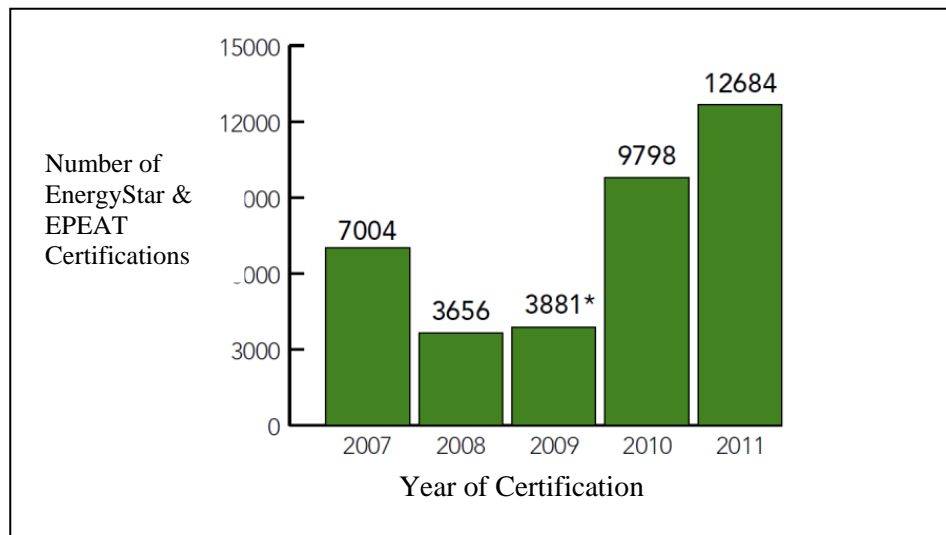


Figure 18: Trends in EnergyStar and EPEAT certification of computers. (Makower 2012)

### **2.5.2 Federal Electronic Stewardship**

A number of federal and state initiatives and programs have been developed to provide guidance on environmental considerations in the design, procurement, use, recycle, and disposition of electronic and IT equipment. The Green IT efforts of the EPA bring environmental awareness and responsibility to the world of IT by promoting the use of its environmentally-friendly programs and providing resources, guidelines, and special programs for federal agencies (EPA 2010). The Federal Electronic Challenge (FEC), EPEAT, EnergyStar, the Federal Energy Management Program (FEMP), Recycling Electronics and Asset Disposition (READ) Services Contract, and the Electronic Stewardship are few examples of Green IT programs developed by EPA. The Federal Energy Management Program (FEMP) promotes energy efficiency and the use of renewable energy resources at federal facilities (FEMP 2012).

One year after the release of EPEAT, the U.S. government issued Executive Order 13423, required that all federal agencies satisfy 95% of their purchase requirements with EPEAT-registered products (EO13423 2007). Executive Order 13514 (2009) included the following goals for federal electronic stewardship (Berard 2012; EO13514 2009):

1. Ensure procurement preference for EPEAT registered electronics
2. Ensure procurement preference for ENERGY STAR qualified and FEMP designated electronics
3. Enable power management, duplex-ing and other environmentally preferable features on electronics
4. Use environmentally sound practices during disposition of electronics

## 5. Implement best management practices for data centers and servers

FEC, and the State Electronic Challenge (SEC) encourage federal facilities and agencies to purchase greener electronic and reduce their impact during use and disposition (EPA and OFEE 2012; SEC 2012). FEC is a voluntarily partnership program, where interested federal agencies submit a baseline survey and annual report. The program awards high achieving agencies on annual basis based on the submitted reports. The FEC program helps federal agencies and facilities meet their federal electronic stewardship requirements by assisting them to: purchase greener electronic, reduce impact of electronics during use, and manage used electronics in an environmentally safe way (EPA and OFEE 2012; Berard 2012).

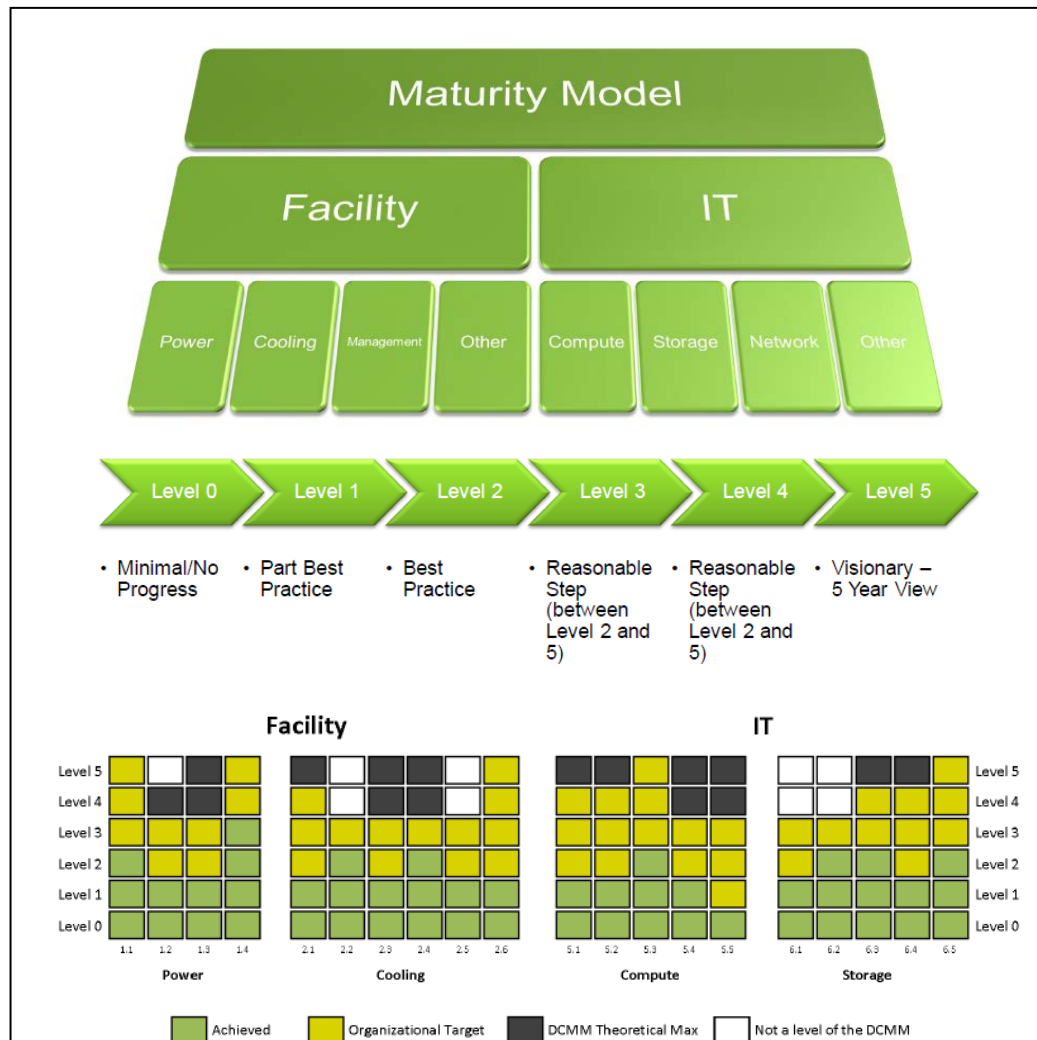
### **2.5.3 Global eSustainability Initiative (GeSI)**

On an international sector level, the assessment methodology for evaluating the carbon-reducing impact of ICT was developed by the Global e-Sustainability Initiative (GeSI 2010). The methodology provides a framework for assessing potential carbon-reducing impacts of ICT initiatives and projects. It can be utilized as a planning tool to assist in selecting approaches with maximum carbon-reduction potential. GeSI was launched in 2001 with the objective to further sustainable development in the ICT sector. Today it is an internationally recognized non-profit organization focused on sustainability through innovative technology and brings together leading IT and Telecomm companies, industry associations, and NGOs. GeSI released a landmark report called smart2020 about the enabling effect of IT in reducing carbon footprint (TCG 2008). Recently, it

released an assessment methodology and tool to assist companies in evaluating the carbon reducing impact of ICT solutions and practices (GeSI 2010).

#### **2.5.4 The Green Grid and the Climate Savers Computing Initiative**

The Green Grid is a non-profit organization for a consortium of industry, academic, government, and professional organizations that is developing standards for assessing the maturity of the efficiency of data center facilities and equipment infrastructure (TGG 2007). It developed the Data Center Maturity Model (DCMM) that allows members to assess the efficiency level of their data center and voluntarily share their information with other members for benchmarking and comparison (TGG 2011). DCMM addresses energy efficiency, Green IT issues, and facility aspects of the data center (Figure 19). The maturity levels are defined to reflect both the current state of the data centers and a five-year roadmap for the future. The maturity levels are visually presented using an equalizer for all aspects addressed in the model. Data centers voluntarily apply the model and can submit their results to the Green Grid database to benchmark against other data centers.



**Figure 19 The Green Grid Data Center Maturity Model, (TGG 2011)**

The Climate Savers Computing Initiative (CSCI) was a commitment initiative from a number of leading IT companies to purchase energy-efficient desktops and servers and to deploy power management strategies and systems (CSCI 2007). A certification for power management efficiency of power distributing units was started by the Climate Savers Computing Initiative (CSCI 2009). The certification is based on EnergyStar and EPA guidelines for power efficiency, and provides a bronze, silver, and gold rating of

power efficiency targets (Table 6). CSCI also provides guidelines for buying PCs and servers by providing a catalogue with energy efficiency ratings. In July of 2012, the CSCI moved its programs and membership under TGG to work jointly on improving resource efficiency in IT and data centers (Baker and Tellu 2012).

**Table 6 Climate Savers Computing Initiative Certification, (CSCI 2009)**  
Non-redundant Capable Power Supply Unit\* (Current criteria)

Loading Condition	Bronze		Silver <i>Target efficiency level starting July 2009</i>		Gold <i>Target efficiency level starting July 2010</i>	
	Efficiency	Power Factor	Efficiency	Power Factor	Efficiency	Power Factor
20%	82%	0.8	85%	0.8	87%	0.8
50%	85%	0.9	88%	0.9	90%	0.9
100%	82%	0.95	85%	0.95	87%	0.95

### 2.5.5 The Uptime Institute

The Uptime Institute was created in 1993 and provided a tiered certification program for data centers. Recently, it introduced a sustainable operations component to its certifications (Uptime Institute 2010). The Uptime Institute Tier Standard: Operational Sustainability is a new tier standard to its data center resilience assessment to address long term operational sustainability (Figure 20).

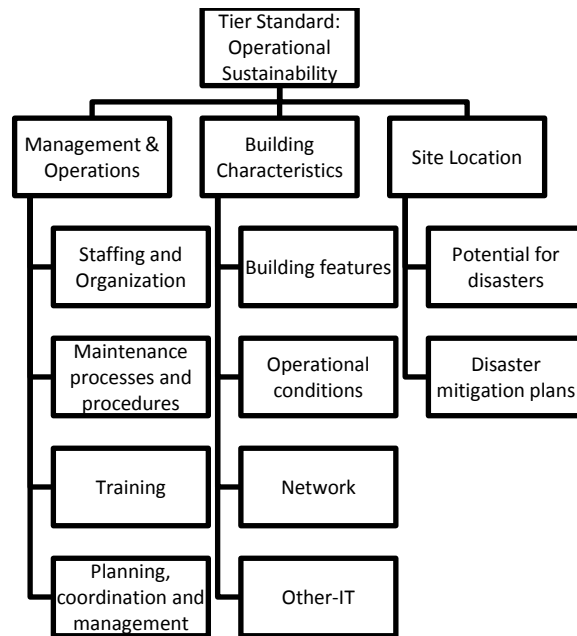


Figure 20 Tier Standard: Operational Sustainability. The Uptime Institute (Uptime Institute 2010)

### 2.5.6 The Green IT Maturity Model

The Forrester Green IT Maturity model was introduced in 2009. Under this model, the Green IT issues are grouped in four major categories: Process and Governance, Data Center, Distributed IT, and Green Enterprise. Under each of the categories, the model provides a set of criteria to assess maturity level based on the following scales: Needs improvement, Improving, Robust and State of art (Washburn and Mines 2009). The model is illustrated in Figure 21.

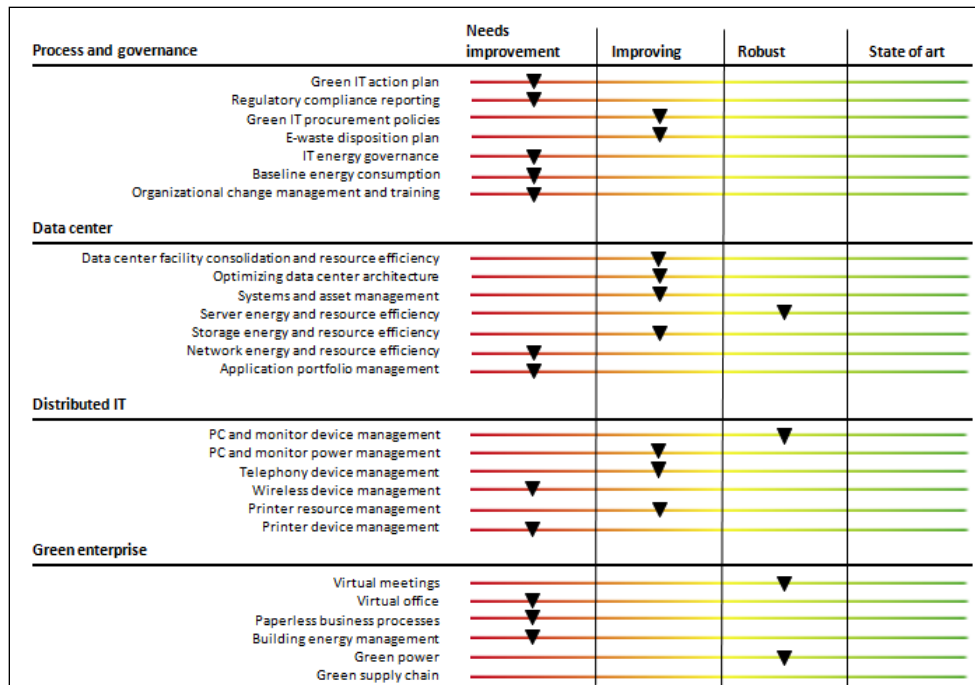


Figure 21 The Green IT Maturity Model, Forrester Research (Washburn and Mines 2009; Mines 2010)

### 2.5.7 Other Initiatives

Some of the sector initiatives took the form of a voluntary code of conduct.

Examples include The Electronics Industry Code of Conduct, and the European Commission Code of Conduct on Data Centers Energy Efficiency (EUC 2008) (EICC 2009). Other non-official consumer guide type ICT product rating systems were initiatives from environmental groups and nongovernmental organizations like the Greenpeace Guide to Greener Electronics (Greenpeace 2010) and the Good Guide for cell phones with lower environmental impact (GoodGuide 2011). The Green IT Review and the Computing and IT section of GreenBiz, are two leading websites and blogs that provide updates on Green IT issues (TheGreenITReview 2008) (GreenBiz 2010).

In addition, there are industry and government award and ranking programs related to ICT. Tomorrow's Value for IT (TVR 2010) is a sustainability and social responsibility rating system that covers various sectors, and has a rating for Information Technology companies. The Greenpeace Cool IT Leader Board (Greenpeace 2011) is published every year and scores ICT companies per the criteria summarized in Figure 22.

<p><b>IT CLIMATE SOLUTIONS</b> represent 40 out of 100 points, divided as follows:</p> <ul style="list-style-type: none"> <li>• <b>Current Savings Calculations</b> (20 points): Company makes public calculations of current net GHG emissions savings provided by IT solution(s) in any of five key areas of the economy - buildings, transport, manufacturing, power and 'dematerialisation' of services - via case study data. In the case of software solutions, company projects reductions from associated behavioural change.</li> <li>• <b>Public Metrics</b> (10 points): Company makes public the metrics and assumptions used to calculate net GHG emissions savings of IT solutions.</li> <li>• <b>Investment</b> (5 points): Company makes significant financial investment in clean technology solutions, including specific investments in existing offerings and R&amp;D for IT climate solutions and/or makes direct investments in external third-party clean energy opportunities.</li> <li>• <b>Future Savings Goal</b> (5 points): Company sets short to mid-term target for future net GHG savings based on current savings calculations, investment and growth.</li> </ul> <p><b>Note:</b> <i>Points listed above represent the maximum number of points for given criteria.</i></p>	<p><b>IT ENERGY IMPACT</b> represents 25 out of 100 points, divided as follows:</p> <ul style="list-style-type: none"> <li>• <b>Absolute Emissions Reduction Target</b> (5 points): Company makes commitment to reduce absolute GHG emissions of its own operations on a defined timeline. Maximum points awarded to companies with absolute reduction goals of at least 20% by 2012 using a 2008 or earlier baseline.</li> <li>• <b>Mitigation Strategies</b> (10 points): Company demonstrates specific GHG mitigation strategy in the following order of importance: energy efficiency and avoided emissions; direct installation of renewable energy; offsets directly secured in electricity load centre, servicing data centre or major company infrastructure; renewable energy credits and/or offsets clearly proven to be additional.</li> <li>• <b>Infrastructure Siting Policy</b> (5 points): Cloud service companies have a cloud infrastructure siting policy that maximises clean energy sources and avoids growth in demand for coal or nuclear-powered electricity.</li> <li>• <b>Product Efficiency &amp; Supply Chain Footprint</b> (5 points): IT equipment companies manufacture high-efficiency products and aggressively manage the carbon footprint of their product supply chains.</li> </ul> <p><b>Notes:</b> (1) No points for target / mitigation are possible without footprint disclosure. (2) Points listed above represent the maximum number of points for given criteria.</p>	<p><b>POLITICAL ADVOCACY</b> represents 35 out of 100 points, divided as follows:</p> <ul style="list-style-type: none"> <li>• <b>Political Speech</b> (10 points): Public speech, preferably by the CEO, made before a relevant national or international audience, which references need for science-based, mandatory GHG reduction cuts.</li> <li>• <b>Political Policy</b> (15 points): Company takes public position in favour of specific and current policy advocacy priorities that support sciencebased, mandatory GHG reduction cuts at the national or international level.</li> <li>• <b>Repetition Bonus</b> (10 points): Measures the repetition of positive speech and advocacy.</li> <li>• <b>Negative Lobby Penalty</b> (-5 to -15, dependent on severity): Companies that directly undertake or are members of trade associations/organisations which engage in negative lobbying, defined as a policy position that undermines or negates a scientifically-achieved emissions reduction target and/or clean energy policies.</li> </ul> <p><b>Notes:</b> (1) Only advocacy conducted within the past 12 months will be applied. (2) Points listed above represent the maximum number of points for given criteria.</p>
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Figure 22 Greenpeace Cool IT Leader Board Criteria(Greenpeace 2011)

## **2.6 Summary**

The literature review revealed a number of significant findings relative to the state of the art in sustainability rating methodologies associated with the ICT industry sector. First and foremost, the ICT sector's contribution to global carbon footprint is considerable. Although a variety of tools exist to measure various environmentally related effects, no industry standard methodology was identified that incorporates the three pillars of sustainability: environmental stewardship, economic viability and social responsibility. This fact, coupled with the sector's growth and significance to global economic development, suggest the need for a sustainability rating approach that can provide guidance to ICT organizations.

The review of literature also revealed that the concept of sustainable computing is still evolving; to date research and industry efforts have been limited to energy efficiency and power management of the data center. A review of successful sector-specific practices showed that indicator-based assessment and performance rating approaches have been widely adopted. Preferred approaches are transparent and allow participants to have visibility in the criteria and methodology. Sustainability rating systems are differentiated from one-dimensional decision methods by the balanced approach to the incorporation of the three dimensions of sustainability.

### **3. RESEARCH METHOD**

The primary objective of my research was to develop a sustainability rating model that can assess the environmental, social and economic sustainability of ICT organizations. A multi-attribute approach to the development of a sustainability rating is appropriate because of the multi-dimensional nature of sustainability. The model integrates individual sustainability criteria into a sustainability rating that mimics the views of ICT sustainability experts. Ratings are based on a simple sum of weighted and normalized criteria and criteria weights. My research hypothesis is that the ratings produced by a linear weighted criteria model can be used by ICT sustainability experts. The methodology applied to the development and validation of the rating model is presented in the following sections.

The literature review of sustainability assessment frameworks revealed the following common characteristics:

1. Integrated consideration of all three (environmental, social and economic) dimensions of sustainability,
2. Contributions of each dimension to overall sustainability are considered equally important, and

3. Identification of the “best” option with the greatest overall sustainability benefit and minimal undesirable trade-off between the dimensions (Gibson 2006a).

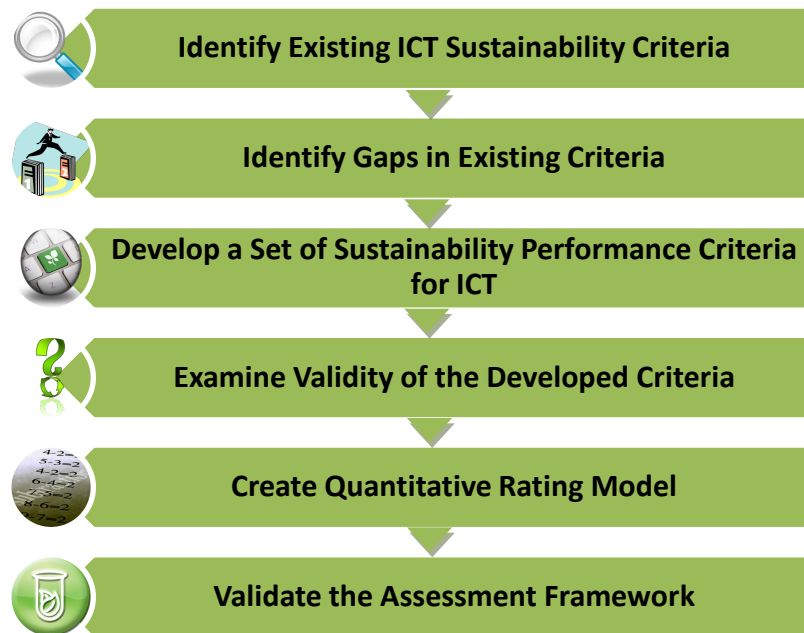
The sustainability rating method for ICT organizations must incorporate clear and transparent definitions of environmental, social and economic sustainability performance. The assessment model must integrate the individual criteria into an interpretation of overall sustainability. This approach permits the comparison of alternatives, prioritization of resources, and evaluation of undesirable trade-offs that leads to informed decision-making.

The literature review disclosed that sustainability indicators and composite indices of multiple criteria are the most commonly used metrics for assessing sustainability performance. Results are commonly displayed in the form of a score or rating. The techniques are widely used in eco-labeling and sustainability ranking of products, companies, cities, and countries. This technique is used by the US Green Building Council (USGBC) in its LEED rating program for buildings. Ratings serve to "simplify, quantify, analyze and communicate otherwise complex and complicated information" (R. K. Singh et al. 2009). This research seeks to apply similar techniques in the development of a framework for the sustainability assessment and rating of ICT practices.

To accomplish this, the following high-level research tasks were undertaken (highlighted in Figure 23):

1. Identify sustainability criteria commonly used by the ICT sector.

2. Evaluate the suitability of the existing criteria for use in the framework and identify any gaps.
3. Develop a set of sustainability performance criteria for ICT organizations that represent best practice criteria and new criteria needed to close any existing gaps in sustainable performance.
4. Examine the validity of the criteria and relative significance to organizational sustainability.
5. Create a quantitative rating model by weighting and aggregating criteria.  
Assign sustainability ratings to levels of the model outputs and develop qualitative descriptions for each rating level.
6. Validate the model results and ratings.



**Figure 23 Research Methodology Steps**

### **3.1 Identification of Sustainability Criteria in the ICT Sector**

Preliminary sustainability priorities were established for the ICT sector through the comprehensive literature review. This set of criteria was derived from existing sector specific sustainability evaluation initiatives that had the following characteristics:

1. Mature implementations
2. Credible source

To be considered a mature implementation, the initiative must have been applied to multiple organizations. Similarly, feedback had been collected and analyzed. Thus, the criteria had been vetted by multiple ICT organizations. Although sustainability in ICT organizations is often discussed, only evaluation initiatives from Government entities, recognized professional associations and institutes, and published market research were considered in this step.

### **3.2 Evaluation of Sustainability Criteria in the ICT Sector**

The second step entailed the evaluation of the preliminary set of criteria. To perform this evaluation, the ICT criteria were compared with well-developed sustainability rating criteria from other sectors. The criteria were compared with rating methodologies that incorporated all three principles of sustainability:

1. Environmental preservation
2. Economic viability
3. Social contribution

Gaps between the existing ICT sustainability criteria and other established frameworks for differing sectors were determined. It should be noted that the established frameworks that were included in this analysis represented methods that embodied the

guidelines of the Brundtland Report. This report is widely accepted as the definitive reference for sustainable development.

### **3.3 Development of a Preliminary Set of Sustainability Criteria for the ICT Sector**

The third step in the process involved the development of the preliminary set of comprehensive criteria to reflect organization usability, industry best practice and guiding sustainability principles. To accomplish this step, the existing ICT criteria were merged with newly established criteria to fill the existing gaps identified by the previous step. The newly established criteria were based on well-established sustainability criteria that had been applied to other sectors. In some cases, modifications were required to represent the unique context of the ICT sector. No filter was applied at this stage. Duplicates were eliminated to insure that the criteria assessed a unique aspect of sustainability. Every attempt was made to avoid double counting. This is a recognized best practice in the development of composite indices and multi-attribute decision theory.

### **3.4 Examining the Validity of the Preliminary Set of Sustainability Criteria for the ICT Sector**

Two approaches were used to test the validity of the sustainability criteria. The usability was tested with the assistance of a North American Telecommunications Company (referred to as NATC). NATC performed a self-assessment using the preliminary set of criteria. At this stage, the primary criteria (environmental, social and economic) were equally weighted to reflect the Brundtland core views. Sub-criteria within the primary criteria were weighted to reflect the priorities of the ICT sector as reflected by the literature review. These weights were selected as a starting point for

discussion and evaluation. To avoid bias, the assessment of the NATC was performed by two graduate assistants at George Mason University. The assessment process was evaluated for ease of use, clarity, availability of data, availability of standards, measurability and importance. The results were incorporated into the rating model.

The second approach used to test the validity of the criteria was an expert survey. The experts consisted of ICT sustainability experts, non-ICT sector sustainability experts and ICT leaders. The experts were surveyed for their views and opinions about the following aspects of the assessment criteria:

- *Relevance*: to assess the degree of need of the criteria in measuring sustainability performance of ICT organization's practices
- *Practicality* (measurability): to determine whether the criteria can be measured by quantitative or qualitative indicators and metrics
- *Reliability* (availability of data): to determine whether the measurement data is available and accessible
- *Significance* (importance): to assess the sustainability achievements of an ICT organization.

The experts' views from the survey were analyzed to determine which criteria should be kept and the level of significance of each criterion's contribution to the overall sustainability assessment.

### **3.5 Development of the Rating Model for the ICT Sector**

To develop the rating model, I reviewed the MAUT literature and combined the findings with the results of my NATC implementation and expert survey. As a starting

point, I elected to weight the sustainability components equally. My decision was influenced by the core principles of sustainability and the need to balance the importance placed on each of its pillars. "The lack of evidence that suggests weighting should not be equal rather than anything else" further supported my decision (Morse, Vogiatzakis, and Griffiths 2011, 43). Ultimately, the objective of my research is to determine the "best" set of weights and criteria that match the experts' viewpoints. To accomplish this objective, I selected the participatory method from which to derive weights for the sub-criteria in absence of a statistical basis.

### **3.6 Validation of the Rating Model for the ICT Sector**

To validate the developed rating model, organizational profiles of various characteristics and sustainability achievement levels were developed and the rating model was applied to each of the profiled organizations. The ratings resulted from the model were validated by a focus group of experts. The experts were surveyed and the results analyzed to determine their individual viewpoint on the relative importance of sustainability criteria and their professional judgment of the rating of the ICT organizations profiled here. The experts were asked to review the sustainability achievements of each organization, rate the performance in each individual sustainability category in the profiles, and give an overall sustainability rating for each organization. The experts completed an independent review and analysis of the profiles and suggested their own rating of each organization based on the achievement profiles.

The validation of the developed model was based on analyzing the difference between the model's ratings and the experts' overall rating of each organization. If the

results demonstrate a non-significant difference between the two ratings and a level of consistency and agreement within the experts' views, the model is considered valid. The following validation steps and statistical analysis methods were applied:

1. Ratings comparison: The ratings resulted from the model and those resulted from the experts views were considered two data sets that are mutually independent (results of different and independent methods). Therefore, a nonparametric matched pair's test method was needed to compare the two data sets. The "Wilcoxon Signed Rank Sum Test" was selected for this test.
2. Method comparison and evaluation: To compare the two measurement techniques (the rating model and the experts' ratings). Bland-Altman plot or difference plot was selected to compare the two measurement techniques.
3. Consistency and agreement level in experts' ratings: To examine the consistency and agreement levels amongst the experts in rating the various categories. The Intra-class Correlation Coefficient (ICC) was used for this purpose.

The "Wilcoxon Signed Rank Sum Test" was selected for the first validation step. It is the nonparametric equivalent to the two-sample t-test. It compares two paired groups that are mutually independent, and is recommended for data sets with less than 25 pairs. The test calculates the difference between each set of pairs and tests the null hypothesis that "the two distributions are identical" against the alternative hypothesis that "the two distributions differ". The significance (P-value) level of the test is 0.05. A  $p\text{-value} < 0.05$  indicates significant difference and results in rejecting the null hypothesis. The paired

samples in this first validation test were the model rating values and the median experts' rating for each of the organization profiles. The null hypothesis was that "there is no significant difference between the model ratings and the experts' ratings".

Bland-Altman plot or difference plot was selected for the second step - method comparison. It is a graphical method to compare two measurement techniques, where the differences, or ratios, between two techniques are plotted against the averages of the two techniques. Horizontal lines are drawn at the mean difference and at the limits of agreement, which are defined as the mean difference plus and minus 1.96 times the standard deviation of the differences. The plot is useful to reveal a relationship between the differences and the averages, to look for any systematic biases, and to identify possible outliers. When the differences between methods are within the mean  $\pm$  1.96 SD, the two methods may be used interchangeably.

The Intra-class Correlation Coefficient (ICC) was used for the third step. The ICC is a measure of the reliability of measurements or ratings when two, or preferably more, raters rate a number of study subjects. When each subject is rated by the same raters, the ICC is a measure of the consistency when systematic differences between raters are irrelevant, and the absolute agreement when systematic differences are relevant. One of the advantages ICC has over correlation coefficient is that it is adjusted for the effects of the scale of measurements and it will represent agreements from more than two raters. ICC provides a scalar measure of agreement or concordance between all ratings. The value 1 represents perfect agreement and 0 as no agreement at all. ICC can be interpreted as follows: 0-0.2 indicates poor agreement; 0.3-0.4 indicates fair agreement; 0.5-0.6

indicates moderate agreement; 0.7-0.8 indicates strong agreement; and  $>0.8$  indicates almost perfect agreement. The aim of this validation step was to achieve an ICC value above 0.7 to indicate strong to perfect agreement among the raters.

To test the original assumption of equal component weights, I calculated the implied weights of the experts by minimizing the sum of the differences between the model ratings and the experts' ratings. The results of the model with the newly determined weights were analyzed.

### **3.7 Research Assumptions and Limitations**

I proposed a conceptual design of a sustainable ICT assessment framework and established a preliminary set of sustainability criteria with ICT context. However, developing detailed governance and rating management model was beyond the scope of the research. The identification of proper indicators, measures, target values, and baselines of such measures of sustainability criteria requires engagement of communities of experts in various areas; therefore, the development of indicator measures was beyond the scope of the research. Sample indicators to measure the impacts of the criteria were proposed in the rater guidelines for demonstration purposes.

The nature of the problem addressed in my research required an approach that depended significantly on ICT and sustainability experts' knowledge and views. It should not be inferred that the results will emulate any panel of experts. However, it constitutes an important first step in the development of a sustainability rating system for the ICT sector.

### **3.8 Confidentiality and Ethical Considerations**

The research process involved voluntary participation of ICT and sustainability experts in defining the rating criteria and in validating the framework and rating system. Although it was anticipated that there are no foreseeable risks in participating in the research, I followed GMU's protocol defined by the Office of Research Subjects Protection. In addition to ensuring the participants knew of their informed consent, participants' interests and confidentiality of data were considered of primary importance when choices were made regarding reporting and dissemination of data.

## **4. RESEARCH RESULTS**

Composite indices of multiple criteria are the most widely adopted means for assessing sustainability performance in various industry sectors. This chapter describes the research results obtained from the implementation of a similar technique to the development of a framework for the assessment and rating of sustainable ICT practices.

### **4.1 Identification of Sustainability Criteria in the ICT Sector**

The objective of this step was to identify the sustainability criteria that reflect the current practices in the ICT sector. The identified criteria met the following constraints: (1) they were developed by a credible source and (2) the criteria were considered mature as measured by multiple implementations. Criteria included in the evaluation were developed by a government entity, recognized professional association, institute, or market research entity. Only frameworks with 100 or more implementations or data points were considered. The following sustainable ICT initiatives met the constraints:

1. The Federal Electronic Challenge by the EPA
2. The Data Center Maturity Model by the Green Grid
3. The Data Center Site Infrastructure Tier Standard: Operational Sustainability  
by the Uptime Institute
4. The Green IT Maturity Model by the Forrester Research Group

Table 7 provides an overview of the focus areas of ICT practice for each of the above sustainable ICT evaluation initiatives and frameworks. It also summarizes the credibility and maturity factors considered for inclusion.

**Table 7 Current Initiatives and Frameworks for Sustainability Assessment of ICT Practices – Scope, Credibility and Maturity factors**

Sustainable ICT Evaluation Initiative	Overview and area of ICT practice	Credibility	Maturity
<b>The Federal Electronic Challenge (FEC)</b>	<b>Voluntary Partnership program</b> to assist federal agencies and facilities meet federal electronic stewardship goals. Focused on the following three areas: <b>Purchasing</b> greener electronics Reducing impact of electronics during <b>use</b> <b>Managing used electronics</b> in an environmentally safe way Utilize best management practices of <b>data centers</b>	<b>Federal Government – EPA</b>	Has more than <b>125 facility partners</b> representing over <b>495000 employees</b> from <b>19 federal agencies</b> .
<b>The Data Center Maturity Model (DCMM)</b>	<b>Voluntary assessment and benchmarking model</b> to assess resource efficiency of the <b>data center and computing</b> . It integrates the following aspects of data centers (Facility and IT): -Power -Cooling -Management -Compute -Storage -And Network  The scope for resource efficiency includes: Energy Efficiency: demand, supply, utilization/effectiveness Sustainability: carbon, water, waste heat, materials management ( eWaste, cradle to cradle), and building sustainability Monitoring and metrics  Levels of maturity are from 0-5 where level 2 represents current best practices, and levels 3-5 drive data center design innovation.	<b>The Green Grid: Non-profit, open industry consortium</b> of end-users, policy-makers, technology providers, facility architects, and utility companies collaborating to improve the resource efficiency of data centers and business computing ecosystems.	More than <b>175 member companies</b> around the world since its start in 2007. The Climate Savers Computing Initiative joined TGG in July 2012 indicating a wide global industry endorsement of TGG and the DCMM.  Its principles: To provide <b>vendor-neutral</b> guidance for best practices Provide feedback to governmental programs based <b>consensus of members</b>  Evolved over five years, started with energy efficiency and extended to water and material management. Now looking into including financial metrics (ROI).  Created the power usage effectiveness (PUE) metric, and within five years driven the industry PUE from over 2.0 to ~ 1.5 (enterprise) and < 1.2 (web).

Sustainable ICT Evaluation Initiative	Overview and area of ICT practice	Credibility	Maturity
<b>Data Center Site Infrastructure Tier Standard: Operational Sustainability</b>	The Tier Standard is a <b>standardized methodology</b> used to determine availability in a data center facility. Operational Sustainability Certification covers data center facility management. The other two tiers include design document (topology) and the constructed facility of the data center. Operational Sustainability covers the following major areas of data center: Management and Operations Building Characteristics Site Location	<b>The Uptime Institute LLC</b> is a consortium of <b>private</b> companies founded in 1993 that provide services to enterprise data centers and data centers professionals. It has a widely adopted tier certifications of data centers, which is considered a standard method for improving reliability and high availability of the data center.	The data center tier certification evolved from concept paper to a standard guiding design and investment for data centers globally. The tier certification covered Design Documents and Constructed Facility. In 2010 Operational Sustainability Certification was added. Uptime Institute has awarded <b>187 certifications</b> in <b>33 countries</b> around the world
<b>The Green IT Maturity Model</b>	<b>General framework</b> for assessing the maturity of Green IT initiatives in an enterprise in the following major areas: <b>Process and Governance</b> <b>Data Center</b> <b>Distributed IT</b> <b>Green Enterprise</b>  Four levels of maturity: Needs improvement, Improving, Robust, and State of art	<b>Forrester</b> is a <b>global research and advisory</b> firm that serves three segments of clients: IT Professionals, Technology Industry, and Marketing and Strategy	The framework was developed based on Forrester's Global Green IT online survey – more than <b>600 global enterprises and SMEs</b> .

#### 4.1.1 The Federal Electronic Challenge (FEC)

The FEC program provides clear targets (summarized in Table 8) for the federal facility or participating agency in the following three areas:

1. Acquisition and Procurement
2. Operation and Maintenance
3. End-of-Life Management

The facilities and agencies complete a baseline survey, and then report annually their achievements towards the above targets. FEC provides resources, training and guidelines to the partners on how to assess and measure progress towards the FEC's targets. On an annual basis, high achieving partners under FEC receive national

recognition by EPA. A sample of the measures and metrics collected in the baseline survey and the annual report to assess the achievement level towards the FEC targets is provided in Appendix A. This information was used to derive the criteria shown in Table 8.

**Table 8 Federal Electronic Challenge Criteria – ICT Sustainability Criteria**

ICT Sustainability Categories	Criteria	Description
<b>IT Office Equipment and Supplies Management</b>	eWaste Management	Policy for Reuse or donation Policy for proper recycling of No-reusable electronics Recycled using third-party certified recyclers
	PC and monitor devices and accessories	EPEAT-registered electronics
	Power usage of PC, monitors & equipment	ENERGY STAR® power management features enabled Duplexing features set to default
	Printing	ENERGY STAR® power management features enabled Duplexing features set to default

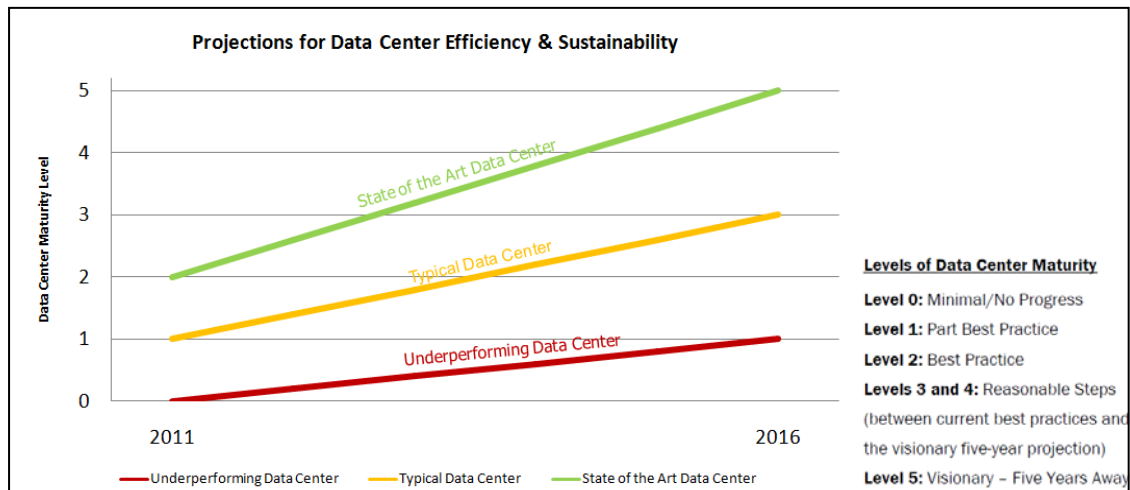
#### **4.1.2 The Data Center Maturity Model (DCMM)**

The DCMM was the result of the effort of “The Green Grid” industry consortium to address the efficiency challenge of power utilization in the data center. It is not a rating or certification system, but was developed as a model to guide and help the ICT industry conserve electrical power.

The model defines six maturity levels (0-5). Levels 0 to 2 characterize achievements that range from a “typical” data center where no efficiency improvement measures are taken (level 0) to an “average” data center where some improvements exist (level 1) to one that employs “current” best practices (level 2). Levels 3 through 5 are role models of sustainability. Level 5 represents the sustainability vision of the industry; levels 3 through 4 represent progress toward the vision. Figure 24 provides an

illustration of the different maturity levels and the projected timetable for achievement.

Selected maturity levels details for the DCMM are provided in Appendix B.



**Figure 24 Illustrated Timetable for Achieving Maturity Levels in the DCMM (H. Singh 2011)**

The Green Grid developed standard metrics to measure resource efficiency such as power and water. The DCMM incorporates established metrics from the National Electrical Manufacturers Association (NEMA) and the American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE). Additionally, DCMM includes a number of sustainability metrics developed by the Green Grid to assess resource efficiencies associated with energy, material and water (H. Singh 2011). A description of the criteria selected from the DCMM is detailed in Table 9. Specific details regarding the criteria are provided in Appendix B.

**Table 9 Data Center Maturity Model Sustainability Criteria**

ICT Sustainability Category	Criteria	Description
<b>Data Center and Computing</b>	Data center facility	Critical Power Path Efficiency – Building Entrance to IT load Architecture Operations Generation Power Usage Effectiveness (PUE) – Cooling Contribution Rack Cooling Index (RCI) high & RCI low Mechanical/ Refrigerant Cooling Reduction Environmental – monitoring and control Operations Monitoring PUE Waste heat reuse Carbon Usage Effectiveness (CUE) Water Usage Effectiveness (WUE) xUE/ additional metrics Operational Resilience Resilience vs. Need Lighting Building/ Shell M&E Waste Procurement
	Design and Architecture	Classifying data/ tiering Virtualization and consolidation -Line up equipment to have air movement from front to back -Hot/Cold aisle configuration -Remove gaps/holes in the floors and racks to reduce leakage between hot/cold aisles -Blanking panels to fill the gaps in the cabinets -Proactively remove redundant cabling -Intentional air flow segregation
	Servers	Utilization Workload Management Operations Power Management Server population
	Storage	Workload Architecture Operations Technology Provisioning
	Network	Utilization Workload Operations Technology Best performance Provisioning
	Power distribution	Internal Power Supply Efficiency
<b>IT Office Equipment and Supplies Management</b>	eWaste Management	Reuse policy for assets across the organization
<b>General Facilities</b>	Energy	Internal Power Supply Efficiency
	Waste	Reuse Policy for components across the organization
	Water	WUE measured, plan and actions in place for improvements
<b>Environmental Management and Reporting Systems</b>	Carbon Management	CUE measured, plan and actions in place for improvements

#### 4.1.3 Data Center Site Infrastructure Tier Standard: Operational Sustainability

The Uptime Institute issues three levels of ratings for operational sustainability:

Gold, Silver and Bronze. The certification is based on operation and management behaviors in the following three areas:

1. Management and Operations
2. Building Characteristics
3. Site Location

Table 10 summarizes the Uptime criteria selected for consideration in this framework. A copy of the detailed Uptime criteria is provided in Appendix C.

**Table 10 Data Center Uptime Tier Standard: Operational Sustainability – ICT Sustainability Criteria**

ICT Sustainability Categories	Criteria	Description
Data Center and Computing	Data center facility	Building Features Infrastructure Operating Conditions Pre-Operational Staffing and organization Maintenance Training Planning, Coordination and Management Site Location

#### 4.1.4 Green IT Maturity Model

Forrester Research group developed the Green IT Maturity Model to assist organizations in planning their Green IT efforts. The model assesses the maturity of IT practice as: *Needs Improvement*, *Improving*, *Robust* and *State of Art*. Table 11 summarizes applicable criteria.

**Table 11 Green IT Maturity Model – ICT Sustainability Criteria**

ICT Sustainability Categories	Criteria	Description
<b>Data Center and Computing</b>	Systems and asset management	Resilience of the data center and the reliability of its systems Redundancy, monitoring, and recovery procedures
	Applications portfolio management	IT Applications and Services Catalogue Utilization
<b>IT Office Equipment and Supplies Management</b>	PC and monitor devices and accessories	Energy efficient devices Client desktop virtualization Frequency of replacements
	Power usage of PC, monitors & equipment	EnergyStar power saving configuration Power saving modes and power management policies
	Printing	Power saving configuration Automatic duplex printing settings Paperless processes EnergyStar Printers
	Telephony and wireless power consumption	Voice Over IP systems Use of Software Phone clients
	Telephony and wireless electronic waste	Frequency of replacements eWaste management EnergyStar
	eWaste Management	Policy in place for proper eWaste management and reuse of electronics
<b>General Facilities</b>	Energy	IT Energy Governance Baseline Energy Consumption Green Power Building Energy Management
	Waste	Policy for reuse and waste disposing
<b>Environmental Management and Reporting Systems</b>	Environmental reporting	Regulatory Compliance Reporting
<b>Sustainability Governance</b>	Vision	Green IT Strategy
	Commitment	Green IT Action Plan
	Compliance	Regulatory Compliance
	Reporting	Regulatory Compliance Reporting
<b>Green Enterprise IT</b>	Virtual meetings & virtual offices	Carbon reduction
<b>Value Chain</b>	Supply chain management	Green Supply chain

#### 4.1.5 Summary of ICT Sustainability Criteria

A comparison of the four initiatives revealed the commonalities shown in Table

12. The four initiatives yielded sustainability criteria relative to the ICT industry as summarized in Table 13. Categories were determined by combining like criteria.

**Table 12 Findings from a Comparison of the ICT Sustainability Initiatives**

Area	Finding
<b>Data Center</b>	DCMM, Uptime and the Green IT Maturity model place considerable emphasis on sustainable practices in the data center.
<b>Voluntary participation</b>	All of the initiatives are voluntary. The goal of each is to raise awareness within the ICT sector. Environmental stewardship and resource conservation are common themes.
<b>Iterative development</b>	Although mature, all the initiatives are evolving. This is a commonly observed characteristic in sustainability assessment frameworks.
<b>Measures and Metrics</b>	Except for the Green IT Maturity Model, the initiatives provided detailed guidelines and descriptions of the criteria and their contribution to the assessment. They also provide measures, metrics, and targets for achieving various defined levels of sustainability.
<b>Innovation</b>	Each of the initiatives recognizes new contributions to the field of sustainable ICT

**Table 13 Existing ICT Sustainability Criteria**

ICT Sustainability Categories	Sustainable ICT Evaluation Initiative			
	DCMM	FEC	UpTime	Green IT Maturity Model
<b>Data Center and Computing</b>	Data center facility Design and architecture Servers Storage Network Power distribution		Data center facility	Systems and asset management Applications portfolio management
<b>IT Office Equipment and Supplies Management</b>	eWaste Management	eWaste Management PC and monitor devices and accessories Power usage of PC, monitors & equipment Printing		PC and monitor devices and accessories Power usage of PC, monitors & equipment Printing Telephony and wireless power consumption Telephony and wireless electronic waste Printing eWaste Management
<b>General Facilities</b>	Energy Waste Water			Energy Waste
<b>Environmental Management and Reporting Systems</b>	Carbon Management			Environmental reporting
<b>Sustainability Governance</b>				Vision Commitment Compliance Reporting
<b>Green Enterprise IT</b>				Virtual meetings & virtual offices
<b>Value Chain</b>				Supply chain management

## 4.2 Evaluation of Sustainability Criteria in the ICT sector

The purpose of this step was to determine the gaps in the existing ICT

sustainability criteria by comparing them with established criteria used by other sectors.

The selected frameworks embodied the vision of the Brundtland report by incorporating

all three pillars of sustainability: environmental protection, economic viability and social responsibility. The Global Reporting Initiative (GRI), Institution of Chemical Engineering (IChemE) Sustainability Framework, and the Dow Jones Sustainability Index (DJSI). These frameworks were selected on the basis of global recognition, incorporation of three pillars, transparency, and clarity. A summary of the criteria for each of these frameworks is included as Appendix D.

Gaps were identified by comparing the ICT sustainability criteria (Table 13) with the criteria of these three frameworks. A great deal of overlap was identified in the criteria; this indicated a high degree of concurrency in the important factors contributing to a sustainable practice. It is important to note that sector-specific criteria not applicable to ICT were excluded (e.g. DJSI's "Strategy to improve access to drugs or products", a social criterion specific to pharmaceutical enterprises). Table 14 reveals the findings of the gap analysis. Criteria determined from the review of the three frameworks are grouped by sustainability pillar. The rose-colored columns signify the gaps between existing ICT criteria and the commonly used criteria in other sectors.

There is a significant gap in the current ICT sustainability criteria in addressing the social responsibilities related to labor practices, human rights, community engagement and society at large. Except for the "Organizational Change Management and Training" criteria under "Process and Governance" of the Green IT Maturity Model, and the Staff presence and Training in the Uptime tier, none of the identified criteria addressed the people's dimension of sustainability.

The Uptime tier, DCMM and the Green IT Maturity Model assist the ICT practitioners in prioritizing resources and investment to green data centers. Unfortunately, none of the criteria address fiscal responsibility or financial stability of the enterprise. To date, the principle focus of the ICT sector has been on minimizing the carbon footprint. Some gaps in environmental criteria include: material use, environmental risk management and environmental reporting.

**Table 14 Evaluating ICT Criteria against GRI, DJSI and IchemE Criteria**

Sustainable ICT Evaluation Initiative		ICT Sustainability Category		Sustainability Criteria from Industry Sector Frameworks (GRI, DJSI and IchemE)																							
				Social								Environmental								Economic							
				Labor Practice	Workplace	Customers and Suppliers,	Local Community	Society	Sustainability Strategy	Governance	Commitment	Stakeholders Engagement	Resource Efficiency	Emissions, Effluents & Waste	Products and Services footprint	Operational Eco-efficiency	Environmental Management System	Compliance and Environmental Reporting	Transport and Distribution	Environmental Risk Management	Electricity Generation	Profit, Value and Tax	Code of Conduct/Corporate Governance/Compliance/ Anti Corruption	Risk and Crisis Management	Marketing Practices and Brand	Financial Management	Investment
D U G	Data Center and Computing									C	C	C	C				P										
D F G	IT Office Equipment and Supplies Management			P						C	C	C	C				P										
D G	General Facilities									P	P		P														
D G	Environmental Management and Reporting Systems										P				P												
G	Sustainability Governance						P	P	P						P												
G	Green Enterprise IT										P		P					P									
G	Value Chain			P																							
Table Key:																											
D: Data Center Maturity Model																											
U: Uptime Data Center Site Infrastructure Tier Standard: Operational Sustainability																											
G: Green IT Maturity Model																											
F: Federal Electronic Challenge																											
P: Partially satisfies the requirements of the indicated criteria																											
C: Completely satisfies the requirements of the indicated criteria																											

The gap analysis confirmed the findings of the literature review that a comprehensive approach to sustainability assessment for the ICT sector does not exist. The existing criteria are environmentally focused and limited to data center practices and electronic products. To close the gap and provide a meaningful ICT sustainability assessment framework, a comprehensive set of social, economic and environmental criteria is needed.

### **4.3 Development of a Preliminary Set of Sustainability Criteria for the ICT sector**

A new set of criteria that reflect the best practices and guiding sustainability principles was developed. Criteria obtained from a wide range of existing sustainability rating systems formed the basis for the preliminary set. In this phase of my research, sustainability frameworks that address at least one of the pillars were selected. The criteria search was centered on the gaps identified in Table 14. Specifically the following needs were addressed:

<b>Social</b>	<b>Economic</b>
Labor Practice	Profit, Value and Tax
Workplace	Code of Conduct/Corporate
Local Community	Governance/Compliance/ Anti Corruption
Society	Risk and Crisis Management
Stakeholders Engagement	Marketing Practices and Brand Management
	Financial Management
<b>Environmental</b>	Investment
Environmental Management	Innovation Management
System	Research and Development
Transport and Distribution	

#### **4.3.1 Defining Boundaries and Scope of Criteria**

Literature review of the design of sustainability assessment methods emphasized that “true” sustainability assessment would balance the contributions of economic, social

and environmental factors (Weaver and Rotmans 2006; Wu and Wu 2012). Therefore, well-established sustainability rating systems are founded on an integrated set of social, economic and environmental criteria. Such frameworks however, varied in the way they integrate cross-cutting criteria such as governance and innovation. Some frameworks define sustainability governance under separate criteria (GRI 2003); others include governance under the heading of social responsibility. In keeping with the commonly accepted approach, I included sustainability governance as a criterion under the social pillar.

Innovation cuts across the sustainability pillars. Some rating systems, such as LEED, incorporate innovation as a criterion under each major area. Other methods include innovation as a bonus criterion. Indices of innovation exist at international and national levels. The Innovation Index and the Summary Innovation Index (SII) for the European member states (R. K. Singh et al. 2009) are noteworthy examples. Sustainability technologies are ever evolving. It is important to recognize significant accomplishments that move an industry towards its sustainability vision. In appreciation for the significance associated with innovation, I accounted for innovative accomplishments as a separate assessment component.

#### **4.3.1.1 Social Boundaries**

The Social Life Cycle Assessment (SLCA) model forms the basis for many social responsibility impact assessments. In the landmark research paper by Jorgensen et al. (2007), a comprehensive list of social responsibility indicators were defined (Jørgensen et al. 2007). These indicators fall into one of the following impact categories: (1) human

rights, (2) labor practices and decent work conditions, (3) society, and (4) product responsibility. These categories define a broad boundary of social criteria. Because these indicators are non specific to any industry, they were adjusted to reflect the unique nature of the ICT sector. The resulting social categories for the ICT sector were: *sustainability governance, employees (workforce), value chain (customers, suppliers, and distributors), local community and society*.

#### **4.3.1.2 Economic Boundaries**

“No amount of excellent social and environmental performance will prolong the life of a company that is economically unsustainable” (Doane and MacGillivray 2001). Achieving economic viability and maintaining economic health are key requirements for a sustainable ICT organization. Economic sustainability accounts for financial and economic measures beyond short-term profits and addresses the interdependencies of an organization's long term economic success to local, national, and global economies. The external-facing economic sustainability contributions are socio-economic in nature; therefore, they are addressed under the social sustainability criteria (i.e. sustainability governance, local community and society). Defining criteria to assess the internal-facing economic sustainability contributions was the focus of this analysis. Internal economic implications of ICT practices are spread between various financial functions: budgeting / accounting, financial analysis, financial risk management, human resources (payroll, employee compensation), and marketing and brand management. The proposed economic sustainability assessment categories for an ICT organization included the following:

*Financial and Risk Management, Marketing and Brand Management, and  
Compensations and Financial Incentives.*

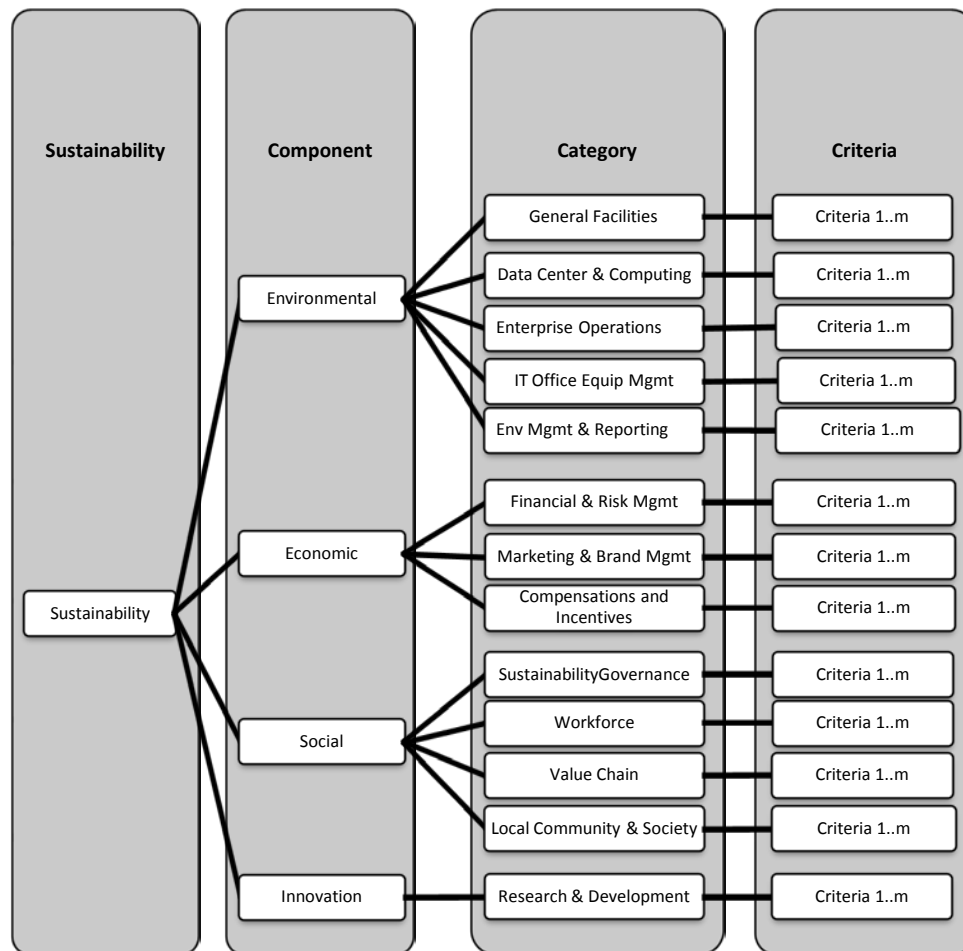
#### **4.3.1.3 Environmental Boundaries**

Environmental sustainability of an ICT organization addresses the impact of its products, operations, and practices on the environment and natural resources. Energy efficiency, water efficiency, waste reduction, air quality improvements, reduction of carbon footprint, and environmental management and reporting systems are all criteria commonly addressed by environmental sustainability assessment methods. The existing ICT criteria identified previously addressed areas specific to the environmental impact, such as resource consumption and electronic waste. The initial list was expanded to include: *General Facilities, Enterprise Operations, Data Center and Computing, IT Office and Equipment Management, and Environmental Management and Reporting.*

#### **4.3.1.4 Innovation Boundaries**

An ICT organization that recognizes innovative approaches and invests in the development of new sustainability solutions is better positioned to capture opportunities, control risk, and lead the sector towards sustainability. The investment in *research and development* to address sustainability issues is the key component of the innovation assessment.

Figure 25 depicts the structure and categories for the development of a preliminary set of criteria that assess the sustainability performance of an ICT organization.



**Figure 25 Structure and Categories of Sustainable ICT Criteria Rating Model**

#### 4.3.2 The Search for Criteria

There are many internationally and nationally recognized frameworks that focus on one of the three aspects of sustainability. I selected internationally-recognized frameworks with an integral and holistic systems approach in accounting for social, environmental, and economic aspects of sustainability. Some of these frameworks were broad in scope (macro-level) and not applicable on a practice level. The selected frameworks varied in their assessment purpose: reporting, monitoring, rating, or performance assessment. The following sustainability assessment frameworks, social

impact assessment methods, and corporate social responsibility reporting and rating systems were reviewed in the search for criteria relevant to ICT:

- Social Life Cycle Assessment – SLCA (Jørgensen et al. 2007).
- Global Reporting Initiative - GRI (GRI 2003) .
- The Dow Jones Sustainability Index - DJSI (DJI 2011)
- Framework for Strategic Sustainable Development - FSSD or The Natural Step Framework (K-H Robèrt et al. 2005b, 147)
- Global 100 Most Sustainable Corporations in the world (Global100 2011).
- Leadership in Energy and Environmental Design - LEED (USGBC 2009)
- Electronic Industry Citizenship Coalition Code of Conduct - EICC Code of Conduct Version 3.0 (EICC 2009)
- Underwriter Laboratories Environment (ULE) 880: Sustainability for Manufacturing Organizations (ULE 2011)
- GreenTick - Sustainability Certification Program (GreenTick 2011)
- Newsweek Green Rankings (Newsweek 2010)
- Tomorrow's Value Rating – TVR Corporate Responsibility Rating (TVR 2010)

Examples of existing assessment criteria from the above list of frameworks and rating systems are summarized in Appendix E.

#### **4.3.3 Social Criteria**

The impact of adopting socially sustainable practices goes beyond satisfying various human needs. It extends to adding business value and benefit to the organization

and extending the sustainability impact to society at large. Promoting work-life balance of employees raises their productivity and contribution to the business success. Selecting suppliers that promote green practices has a direct impact on sustainability. Ensuring that suppliers have sustainable practices in place shows that an organization is not the only link in the sustainable supply chain.

Customers and the community also play an important role due to the fact that any ICT organization relies heavily on its customers – whether internal (users) or external. Becoming involved in the community extends the organization’s sustainability impact beyond its employees, suppliers and business partners. An organization’s commitment to social sustainability can be further reflected through community outreach, volunteer efforts, and donations to community projects and non-profits. As an example, an organization can improve its sustainability impact through awareness programs that encourage employees to adopt sustainable behaviors, like recycling and reduced printing. Integrating awareness programs into outreach initiatives for the community, customers, and suppliers can encourage them to do the same.

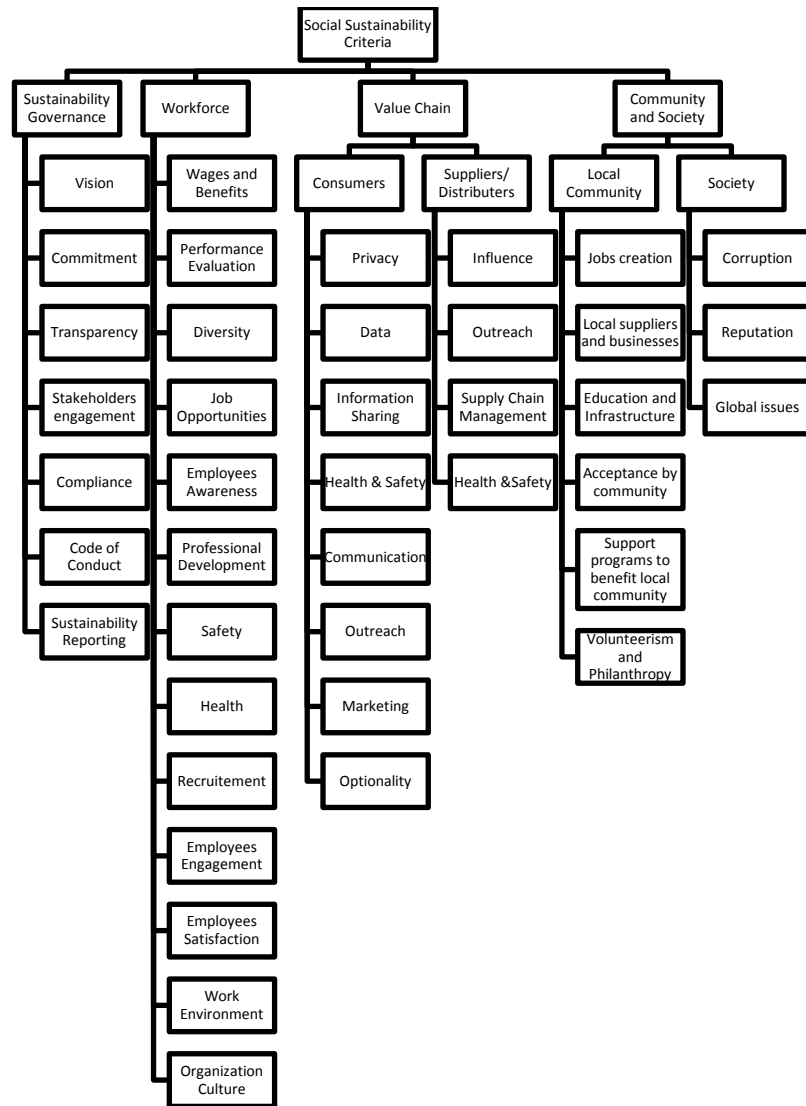
The social criteria were derived from the sustainability frameworks and rating systems listed earlier. In order to be selected, a criterion needed to be relevant to both the ICT sector and one or more of the four social sustainability categories. Duplicates were eliminated to avoid double counting. The resulting criteria are depicted in Table 15.

Figure 26 summarizes the structure of the selected social sustainability criteria.

**Table 15 Summary of Social Sustainability Criteria in Sustainability Assessment Frameworks**

<b>Social Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems</b>	<b>Sustainability Governance</b>	<b>Workforce</b>	<b>Value Chain</b>	<b>Community and Society</b>
<b>Dow Jones Sustainability Index</b>				
<b>Corporate governance:</b> Board structure; Non-Executive Chairman/Lead Director Responsibilities and Committees Corporate; Governance Policy; Audit Conflict of Interest; Diversity: Gender Board Effectiveness Entrenchment provisions; Senior Management Remuneration	X			
<b>Code of Conduct/ Compliance/ Corruption &amp; Bribery:</b> Codes of Conduct: Focus; Codes of Conduct: Systems/Procedures; Corruption and Bribery: Scope of Policy; Codes of Conduct: Report on Breaches; Codes of Conduct/Anti-Corruption & Bribery: business relationships	X			
<b>Human Capital Development:</b> Human resource skill mapping and developing process; Human Capital performance indicators; Personal and organizational learning and development		X		
<b>Talent Attraction and Retention:</b> Coverage of employees through predefined performance appraisal process; Percentage of performance related compensation for each employee category; Balance of variable compensation based on corporate and individual performance Corporate Indicators for performance- related compensation; Type of individual performance appraisal; Communication of individual performance to upper management; Payout type of total performance-related compensation; Trend of employee satisfaction		X		
<b>Labor practice indicators:</b> Grievance Resolution; Labor KPIs		X		
<b>Corporate citizenship and philanthropy:</b> Group Wide Strategy – financial focus; Input; Measuring benefits; Type of Philanthropic activities				X
<b>Social Reporting:</b> Assurance; Coverage; Social Reporting; Qualitative Data; Social Reporting; Quantitative Data	X			
<b>Social Life Cycle Assessment – SLCA</b>				
<b>Human Rights</b>				
Non-discrimination, including indicators on diversity, such as composition of employees on all levels according to gender, age group, disabled, part-time workers and other measures of diversity		X		
Freedom of association and collective bargaining		X		
Child labor, including hazardous child labor		X		
Forced and compulsory labor		X		
<b>Labor practices and decent work conditions</b>				
Wages, including equal remuneration on diverse groups, regular payment, length and seasonality of work and minimum wages		X		
Benefits, including family support for basic commodities and workforce facilities		X		
Physical working conditions, including rates of injury and fatalities, nuisances, basal facilities and distance to workplace		X		
Psychological and organizational working conditions, such as maximum work hours, harassments, vertical, two-way communication channels, health and safety committee, job satisfaction, and worker contracts		X		
Training and education of employees		X		
<b>Society</b>				
Corruption, including incidents/ press reports concerning fraud, corruption and illegal price-fixing, and violation of property rights				X
Development support and positive actions towards society, including job creation, support of local suppliers, general support of developing countries, investments in research and development, infrastructure, and local community education programs				X
Local community acceptance, such as complaints from society , and presence of communication channels				X
<b>Product responsibility</b>				
Integration of customer health and safety concerns in product, such as content of contaminants/ nutrients, other threats/benefits to human health (including special groups) due to product use, and complaint handling system			X	
Information about product to users, such as labeling, info about ingredients, origin, use, potential dangers, and side effects			X	
Marketing communications, such as ethical guidelines for advertisements			X	
<b>Global Reporting Initiative – GRI</b>				
In addition to the ones in SLCA, GRI has the following related criteria:				
Strategy	X			
Governance	X			
Commitments	X			
Engagement	X			
Management Approach and Performance indicators	X			

Social Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems					Sustainability Governance	Workforce	Value Chain	Community and Society
<b>Framework for Strategic Sustainable Development (FSSD) The Natural Step Framework</b>								
Participation - involves people sufficiently		X	X	X				
Transparency - open to reasonable scrutiny		X						
Responsibility - clear accountability		X						
Honesty – being truthful								X
<b>Electronic Industry Citizenship Coalition Code of Conduct - EICC Code of Conduct Version 3.0</b>								
<b>Labor:</b> Including freely chosen employment, child labor avoidance, working hours, wages and benefits, humane treatment, non-discrimination, and freedom of association.			X					
<b>Health and Safety:</b> Including occupational safety, emergency preparedness, occupational injury and illness, industrial hygiene, physically demanding work, machine safeguarding, sanitation, food and housing.			X					
<b>Management Systems:</b> Including company commitment, management accountability and responsibility, legal and customer requirements, risk assessment and risk management, improvement objectives, training, communication, worker feedback and participation, audits and assessments, corrective action process, and documentation and records.	X			X				
<b>Ethics:</b> Including business integrity, no improper advantage, disclosure of information, intellectual property, fair business, advertising and competition, and protection of identity	X			X				
<b>Underwriter Laboratories Environment (ULE) 880: Sustainability for Manufacturing Organizations</b>								
<b>Sustainability Governance:</b> Including sustainability strategic planning, board oversight, internal stakeholder engagement, ethics policies, and creating the infrastructure and fostering the behaviors that create a culture of sustainability	X							
<b>Work Force:</b> Including professional development, workplace integrity, employee satisfaction and retention, workplace safety, and employee health and well-being			X					
<b>Customers and Suppliers:</b> Including fair marketing practices, product safety, customer support and complaint resolution, and sustainable supply chain management, monitoring and improvement				X				
<b>Community Engagement and Human Rights:</b> Including community impact assessment, community investment, and human rights issues								X
<b>GreenTick - Sustainability Certification Program, New Zealand</b>								
The main social related category is <b>Safety</b> , includes 8 criteria the following								
Accident Record			X					
Staff Health and Safety			X					
Supplier Health and Safety				X				
Customer Health and Safety				X				
Management System	X							
Minimizing Risk	X							
Performance Records	X							
<b>Newsweek Green Rankings</b>								
<b>Reputation Survey score:</b> Based on an opinion survey of corporate social-responsibility professionals, academics and other environmental experts who subscribe to CorporateRegister.com								X
<b>Global 100 Most Sustainable Corporations in the world</b>								
<b>Leadership diversity:</b> Measured by the percentage of women board directors	X	X						
<b>CEO-to-Average Worker Pay:</b> Ratio of highest paid officer's compensation to average employee compensation (3-year average)		X						
<b>Safety productivity:</b> Sales (US\$)/ lost-time incidents and fatalities		X						
<b>Sustainability pay link:</b> Whether or not at least one senior officer has his/her pay linked to sustainability	X	X						
<b>Transparency:</b> Measured by % of data points on which the company provided data and level of GRI disclosure	X							
<b>Tomorrow's Value Rating - TVR Corporate Responsibility Rating</b>								
<b>Strategy:</b> Alignment between sustainability efforts and core business strategy, and management of major sustainability impacts, opportunities and risks.	X							
<b>Governance:</b> Quality of top-level governance of sustainability issues.	X							
<b>Engagement:</b> Extent to which stakeholder concerns are understood and acted on.	X							
<b>Value Chain:</b> Management of impacts through the value chain from suppliers to distributors, including the lifecycle of products.				X				
<b>Innovation and leadership:</b> Effectiveness of work to develop products and services that address social and environmental challenges in a profitable and scalable way and extent of sustainability leadership in the sector.	X							



**Figure 26 Social Sustainability Criteria for ICT Organization Practices**

#### **4.2.3.1 Sustainability Governance**

Progress towards sustainable practices in an ICT organization cannot be achieved without a company's acceptance of its responsibility and role in society. This is achieved through the incorporation of sustainability principles within the company's business

strategy. The responsibility must be openly acknowledged and appropriate resources should be allocated. When comparing and classifying the social criteria from the various reviewed frameworks in Table 9, the following criteria were selected for consideration under the governance category: *Vision, Commitment, Transparency, Stakeholders Engagement, Regulatory Compliance, Code of Conduct, and Sustainability Reporting.*

#### **4.2.3.2 Workforce (employees)**

A sustainable IT organization treats its employees well and maintains an environment that enables employees to reach their potential. The following criteria were selected to represent this category: *Wages and Benefits, Performance Evaluation, Diversity, Job Opportunities, Employee Awareness, Professional Development, Health and Safety, Recruitment, Employee Engagement, Employee Satisfaction, Work Environment, and Organization Culture.*

#### **4.2.3.3 Value Chain (customers, suppliers and distributors)**

Social sustainability of an ICT organization entails accounting for the impact of its operations and practices on consumers, suppliers, and distributors. Aspects of consumers' health, safety, and privacy, ethical marketing and responsible management of supply chain relations are addressed with two subsets of criteria: consumer-related, and suppliers and distributors-related ones. The following criteria were selected to represent the consumer part of the value chain category: *Consumer Privacy, Data Protection and Information Sharing, Consumer Health and Safety, Outreach and Engagement, Marketing and Communication, and Consumer Optionality.* The following criteria were

selected to represent the supplier and distributor parts of the value chain category:

*Influence, Outreach, Supply Chain Management, and Health & Safety.*

#### **4.2.3.4 Local Community and Society**

Social responsibility of an ICT organization entails accounting for its impact and contributions to the local community in the immediate vicinity in which it operates and to society at large, both nationally and globally. Impacts on the cultural characteristics and cohesiveness of the local community, its economic development and welfare, education, and security should be addressed. Many ICT organizations operate internationally or outsource services to providers in other countries or emerging market areas. The ICT organization's contribution to the company's public reputation by having practices and policies to prevent corruption/ bribery, and by supporting global issues like poverty and climate change should be accounted for. The following criteria were selected to represent the local community part of this category: *Jobs Creation, Local Suppliers and Businesses, Education and Infrastructure, Acceptance by Community, Support Programs, Volunteerism and Philanthropy*. The following criteria were selected to represent the society at large part of this category: *Corruption Prevention, Reputation, and commitment to support Global Issues.*

#### **4.3.4 Economic Criteria**

Achieving economic viability, maintaining financial health and allocating resources to fund sustainability initiatives are key requirements for a sustainable ICT organization. Making commitment to sustainability within the organization is only one step, unless sufficient resources are made to support sustainability initiatives, progress

can't be achieved. Ability to track financial implications like savings on utility bill as a result of a new energy efficiency initiative are critical in making a business case for sustainable practices. Financial incentives and rewarding environmentally sound and socially responsible practices can contribute to progress towards sustainable practices. Reducing environmental risks by investing in programs and prevention measures can save the organization on the long term. Ethical and responsible marketing and brand management is also critical. The economic criteria were derived from the sustainability frameworks and rating systems listed earlier. In order to be selected, a criterion needed to be relevant to both the ICT sector and one or more of the following financial sustainability categories: *Financial and Risk Management, Marketing and Brand Management, and Compensations and Financial Incentives*. Duplicates were eliminated to avoid double counting. The results of economic criteria relevance assessment are depicted in Table 16. Similarly, Figure 27 summarizes the structure of the selected economic sustainability criteria.

**Table 16 Summary of Economic Sustainability Criteria in Sustainability Assessment Frameworks**

<b>Economic Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems</b>	<b>Financial &amp; Risk Management</b>	<b>Marketing &amp; Brand Management</b>	<b>Compensation &amp; Financial</b>
<b>Dow Jones Sustainability Index</b>			
<b>Industry Specific Criteria:</b> Brand Management, Customer Relationship Management, Innovation Management, Gas Portfolio, Grid Parity, etc	X	X	X
<b>Global Reporting Initiative - GRI</b>			
<b>Economic Performance:</b> Direct economic value generated and distributed, including revenues, operating costs, employee compensation, donations and other community investments, retained earnings, and payments to capital providers and governments; Financial implications and other risks and opportunities for the organization's activities due to climate change; Coverage of the organization's defined benefit plan obligations; Significant financial assistance received from government.	X	X	X
<b>Global 100 Most Sustainable Corporations in the world</b>			
<b>%Taxes Paid:</b> The % Taxes Paid score ranges from 0-100%. It is the percentage of taxes paid in cash (trailing 4 year average) to the amount of taxes owed at statutory rates (trailing 4 year average) in USD.	X		



**Figure 27 Economic Sustainability Criteria for ICT Organization Practices**

#### **4.2.4.1 Financial and Risk Management**

These criteria assess the internal financial stability of the organization.

Incorporating sustainability in the budget and financial analysis, defining and tracking sustainability financial metrics, and managing risks and consequences of environmental accidents are issues addressed with the following criteria: *Budgets and Accounting*, *Financial Analysis*, *Key Performance Indicators (KPI)*, and *Risk Management*.

#### **4.2.4.2 Marketing and Brand Management**

Society is increasingly holding corporations to high standards of social and financial responsibility. To be well received in the marketplace, maintain a positive corporate image, and gain consumer trust, organizations must develop, adopt, and promote, sustainable practices. Ethical and responsible brand management,

communication, and marketing practices, both internally and externally, are critical to strategic positioning of sustainable products and services and to reducing the environmental impact associated with marketing methods and materials. Criteria that address these issues included: *Marketing Strategy, Brand Management, Internal Marketing, and Marketing Material.*

#### **4.2.4.3 Compensations and Financial Incentives**

The last set of criteria involves employee compensation and financial incentives. Rewarding employees for good behavior as well as sustainable behavior contributes to the sustainability of the organization. "Rewards" for carpooling, saving energy, or recycling give the employees incentives to continue making an effort while having a positive impact on the environment. It also impacts utility bills. Maintaining fair living wages and benefits to all employees and contractors and linking financial incentives and rewards to sustainability performance are addressed under the following criteria: *Employee Compensations, and Performance Incentives.*

#### **4.3.5 Environmental Criteria**

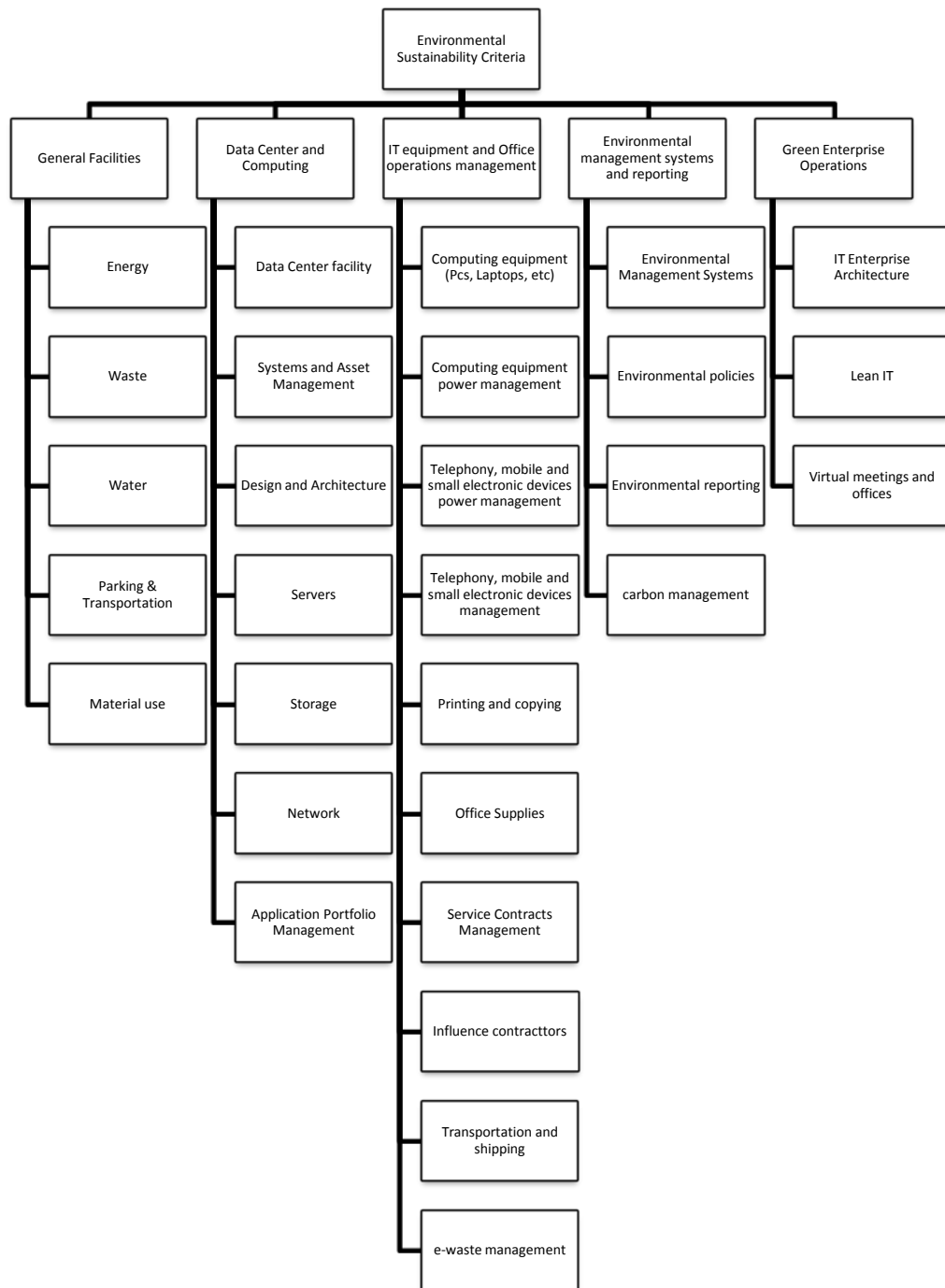
As mentioned in Section 4.2, the environmental criteria for the ICT industry were the most defined. However, gaps were identified in Section 4.2. The gaps include: material use, environmental risk management and environmental reporting. The previously identified environmental criteria were expanded to fill the gaps and fully reflect environmental sustainability. Criteria were evaluated based on their applicability to the ICT sector and relevance to one or more of environmental sustainability categories. Duplicates were eliminated to insure that the criteria assessed a unique aspect of

environmental sustainability and to avoid double counting. In particular, criteria were needed to reflect the sustainability of non-data center facilities (General Facilities) and an organization's commitment to environmental management and reporting. The results of the environmental criteria relevance assessment are summarized in Table 17. Figure 28 summarizes the structure of environmental sustainability criteria.

**Table 17 Summary of Environmental Sustainability Criteria in Sustainability Assessment Frameworks**

<b>Environmental Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems</b>	<b>General Facilities</b>	<b>Data Center &amp; Computing</b>	<b>IT Office &amp; equipment Management</b>	<b>Environmental management &amp; Green Enterprise</b>	<b>Operations</b>
<b>Dow Jones Sustainability Index</b>					
<b>Environmental Reporting:</b> Assurance; Coverage; Environmental Reporting on Qualitative and Quantitative Data				X	
<b>Sector specific:</b> Environmental Management Systems; Climate Strategy; Biodiversity; Product Stewardship; Eco-efficiency				X	
<b>Global Reporting Initiative – GRI</b>					
<b>Material:</b> Materials used by weight or volume; Percentage of materials used that are recycled input materials.	X				
<b>Energy:</b> Direct energy consumption by primary energy source; Indirect energy consumption by primary Source; Energy saved due to conservation and efficiency improvements; Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives; Initiatives to reduce indirect energy consumption and reductions achieved.	X				
<b>Water:</b> Total water withdrawal by source; Water sources significantly affected by withdrawal of water; Percentage and total volume of water recycled and reused.	X				
<b>Biodiversity:</b> Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas;	X				
<b>Emissions, Effluents, and Waste:</b> Total direct and indirect greenhouse gas emissions by weight.; Other relevant indirect greenhouse gas emissions by weight; Initiatives to reduce greenhouse gas emissions and reductions achieved; Emissions of ozone-depleting substances by weight; NO, SO, and other significant air emissions by type and weight; Total water discharge by quality and destination; Total weight of waste by type and disposal method; Total number and volume of significant spills; Weight of transported, imported, exported, or treated waste deemed hazardous.	X				
<b>Products and Services:</b> Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation; Percentage of products sold and their packaging materials that are reclaimed by category.			X		
<b>Compliance:</b> Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations.				X	
<b>Transport:</b> Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce.	X		X		
<b>Overall:</b> Total environmental protection expenditures and investments by type.				X	
<b>Electronic Industry Citizenship Coalition Code of Conduct - EICC Code of Conduct Version 3.0</b>					
<b>Environmental Permits and Reporting</b> All required environmental permits (e.g. discharge monitoring), approvals and registrations are to be obtained, maintained and kept current and their operational and reporting requirements are to be followed.		X			

Environmental Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems	General Facilities	Data Center & Computing	IT Office & equipment Management	Environmental management &	Green Enterprise Operations
<b>Pollution Prevention and Resource Reduction</b> Waste of all types, including water and energy, are to be reduced or eliminated at the source or by practices such as modifying production, maintenance and facility processes, materials substitution, conservation, recycling and re-using materials.		X			
<b>Hazardous Substances</b> Chemicals and other materials posing a hazard if released to the environment are to be identified and managed to ensure their safe handling, movement, storage, use, recycling or reuse and disposal.	X		X		
<b>Wastewater and Solid Waste</b> Wastewater and solid waste generated from operations, industrial processes and sanitation facilities are to be characterized, monitored, controlled and treated as required prior to discharge or disposal.	X		X		
<b>Air Emissions</b> Air emissions of volatile organic chemicals, aerosols, corrosives, particulates, ozone depleting chemicals and combustion by-products generated from operations are to be characterized, monitored, controlled and treated as required prior to discharge.					
<b>Product Content Restrictions</b> Participants are to adhere to all applicable laws, regulations and customer requirements regarding prohibition or restriction of specific substances, including labeling for recycling and disposal.					
<b>Underwriter Laboratories Environment (ULE) 880: Sustainability for Manufacturing Organizations</b>					
<b>Environment:</b> including product stewardship, sustainable resource use, environmental management systems, energy efficiency and carbon management, materials optimization, facilities and land use, habitat restoration, and waste prevention	X				X
<b>GreenTick - Sustainability Certification Program, New Zealand</b>					
<b>Environmental Product Origin:</b> Identify product origin; All product content identified by country of origin.					
<b>2 Environmental Product Quality:</b> High product quality; Product meets all quality standards of industry or government food authority.					
<b>Environmental Product Labeling:</b> Accurate product labeling; Labeling meets required legal standards					
<b>Environmental Resource Use:</b> Maximize resource use efficiency	X				X
<b>Environmental Chemical Use:</b> Minimize chemical use; Chemical residues comply with industry or government standard.	X				
<b>Environmental Energy Use:</b> Minimize energy use	X				X
<b>Environmental Nuisance Effects:</b> Minimize adverse effects on neighbors, eg. noise, dust, spray drift; No continuing or unsatisfactorily addressed complaints from neighbors about nuisances in past 12 months.	X				
<b>Environmental Contaminant Discharges:</b> Minimize contaminant discharges to air, land, freshwaters and sea	X				
<b>Environmental Waste Management :</b> Waste minimization, dispose of wastes correctly ; Waste minimization and recycling program in place with defined performance targets; Wastes reduced, re-used, recycled, or properly disposed of to authorized facilities	X				
<b>Environmental Management System:</b> Environmental Management System (EMS) ; Environmental management program in place with defined performance targets consistent with industry or government standards				X	
<b>Environmental Legal Compliance:</b> Legal compliance and enforcement				X	
<b>Newsweek Green Rankings</b>					
<b>Environmental impacts score:</b> including emissions of nine key greenhouse gases, water use, solid-waste disposal, and emissions that contribute to acid rain and smog	X				
<b>Global 100 Most Sustainable Corporations in the world</b>					
Energy	X				
Greenhouse gas (GHG)	X				
Water productivity	X				
Waste productivity	X				
<b>The Green Grid Data Center Maturity Model</b>					
<b>Facility:</b> power; cooling; management; other		X			
<b>IT:</b> compute; storage; network; Other IT		X			



**Figure 28 Environmental Sustainability Criteria for ICT Organization Practices**

#### **4.3.5.1 General Facilities**

Energy conservation, minimizing waste and use of toxic material, water use efficiency, and minimizing the carbon footprint associated with transportation are fundamental aspects to the environmental sustainability of an ICT organization. The primary contributor to the carbon footprint of an ICT organization is from electricity usage. Facilities and operations generate wastewater and solid waste and consume water resources. To evaluate the organization's environmental impacts associated with energy use, water, transportation, and exposure to toxic material, the following criteria were included: *Energy, Waste, Water, Parking and Transportation, and Material Use*.

#### **4.3.5.2 Data Center and Computing**

Energy conservation, water use efficiency, and minimizing the carbon footprint associated with data center facility and computing equipment are fundamental aspects to the environmental sustainability of an ICT organization. Data center facilities, whether offsite or onsite, take up space and require resources to run and manage them, therefore, efficient use of this space is important for sustainable practices. Site selection of a data center facility, floor space utilization, architecture design of power distribution, cooling, lighting, and environmental controls impact its energy efficiency and air quality.

Resilience of the data center and the reliability of its systems are critical to the ICT organization and the business operations. Without appropriate redundancy, monitoring, and recovery procedures, systems failures cause a loss of productivity, business, and a waste of infrastructure. Greater redundancy in systems than required is also a waste of infrastructure and increases inefficiency. Energy efficiency of a server is generally defined as work performed over energy used for a task.

Servers run more efficiently when utilized at higher percentages. They become inefficient when utilized at less than 20%. Workload management, power management, utilization, and management of installed applications are factors that impact efficiency at the server, storage and network levels.

Having a central applications portfolio (services catalogue) at the data center provides visibility into available applications and services. Managing an applications portfolio centrally enables the ICT team to recognize utilization patterns of applications and services and plan for retiring legacy, underutilized, and high cost maintenance applications.

To address the environmental issues associated with the data center and its computing facility and equipment, the following criteria were included: *Data Center Facility, Systems and Asset Management, Design and Architecture, Servers, Storage, Network, and Application Portfolio Management.*

#### **4.3.5.3 IT Equipment and Office Operations Management**

IT equipment contributes to the carbon footprint in terms of energy consumption and electronic waste. Buying energy efficient devices and limiting the number of devices will save on overall energy consumption. The use of power saving modes and power reduction policies to power off computers at night or when they are idle are appropriate measures that can reduce energy consumption. Having a method to record power savings from these settings and policies and making them visible to users can help to motivate change in user behavior. Telephony and mobile devices increase electronic waste and contribute to the carbon footprint. Policies to reduce the frequency of mobile device

replacement, and using Internet telecommunication features such as Skype and Soft phone can help reduce the number of phone devices in the office.

Printers and printing resources such as paper and cartridges have a carbon footprint associated with their production and use. By reducing printing and recycling ink cartridges, the carbon footprint and printing waste can be reduced. Preference should be given to high efficiency printers that use less power (either in runtime or shorter startup time), have automatic duplex printing settings, use less ink to print and eliminates wasted pages.

To address the environmental impact associated with the use of IT equipment, small electronic devices and office operations, the following criteria were added:

*Computing equipment (PCs, Laptops, etc) device management, Computing equipment power management, Telephony, mobile and small electronic devices power management, Telephony, mobile and small electronic devices management, Printing and Copying, Office Supplies, Service Contracts Management, Influence Contractors, Transportation and shipping, and e-Waste Management.*

#### **4.3.5.4 Environmental Management and Reporting**

Adopting practices and standards that protect public health and the environment, having a corporate environmental policy and environmental management and monitoring system, and publicly reporting and sharing environmental impacts and efforts to mitigate them are the concerns addressed with the following criteria: *Environmental Management System (EMS), Environmental Policy, Environmental Reporting, and Carbon Management.*

#### **4.3.5.5 Green Enterprise Operations**

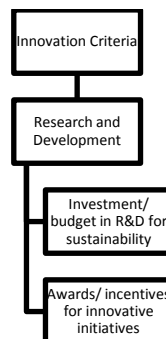
Innovative use of IT solutions contributes to the overall sustainability practices of the enterprise. For example, virtual meetings and offices and tele-working can reduce costs and the carbon footprint associated with travel, office buildings and commute. Having such capabilities in place, maximizing their use, and developing a method to track and estimate savings, both in dollars and carbon footprint, demonstrate the value and contribution of such technologies. Improving operations processes to eliminate waste in general by applying lean methodologies, can assist an organization in reducing its environmental impact and increase its efficiency. These issues are addressed with the following criteria: *IT Enterprise Architecture*, *Lean IT*, and *Virtual Meetings and Offices*.

#### **4.3.6 Innovation Criteria**

Innovation is critical to the continued development of sustainable practices in every sector. An organization should be recognized for contributions to the research and development of solutions that address sustainability concerns. Innovation-related criteria collected from existing sustainability frameworks and rating systems are listed in Table 18. The following criteria selected to reflect innovation (See Figure 29): *Investment/Budget in R&D for Sustainability*, and *Awards and Incentives for Innovative Initiatives*.

**Table 18 Summary of Innovation Sustainability Criteria in Sustainability Assessment Frameworks**

<b>Innovation in Sustainability Criteria in Sustainability Assessment Frameworks, Rating, Ranking, and Reporting Systems</b>	
<b>Dow Jones Sustainability Index</b>	
<b>Innovation management:</b>	under economic sector specific indicators
Investment in Research and Development	
<b>LEED</b>	
<b>Innovative approach:</b>	under each main area of LEED, extra credit is given under innovation.
<b>Global 100 Most Sustainable Corporations</b> in the world	
<b>Innovation Capacity</b>	The Innovation Capacity score ranges from 0-100%. It represents the ratio of 3-year average Research & Development expenditures to 3-year average total revenue.
<b>Tomorrow's Value Rating</b>	
<b>Innovation and leadership:</b>	Effectiveness of work to develop products and services that address social and environmental challenges in a profitable and scalable way and extent of sustainability leadership in the sector.



**Figure 29 Innovation Sustainability Criteria for ICT Organization Practices**

#### **4.3.7 Summary of the Preliminary Set of ICT Sustainability Criteria**

Key assessment categories and a set of criteria to accomplish environmental, economic and social sustainability, and encouragement of innovation goals were identified. A preliminary set of ICT sustainability criteria resulted in four major sustainability objective areas, 13 main categories, and 82 criteria. A complete listing of the criteria is provided in Appendix F. Defining metrics and indicators to assess the different criteria were beyond the scope of this research. However, indicators and measures were used for clarity to illicit expert responses. The definition of intent and the

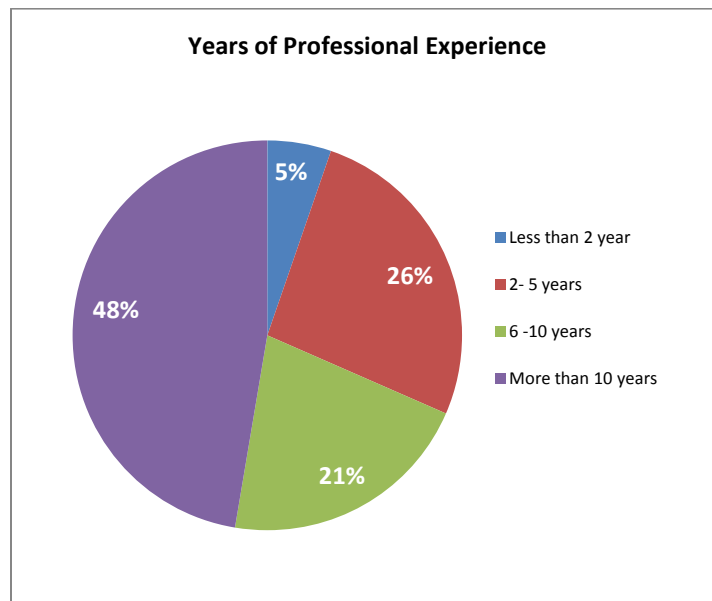
set of indicators used in the model development and validation phases are included in Appendix F.

#### **4.4 Examining the Validity of the Preliminary Set of Criteria**

To examine the validity of the selected categories and criteria an expert survey was conducted. The survey was sent to a wide community of ICT and sustainability experts. General information was collected in the first section to gain an understanding of the expertise of the survey participants and their familiarity with sustainability rating systems. The purpose of the second section was to determine if the identified sustainability categories are sufficient and, if so, to what extent each category should contribute to the overall assessment. The relevance, practicality, reliability, and significance of each of the criteria were surveyed in the last section. The survey involved voluntary participation of ICT and sustainability experts. Although it was anticipated that there are no foreseeable risks in participating in the research survey, I followed GMU's protocol defined by the Office of Research Subjects Protection. In addition to ensuring the participants knew of their informed consent, participants' interests and confidentiality of data were considered of primary importance when choices were made regarding reporting and dissemination of data. A copy of the approved GMU's protocol is provided in Appendix G, and a copy of the survey is provided in Appendix H.

Sixty (60) experts participated in the survey; 48% of the respondents had more than 10 years of experience in their field (Figure 30). The participants' representation was balanced in the main area of expertise between ICT (46.5%) and Sustainability and Green IT (48.3%) as shown in Figure 31. The representation from public/academic (47%) and

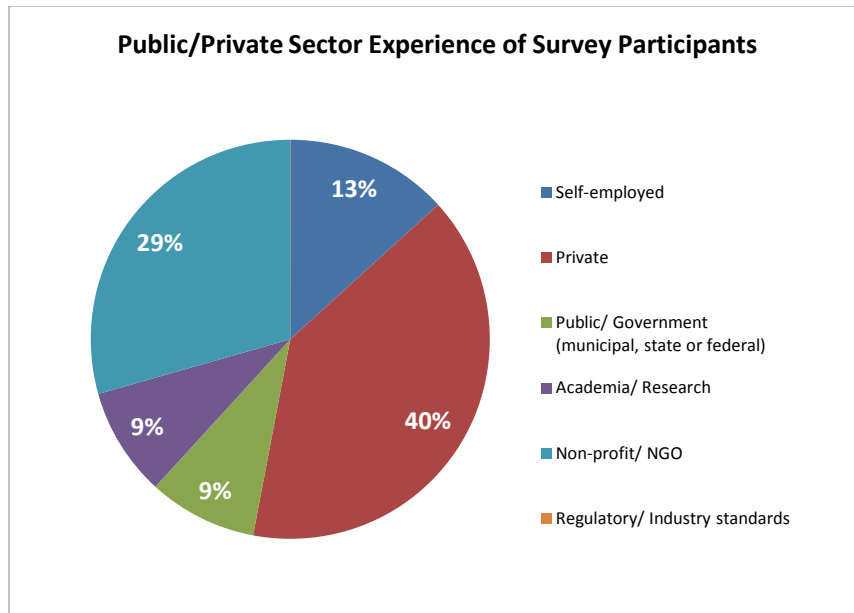
private (53%) sectors was similarly balanced (Figure 32). Energy Star and LEED were the most recognized certification and rating systems as identified by the surveyed experts.



**Figure 30 Expert Survey Participants: Years of Experience**

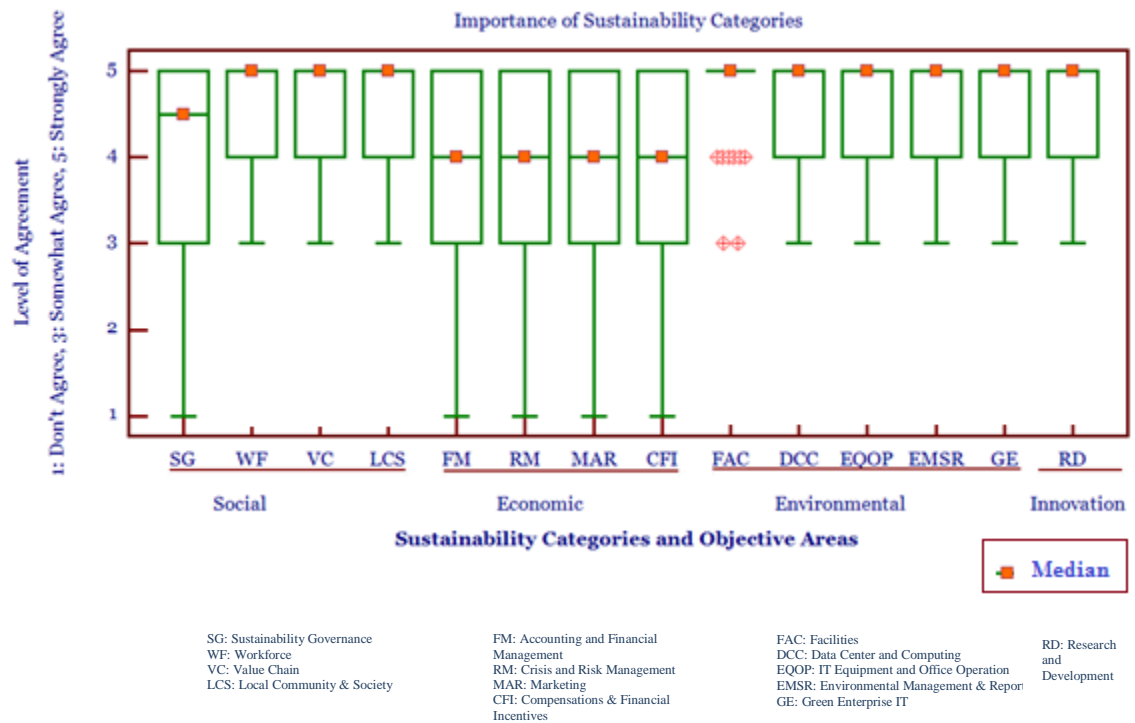


**Figure 31 Expert Survey Participants: Main Area of Expertise**



**Figure 32 Expert Survey Participants: Distribution per Sector**

Survey participants were asked to express their opinion on the importance of including the sustainability category in an ICT sustainability framework using a Likert scale ranging from 1 (Don't agree) to 3 (Somewhat Agree) to 5 (Strongly Agree). Categories with a median score of 3 (Somewhat Agree) or higher were included in the model. The results of the survey are provided in Appendix I. To summarize the results, Box-and-Whisker plots were developed for the experts' assignment of importance to the different categories under each sustainability objective area as shown in Figure 33.



**Figure 33 Box-and-Whisker Plots for Significance of ICT Sustainability Categories**

The Box-and-Whisker plots for the categories under the four sustainability areas (social, economic, environmental and innovation) showed strong consensus among survey participants that the listed categories should be considered. The median values for all categories were between 4 and 5; therefore, all of the categories were included in the framework. The median, 25<sup>th</sup> and 75<sup>th</sup> percentiles for the survey results are shown for each category in Table 19. In all cases the 25<sup>th</sup> percentile was at a value of 3 or higher. Similarly the mean score was calculated.

**Table 19 Likert Score Significance Summaries for Category Inclusion**  
(5=Strongly Agree; 1=Strongly Disagree)

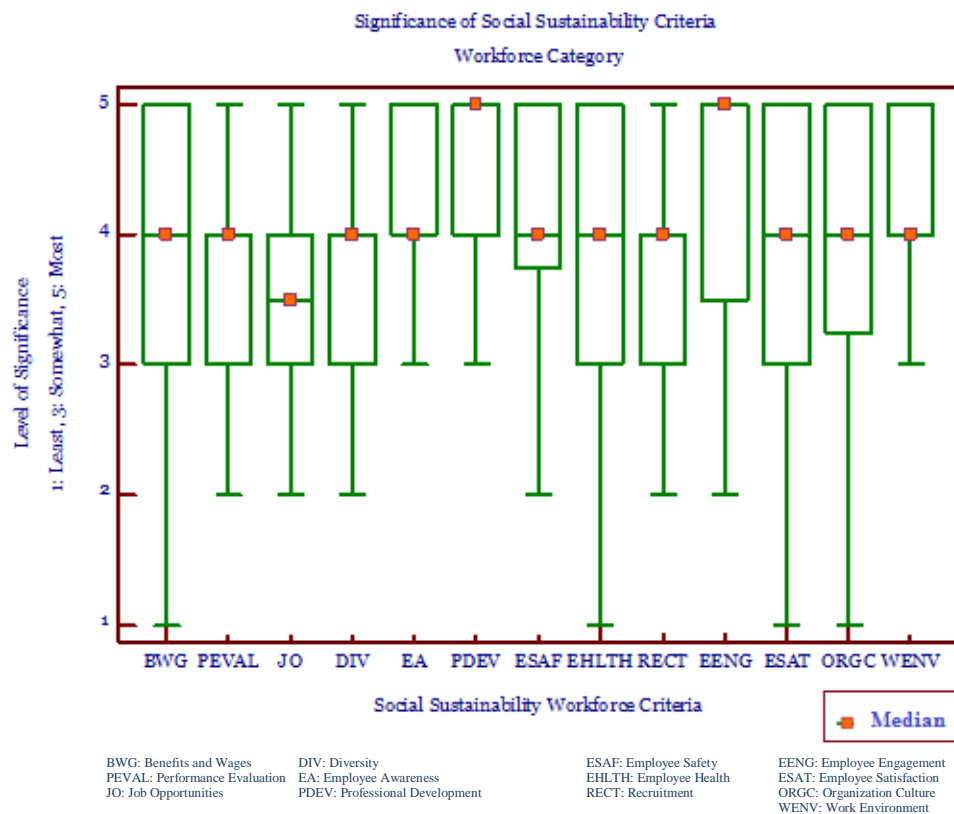
	Category	N	Mean	Median	25 <sup>th</sup> - 75 <sup>th</sup> Percentile
<b>Economic</b>	Financial & Risk Management	52	4.03	4.0	3.5 - 5.0
	Compensations and Financial Incentives	52	3.69	4.0	3.0 - 5.0
	Marketing	51	3.53	4.0	3.0 - 5.0
<b>Environmental</b>	Facilities	52	4.71	5.0	5.0 - 5.0
	Environmental Management and Reporting	52	4.52	5.0	4.0 - 5.0
	Data Centers and Computing	52	4.46	5.0	4.0 - 5.0
	IT Equipment and Office Operations	52	4.40	5.0	4.0 - 5.0
	Green Enterprise IT	52	4.21	5.0	3.5 - 5.0
<b>Social</b>	Workforce	52	4.27	5.0	4.0 - 5.0
	Value Chain	52	4.31	5.0	4.0 - 5.0
	Sustainability Governance	52	4.14	4.5	3.0 - 5.0
	Local Community and Society	52	4.31	5.0	4.0 - 5.0
<b>Innovation</b>	Research and Development	51	4.31	5.0	4.0 - 5.0

The survey respondents were asked to evaluate the individual sustainability criteria against the following four factors:

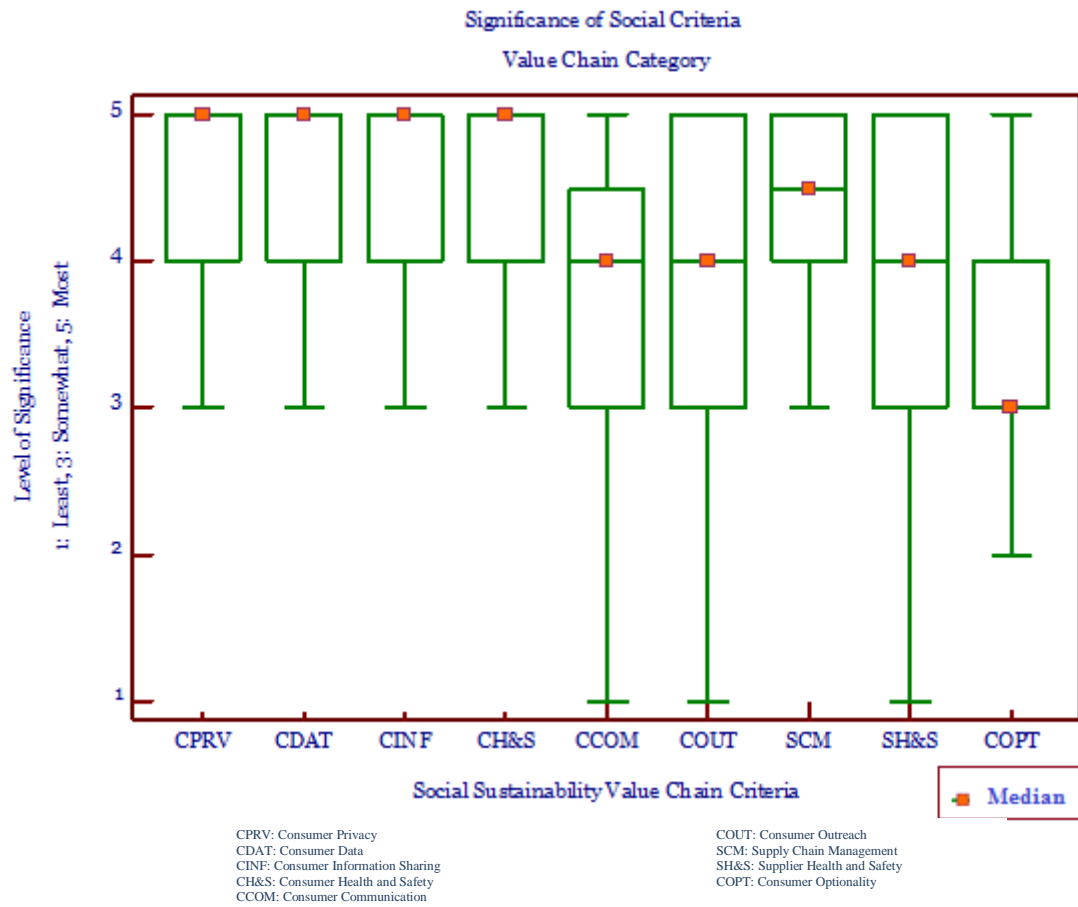
- *Significance*: to determine how important it is to include the criteria in the assessment framework
- *Relevance*: to assess the degree of applicability of the criteria to the ICT sector in assessing sustainability performance
- *Practicality*: to assess the reasonableness of assigning or measuring qualitative or quantitative indicators and metrics to the criteria
- *Reliability*: to determine whether the information or data that relates to criteria are dependable, accurate and consistent

The level of significance was used to determine if a criterion should be retained and to what extent it should contribute to the overall rating of sustainability. In other words, the weights used in the sustainability assessment model were derived from the level of significance. The other three factors assessed the ability of an ICT organization to assign a dependable value to the criteria. Likert scale values from 1 (signifying least)

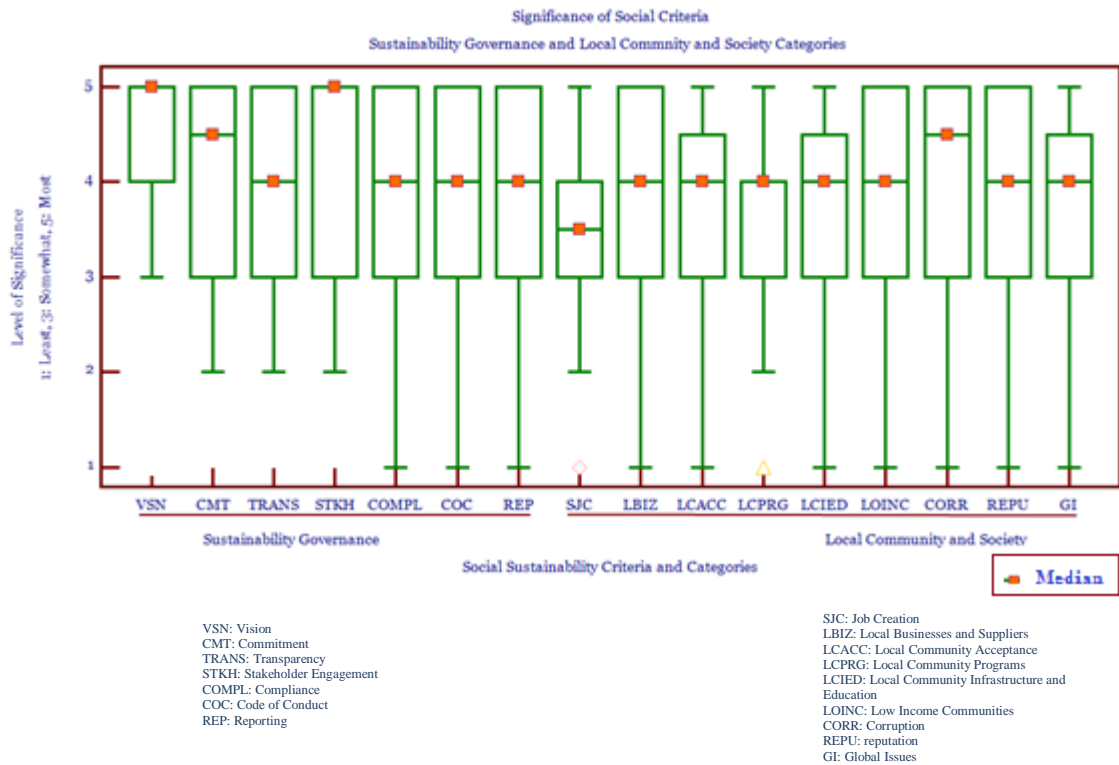
to 3 (signifying somewhat) to 5 (signifying most) were assigned to each criterion for relevance, practicality, reliability and significance. Criteria with median values of 3 (valued somewhat) or higher for all four values were retained; based on this condition all 80 criteria surveyed were included in the model. The lowest median (3) was observed for three criteria: office supplies, contractor influence, and consumer optionality. A complete set of survey results for the criteria is provided in Appendix I. Box-and-Whisker plots for each criterion are shown in Figures 34-40. The results for each of the 80 criteria surveyed are shown by sustainability objective area in Tables 20-22.



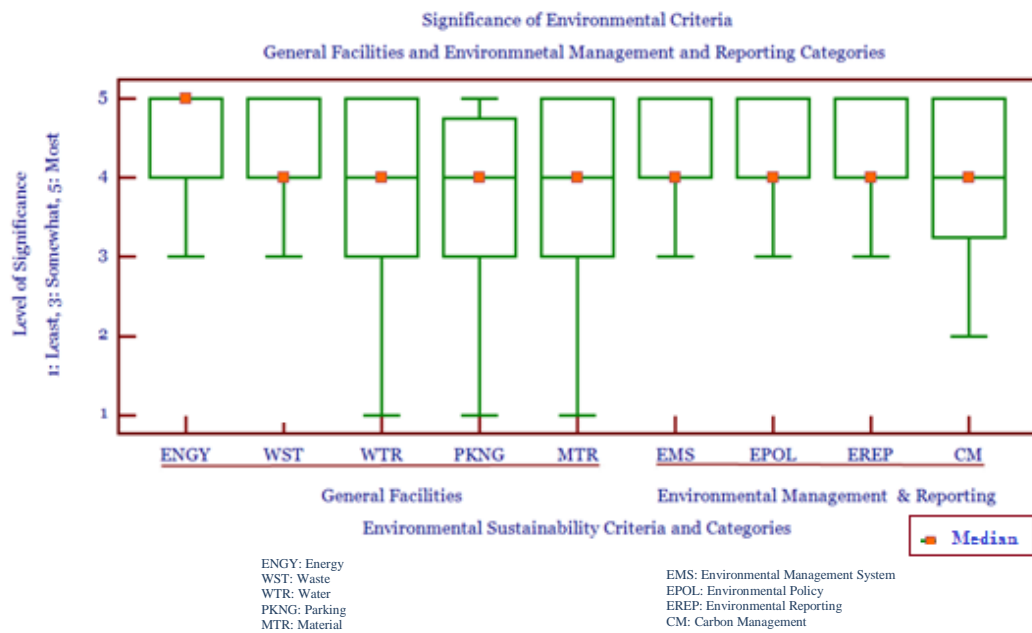
**Figure 34 Box-and-Whisker Plots for Significance of Social Sustainability Criteria in Workforce Category**



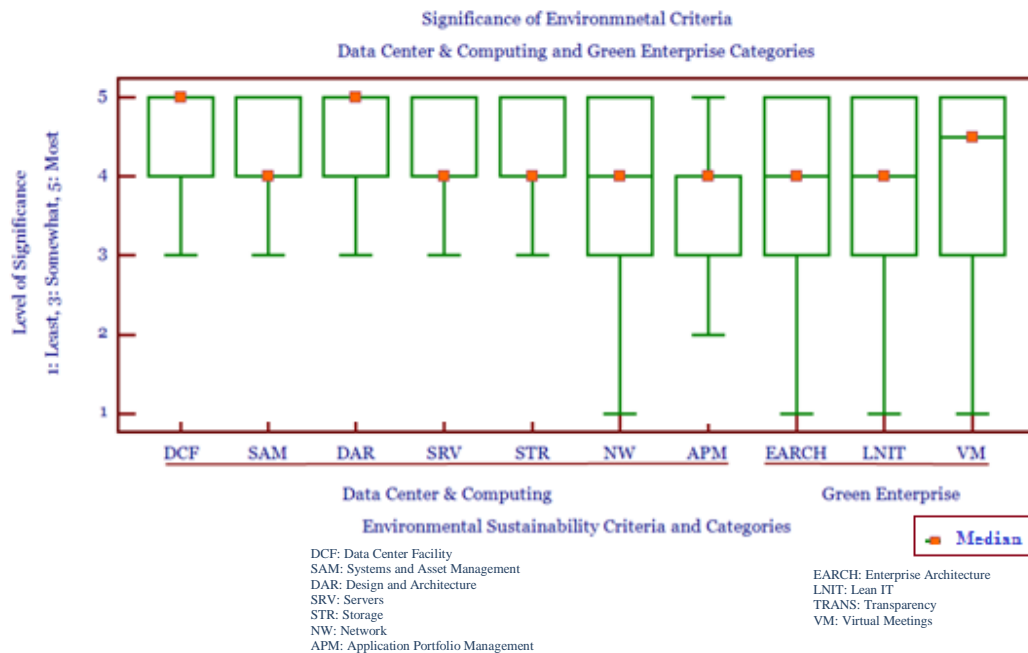
**Figure 35 Box-and-Whisker Plots for Significance of Social Sustainability Criteria in Value Chain Category**



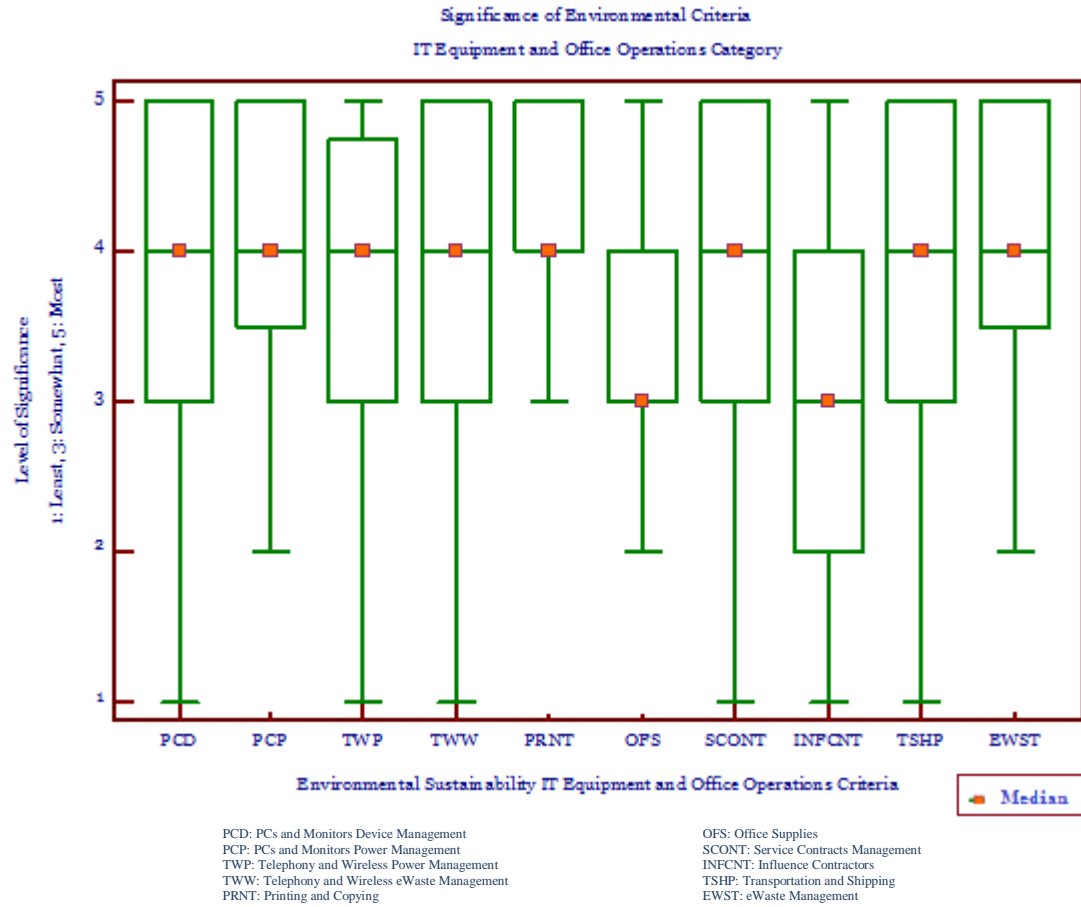
**Figure 36 Box-and-Whisker Plots for Significance of Social Sustainability Criteria in Sustainability Governance and Local Community & Society Categories**



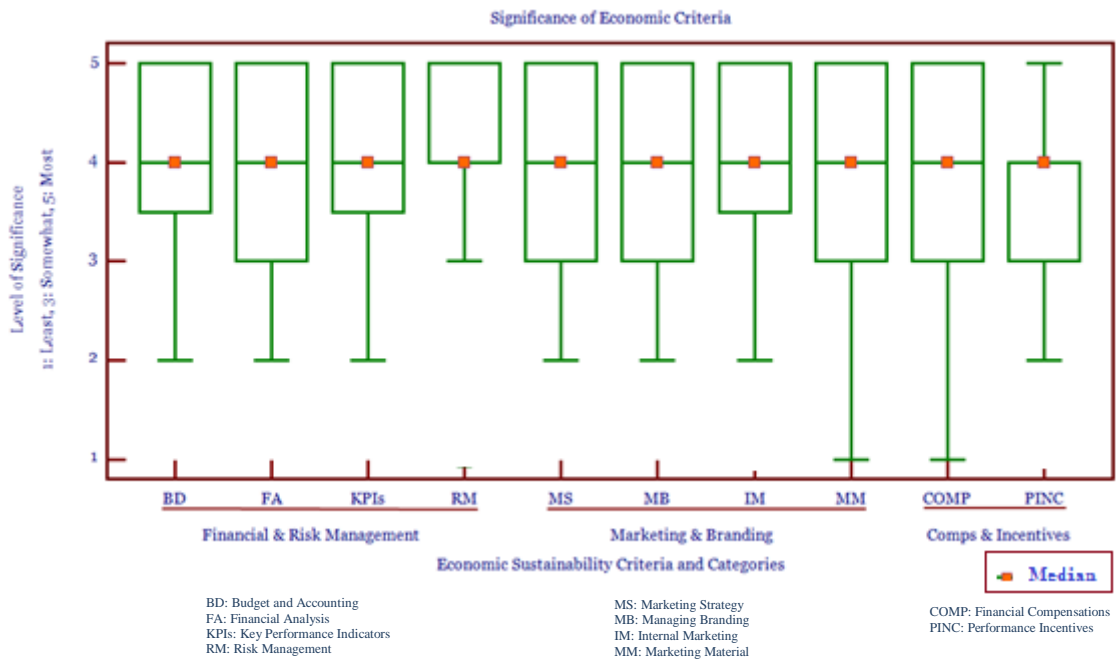
**Figure 37 Box-and-Whisker Plots for Significance of Environmental Sustainability Criteria in General Facilities and Environmental Management & Reporting Categories**



**Figure 38 Box-and-Whisker Plots for Significance of Environmental Sustainability Criteria in Data Centers and Green Enterprise Categories**



**Figure 39 Box-and-Whisker Plots for Significance of Environmental Sustainability Criteria in IT Equipment and Office Operations Category**



**Figure 40 Box-and-Whisker Plots for Significance of Economic Sustainability Criteria**

**Table 20 Summary Statistics for Significance of Environmental Criteria**

	Environmental Criteria	Number of Responses						Mean	N
		1 Least	2	3 Somewhat	4	5 Most	Median		
Facility	Energy	0	1	4	5	30	5	4.56	43
	Waste	1	0	4	19	18	4	4.26	43
	Water	1	2	9	12	18	4	4.05	43
	Parking	3	2	13	14	11	4	3.65	43
	Material	2	7	6	14	14	4	3.72	43
Data Center	DC Facility	1	1	4	9	22	5	4.35	37
	Sys & Asset Management	1	0	6	13	16	4	4.19	36
	Design & Architecture	1	0	5	9	20	5	4.33	36
	Servers	1	0	4	13	17	4	4.27	37
	Storage	1	0	6	13	14	4	4.15	34
	Network	1	2	12	8	13	4	3.83	36
	App Portfolio Mgmt	4	3	8	12	8	4	3.50	36
	PC Power	1	4	4	10	17	4	4.06	36
IT Equip and Off Opp	PC Equip	1	4	7	10	12	4	3.83	35
	Tel Power	1	5	9	11	9	4	3.63	35
	Tel eWaste	3	3	9	8	12	4	3.66	35
	Printing	2	0	3	13	16	4	4.21	34
	Office Supplies	3	3	12	8	8	3	3.46	35
	Service Contracts	2	3	9	8	14	4	3.81	36
	Influence Contractors	4	9	11	4	7	3	3.06	36
	Transport & Shipping	2	5	6	9	13	4	3.75	36
	eWaste Mgmt	1	1	7	11	15	4	4.08	36
	EMS	0	0	6	13	16	4	4.29	35
EMSR	Env. Policies	0	0	6	14	14	4	4.23	35
	Env. Reporting	0	2	6	11	15	4	4.14	35
	Carbon Management	0	1	8	12	13	4	4.09	35
	Enterprise Architecture	2	0	8	9	13	4	3.97	33
GE	Lean IT	3	1	8	12	10	4	3.74	34
	Virtual Meeting/Office	2	2	7	5	17	4.5	4.00	34
EMSR: Environmental Management System GE: Green Enterprise									

**Table 21 Summary Statistics for Significance of Economic Criteria**

	Economic Criteria	Number of Responses						Mean	N
		1 Least	2	3 Somewhat	4	5 Most	Median		
FM	Budget	0	2	5	8	13	4	4.14	28
	Financial Analysis	0	2	7	8	11	4	4.00	28
	KPIs	0	3	4	8	13	4	4.11	28
	Risk Management	1	1	4	9	13	4	4.14	28
MBM	Marketing Strategy	0	3	6	8	11	4	3.96	28
	Marketing Branding	0	2	7	9	10	4	3.96	28
	Internal Marketing	1	1	5	11	10	4	4.00	28
	Mark Material	3	2	4	10	8	4	3.67	27
CI	Compensations	2	1	4	8	11	4	3.96	26
	Performance Incentives	2	3	5	12	6	4	3.61	28
FM: Financial and Risk Management MBM: Marketing and Brand Management CI: Compensations and Financial Incentives									

**Table 22 Summary Statistics for Significance of Social Criteria**

	Social Criteria	Number of Responses						Mean	N
		1 Least	2	3 Somewhat	4	5 Most	Median		
Sus. Governance	Vision	1	2	5	8	18	5	4.18	34
	Commitment	0	1	8	7	16	4.5	4.19	32
	Transparency	0	3	7	10	14	4	4.03	34
	Stakeholders	0	2	7	7	18	5	4.21	34
	Compliance	1	3	7	10	12	4	3.88	33
	Code Of Conduct	2	0	9	10	11	4	3.85	33
	Reporting	1	0	9	10	12	4	4.00	32
Workforce	Benefits - Wages	2	1	8	8	15	4	3.97	34
	Performance Evaluation	1	4	6	16	7	4	3.71	34
	Job Opportunity	4	3	10	11	6	3.5	3.35	34
	Diversity	2	4	6	13	7	4	3.58	33
	Employee Awareness	0	1	6	11	16	4	4.24	34
	Professional Development	0	2	5	9	18	5	4.26	34
	Employee Safety	1	2	4	10	15	4	4.09	33
	Employee Health	1	2	6	7	16	4	4.06	33
	Recruit	3	4	7	12	6	4	3.42	33
	Employee Engagement	1	1	6	7	17	5	4.19	32
	Employee Satisfaction	2	1	5	10	12	4	3.94	31
	Work Environment	2	1	4	10	16	4	4.12	33
	Organization Culture	3	2	3	9	14	4	3.94	31
	Consumer Privacy	3	1	1	9	15	5	4.10	29
Value Chain	Consumer Data	3	1	1	8	16	5	4.14	29
	Consumer Info. Sharing	3	1	2	7	15	5	4.07	28
	Consumer Health & Safety	2	1	1	8	15	5	4.18	28
	Consumer Communication	1	2	7	11	7	4	3.75	28
	Consumer Outreach	2	1	5	9	11	4	3.93	28
	Consumer Marketing	1	1	6	10	10	4	3.96	28
	Supplier Influence	0	1	3	10	14	4.5	4.32	28
	Supplier Outreach	0	1	3	10	13	4	4.30	27
	Supply Chain Management	0	1	3	10	14	4.5	4.32	28
	Supplier Health & Safety	1	3	7	8	8	4	3.68	28
	Consumer Option	3	2	10	8	4	3	3.30	27
	Jobs Creation	1	2	10	9	5	3.5	3.54	28
	Local Bus Suppliers	1	2	8	7	8	4	3.70	27
	Global Issues	1	4	6	10	7	4	3.64	28
Local Community & Society	Local Comm. Infrastructure & Edu.	2	2	4	12	7	4	3.71	28
	Local Comm. Acceptance	1	2	4	13	7	4	3.82	28
	Local Comm. Programs	1	1	5	14	6	4	3.82	28
	Low Income Community	1	2	8	8	9	4	3.79	28
	Corruption	3	1	5	5	14	4.5	3.93	28
	Reputation	2	0	6	8	12	4	4.00	28

**Table 23 Number of Criteria by Median Value**

Median	Number of Criteria
1	0
2	0
3	3
3.5	2
4	59
4.5	5
5	11

As shown in Table 23, 75 of 80 (94%) of the criteria have a median value of 4 or greater. The median values for relevance, practicality, reliability and significance are displayed in Table 24 by criteria. The results summarized in the table showed that the median value for each answer for each criterion on the four factors was at or above 3 for all criteria; therefore, none of the criteria were excluded or dropped from the framework.

**Table 24 Summary of the Survey Participants' Views of the Presented ICT Sustainability Criteria**

C#	Criteria	Relevance (Median)	Practicality (Median)	Reliability (Median)	Significance (Median)
C1	Vision	5	4	4	5
C2	Commitment:	5	4	4	4.5
C3	Transparency	5	4	4	4
C4	Stakeholders Engagement:	5	3.5	4	5
C5	Compliance	4	4	4	4
C6	Code of Conduct	4	4	4	4
C7	Reporting	4	4	4	4
C8	Benefits and Wages	4	4	4	4
C9	Performance Evaluation	4	4	3.5	4
C10	Diversity	4	4	4	4
C11	Job Opportunities	3	3	3	3.5
C12	Employees Awareness	5	4	4	4
C13	Professional Development	4.5	4	4	5
C14	Workplace Safety	4	4	4	4
C15	Healthy Environment	4	4	4	4
C16	Recruitment	3	4	3	4
C17	Employees Engagement	5	4	4	5
C18	Employees Satisfaction	4	4	4	4
C19	Work Environment	4	4	4	4
C20	Organization Culture	4.5	4	3.5	4
C21	Privacy	5	4	4	5
C22	Data	4.5	4	4	5
C23	Information Sharing	5	5	4	5
C24	Consumer Health and Safety	5	4	4	5
C25	Consumer communication	4	4	4	4
C26	Consumer outreach	4	4	3	4
C27	Customer marketing	4	4	4	4
C28	Consumers Optionality	4	3	3	3
C29	Supplier influence	4	4	4	4.5
C30	Supplier Outreach	4	4	4	4
C31	Supply Chain Management	4.5	4	4	4.5
C32	Supplier health and safety	4	3	3	4
C33	Jobs creation	4	3	3	3.5
C34	Support of local suppliers and businesses	4	4	4	4
C35	Education and Infrastructure in local community	4	4	3	4
C36	Acceptance by local community	4	4	4	4
C37	Support of programs that benefit local community	4	4	3.5	4
C38	Volunteerism and Philanthropy	4	3.5	3	4
C39	Corruption	4	3	3	4.5
C40	Reputation	4	4	4	4
C41	Global Issues	4	3.5	3	4
C42	Budget	4	4	4	4
C43	Financial Analysis	4	4	4	4
C44	Key Performance Indicators	4	4	4	4
C45	Risk Management:	4	4	4	4
C46	Marketing Strategy	4	4	4	4
C47	Branding	4	4	4	4
C48	Internal Marketing	4	4	4	4
C49	Marketing materials and give-aways	4	4	3.5	4
C50	Employees compensations	4	4	4	4
C51	Performance Evaluations and Incentives	4	4	4	4
C52	Energy	5	4	4	5
C53	Waste	4	4	4	4
C54	Water	4	4	4	4
C55	Parking and Transportation Facilities	4	3	3	4

C#	Criteria	Relevance (Median)	Practicality (Median)	Reliability (Median)	Significance (Median)
C56	Material Use	3	4	4	4
C57	Data center facility	5	4	4	5
C58	Systems and Asset Management	5	4	4	4
C59	Design and Architecture	5	4	4	5
C60	Servers	4.5	4	4	4
C61	Storage	4	4	4	4
C62	Network	4	4	4	4
C63	Applications Portfolio Management	4	3	3	4
C64	PC and monitor devices and their accessories	4	4	3.5	4
C65	Power usage of PC monitors and equipment	5	4	4	4
C66	Telephony and wireless power consumption	3	3	3	4
C67	Telephony and wireless electronic waste	4	3	3	4
C68	Printing & Copying	5	4	4	4
C69	Office Supplies	3	3	3	3
C70	Service Contracts Management	4	3	3	4
C71	influence contractors	3	3	3	3
C72	Transportation	4	4	4	4
C73	eWaste Management:	4	4	4	4
C74	Environmental Sustainability Management System	5	4	4	4
C75	Environmental Policies	4	4	4	4
C76	Environmental Reporting	4	4	4	4
C77	Carbon Management	4	4	4	4
C78	Enterprise IT design and architecture	4	4	4	4
C79	Lean IT	4	4	4	4
C80	Virtual meetings and virtual offices	5	4	4	4.5
	Signifies criteria with median values below 4				

## 4.5 Development of the Rating Model

As explained in the methodology, I elected to develop the ICT sustainability ratings based on a composite index (CI) of multiple criteria. CI ratings are the most widely adopted means for assessing sustainability performance in various industry sectors (R. K. Singh et al. 2007). Composite indices are based on the theory of Multiple Criteria Decision Analysis (MCDA). In MCDA, contributions of criteria must be explicit and unique; judgment forms the foundation for many MCDA models. The process of MCDA involves: criteria assessment and valuation, developing weights for criteria based on stakeholder input, and combining criteria values and weights into a meaningful performance score (Adams and Ghaly 2007).

The MCDA technique provides a consistent method for dealing with the complexity of integrating the three pillars of sustainability and the contributing criteria embedded in each pillar. Integrating the three dimensions of sustainability as part of the

evaluation design is what distinguishes today's successful sustainability assessment methods. According to Gibson (2006), "many approaches to sustainability oriented assessments — at the project as well as strategic level — have begun by addressing the social, economic and ecological considerations separately and have then struggled with how to integrate the separate findings" (Gibson 2006b).

The development of a composite sustainability index requires that different dimensions of sustainability be combined in a meaningful way. To do so, criteria must be normalized and weighted. This implies a decision on which normalization method to use, which weighting model to choose, which aggregation procedure to apply and how to interpret the resulted rating (index) in practical terms. Weights and aggregation methods strongly relate to each other and have important impact on the value of the composite of indicators and the resulting rating. The normalization, weighting and aggregation techniques selected should fit the overall objective of the rating model and must be appropriate for arriving at a meaningful and informative rating.

#### **4.5.1 Normalization**

By their nature, social, economic and environmental criteria are not commensurate with one another. To combine the multi-dimensional criteria into a meaningful composite index, it was first necessary to bring the information into a common unit of measurement (normalize the data). Categorical scales are commonly used for normalization in sustainability ratings, along with re-scaling, ranking and standardization (z-score) methods (Nardo et al. 2005). In the categorical scales method, classifications such as: "one, two or three stars", or "fully achieved, partly achieved, or

not achieved" are designated; each level of achievement is assigned a score on a common scale. The selected normalization method should take into account the data properties and the objectives of the criteria. The main objective of the sustainability rating is to represent the level of achievement and sustainability performance of an ICT organization; a categorical scale satisfied this objective. The progress and achievement level were reflected on a scale of 0 (lowest) to 5 (highest). The following definitions were based on a review of other sustainability frameworks:

- Level 0 (zero) signifies "no effort or progress". It is also used to reflect the situation where insufficient amounts of data are available.
- Level 1 signifies "initial and minimum progress", if the indicator is minimally met, or at the lower threshold if it is a numeric measure.
- Level 3 signifies "intermediate progress and partial fulfillment" of the indicator.
- Level 5 signifies "top achievement and complete fulfillment" of the indicator.

#### **4.5.2 Weighting**

There are three primary techniques (schemes) for determining weights in composite indicators frameworks (R. K. Singh et al. 2007; Nardo et al. 2005; Mayer 2008):

- **Equal Weighting (EW)**

In this approach all criteria are assigned the same weight. This method is commonly used in policies and sustainability related indices because of the

transparency and recognition of equal status of all criteria. It is also simple to apply and easy to understand.

- **Weights based on statistical models**

Principal component analysis, factor analysis and multiple regression techniques may be used to assign weights. In these techniques weights are based on a statistical analysis that relates the rating (dependent variable) with the criteria (independent variables). One concern is that weights are assigned to achieve a statistically valid result; often these models do not produce values that are easily understood or appreciated by the stakeholder. For models with a large number of independent variables, a very large data set is required from which to perform a statistically valid analysis. This may be impractical based on the availability of information.

- **Weights based on participatory methods**

In this approach, experts (who represent various stakeholders) are queried to determine the weights for the criteria. The Analytic Hierarchy Process (AHP) is a commonly used participatory approach. Experts are selected based on their knowledge of issues being rated and appreciation for priorities to reflect multiple stakeholders' viewpoints. Weights in this model are based on expert opinion and not mathematical manipulation; thus values of weights are more accepted as surrogates for importance. Weighting reliability is one concern associated with the participatory models; weights might reflect the urgency of

certain issues rather than the importance. A large number of criteria may be exhausting for experts to evaluate and may result in inconsistencies.

The use of equal weighting (EW) is common in sustainability related composite indicators such as the Environmental Sustainability Index (ESI) (Esty et al. 2005). The technique works well when all dimensions (economic, social, and environmental) have equal representation by having a similar number of indicators, when indicators do not overlap or have redundancy, and when the scales of the indicators are commensurate.

As a starting point, I selected a combination of the EW technique and participatory model to determine the weights of criteria in the development of the composite index. My selection of EW was mainly driven by the core principles of sustainability to recognize equally the status of all dimensions (economic, social, and environmental). This approach also provided for transparency, ease of understating and consistency with the global sustainability community (Morse, Vogiatzakis, and Griffiths 2011, 43). The following quotes from recognized sustainability authorities from around the world strongly support the need for equal weighting:

**The Forrester Stewardship Council (FSC)**

“With the FSC certification, EBFlora confirms the commitment to the responsible handling of forests, with the means of attending three equally important values of future generations: social, environmental, and economic necessities” (ebflora 2012).

**Environmental Sustainability Index**

"We settled on uniform weighting of the 21 indicators because simple aggregation is transparent and easy to understand. Moreover, when we asked leading experts from the governmental, business, and non-governmental sectors to rank the indicators, none stood out as being of substantially higher or lower importance than the others" (Esty et al. 2005, 13).

### **Urban Affairs Review**

"In a recent literature, scholars have defined sustainability as being made up of three interrelated and equally important pillars: environment, economics, and social justice or equity" (Opp and Saunders 2013).

### **Secretary General of the United Nations**

"Despite growing global awareness of the dangers of environmental decline – including climate change, biodiversity loss and desertification – progress since the Earth Summit has been too slow. We will not build a just and equitable world unless we give equal weight to all three pillars of sustainable development – social, economic and environmental" (UNESCO 2011).

### **The European Union**

"...the largest proportion of respondents believe policymakers should regard environmental issues as of equal importance to social and economic ones" (ENS 2005).

Within the equally weighted objectives, I used a participatory model to assign individual criteria weights.

#### 4.5.2.1 Weights of Main Assessment Components: Social, Economic, Environmental and Innovation

Equal weighting was applied to each of the main sustainability objectives (economic, social and environmental). In recognition of the role of innovation in sustainability, I followed the approach of the USGBC in the LEED rating scheme and the Data Center Maturity Model of the Green Grid. Using an equal weighting technique, the sustainability components (economic, social and environmental) were each assigned a weight of 30%; thus 10% was contributed by innovation. In summary, the weights were structured per the hierarchy depicted in Figure 41.

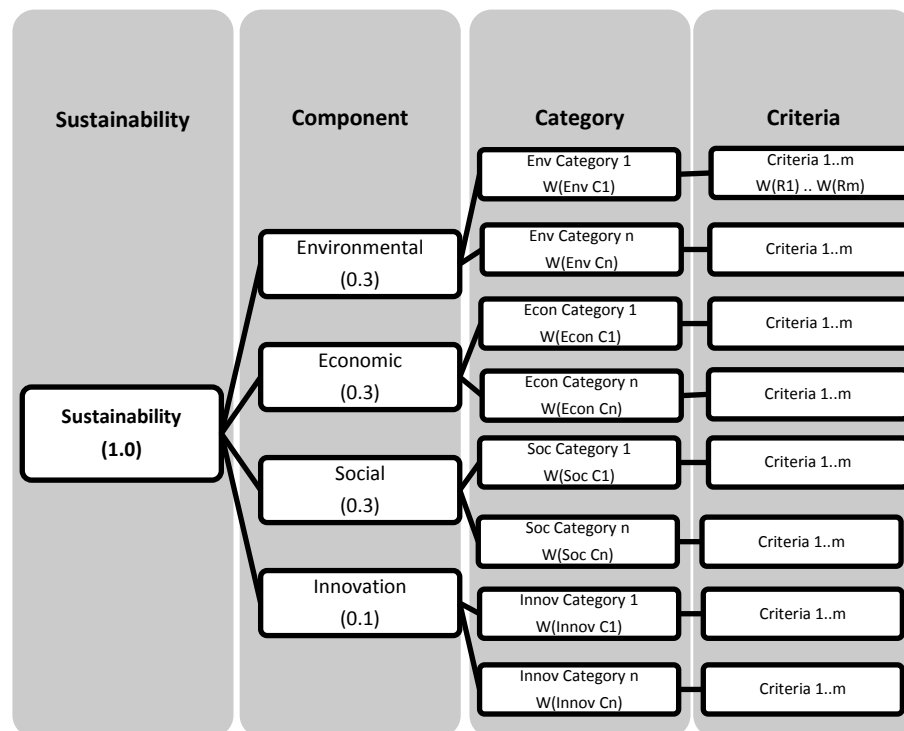


Figure 41 Weightings Structure of Rating Criteria

#### 4.5.2.2 Weights of Main Categories

The weights of the categories were determined based on expert opinion. The survey results were used to determine the weights of the categories. Experts were surveyed about the importance of considering selected categories under each sustainability component. The weights of the main categories were extracted from the experts' answers regarding the importance of each category. The weights of each category were then calculated per the following method:

1. For each category, experts rated the importance on a Likert scale (1 to 5). The median value was selected over the average value for weight calculations. The median is more robust than other statistics. The average is more easily influenced by extreme results or outliers. The median value is a more consistent value and less likely to change subject to one opinion.
2. The weight of the categories under the economic, social and environmental was prorated as shown in equation 1.

##### Equation 1 Weight of Category

$$W(C_i) = \frac{M(C_i)W(P_k)}{\sum_{i=1}^n M(C_i)}$$

Where:

$W(C_i)$ : Weight of Category  $C_i$

$M(C_i)$ : Median of Expert Scores for Category  $C_i$

$W(P_k)$ : Weight of Pillar Component  $P_k$  ,  $W(P_k) = 0.3$

$i$ : indicator variable for the sustainability category

$k$ : indicator variable for the sustainability pillar component

A summary of the resulting category weights are provided in Table 25. The research and development category assumed the value of 10% assigned to innovation.

**Table 25 Calculated Weights for the Categories**

Component	Category	Median	Total Medians/ Component	Component Weight	Weight
Social	Sustainability Governance	4.5	19.5	0.30	0.07
	Workforce	5			0.08
	Value Chain	5			0.08
	Local Community & Society	5			0.08
Economic	Financial and Risk Management	4	12	0.30	0.10
	Marketing	4			0.10
	Compensation & Financial Incentives	4			0.10
Environmental	General Facilities	5	25	0.30	0.06
	Data Center and Computing	5			0.06
	IT Office Equipment Management	5			0.06
	Environmental Management & Reporting	5			0.06
	Green Enterprise IT	5			0.06
Innovation	Research and Development	5	5	0.10	0.10
<b>Total</b>				<b>1.00</b>	<b>1.00</b>

#### 4.5.2.3 Weights of Criteria

Weights of the criteria under each sustainability category were determined in a similar fashion. Experts were surveyed for their views and opinions about the relevance, practicality, reliability and significance. The weights were determined based on the significance factor. The basis for this assignment was a recommendation by OECD regarding composite indicator development: “Greater weight should be given to components which are considered to be more significant in the context of the particular composite indicator” (Freudenberg 2003, 12). The significance-based weights for the criteria were calculated as shown in equation 2.

#### Equation 2 Weight of Criteria

$$WS(R_{ij}) = \frac{MS(R_{ij})W(C_i)}{\sum_{j=1}^m MS(R_{ij})}$$

Where:

$WS(R_{ij})$ : Weight of Criteria  $j$  in Category  $i$

$MS(R_{ij})$ : Median of Expert Scores  $R_{ij}$  of Criteria  $j$  in Category  $i$

$W(C_i)$ : Weight of Category  $i$

$j$  = the indictor variable for sustainability criteria

$i$  = the indictor variable for sustainability category

A summary of criteria weights calculations are provided in Table 26. The Research and Development criteria (criteria 81 and 82) in the innovation area were not included in the survey; both were assigned an equal weight.

**Table 26 Criteria Weights**

C#	Criteria	Category Weight	Weight in Category
C1	Vision	0.069	0.011
C2	Commitment:		0.010
C3	Transparency		0.009
C4	Stakeholders Engagement:		0.011
C5	Compliance		0.009
C6	Code of Conduct		0.009
C7	Reporting		0.009
C8	Benefits and Wages	0.077	0.006
C9	Performance Evaluation		0.006
C10	Diversity		0.006
C11	Job Opportunities		0.005
C12	Employees Awareness		0.006
C13	Professional Development		0.007
C14	Workplace Safety		0.006
C15	Healthy Environment		0.006
C16	Recruitment		0.006
C17	Employees Engagement		0.007
C18	Employees Satisfaction		0.006
C19	Work Environment		0.006
C20	Organization Culture		0.006

C#	Criteria	Category Weight	Weight in Category
C21	Privacy	0.077	0.007
C22	Data		0.007
C23	Information Sharing		0.007
C24	Consumer Health and Safety		0.007
C25	Consumer communication		0.006
C26	Consumer outreach		0.006
C27	Customer marketing		0.006
C28	Consumers Optionality		0.004
C29	Supplier influence		0.007
C30	Supplier Outreach		0.006
C31	Supply Chain Management		0.007
C32	Supplier health and safety		0.006
C33	Jobs creation	0.077	0.008
C34	Support of local suppliers and businesses		0.010
C35	Education and Infrastructure in local community		0.010
C36	Acceptance by local community		0.010
C37	Support of programs that benefit local community		0.010
C38	Volunteerism and Philanthropy		0.010
C39	Corruption		0.011
C40	Reputation		0.010
C41	Global Issues		0.010
C42	Budget	0.100	0.025
C43	Financial Analysis		0.025
C44	Key Performance Indicators		0.025
C45	Risk Management:	0.100	0.025
C46	Marketing Strategy		0.025
C47	Branding		0.025
C48	Internal Marketing	0.100	0.025
C49	Marketing materials and give-aways		0.025
C50	Employees compensations		0.050
C51	Performance Evaluations and Incentives	0.100	0.050
C52	Energy		0.014
C53	Waste		0.011
C54	Water	0.060	0.011
C55	Parking and Transportation Facilities		0.011
C56	Material Use		0.011
C57	Data center facility	0.060	0.010
C58	Systems and Asset Management		0.008
C59	Design and Architecture		0.010
C60	Servers		0.008
C61	Storage		0.008
C62	Network		0.008
C63	Applications Portfolio Management		0.008
C64	PC and monitor devices and their accessories	0.060	0.006
C65	power usage of PC monitors and equipment		0.006
C66	Telephony and Wireless power consumption		0.006
C67	Telephony and wireless electronic waste		0.006
C68	Printing & Copying		0.006
C69	Office Supplies		0.005
C70	Service Contracts Management		0.006
C71	influence contractors		0.005
C72	Transportation		0.006
C73	eWaste Management:		0.006
C74	Environmental Sustainability Management System	0.060	0.015
C75	Environmental Policies		0.015
C76	Environmental Reporting		0.015
C77	Carbon Management:	0.060	0.015
C78	Enterprise IT design and architecture		0.019
C79	Lean IT		0.019
C80	Virtual meetings and virtual offices	0.100	0.022
C81	Investment in R&D		0.050
C82	Incentives & Awards		0.050

#### 4.5.3 Aggregation Technique

For aggregating the criteria into a composite index, I selected the summation of weighted and normalized sub indicators (linear aggregation) technique. Linear aggregation is the most commonly used method (R. K. Singh et al. 2007; Nardo et al. 2005). One of the concerns associated with linear aggregation is related to the properties of the weights assigned to the different criteria. If weights are not carefully designed and determined, the resulting composite index might not reflect the information of all criteria. The selection of an equal weighting technique for the sustainability pillar components helps to alleviate this concern. The significance of each component is not influenced by the addition of criteria to a category. The sustainability rating (index) is calculated as shown in equation 3.

**Equation 3 Sustainability Model Rating**

$$SB = \sum_{i=1}^n WS(R_{ij})S_{ij}$$

Where:

$SB$ : ICT Organization Sustainability Rating ( $0 \leq SB \leq 5$ )

$S_{ij}$ : Normalized Score of Criteria  $j$  in Category  $i$

$WS(R_{ij})$ : Weight of Criteria  $j$  in Category  $i$

$$\sum_{i=1}^n \sum_{j=1}^m WS(R_{ij}) = 1$$

$i = 1, \dots, n$

$j = 1, \dots, m$

#### 4.5.4 Rating Levels

Based on the achievement of the ICT organization, a rating value between 0 and 5 was determined. Five levels were defined based on four areas.

1. ***Achievements***: Level of achievement in all sustainability objective areas.
2. ***Areas for improvements***: Type and level of improvements needed in all sustainability objective areas (e.g. minor, significant).
3. ***Leadership*** (internally and externally): The leadership role in sustainability of the organization both internally (supporting and sponsoring sustainability efforts within the organization), and externally (within the sector and as part of global sustainability efforts).
4. ***Strategic integration***: Integration of sustainability within the organization practices and business decisions.

A detailed definition of each level is provided in Table 27. As noted in the definitions, the pre-commitment level reflects a default level. It is called "pre-committed" because once an ICT organization decides to be voluntarily rated, information and data will become available to assess achievements. The "committed" level (1-1.9) is the lowest rating possible for an ICT organization in terms of sustainability achievements.

**Table 27 Rating Level Definitions**

Champion 4 - 5	Exemplary 3 - 3.9	Capable 2 - 2.9	Committed 1 - 1.9	Pre-Committed 0-0.9
<b>Achievements</b>				
Significant achievements in all sustainability goals. Goes beyond compliance and voluntarily endorsement of international, local, and industry initiatives.	Advanced achievements in most sustainability goals in a balanced way. Compliance with all laws and regulations and proactive towards upcoming regulations and voluntary international, local, and industry initiatives.	Key achievements are made towards sustainability goals. Liabilities are well-managed by compliance with the law and all labor, environmental, health, and safety regulations.	There is some commitment to sustainability goals but achievements are limited to areas with immediate financial benefits and savings. Liabilities and risks are poorly managed.	Insufficient information or no efforts
<b>Areas for improvement</b>				
Little to none.	Some optional improvements.	Room for some improvements exist in some areas with need to balance efforts towards achieving social, environmental, and economic goals.	Room for significant improvements exists in all sustainability goal areas.	Insufficient information or no efforts
<b>Leadership</b>				
<i>Internal:</i> Sustainability notion is internalized with values, behaviors, and culture of the organization and strong support and sponsorship from senior executives.  <i>External:</i> Takes a public stand for sustainability in the ICT sector and is helping the sector as a whole make the transition.	<i>Internal:</i> Sustainability is embraced as an organizational value, and there is a high level of awareness on sustainability across the organization, and buy-in and support from leadership.  <i>External:</i> Actively participates in and contributes to the ICT sector initiatives on sustainability.	<i>Internal:</i> The organization is taking part in the sustainability initiatives within the company. Partial buy-in and some support from leadership.  <i>External:</i> Communication on sustainability initiatives is considered a public-relations, marketing, and corporate social responsibility matter.	<i>Internal:</i> Sustainability is not internalized or part of the organization's or company's values. Initiatives are limited to groups or teams with limited support or buy-in from leadership.  <i>External:</i> The organization is observing what's happening in the area of sustainability in the ICT sector.	Insufficient information or no efforts
<b>Strategic Integration</b>				
Sustainability is fully integrated into the framework of how the organization and company operates and functions.  Costs associated with sustainability initiatives and efforts are considered investments and the right thing to do to boost innovation, productivity and competitive advantage.	Sustainability is partially integrated into how the organization operates and functions where sustainability initiatives are likely to be in specialized departments and not built in and institutionalized or integrated in the business model.  Cost associated with sustainability initiatives is considered an investment to minimize uncertainty, enhance reputation, and help maximize stakeholder value.	Integration of sustainability into the way the organization operates and functions is very limited and is in response to some compliance requirements. The organization reactively does what it legally has to do and does it well.  Emerging environmental and philanthropic social actions are treated as costs and not as investments.	Sustainability is not integrated into the way the organization operates or functions.  There is some interest in supporting sustainability initiatives within the organization, but with no resources allocated to support such interest	Insufficient information or no efforts

## **5. VALIDATION AND RESULTS ANALYSIS**

Sustainability in the ICT sector is still developing. Organizational profiles were needed to validate the results of the model and the assignment of the criteria scores. To test the full range of ratings, organizational profiles were developed that represent a wide variety of characteristics and sustainability achievement. One profile represented the actual accomplishments of a “real” North American Telecommunications Corporation (NATC). All other profiles were hypothetical. ICT and sustainability experts developed ratings for individual criteria on a 1-5 scale for each of the 82 criteria previously described. Similarly, the experts rated the organization based on the descriptions that relate to sustainability accomplishment. The expert results and the model results were compared to validate the ability of the model to accurately reflect the expert judgment. This chapter provides details regarding the validation approach and results.

### **5.1 Developing ICT Organizational Profiles**

Thirteen organization profiles with various levels of achievement in social, economic, environment, and innovation sustainability were developed. One of the profiles was an actual ICT Organization. The rest of profiles were developed for the purpose of testing the rating model and validating it against the opinions of the experts’ focus group. For each profile, the sustainability performance was described as a number

of characteristics in the form of a checklist of achievements. The characteristics were organized by category and sustainability area (environmental, economic, social, and innovation). The achievements for an organization were indicated by an “x” next to the possible criteria characteristics. Table 28 shows an example of how the profile was structured for the Sustainability Governance category under the social area for the first profile. A full example of an organization profile is displayed in Appendix J and a summary of the thirteen organizational profiles is provided in Appendix K.

**Table 28 Sample Organizational Profile; Sustainability Governance Category**

Profile 1	<b>SOCIAL</b>	
	<b>Sustainability Governance</b>	
	<b>C1. Vision</b> <b>C2. Commitment</b> <b>C3. Transparency</b> <b>C4. Stakeholder Engagement</b>	<b>C5. Compliance</b> <b>C6. Code of Conduct</b> <b>C7. Reporting</b>
x	There is a vision for sustainability within the organization and the company at large.	
x	There is a clear business case for pursuing sustainability	
x	Clear set of sustainability commitments publicly communicated	
	Formal strategic sustainability plan/ Initiative	
x	Consideration of sustainability in the planning process and method or a sustainability planning process is in place and is engaging, transparent and solicits feedback from all levels of employees	
	Sustainability is integrated as the decision criteria on projects and actions	
x	Allocated resources for sustainability efforts with clear measures of accountability	
x	Executive leadership support, sponsorship and advocacy within sector for sustainability	
x	Provide access to complete and accurate sustainability performance data to investors, regulators, and the public	
x	Produce a publicly available formal annual sustainability report	
x	Provide timely, accurate and complete information to authorities and the public when a crisis does occur (e.g. environmental, privacy breach), and provide access for the media and public about such incidents and responses	
x	Regular assessment of stakeholders’ expectations and satisfaction levels with the organization sustainability performance	
x	Educate stakeholders about sustainability efforts and promote sustainability as part of organization image to those stakeholders and markets that will care	
x	Keep up to date with mandates, regulations, and standards set by the federal, state/local governments and the industry	
x	Voluntarily endorsement and participation in government, international, and sector initiatives, standards and recommendations	
x	The organization has its own policy or code of conduct or endorse an industry code of conduct for ethical and environmental responsibility with mechanisms in place to assure effective implementation of such policy	
x	Report to management and other stakeholders on sustainability performance	
x	Regular internal communication to all staff with updates on sustainability goals and achievements	

## 5.2 Applying the Rating Model

### 5.2.1 Applying the Rating Model at a Leading North American Telecommunication Company

One profile reflects the accomplishments of a prominent North American Telecommunication Company (referred to as NATC). For the validation of the rating model, the characteristics of the organization were compiled by George Mason University graduate students who were working under a grant with NATC. The author did not participate in the data collection effort to avoid any potential bias. Clarification was provided as needed during the data collection effort. The resulting profile was included in the model validation. A set of guidelines for conducting the assessment were developed; instructions for assessing each of the criteria in the rating model were provided. Methods to be used in the interviews, analysis of documents, and needed calculations were suggested. Some observations regarding the assessment are noted in Table 29.

**Table 29 Organizational Profile Development for NATC – Observations**

<b>Task</b>	<b>Observation</b>
<b>Data availability</b>	There were areas where the company did not receive any credit because of a lack of data
<b>Measurability of indicators</b>	Some indicators were hard to measure because of their qualitative nature (e.g. governance and change management).
<b>Rating and point allocation</b>	A tiered approach (or scale-base) scoring or points system was recommended.
<b>Baseline and Targets</b>	Having baseline values showing where the sector stands today can have significant value for ICT organizations in their attempt to improve and move to more sustainable practices. Defined targets or goals can be of great value to the organization in terms of assessing progress, priorities, and planning.
<b>Benchmarking</b>	Knowing how the company compares to peers is as valuable as knowing how the company is doing. Benchmarking is particularly important in newly recognized areas like sustainability when there is little information available. ICT companies are accustomed to benchmarking against their peers in technical areas, products, specifications, capacity, IT services quality, and more.
<b>Innovation</b>	Recognizing innovative approaches to addressing sustainability challenges related to ICT practices is both useful and important.
<b>Linkage to company-wide sustainability efforts</b>	While the rating system's focus is on ICT practices, it should recognize the linkage and contributions of sustainable ICT practices to company-wide sustainability.

The successful data collection effort at NATC demonstrated that the model could be applied beyond a conceptualized set of profile characteristics. Feedback was collected on how the framework, rating, and data collection guidelines could be improved in the future to enhance usability and applicability of the assessment criteria. The NATC data collection team participated in the application of the rating model and provided the feedback on the practicality, feasibility of data collection, data availability, and general applicability of the framework.

From a practicality perspective, the framework identified areas that required attention for improvement. Decision makers were able to define priorities for short and long term actions based on the rating results and analysis. Examples of the resulting strategies that were developed in response to specific model results are shown in Table 30.

**Table 30 Action Plans Adopted at NATC as a Result of the Sustainability Rating**

Challenge	Action
Enhancing energy efficiency in the data center	<p>Made a policy that all future purchased servers, storage, and network infrastructure are energy efficient per EPEAT, EnergyStar or Climate Saver Computing Initiative recommendations.</p> <p>Reduced redundant infrastructure and underutilized systems.</p> <p>Adopted Green Grid Data Center Maturity Model metrics, recommended energy efficiency goals, and power and cooling efficiency guidelines.</p>
Financial data availability and feasibility of collection	<p>Raised awareness, obtained buy-in from finance and human resources teams, and collaborated with them on developing internal financial sustainability metrics that can be embedded and tracked in budgets, accounting, and financial analysis systems.</p> <p>Defined the baseline of the developed metrics (where is NATC today) and short and long term targets</p> <p>Identified data owners who will collect/provide data for the developed metrics on a regular basis. Made the analysis part of the regular financial audit, and reporting process.</p>

## 5.2.2 Applying the Rating Model to the Profiled Organizations

The rating model was applied to the thirteen organizational profiles including NATC. Tables 31 through 34 identify the sustainability criteria scores for each profile under the four major components. Table 35 below provides a summary of the overall rating results.

**Table 31 Model Score for Social Criteria**

Category	Criteria		Organizational Profile Index												
			1	2	3	4	5	6	7	8	9	10	11	12	13
Sustainability Governance	C1	Vision	5	4	1	2	3	2	1	1	1	5	2	1	5
	C2	Commitment:	4	3	1	2	2	2	1	1	3	5	4	3	5
	C3	Transparency	5	4	2	3	3	2	3	3	3	5	3	3	5
	C4	Stakeholders Engagement	4	3	2	3	2	1	3	1	1	5	4	3	5
	C5	Compliance	5	3	3	4	2	3	2	1	3	5	4	3	5
	C6	Code of Conduct	5	2	1	2	1	1	1	1	2	5	4	3	5
	C7	Reporting	5	3	1	2	2	2	1	1	2	5	4	3	5
Workforce	C8	Benefits and Wages	4	4	3	4	3	4	4	4	3	5	4	3	5
	C9	Performance Evaluation	4	4	1	2	3	1	1	1	1	5	3	3	4
	C10	Diversity	3	3	1	2	2	3	4	4	4	5	4	3	5
	C11	Job Opportunities	5	3	1	2	2	3	1	1	3	5	3	2	5
	C12	Employees Awareness	3	2	1	2	1	1	1	1	2	5	4	3	4
	C13	Professional Development	4	3	1	2	2	1	3	2	2	5	3	3	4
	C14	Workplace Safety	5	5	5	5	4	5	4	4	2	5	4	3	4
	C15	Healthy Environment	5	4	4	4	2	3	4	4	5	5	3	3	3
	C16	Recruitment	5	3	1	2	2	2	2	1	4	5	4	4	4
	C17	Employees Engagement	4	3	1	2	2	1	1	1	3	5	3	4	4
	C18	Employees Satisfaction	4	3	1	2	3	2	3	3	1	5	4	4	4
	C19	Work Environment	5	4	2	3	3	3	3	2	2	5	3	4	4
Value Chain	C20	Organization Culture	4	4	2	3	3	3	3	2	3	5	4	4	4
	C21	Privacy	5	4	3	4	3	3	4	3	4	5	3	4	5
	C22	Data	5	4	3	4	3	3	4	3	4	5	4	4	5
	C23	Information Sharing	5	4	3	4	3	2	4	3	4	5	4	3	5
	C24	Consumer Health and Safety	5	3	2	3	2	1	4	3	4	5	4	3	4
	C25	Consumer Communication	4	3	1	2	2	3	1	1	1	5	5	3	4
	C26	Consumer Outreach	4	3	1	2	2	3	1	1	1	5	4	3	4
	C27	Customer Marketing	5	3	2	3	2	2	1	1	1	5	4	3	4
	C28	Consumers Optionality	5	3	1	2	2	2	1	3	1	5	4	4	4
	C29	Supplier Influence	5	3	1	2	2	1	1	1	1	5	4	4	4
	C30	Supplier Outreach	3	3	1	2	2	1	1	1	1	5	4	4	5
	C31	Supply Chain Management	4	3	1	2	2	2	1	1	1	5	3	3	4
	C32	Supplier Health and Safety	3	3	1	2	2	1	4	3	1	5	3	3	4
Community and Society	C33	Jobs Creation	3	3	1	2	2	3	1	2	2	5	4	3	5
	C34	Support of local suppliers and businesses	3	3	1	2	2	3	1	2	3	5	3	3	4
	C35	Education and Infrastructure in local community	5	4	1	2	3	1	1	2	2	5	4	4	4
	C36	Acceptance by local community	4	3	1	2	2	2	3	3	2	5	5	4	4
	C37	Support of programs that benefit local community	5	3	1	2	2	2	1	2	2	5	4	4	4
	C38	Volunteerism and Philanthropy	5	3	1	2	2	3	2	3	3	5	5	4	4
	C39	Corruption	5	4	3	4	3	3	4	4	3	5	4	4	4
	C40	Reputation	3	4	2	3	3	3	4	3	3	5	5	4	4
	C41	Global Issues	4	2	1	2	1	1	1	3	2	5	4	4	4

**Table 32 Model Scores for Economic Criteria**

Category	Criteria		Organizational Profile Index												
			1	2	3	4	5	6	7	8	9	10	11	12	13
Financial Mgmt	C42	Budget	5	4	1	2	3	1	1	1	1	5	5	4	5
	C43	Financial Analysis	4	4	1	2	3	2	1	1	1	5	4	3	3
	C44	Key Performance Indicators	4	4	1	2	3	3	1	1	1	4	4	4	4
	C45	Risk Management:	3	4	1	2	3	3	4	1	1	5	4	3	4
Marketing	C46	Marketing Strategy	4	4	1	2	3	3	1	1	1	5	5	4	4
	C47	Branding	3	3	1	2	2	3	1	1	2	5	4	3	4
	C48	Internal Marketing	5	4	1	2	3	2	1	1	2	5	4	4	4
	C49	Marketing materials and giveaways	4	4	1	2	3	3	1	1	1	5	4	4	4
Compensations	C50	Employees compensations	4	3	3	4	2	3	4	3	3	5	4	4	5
	C51	Performance Evaluations and Incentives	4	3	1	2	2	3	1	1	1	4	4	3	5

**Table 33 Model Scores for Environmental Criteria**

Category	Criteria		Organizational Profile Index												
			1	2	3	4	5	6	7	8	9	10	11	12	13
Facilities	C52	Energy	4	4	2	3	3	3	1	1	3	5	5	4	4
	C53	Waste	4	3	2	3	2	4	1	1	4	5	4	4	4
	C54	Water	5	4	2	3	3	4	1	1	4	5	5	4	4
	C55	Parking and Transportation Facilities	5	3	1	2	2	3	2	1	1	5	4	4	5
	C56	Material Use	5	3	1	2	2	3	1	1	3	5	4	4	4
Data Center	C57	Data center facility	4	4	1	2	3	4	1	3	3	5	4	3	4
	C58	Systems and Asset Management	4	4	1	2	3	4	3	3	4	4	3	3	4
	C59	Design and Architecture	5	3	1	2	2	3	1	3	3	4	3	4	4
	C60	Servers	3	3	1	2	2	3	2	2	2	5	3	4	4
	C61	Storage	4	3	1	2	2	3	2	2	2	5	5	4	5
	C62	Network	4	4	1	2	3	4	4	3	3	5	3	3	5
	C63	Applications Portfolio Management	4	3	1	2	2	3	2	2	2	4	3	3	4
IT Equipment and Office	C64	PC and monitor devices and their accessories	5	4	1	2	3	4	1	2	2	5	4	4	5
	C65	power usage of PC monitors and equipment	5	4	2	3	3	4	1	1	2	5	3	3	4
	C66	Telephony and Wireless power consumption	5	4	1	2	3	5	1	1	2	5	4	3	5
	C67	Telephony and wireless electronic waste	5	4	1	2	3	5	1	1	2	5	4	3	4
	C68	Printing	5	4	3	4	3	5	3	4	4	5	4	4	5
	C69	Office Supplies	5	4	1	2	3	4	2	1	3	5	4	4	4
	C70	Service Contracts Management	4	3	1	2	2	3	1	1	2	4	4	4	5
	C71	influence contractors	3	3	1	2	2	3	1	1	1	4	4	4	5
	C72	Transportation	3	3	2	3	2	3	2	1	4	5	4	4	4
	C73	eWaste Management:	5	4	1	2	3	4	1	1	3	4	4	4	4
Env Mgmt	C74	Environmental Sustainability Management System	4	4	1	2	3	4	1	1	2	5	4	4	5
	C75	Environmental Policies	5	3	1	2	2	3	1	1	2	5	4	3	5
	C76	Environmental Reporting	5	4	1	2	3	3	1	1	1	4	3	3	4
	C77	Carbon Management	5	4	1	2	3	1	1	1	4	4	4	3	5
Green Enterprise	C78	Enterprise IT design and architecture	4	3	3	4	2	3	2	4	4	4	4	3	4
	C79	Lean IT	4	3	1	2	2	3	1	2	3	4	3	3	5
	C80	Virtual meetings and virtual offices	5	3	2	3	2	3	4	5	5	5	4	4	5

**Table 34 Model Scores for Innovation Criteria**

Category	Criteria		Organizational Profile Index												
			1	2	3	4	5	6	7	8	9	10	11	12	13
R&D	C81	Investment in R&D	5	3	1	2	2	2	1	1	1	3	3	3	4
	C82	Incentives and Innovation awards	5	3	1	2	2	2	1	1	1	3	4	3	4

**Table 35 Model Rating for Each Organizational Profile**

Organizational Profile Index	Rating Score	Rating Description
1	4.4	Champion
2	3.4	Exemplary
3	1.4	Committed
4	2.4	Capable
5	2.4	Capable
6	2.7	Capable
7	1.8	Committed
8	1.7	Committed
9	2.1	Capable
10	4.7	Champion
11	3.9	Exemplary
12	3.5	Exemplary
13	4.4	Champion
<b>Rating Key</b> 0 – <1 Pre-Committed 1 – <2 Committed 2 – <3 Capable 3 – <4 Exemplary 4 – 5 Champion		

### 5.3 Selecting a Panel of Elite Experts

The basis for the selection of individuals to serve on this panel was that they possessed extensive knowledge in sustainability rating practices. The panel served as a surrogate for the type of experts that might be consulted to provide feedback on the sustainability achievements of an ICT organization. This panel might be considered to be biased in favor of sustainable practices. This was necessary to ensure that the sustainability model ratings would provide useful results. The purpose of the panel was to validate the model results. This panel was carefully selected to reflect diverse

backgrounds and sector knowledge. The panel consisted of eleven professionals in the areas of finance, corporate social responsibility, ICT, and sustainability rating. In the selection process, I ensured a balanced representation of experts from the private, public, academic, government, nongovernmental and non-profit sectors. Biographical sketches for the experts are provided in Appendix L.

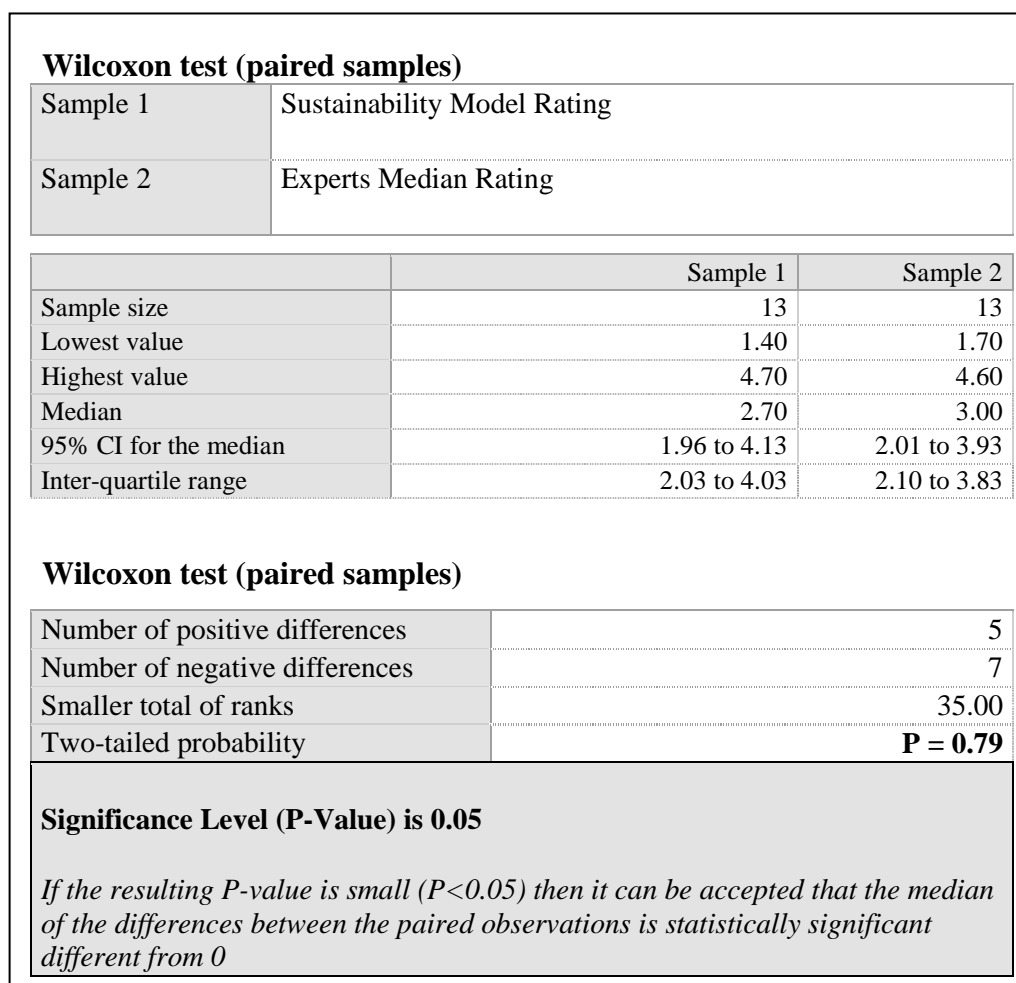
## 5.4 Validation and Results Analysis

For each organizational profile, the panel of experts rated the performance/achievements of the categories and the organization on a 1-5 scale; the rating descriptions (previously discussed in Chapter 4) for each level were provided. The following two tables provide a summary of the results of the expert assessments and ratings of the 13 organization profiles. Table 36 shows the experts' ratings by organizational profile. A summary of experts' ratings for each sustainability category for the 13 profiles is provided in Appendix M.

**Table 36 Summary of the experts overall ratings of the organization profiles**

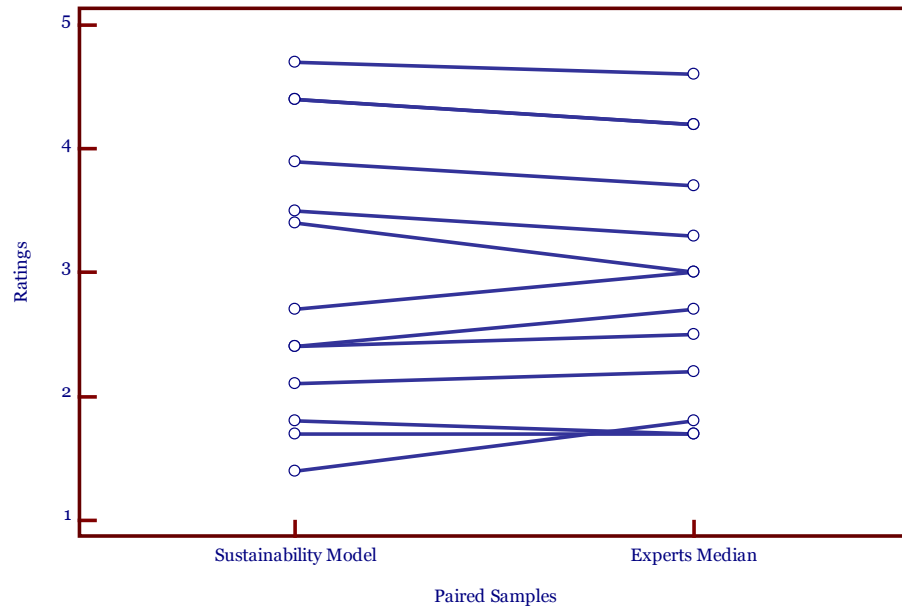
Panel Member Index	Organizational Profile Index												
	1	2	3	4	5	6	7	8	9	10	11	12	13
1	3.4	1.9	1.4	2.5	2.6	2.3	1.2	1.3	1.6	4.3	2.1	2.0	3.2
2	3.0	3.0	1.0	2.0	1.0	3.0	2.0	2.0	3.0	4.0	3.8	3.0	4.0
3	4.3	3.3	1.6	2.8	2.8	3.0	1.5	1.7	2.2	4.6	3.7	3.6	4.4
4	4.2	3.4	2.0	2.8	2.9	3.3	1.8	1.9	2.4	4.7	3.9	3.5	4.5
5	4.2	3.0	1.3	2.4	2.3	2.9	1.5	1.4	2.2	4.6	3.7	3.3	4.2
6	4.4	3.0	1.6	2.7	3.0	2.8	1.7	1.7	1.9	4.2	3.7	3.3	4.4
7	5.0	4.0	2.0	3.0	2.0	3.0	2.0	2.0	2.0	5.0	4.0	4.0	5.0
8	4.0	3.0	2.0	2.0	3.0	3.0	3.0	3.0	3.0	5.0	3.0	3.0	4.0
9	4.8	3.9	1.9	2.9	3.2	4.2	2.5	2.3	3.0	4.8	3.8	3.5	4.0
10	3.5	3.5	1.8	2.5	2.7	2.9	1.7	1.7	2.2	4.6	3.6	3.5	4.3
11	3.0	3.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	4.0	2.0	1.0	3.0
Sustainability Model	4.4	3.4	1.4	2.4	2.4	2.7	1.8	1.7	2.1	4.7	3.9	3.5	4.4
Median Experts Rating	4.2	3.0	1.8	2.5	2.7	3.0	1.7	1.7	2.2	4.6	3.7	3.3	4.2
Average Experts Rating	4.0	3.2	1.7	2.4	2.5	2.9	1.8	1.8	2.2	4.5	3.4	3.1	4.1

The first step in the validation of the model involved a variety of statistical comparisons between the experts' ratings with the model ratings for the organizational profiles. The "Wilcoxon Signed Rank Sum Test" was selected as the nonparametric equivalent to the two-sample t-test. It compares two paired groups that are mutually independent, and is recommended for data sets with less than 25 pairs. The test calculates the difference between each set of pairs and tests the null hypothesis that the two distributions are identical against the alternative hypothesis that the two distributions differ. The significance (P-value) level of the test is 0.05. When P-value is less than 0.05 then a significant difference exists between the two distributions. The paired samples in this first validation test included the rating values and the median of the expert rating for each of the organization profiles. The null hypothesis was that there is no significant difference between the model ratings and the expert ratings. The results obtained from the Wilcoxon test are summarized in Figure 42. The results showed a non-significant difference,  $P = 0.79$ ,  $P > 0.05$ . The null hypothesis was concluded; the difference between the two distributions is not significant for  $P=0.05$ .

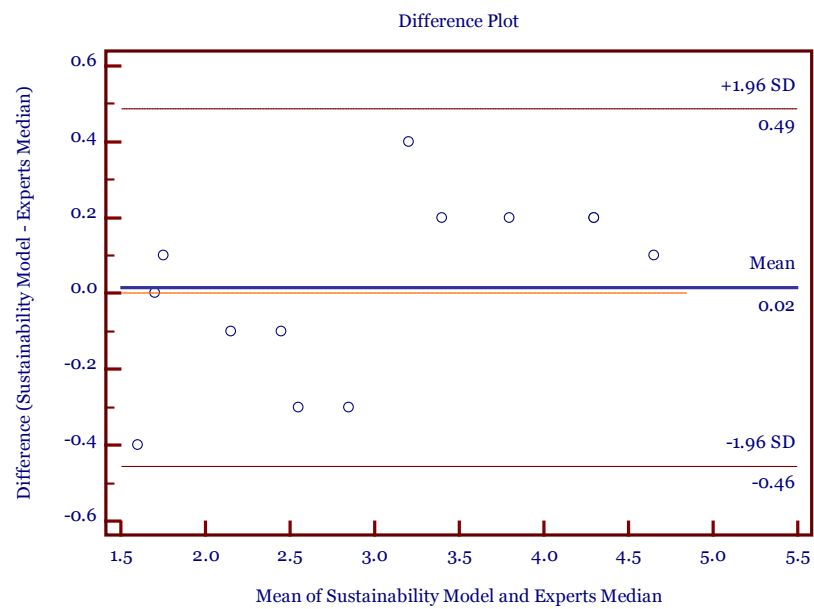


**Figure 42 Wilcoxon Signed Rank Test of the Sustainability Model Ratings and the Experts' Median Rating**

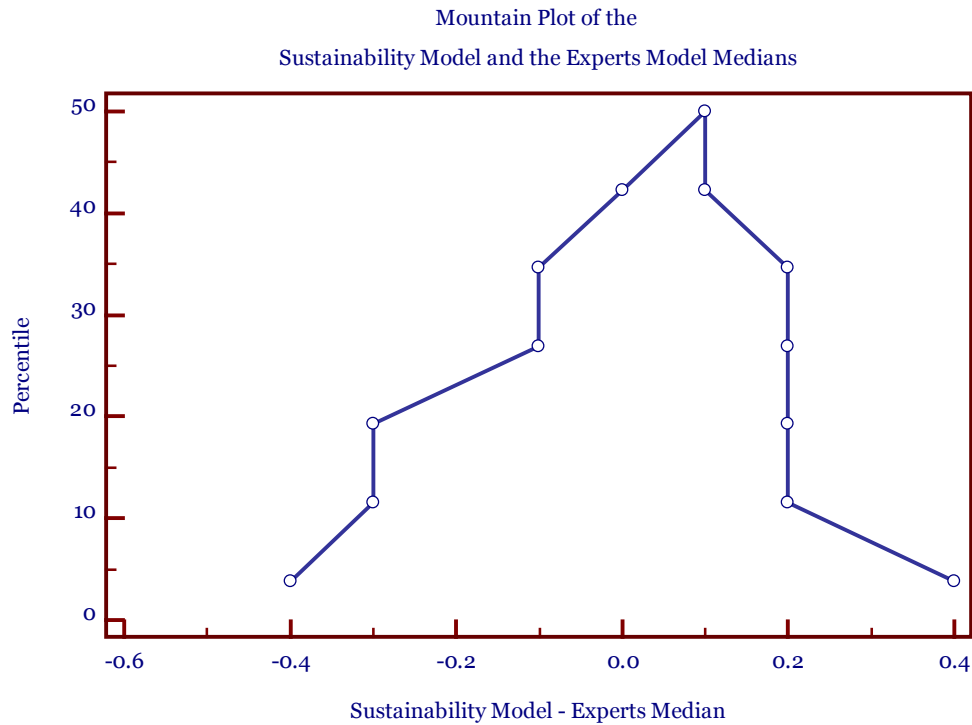
Figure 43 is a dot-and-line diagram of the matched pairs for the sustainability model ratings and the median experts' ratings for the 13 profiles. This diagram illustrates two important results. First, the model was applied to profiles that represent a broad range of sustainability accomplishments. Second, the diagram graphically reinforces the results of the Wilcoxon test. The parallel nature of the lines suggests a high degree of statistical significance between the model prediction and expert panel rating.



**Figure 43 Dot-and-Line Diagrams of Sustainability Model and Expert Median Ratings**



**Figure 44 Bland-Altman Plot of the Sustainability Model-Experts Median rating**



**Figure 45 Mountain Plot of Sustainability Model and Expert Median Ratings**

The Bland-Altman plot is used to compare two measurement techniques; the differences between two techniques are plotted against the mean value of the two techniques. Horizontal lines are drawn at the mean difference and at the limits of agreement, which are defined as the mean difference plus and minus 1.96 times the standard deviation (SD) of the differences. The plot is useful for revealing a relationship between the differences and the averages, for revealing systematic biases, and to identify possible outliers. When the differences between methods are within the mean  $\pm 1.96$  SD the two methods may be used interchangeably. A Bland-Altman plot of the difference between the sustainability model rating and experts' median rating is shown in Figure 44. All differences are within the  $\pm 1.96$  SD. The mean difference was 0.02 and the

differences ranged from a low of -0.46 to a high of 0.49. The plot also shows a tendency for the model to over-predict higher achieving organizations as indicated by the upward trend of the differences.

“Mountain Plots” complement the Bland-Altman plots by offering a way to investigate the distribution of the differences. A Mountain Plot is created by computing the percentile for the ranked differences between a two methods. These percentiles are then plotted against the differences. A Mountain Plot of the experts’ median ratings (reference) and the sustainability model rating (the new method) is shown in Figure 45.

A number of comparisons between the expert category ratings and the model category ratings were performed. The first test examined the consistency and agreement levels amongst the experts in rating the various categories. The Intra-class Correlation Coefficient (ICC) was used for this purpose. The ICC is a measure of the reliability of measurements or ratings when two, or preferably more, raters rate a number of study subjects. Figure 46 provides the results for the ICC values associated with the expert ratings for the Sustainability Governance category. In other word, the ICC value tests the consistency in the expert opinion within the Sustainability Governance category. Expert ratings of this category showed a high level of consistency for a single rater (single measure of 0.87) and of the averages of the 11 raters (average measure of 0.99). Table 37 provides ICC summary values for the expert ratings of the main sustainability categories of the 13 organizational profiles.

Sustainability Governance Ratings											
Profile Index	Expert Index										
	1	2	3	4	5	6	7	8	9	10	11
1	4	4	4	4	4.4	4	5	4	5	4.5	4
2	1	2	2.5	3	2.5	2.5	4	2	4	3.5	3
3	2	1	1	2	1.5	1.5	3	2	2	2	2
4	3	1	3	2	1.8	2.5	2	3	3	2	1
5	2	1	1	1.5	1.2	1.5	2	2	2	1.5	2
6	2	1	1.5	1.5	1.3	1.5	3	2	4	1	1
7	1	1	1	1	0.6	1.25	1	2	3	1.2	1
8	1	1	1	1	0.4	1	1	2	2	1	1
9	2	1	2	2	1.6	2.5	3	2	3	2.5	1
10	5	5	5	5	5	5	5	5	5	5	5
11	2	4	3.5	3.8	3.6	3.5	4	3	4	4	2
12	2	2	3	2.5	2.4	2.5	3	3	3	3.5	1
13	5	5	5	5	5	5	5	5	5	5	5

#### Intra-class correlation coefficient - Sustainability Governance

Number of subjects (n)	13
Number of raters (k)	11
Model	The same raters for all subjects. Two-way model.
Type	Consistency
Measurements	Experts 1-11 Ratings

#### Intra-class Correlation Coefficient - Sustainability Governance

	Intra-class correlation <sup>a</sup>	95% Confidence Interval
Single measures <sup>b</sup>	0.87	0.76 to 0.95
Average measures <sup>c</sup>	0.99	0.97 to 0.99

<sup>a</sup> The degree of consistency among measurements.

<sup>b</sup> Estimates the reliability of single ratings.

<sup>c</sup> Estimates the reliability of averages of *k* ratings.

**Figure 46 Intra-class Correlation Coefficient (ICC) - Measure of Consistency of the Expert Ratings for the Sustainability Governance Category**

**Table 37 Intra-class Correlation Coefficient (ICC) consistency measures of expert ratings of the main categories**

Category	Single measures <sup>b</sup>		Average measures <sup>c</sup>	
	Intra-class correlation <sup>a</sup>	95% Confidence Interval	Intra-class correlation <sup>a</sup>	95% Confidence Interval
Sustainability Governance	0.87	0.76 to 0.95	0.99	0.97 to 0.99
Workforce	0.65	0.46 to 0.84	0.95	0.90 to 0.98
Value Chain	0.76	0.60 to 0.90	0.97	0.94 to 0.99
Local Community and Society	0.72	0.55 to 0.88	0.97	0.93 to 0.99
Financial and Risk Management	0.79	0.64 to 0.91	0.98	0.95 to 0.99
Marketing	0.77	0.61 to 0.90	0.97	0.95 to 0.99
Compensations and Financial Incentives	0.72	0.55 to 0.88	0.97	0.93 to 0.99
General Facilities	0.84	0.72 to 0.94	0.98	0.97 to 0.99
Data Center and Computing	0.75	0.59 to 0.90	0.97	0.94 to 0.99
IT Equipment and Office Management	0.81	0.66 to 0.92	0.98	0.96 to 0.99
Environmental Management Systems and Reporting	0.84	0.72 to 0.94	0.98	0.97 to 0.99
Green Enterprise IT	0.66	0.48 to 0.85	0.96	0.91 to 0.98
Research and Development	0.77	0.61 to 0.90	0.97	0.95 to 0.99

<sup>a</sup> The degree of consistency among measurements.

<sup>b</sup> Estimates the reliability of single ratings.

<sup>c</sup> Estimates the reliability of averages of  $k$  ratings.

## 5.5 Development and Analysis of New Model Weights

Although the model results and expert ratings compared favorably, it was of interest to determine the implied expert weights based on the expert assigned ratings for each category and organizational profile. The purpose was to study the difference between the assigned equal weights of the sustainability objectives (environmental, economic and social) and the weights implied by the expert assignment of scores. To determine the new weights ( $W_t$ ) for each category  $t$ , a linear program was developed with the objective of minimizing the sum of the differences between the experts' overall rating ( $ExpR_{pc}$ ) and ratings obtained from the aggregation of the weighted category ratings ( $W_t R_{pct}$ ).  $R_{pct}$  is the rating for profile  $p$ , expert  $c$  and category  $t$ ; the sum of the weights  $W_t$

for all categories is equal to 1. The objective function used to derive the expert weights is shown in Equation 4. This method was used instead of a multi-linear regression to insure that the derived weights would not be influenced by outliers.

**Equation 4 Objective Function to Derive Experts Weights**

$$\min \sum_{p=1}^{13} \sum_{c=1}^{11} \left| \left( \sum_{t=1}^9 W_t R_{pct} \right) - ExpR_{pc} \right|$$

Where:

$$\sum_{t=1}^9 W_t = 1$$

$ExpR_{pc}$  = the rating for expert  $c$  and profile  $p$

$W_t$  = the weight for category  $t$

$R_{pct}$  = the rating for expert  $c$ , profile  $p$ , and category  $t$

$t$  = the indicator variable for categories  $\{1 \leq t \leq 9\}$

$c$  = the indicator variable for experts  $\{1 \leq c \leq 11\}$

$p$  = the indicator variable for organizational profiles  $\{1 \leq p \leq 13\}$

The results of the linear program provided values for the weights that most closely represent the values of the experts. Based on the calculated experts' weights for the categories, the weights for the main sustainability objective areas (environmental, economic, social, and innovation) were determined. Tables 38 and 39 summarize the linear program weights compared with the model weights.

**Table 38 Calculated Experts Weights of the assessment categories**

Sustainability Category	Experts' Weights	Original Model Criteria Weights	Difference
Sustainability Governance	0.087	0.069	0.018
Workforce	0.035	0.077	0.042
Value Chain	0.061	0.077	0.016
Local Community and Society	0.091	0.077	0.014
Financial and Risk Management	0.034	0.108	0.074
Marketing	0.097	0.096	0.001
Compensation & Financial Incentives	0.065	0.096	0.032
General Facilities	0.055	0.060	0.005
Data Center and Computing	0.138	0.060	0.078
IT Office Equipment Management	0.123	0.060	0.063
Environmental Management & Reporting	0.049	0.060	0.011
Green Enterprise IT	0.064	0.060	0.004
Research and Development	0.103	0.100	0.003
<b>Sum of the differences</b>			<b>0.362</b>

**Table 39 Calculated Expert Weights Compared with Model Weights for the Main Sustainability Areas**

Sustainability Area	Experts Calculated Weights	Sustainability Model Weights	Difference
<b>Social</b>	0.273	0.300	-0.027
<b>Economic</b>	0.195	0.300	-0.105
<b>Environmental</b>	0.429	0.300	0.129
<b>Innovation</b>	0.103	0.100	0.003

Although the equally weighted model yielded results that were not statistically different than the expert evaluations, it is interesting to note that the weightings that most closely matched the expert ratings showed a strong preference for the environmental area. The economic area was the least important as suggested by the experts. The innovation weights and the social sustainability weights were very close to the original designations.

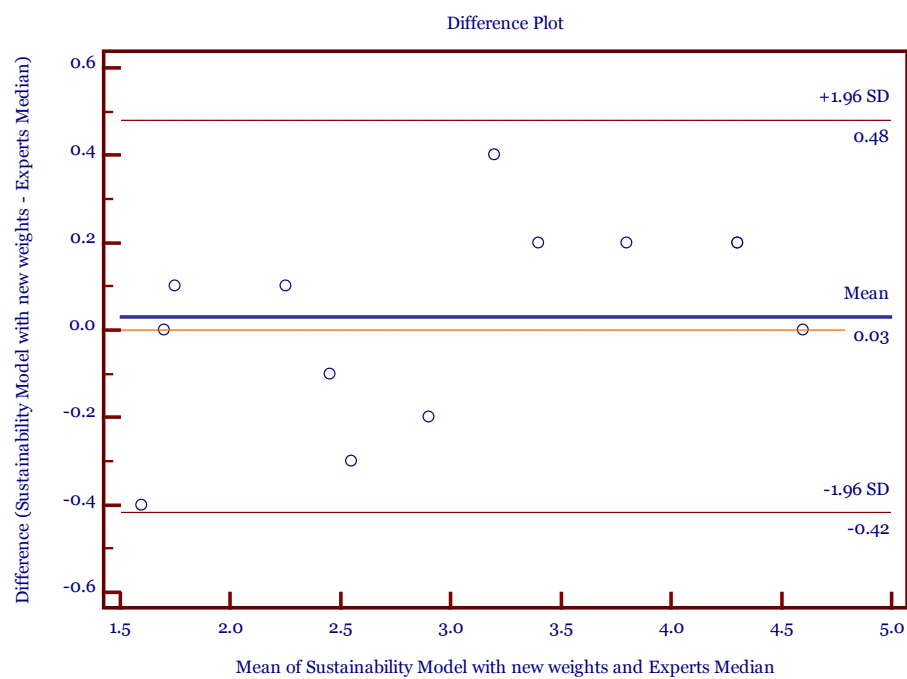
## 5.6 Model Results with New Weights

The sustainability rating model was adjusted to reflect the weights defined by the experts. The results of the model, compared with the expert scores are shown in Table

40. As expected, the model scores more closely reflected those of the experts. The sum of the absolute difference between the original model and the average expert or median expert rating were reduced by a value of 0.2 for the model with the new category weights. The reduction in difference is shown in the new Bland-Altman plot of the difference between the ratings from the adjusted sustainability model with the new weights and experts' median rating, see Figure 47.

**Table 40 Comparison of New Model Weighting Results with Expert Ratings**

Type of Rating	Organizational Profile Index													Sum
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Original Sustainability Model	4.4	3.4	1.4	2.4	2.4	2.7	1.8	1.7	2.1	4.7	3.9	3.5	4.4	
Sustainability Model With New Weights	4.4	3.4	1.4	2.4	2.4	2.8	1.7	1.8	2.3	4.6	3.9	3.5	4.4	
Median Experts	4.2	3.0	1.8	2.5	2.7	3.0	1.7	1.7	2.2	4.6	3.7	3.3	4.2	
Average Experts	4.0	3.2	1.7	2.4	2.5	2.9	1.8	1.8	2.2	4.5	3.4	3.1	4.1	
Differences														Sum
Original Model and Median Expert	0.2	0.4	0.4	0.1	0.3	0.3	0.1	0	0.1	0.1	0.2	0.2	0.2	2.6
New Model and Median Expert	0.2	0.4	0.4	0.1	0.3	0.2	0	0.1	0.1	0	0.2	0.2	0.2	2.4
Original Model and Average Expert	0.4	0.2	0.3	0	0.1	0.2	0	0.1	0.1	0.2	0.5	0.4	0.3	2.8
New Model and Average Expert	0.4	0.2	0.3	0	0.1	0.1	0.1	0	0.1	0.1	0.5	0.4	0.3	2.6



**Figure 47 Bland-Altman Plot of the Sustainability Model with the new weights-Experts Median rating**

## **6. CONCLUSIONS AND FUTURE WORK**

### **6.1 Contributions and Summary of Research**

To date, efforts to improve the sustainability of the ICT sector have focused primarily on reducing the carbon footprint. My research represents the first comprehensive approach to evaluating the sustainability of an ICT organization. The developed rating methodology attempts to balance the importance placed on environmental protection, economic viability, and social responsibility. Similarly, the methodology rewards leaders in the sector who incorporate innovative approaches in the achievement of sustainable goals.

Another important contribution was the development of a methodology that can be applied to other sectors seeking guidance on sustainability rating. The approach is generic; however the results are specific to ICT.

The simple linear model produced results that are representative of an expert panel's views. This type of model implies that a rating of 5 is five times better than a rating of 1. Similarly, the weights were considered to be "fixed" values. This rating framework could produce results that violate sustainability principles. For example, an organization that achieves scores of 5 for economic, social and innovation criteria would be rated as "Exemplary". Clearly, this is not a balanced ICT organization from a sustainability perspective.

This research studied the balance between the three pillars of sustainability. The initial assumption of equal weighting produced ratings that were statistically validated using an expert panel. When the equal weight constraint was relaxed, the pillar weights were found to favor environmental criteria over the social and economic ones. Table 41 compares the pros and cons of using equal weights for the pillars as compared with the weights derived from the experts. The sector should select the approach that best meets their priorities and needs.

**Table 41 Comparison of weighting approaches**

	<b>Pros</b>	<b>Cons</b>
<b>Equal Weighting</b>	Representative of the core principles of sustainability Easy to understand Easy to adjust weights as sub-criteria are added to or removed from the model	Does not emphasize current industry priorities Difficult to justify May appear overly idealistic
<b>Expert Weighting</b>	Representative of current industry priorities Emulates current best available practices More realistic perception	Total relaxation of weighting constraints may produce imbalanced model Depends on credibility of the experts Maybe influenced by the number of sub-criteria

Although the equally weighted model yielded results that were not statistically different than expert evaluations, it is interesting to note that the weightings that most closely matched the expert ratings showed a strong preference for the environmental area. The best fit rating that represented the experts' opinion was found to be approximately 40% environmental accomplishment, 30% social responsibility, 20% economic viability, and 10% innovation. This weighting may reflect the current needs of the ICT sector. The

literature review showed that current ICT sustainability initiatives are exclusively focused on environmental issues. This result might also suggest that weights may be influenced by the number of criteria. The environmental pillar included the largest number of criteria.

## **6.2 Opportunities for Future Research**

This research laid the groundwork for many efforts to follow. Work on the development of sustainability targets for the criteria is needed. These numbers will serve as industry-wide baselines. The development and selection of metrics and indicators will evolve as the ICT industry and communities of practice begin to measure their sustainability accomplishments. Similarly, research pertaining to the development of a governance model for implementation of the rating methodology is needed. The governance model must be able to address the different types of ICT organizations, namely service versus product focused. Research will be needed to develop variations of the rating methodology that are tailored to the specific nature of the ICT organization. In much the same way that the US Green Buildings Council (USGBC) has tailored LEED to accommodate a variety of building types (office, residential, school, medical, etc.) and construction types (interior renovation versus new construction), so must the ICT sustainability rating methodology be modified to fit specific organizational types. Lastly, alternative forms (e.g. nonlinear or regression) of the model should be investigated to address limitations inherited in simple linear methods.

## APPENDIX A

A Summary Table of the Federal Electronics Challenge (FEC) Criteria, Goals and Measures is provided below, followed by a copy of the FEC Baseline Survey and Annual Report Form.

**Federal Electronic Challenge Criteria, Goals and Measures**

Criteria	Goals	Measure/ Indicator
<b>General Information</b>	Commitment to Electronic Stewardship	Organization has an Environmental Management System (EMS) EMS addresses electronic Stewardship
<b>Acquisition and Procurement</b>	95% of eligible electronic equipment purchased or leased annually by FEC Partners facilities is EPEAT-registered	Number of electronic products purchased, leased, and/or provisioned under seat management were, or were not EPAET registered.
<b>Operations and Maintenance</b>	100% of eligible computers and monitors in operation at FEC Partner facilities have ENERGY STAR® power management features enabled	% of computers and displays with Energy Star® power management features enabled
	100% of eligible computers and imaging equipment in operation at FEC Partner facilities have duplexing features set to default	Are eligible computers, printers, copiers and multifunction devices set to default to double-sided printing? % of printers, copiers and multifunction devices set to double-sided printing by default
	Desktop computers at FEC Partner facilities have an average life span of at least four years	Average lifespan of a desktop computer at the organization
<b>End-of-Life Management</b>	Used electronic equipment from FEC Partner facilities is reused internally or donated for reuse, to the maximum extent practicable.	# and total weight of electronic equipment reused
	100% percent of non-reusable electronic equipment disposed of annually by FEC Partner facilities is recycled using third-party certified recyclers	# and total weight of electronic equipment recycled # and total weight of electronic equipment land-filled/ incinerated # and total weight of electronic equipment with unknown disposition



## Federal Electronics Challenge Baseline Survey and Annual Reporting Form

Updated: 4/27/2012

Federal Electronics Challenge (FEC) Facility Partners are required to submit a baseline survey when they join the program, and report annually on their electronics stewardship activities, for each fiscal year after they join. The FEC Baseline Survey and Annual Reporting Form was developed to measure partner progress against the FEC national program goals and the information collected may be translated into the partner's and program's environmental benefits utilizing the Electronics Environmental Benefits Calculator.

### INSTRUCTIONS

Please see [Instructions for Completing the Federal Electronics Challenge \(FEC\) Baseline Survey and Annual Reporting Form](#) for detailed instructions on how to complete this form.

### SECTION 1: GENERAL INFORMATION

- This information will automatically be populated in your online form. Please check this information and contact the FEC at [fec@epa.gov](mailto:fec@epa.gov) with any necessary changes.

Agency: \_\_\_\_\_  
 Facility: \_\_\_\_\_  
 EPA Region: \_\_\_\_\_  
 State: \_\_\_\_\_  
 FEC Contact: \_\_\_\_\_  
 Phone: \_\_\_\_\_  
 Email: \_\_\_\_\_

- This form is being submitted for my facility as our:

Baseline Survey  
 Annual Reporting Form for fiscal year \_\_\_\_\_

- Does your organization's Environmental Management System (EMS) address electronics stewardship? (If your organization does not have an EMS, check "Not applicable.")

Yes  
 No  
 Don't know  
 Not applicable

### SECTION 2: ACQUISITION & PROCUREMENT

- How many electronic products purchased, leased, and/or newly provisioned under seat management were, or were not, EPEAT registered?

	Number of EPEAT registered units (Bronze)	Number of EPEAT registered units (Silver)	Number of EPEAT registered units (Gold)	Number of units not EPEAT registered
Desktop computers				
Cathode ray tube (CRT) monitors				
Liquid crystal display (LCD) monitors				



## Federal Electronics Challenge Baseline Survey and Annual Reporting Form

Updated: 4/27/2012

	Number of EPEAT registered units (Bronze)	Number of EPEAT registered units (Silver)	Number of EPEAT registered units (Gold)	Number of units not EPEAT registered
Laptop/notebook computers				
Printers*				
Multifunction devices (MFDs)*				
Televisions*				
Servers*				
Cellular/mobile telephones*				
Personal digital assistants (PDAs)*				

\*Reporting acquisition information for these products is optional for partners completing this form for annual reporting.

### SECTION 3: OPERATION & MAINTENANCE

1. How many computers and monitors are in use at your organization?

\_\_\_\_\_ Desktop computers  
 \_\_\_\_\_ Laptop/notebook computers  
 \_\_\_\_\_ LCD Monitors  
 \_\_\_\_\_ CRT Monitors

2. Are ENERGY STAR® power management features (e.g., sleep, standby, hibernate) enabled on non-exempt computers (desktop and laptop/notebook computers) and/or displays (monitors and laptop/notebook displays) at your organization?

Yes

Estimated percentage of enabled non-exempt computers: \_\_\_\_\_ %

Estimated percentage of enabled non-exempt displays: \_\_\_\_\_ %

No

Don't Know

**PLEASE NOTE:** Exemption from power management requirements are provided for equipment running mission critical applications (i.e., facility security monitoring, air traffic control, uninterruptable laboratory experiments). Exemptions are not provided for the purposes of computer patching or virus scanning.

3. What is the average lifespan of a desktop computer at your organization?

\_\_\_\_\_ Months

4. Are eligible computers, printers, copiers, and multifunction devices at your organization set to default to double-sided printing?

Yes

Estimated percentage of eligible computers set to double-sided printing by default: \_\_\_\_\_ %



## Federal Electronics Challenge Baseline Survey and Annual Reporting Form

Updated: 4/27/2012

Estimated percentage of eligible printers, copiers and multifunction devices set to double-sided printing by default: \_\_\_\_\_ %

No

Don't Know

**PLEASE NOTE:** Eligible computers are desktops or laptops connected to one or more imaging products capable of double-sided printing. Eligible printers, copiers, and multifunction devices are imaging products capable of double-sided printing.

### SECTION 4: END-OF-LIFE MANAGEMENT

#### 1. How did your organization manage electronic equipment taken out of service?

**PLEASE NOTE:** Equipment may be reported in units of specific products and/or by weight of mixed loads. Please do not report the same equipment in both units and as part of a mixed load.

	Number of units reused	Number of units recycled	Number of units landfilled/incinerated	Number of units with unknown disposition (including sales)
Desktop computers				
Cathode ray tube (CRT) monitors				
Liquid crystal display (LCD) monitors				
Laptop/notebook computers				
Printers*				
Multifunction devices (MFDs)*				
Televisions*				
Servers*				
Cellular/mobile telephones*				
Personal digital assistants (PDAs)*				
	Weight of load reused	Weight of load recycled	Weight of load landfilled/incinerated	Weight of load with unknown disposition (including sales)
Mixed electronic products				

\*Reporting disposition information for these products is optional for partners completing this form for annual reporting.

#### 2. If your organization sent electronic equipment to be recycled, which of the following did you use? (Check all that apply.)

- Responsible Recycling (R2) Certified or e-Stewards Certified Recycler
- Manufacturer Take-Back Program (for EPEAT registered products)
- Manufacturer Take-Back Program (for non-EPEAT registered products)
- Defense Logistics Agency (DLA)
- Other (e.g., non-certified recycler)



## Federal Electronics Challenge Baseline Survey and Annual Reporting Form

Updated: 4/27/2012

(If you checked "Manufacturer Take-Back Program (for non-EPEAT registered products)" or "Other") What, if any, due diligence measures did your organization take to ensure that the equipment was recycled in an environmentally sound manner? (Check all that apply.)

Conducted onsite review of the recycler

Relied on onsite review conducted by another federal facility or agency

Other (Please specify: \_\_\_\_\_)

No followup conducted

### CONTACT INFORMATION

If you have questions related to this resource or need other assistance with the Federal Electronics Challenge, please contact your Regional Champion: <http://www.epa.gov/fec/technical.html>.

Visit the FEC online: <http://www.epa.gov/fec/>

E-mail the FEC: [fec@epa.gov](mailto:fec@epa.gov)

## APPENDIX B

### Data Center Maturity Model Criteria and Metrics for Level 2-Best Practices and Level 5-Visionary (TGG 2011)

Criteria	Metrics	Best Practice – Level 2	Visionary – Level 5
<b>Facility</b>			
Power	Critical Power Path Efficiency – Building Entrance to IT load	90% efficiency based on your typical utilization	96% efficiency based on your typical utilization
	Architecture	-Eco Mode UPS if applicable to business type -Fewer and higher efficiency transformers (NEMA TP1 or equivalent) -Verify the product's efficiency curve is highest for the load range used vs. highest overall	
	Operations	-Monitor equipment and performance in real time -Document and participate in the recycling plans for batteries and other consumables	-Power infrastructure automatically adapts while maintaining required availability and redundancy
	Generation		-Use of onsite or offsite (require proof of "additionality") low carbon power generation -Implementation of new, currently undiscovered or undefined energy storage techniques
Cooling	PUE – Cooling Contribution	Annual average of 0.5	Annual average of 0.05
	RCI (hi) & RCI (lo) – if applicable	One as low as 50%	
	Mechanical/ Refrigerant Cooling reduction	-Variable speed fans, motors, pumps, compressors etc. -Optimize current infrastructure to take advantage of economization available based on local climate data (e.g. local BIN weather data & The Green Grid Economization Maps)	-No mechanical/ refrigerant cooling (e.g. economization) for 100% of annual hours – 8,760 hours
	Environmental – set point range at inlet conditions to IT equipment		Increase temperature and humidity ranges in order to achieve level 5 on the Mechanical/ refrigerant cooling reduction
	Environmental – monitoring and control	Move temperature control point AWAY from CRAC return, begin controlling at CRAC supply	
	Operations	-Align CRAC (Computer Room Air Conditioning)/ CRAH (Computer Room Air Handling) output -Match cooling to heat emitted and need of servers – periodic manual review -Tile optimization -Line up equipment to have air movement from front to back -Hot/Cold aisle configuration -Remove gaps/holes in the floors and racks to reduce leakage between hot/cold aisles -Blanking panels to fill the gaps in the cabinets -Proactively remove redundant cabling -Intentional air flow segregation -Variable control of airflow (e.g. at the CRAC, floor tile) - manual	Dynamic changes to improve environment based on continuous monitoring
Management	Monitoring	Automated monitoring of key components in the data center	-"Holistic" monitoring capability across the data center – from source of power to business benefit of data center
	PUE	PUE Level 1 measured, plan and actions in place for improvements	-PUE level 3 measured, plan and actions in place for improvements. Automated analysis/reporting of data to identify energy saving opportunities

	Waste heat reuse (as measured by ERF/ERE)	Plan for reuse of heat	-ERF = 0.5
	CUE	CUE measured, plan and actions in place for improvements	-Embedded carbon considered as part of calculated carbon emission
	WUE	WUE measured, plan and actions in place for improvements	-embedded water considered as part of calculated usage
	xUE/ additional metrics	Basic xUE measured	-Advanced xUE measured, plan and actions in place for improvements. Automated analysis/reporting of data to identify energy saving opportunities
Other - Facility	Operational Resilience	Clear mapping and understanding of resilient M&E components	-Automated updates on resilience based on changes made in the data center (e.g. if a component was to fail, components being maintained etc ) including full understanding of all impacts upstream and downstream
	Resilience vs. Need	Business requirements 'known' – data center resilience not matched	-Matching resilience to the individual platform service
	Lighting	-Optimize Lighting -Move to lighter color cabinets to minimize lighting requirement	-Maximize natural light where lighting technologies are installed use components with a lower energy consumption, greater quality of light, longer lifespan and from recyclable components
	Building/ Shell	Data center building/shell in accordance with local sustainability standard (e.g. LEED in the US, BREEAM in the UK or similar) – Bronze standard	-Data center building/ shell to exceed Platinum ratings by 15% in terms of reduce, reuse, recycling, land/environmental impact, and consumption of natural resources in the design and build process
	M&E Waste	Reuse Policy for components across the organization	-Supplier and supply chain waste & environmental compliance programs included as part of procurement/ sourcing decision process
	Procurement	Procure assets that comply with reducing hazardous substances and are recyclable	-Components in the data center to be operable at higher temperatures in alignment with Other IT Level 5 – “All IT equipment for the data center available to be operated continuously and warranted at air inlets temperatures between 5°C/41°F and 40°C/104°F (and under exceptional conditions up to +45°C/113°F) and 10% - 80% Relative Humidity, non-considering respectively.” -Cradle to cradle lifecycle view on all M&E equipment – looking at embedded carbon, ease of recycling of the product, etc -Carbon intensity of different M&E options considered
<b>IT</b>			
Compute	Utilization	Tracking average monthly and peak utilization across the data center	-Average monthly CPU utilization is greater than 60% across the data center -Manage spare compute capacity to maintain utilization target (e.g. selling spare capacity)
	Workload Management	-CMDB adoption (understanding assets and associated applications) – enabling an understanding of workload -Rationalization of applications	-Ability to shift all of the workload in an automated manner across many other data centers to optimize demand taking into account business priorities, external drivers, availability of resource and TCO- “Follow the Moon” strategy -Future applications – reviewing TCO of different architectures, implementations and design
	Operations	Perform audits/ infrastructure reviews to decommission unutilized servers	-Improve application use of processor, memory and major power consuming components
	Power Management	-Basic power monitoring and measurement (estimate server power consumption through power distribution equipment -Some servers have embedded power management enabled where there is no business impact	-Power Management that has impact on performance or application
	Server population	-Policy for hardware refresh based on years of service -Exception allowed for business or operational reasons	-Technology refresh – real time analysis of TCO and ROI on a server by server basis across the data center - Energy proportionality – power consumption scales directly with workload -smart components – energized on demand
Storage	Workload	Deduplication (backup data)	
	Architecture	Classifying data/ tiering	

	Operations	-Storage decommissioning/ repurpose – aligned to other decommissioning initiatives (e.g. server, application) -Share resources between similar types of business units	-Improve application use and creation of data -Operational media choice (solid) state vs. tape vs. DVD vs. disk vs. MAID vs. Cloud, etc) based on TCO model, energy usage, embedded carbon footprint and business need
	Technology	Utilize low power drive technology. Use small form factor drives	-Use/enableness of low power states for storage
	Provisioning	Shared storage (hardware – SAN, iSCSI, etc) without robust capacity control	-Ability to shift storage – abstract from hardware and linked to application – “follow the Moon” strategy
Network	Utilization	-Understand network infrastructure and port utilization -Manual port switching capability – e.g. turn off unused ports	-Average monthly utilization (bandwidth usage divided by bandwidth capacity) is greater than 90% in the data center -Manage spare network capacity to maintain utilization target (e.g. selling spare capacity)
	Workload	Identify data volumes	-Ability to adapt network configuration/IP details –abstract from hardware and linked to application – “Follow the moon” strategy
	Operations	Consolidate and simplify multiple networks	
	Technology		-Energy proportionality – based on application requirements -Smart components – energized on demand
	Best performance	Understand bits per watt for network equipment	
	Provisioning	Inefficient capacity management (peak, average, total capacity) – over provisioned bandwidth)	-Automated provisioning
Other – IT	Overall	Systems designed for optimal cooling with front to rear air flow to provide hot and cold aisle separation	-Automated relational changes to infrastructure based on application demand
	Utilization	Gathering information on server, storage, network, M&E utilization for key data centers – e.g. using TGG indicators	-Automated information on servers, storage, network, M&E utilization for all data centers – e.g. using TGG indicators and proactively reviewing data to identify opportunities for improvement
	IT sizing	IT resource sized based on validated requests	
	Internal Power Supply Efficiency	45% of IT PSUs – certified by Climate Savers Computing Initiative (CSCI) – Bronze or above	-100% of PSUs certified by Climate Savers Computing Initiative (CSCI) – greeter than 80% at Platinum
	Service Catalogue/ SLA's	Centralized service catalogue	
	Incentivizing changes for efficient behavior (e.g. chargeback and or cost awareness)	Incentive for efficient behavior at an organizational level	-Incentive for efficient behavior based on usage at a user-level
	E-Waste	Reuse policy for assets across the organization	-Supplier and supply chain waste & environmental compliance programs included as part of procurement/sourcing decision process
	Procurement	Procure assets that comply with reducing hazardous substances and recycling such as RoHS/ WEEE or equivalent local standard	-Cradle to cradle lifecycle view on all IT equipment – looking at embedded carbon, ease of recycling of the product (e.g. RoHS/ WEEE), etc -Carbon intensity of different IT options -All IT equipment for the data center available to be operated continuously and warranted at air inlets temperatures between 5°C/41°F and 40°C/104°F (and under exceptional conditions up to +45°C/113°F) and 10% - 80% Relative Humidity, non-considering respectively.”

## APPENDIX C

### Data Center Uptime Tier Standard: Operational Sustainability: Criteria and Metrics (Uptime Institute 2010)

Category	Intent	Component	Sample Behaviors (measures)
<b>Management and Operations</b>			
Staffing and organization	To have the right number of qualified people on appropriate shifts	Staffing Presence	-Staff full-time equivalent (FTE) or vendor assigned full or part time to oversee critical facility operations -Escalation and call-out procedures are in place -24x7 staff presence: minimum 1 qualified FTE
		Qualifications	-Appropriate staff trade licenses required by governmental regulation -Documented training on site specific data center equipment and processes -completed formal site training for all personnel on configurations and policies
		Organization	-Org chart showing reporting chain -critical facility job descriptions -roles and responsibilities matrix covering all activities at DC
Maintenance	A comprehensive approach to maintaining the data center	Preventative Maintenance Program	-Effective preventative maintenance program -Detailed procedures for switching between redundant equipment
		Housekeeping Policies	-Computer room floor and under floor free of dirt and debris -Data center free of combustibles Housekeeping protocols in practice to ensure a contaminant free data center environment
		Maintenance Management System	-effective maintenance management system -maintains list of installed equipment -Track PM tools and parts
		Vendor Support	-Lit of qualified vendors by system available for normal and emergency work
		Life-Cycle Planning	Effective process for planning, scheduling and funding the life-cycle replacement of major infrastructure components
		Failure Analysis Program	-Maintains list of all outages including dates, times equipment involved -effective process to determine root cause
		Deferred Maintenance Program	-PM and scheduled tasks accomplishment rate > 90%
		Predictive Maintenance Program	Effective predictive maintenance program
Training	To ensure that all personnel understand policies, procedures, and unique requirements of work in the data center to avoid unplanned outages and respond to anticipated events	Data Center Staff Training	-on the job training -formal classroom, operational demonstrations and shift drills
		Vendor Training (Part-Time Support)	-Training required on data center access, work rules and housekeeping
Planning, Coordination and Management	Effective management of the data center through site policies, financial management policies, site infrastructure library; and space, power, and cooling capacity management tools	Site Policies	Formal documented policies and procedures
		Financial Management	-Operating expense and capital funding levels consistently sufficient and available -operating and capital budget managed separately
		Reference Library	-reference and record documents available for use (off-site and on-site)
		Space, Power, and Cooling Capacity Management	-process for managing the installation and removal of IT equip -computer room master plan
		3 <sup>rd</sup> Party Certifications	-International Organization for standardization (ISO) certification -ITIL certification
		Computer Room Management	-effective process for a-computer room airflow management and b-electrical power monitoring, management and analysis

Building Characteristics			
Building Features	Features that impact the availability objectives like the topology enhancements.	Purpose Built	-Purpose-built data center -single-purpose facility to support IT equipment
		Support and Specialty Spaces	-Adequate space separate from computer room for hardware receiving, storage...etc
		Security and Access	-controlled access to all computer rooms and support spaces -controlled building access
		Setbacks	-adequate space around the data center to minimize impacts from adjacent facilities
		Topology Enhancements	Electrical/mechanical/cooling topology enhancements
		3 <sup>rd</sup> Party Certifications	-EnergyStar Rating -LEED certification
Infrastructure	The infrastructure is available for incremental capacity increases	Flexibility for Incremental Capacity Increases	-connection points for future / temporary extensions or capacity units
		Infrastructure to Support Operations	-mechanical support systems available -consistent labeling of infrastructure equipment and standardized sizes
		Ease of Maintenance	-Adequate space for safe conduct of normal maintenance activities
		Space, Power, and Cooling Exhaust Points	-data center design coordinated space, power, and cooling capacity exhaust points
Operating Conditions	Consistent and documented load limits to reduce risk and provide for efficient operations	Redline Ratings	Redline rating process
		Operating Set Points	-consistent operating set points
		Rotating Redundant Equipment	-effective process for alternating use
Pre-Operational	Activities to bring new data centers or expansions online and operational as designed. Transition-to-operations plan	Commissioning	-factory witness testing of critical infrastructure equipment -Functional testing
		Transition-to-Operations Plan (New facility or major capacity expansion)	-owner used a transition-to-operations protocol with requirements defined
Site Location			
Natural Disasters	Risk assessment for natural disasters and appropriate mitigation actions to reduce impact.	Flooding (river, lake, reservoir, canal, pond, etc) and Tsunami	Scale of risk: Higher: <100 year flood Plain Lower: > 100 year flood plain
		Hurricanes, Tornadoes, and Typhoons	
		Seismic Activity	
		Active Volcanoes	
Man-Made Disasters	Regularly review adjacent property exposures or transportation corridor risks.	Airport/ Military Airfield	
		Adjacent Properties Exposures	
		Transportation Corridors	

## APPENDIX D

### Common Sustainability Criteria in: GRI, IChemE and DJSI

Framework	Social	Environmental	Economic	Additional
<b>GRI</b>	<p>Organization impact on social environment where it operates: Labor, Human Rights, Society and Product Responsibility</p> <p>Labor Practice and Decent Workplace :</p> <ul style="list-style-type: none"> <li>-Employment</li> <li>-Labor/Management Relation</li> <li>-Occupational Health and Safety</li> <li>-Training and Education</li> <li>-Diversity and Equal opportunity</li> <li>-Equal Remuneration for women and men</li> </ul> <p>Human Rights:</p> <ul style="list-style-type: none"> <li>-Investment and Procurement Practices;</li> <li>-Non-discrimination;</li> <li>-Freedom of Association and Collective Bargaining;</li> <li>- Child Labor;</li> <li>- Prevention of Forced and Compulsory Labor;</li> <li>-Security Practices;</li> <li>-Indigenous Rights;</li> <li>-Assessment; and</li> <li>- Remediation.</li> </ul> <p>Society</p> <ul style="list-style-type: none"> <li>-Local Communities;</li> <li>-Corruption;</li> <li>-Public Policy;</li> <li>-Anti-Competitive Behavior; and</li> <li>-Compliance</li> </ul> <p>Product Responsibility</p> <ul style="list-style-type: none"> <li>-Customer Health and Safety;</li> <li>-Product and Service Labeling;</li> <li>-Marketing Communications;</li> <li>-Customer Privacy; and</li> <li>-Compliance.</li> </ul>	<p>Organization's impact on living and non-living natural system including ecosystems, land, air and water, Performance related to inputs (e.g. energy, material, water), performance related to outputs (emissions, waste, effluents), biodiversity, environmental compliance, expenditure, and impact of products and services</p> <ul style="list-style-type: none"> <li>-Material</li> <li>-Energy</li> <li>-Water</li> <li>-Biodiversity</li> <li>-Emissions, Effluents, and Waste</li> <li>-Products and Services</li> <li>-Compliance</li> <li>-Transport</li> <li>-Overall</li> </ul>	<p>Flow of capital among different stakeholders, and Main economic impact of the organization throughout society</p> <ul style="list-style-type: none"> <li>-Economic Performance (direct)</li> <li>-Market Presence</li> <li>-Indirect Economic Impact</li> </ul>	<ul style="list-style-type: none"> <li>-Strategy and Analysis</li> <li>-Governance, Commitment and Engagement</li> </ul>
<b>DJSI</b>	<ul style="list-style-type: none"> <li>-Assessing cost burden</li> <li>-Bioethics</li> <li>-Corporate citizenship and Philanthropy</li> <li>-Controversial Issues, Dilemmas in lending/ financing</li> <li>-Financial Inclusion/ Capacity Building</li> <li>-Health Outcome Contribution</li> <li>-Human Capital Development</li> <li>-labor Practice Indicators</li> <li>-Social Reporting</li> <li>-Stakeholder Engagement</li> <li>-Standards for Suppliers</li> <li>-Strategy to improve access to drugs or products</li> <li>-Talent Attraction and Retention</li> </ul>	<ul style="list-style-type: none"> <li>-Biodiversity</li> <li>-Business opportunities</li> <li>-Financial Services/ Products</li> <li>-Business Risks Large Projects/ Export Finance</li> <li>-Climate Change Governance</li> <li>-Climate Strategy</li> <li>-Electricity Generation</li> <li>-Environmental footprint</li> <li>-Environmental policy/ Management System</li> <li>-Environmental Reporting</li> <li>-Operational Eco-efficiency</li> <li>-Transmission and Distribution</li> <li>-Water-related Risks</li> </ul>	<ul style="list-style-type: none"> <li>-Anti-crime policy/ measures</li> <li>-Brand Management</li> <li>-Code of Conduct/Compliance/ Corruption &amp; Bribery</li> <li>-Corporate Governance</li> <li>-Customer Relationship Management</li> <li>-Innovation Management</li> <li>-Market Opportunities</li> <li>-Marketing Practices</li> <li>-Price Risk Management</li> <li>-Research and Development</li> <li>-Risk and Crisis Management</li> <li>-Stakeholder Engagement</li> <li>-Scorecards/ Measurement Systems</li> </ul>	
<b>IChemE</b>	<ul style="list-style-type: none"> <li>-Workplace</li> <li>-Society</li> </ul>	<ul style="list-style-type: none"> <li>-Resource usage</li> <li>-Emissions, Waste and effluents</li> </ul>	<ul style="list-style-type: none"> <li>-Profit, value and tax</li> <li>-Investments</li> </ul>	

	-Additional items	-Additional items	-Additional items	
<b>Consolidated</b>	Labor Practice, Workplace, Customers and Suppliers, Local Community and Society	-Resource Efficiency -Emissions, Effluents and Waste -Products and Services footprint -Operational Eco-efficiency -Environmental Management System -Compliance and Environmental Reporting -Transport and Distribution - Environmental Risk Management -Electricity Generation	-Profit, Value and Tax -Code of Conduct/Corporate Governance/Compliance/ Anti Corruption - Risk and Crisis Management -Marketing Practices and Brand Management -Financial Management -Investment -Innovation Management -Research and Development	-Sustainability Strategy -Governance -Commitment -Stakeholders Engagement

## APPENDIX E

### Summary of Example Social, Economic, Environmental and Innovation Sustainability Criteria in Sustainability Assessment Frameworks

Social Sustainability Criteria
Dow Jones Sustainability Index (DJI 2011)
<b>Corporate governance:</b> Board structure; Non-Executive Chairman/Lead Director Responsibilities and Committees Corporate; Governance Policy; Audit Conflict of Interest; Diversity: Gender Board Effectiveness Entrenchment provisions; Senior Management Remuneration
<b>Code of Conduct/ Compliance/ Corruption &amp; Bribery:</b> Codes of Conduct: Focus; Codes of Conduct: Systems/Procedures; Corruption and Bribery: Scope of Policy; Codes of Conduct: Report on Breaches; Codes of Conduct/Anti-Corruption & Bribery: business relationships
<b>Human Capital Development:</b> Human resource skill mapping and developing process; Human Capital performance indicators; Personal and organizational learning and development
<b>Talent Attraction and Retention:</b> Coverage of employees through predefined performance appraisal process; Percentage of performance related compensation for each employee category; Balance of variable compensation based on corporate and individual performance Corporate Indicators for performance- related compensation; Type of individual performance appraisal; Communication of individual performance to upper management; Payout type of total performance-related compensation; Trend of employee satisfaction
<b>Labor practice indicators:</b> Grievance Resolution; Labor KPIs
<b>Corporate citizenship and philanthropy:</b> Group Wide Strategy – financial focus; Input; Measuring benefits; Type of Philanthropic activities
<b>Social Reporting:</b> Assurance; Coverage; Social Reporting; Qualitative Data; Social Reporting; Quantitative Data
Social Life Cycle Assessment (Jørgensen et al. 2007) - SLCA
<b>Human Rights</b>
Non-discrimination, including indicators on diversity, such as composition of employees on all levels according to gender, age group, disabled, part-time workers and other measures of diversity
Freedom of association and collective bargaining
Child labor, including hazardous child labor
Forced and compulsory labor
<b>Labor practices and decent work conditions</b>
wages, including equal remuneration on diverse groups, regular payment, length and seasonality of work and minimum wages
benefits, including family support for basic commodities and workforce facilities
physical working conditions, including rates of injury and fatalities, nuisances, basal facilities and distance to workplace
psychological and organizational working conditions, such as maximum work hours, harassments, vertical, two-way communication channels, health and safety committee, job satisfaction, and worker contracts
training and education of employees
<b>Society</b>

corruption, including incidents/ press reports concerning fraud, corruption and illegal price-fixing, and violation of property rights
development support and positive actions towards society, including job creation, support of local suppliers, general support of developing countries, investments in research and development, infrastructure, and local community education programs
local community acceptance, such as complaints from society , and presence of communication channels
<b>Product responsibility</b>
integration of customer health and safety concerns in product, such as content of contaminants/ nutrients, other threats/benefits to human health (including special groups) due to product use, and complaint handling system
information about product to users, such as labeling, info about ingredients, origin, use, potential dangers, and side effects
marketing communications, such as ethical guidelines for advertisements
<b>Global Reporting Initiative (GRI 2003) - GRI</b>
In addition to the ones in SLCA, GRI has the following related criteria:
Strategy
Governance
Commitments
Engagement
Management Approach and Performance indicators
<b>Framework for Strategic Sustainable Development (FSSD) The Natural Step Framework (K-H Robèrt et al. 2005b, 147)</b>
Participation - involves people sufficiently
Transparency - open to reasonable scrutiny
Responsibility - clear accountability
Honesty – being truthful
<b>Electronic Industry Citizenship Coalition Code of Conduct - EICC Code of Conduct Version 3.0 (EICC 2009)</b>
<b>Labor:</b> Including freely chosen employment, child labor avoidance, working hours, wages and benefits, humane treatment, non-discrimination, and freedom of association.
<b>Health and Safety:</b> Including occupational safety, emergency preparedness, occupational injury and illness, industrial hygiene, physically demanding work, machine safeguarding, sanitation, food and housing.
<b>Management Systems:</b> Including company commitment, management accountability and responsibility, legal and customer requirements, risk assessment and risk management, improvement objectives, training, communication, worker feedback and participation, audits and assessments, corrective action process, and documentation and records.
<b>Ethics:</b> Including business integrity, no improper advantage, disclosure of information, intellectual property, fair business, advertising and competition, and protection of identity
<b>Underwriter Laboratories Environment (ULE) 880 (ULE 2011): Sustainability for Manufacturing Organizations</b>
<b>Sustainability Governance:</b> Including sustainability strategic planning, board oversight, internal stakeholder engagement, ethics policies, and creating the infrastructure and fostering the behaviors that create a culture of sustainability
<b>Work Force:</b> Including professional development, workplace integrity, employee satisfaction and retention, workplace safety, and employee health and well-being
<b>Customers and Suppliers:</b> Including fair marketing practices, product safety, customer support and complaint resolution, and sustainable supply chain management, monitoring and improvement
<b>Community Engagement and Human Rights:</b> Including community impact assessment, community

investment, and human rights issues
<b>GreenTick</b> (GreenTick 2011) - Sustainability Certification Program, New Zealand
The main social related category is <b>Safety</b> , includes 8 criteria the following
Accident Record
Staff Health and Safety
Supplier Health and Safety
Customer Health and Safety
Management System
Minimizing Risk
Performance Records
Legal Compliance
<b>Newsweek Green Rankings</b> (Newsweek 2010)
<b>Reputation Survey score:</b> Based on an opinion survey of corporate social-responsibility professionals, academics and other environmental experts who subscribe to CorporateRegister.com
<b>Global 100 Most Sustainable Corporations</b> (Global100 2011) in the world
<b>Leadership diversity:</b> Measured by the percentage of women board directors
<b>CEO-to-Average Worker Pay:</b> Ratio of highest paid officer's compensation to average employee compensation (3-year average)
<b>Safety productivity:</b> Sales (US\$)/ lost-time incidents and fatalities
<b>Sustainability pay link:</b> Whether or not at least one senior officer has his/her pay linked to sustainability
<b>Transparency:</b> Measured by % of data points on which the company provided data and level of GRI disclosure
<b>Tomorrow's Value Rating</b> (TVR 2010) - TVR Corporate Responsibility Rating
<b>Strategy:</b> Alignment between sustainability efforts and core business strategy, and management of major sustainability impacts, opportunities and risks.
<b>Governance:</b> Quality of top-level governance of sustainability issues.
<b>Engagement:</b> Extent to which stakeholder concerns are understood and acted on.
<b>Value Chain:</b> Management of impacts through the value chain from suppliers to distributors, including the lifecycle of products.
<b>Innovation and leadership:</b> Effectiveness of work to develop products and services that address social and environmental challenges in a profitable and scalable way and extent of sustainability leadership in the sector.
<b>Economic Sustainability Criteria</b>
<b>Dow Jones Sustainability Index</b>
<b>Industry Specific Criteria:</b> Brand Management, Customer Relationship Management, Innovation Management, Gas Portfolio, Grid Parity, etc
<b>Global Reporting Initiative - GRI</b>
<b>Economic Performance:</b> Direct economic value generated and distributed, including revenues, operating costs, employee compensation, donations and other community investments, retained earnings, and payments to capital providers and governments; Financial implications and other risks and opportunities for the organization's activities due to climate change; Coverage of the organization's defined benefit plan obligations; Significant financial assistance received from government.
<b>Global 100 Most Sustainable Corporations</b> in the world
<b>% Taxes Paid:</b> The % Taxes Paid score ranges from 0-100%. It is the percentage of taxes paid in cash (trailing four year average) to the amount of taxes owed at statutory rates (trailing four year average) in USD.

Environmental Sustainability Criteria
Dow Jones Sustainability Index
<b>Environmental Reporting:</b> Assurance; Coverage; Environmental Reporting on Qualitative and Quantitative Data
<b>Sector specific:</b> Environmental Management Systems; Climate Strategy; Biodiversity; Product Stewardship; Eco-efficiency
Global Reporting Initiative - GRI
<b>Material:</b> Materials used by weight or volume; Percentage of materials used that are recycled input materials.
<b>Energy:</b> Direct energy consumption by primary energy source; Indirect energy consumption by primary Source; Energy saved due to conservation and efficiency improvements; Initiatives to provide energy-efficient Or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives; Initiatives to reduce indirect energy consumption and reductions achieved.
<b>Water:</b> Total water withdrawal by source; Water sources significantly affected by withdrawal of water; Percentage and total volume of water recycled and reused.
<b>Biodiversity:</b> Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas;
<b>Emissions, Effluents, and Waste:</b> Total direct and indirect greenhouse gas emissions by weight.; Other relevant indirect greenhouse gas emissions by weight; Initiatives to reduce greenhouse gas emissions and reductions achieved; Emissions of ozone-depleting substances by weight; NO, SO, and other significant air emissions by type and weight; Total water discharge by quality and destination; Total weight of waste by type and disposal method; Total number and volume of significant spills; Weight of transported, imported, exported, or treated waste deemed hazardous.
<b>Products and Services:</b> Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation; Percentage of products sold and their packaging materials that are reclaimed by category.
<b>Compliance:</b> Monetary value of significant fines and total number of non-monetary sanctions for noncompliance with environmental laws and regulations.
<b>Transport:</b> Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce.
<b>Overall:</b> Total environmental protection expenditures and investments by type.
Electronic Industry Citizenship Coalition Code of Conduct - EICC Code of Conduct Version 3.0
<b>Environmental Permits and Reporting</b> All required environmental permits (e.g. discharge monitoring), approvals and registrations are to be obtained, maintained and kept current and their operational and reporting requirements are to be followed.
<b>Pollution Prevention and Resource Reduction</b> Waste of all types, including water and energy, are to be reduced or eliminated at the source or by practices such as modifying production, maintenance and facility processes, materials substitution, conservation, recycling and re-using materials.
<b>Hazardous Substances</b> Chemicals and other materials posing a hazard if released to the environment are to be identified and managed to ensure their safe handling, movement, storage, use, recycling or reuse and disposal.
<b>Wastewater and Solid Waste</b> Wastewater and solid waste generated from operations, industrial processes and sanitation facilities are to be characterized, monitored, controlled and treated as required prior to discharge or disposal.
<b>Air Emissions</b> Air emissions of volatile organic chemicals, aerosols, corrosives, particulates, ozone depleting chemicals and combustion by-products generated from operations are to be characterized, monitored, controlled and treated as required prior to discharge.

<b>Product Content Restrictions</b> Participants are to adhere to all applicable laws, regulations and customer requirements regarding prohibition or restriction of specific substances, including labeling for recycling and disposal.
<b>Environment:</b> including product stewardship, sustainable resource use, environmental management systems, energy efficiency and carbon management, materials optimization, facilities and land use, habitat restoration, and waste prevention
<b>Environmental Product Origin:</b> Identify product origin; All product content identified by country of origin.
<b>Environmental Product Quality:</b> High product quality; Product meets all quality standards of industry or government food authority.
<b>Environmental Product Labeling:</b> Accurate product labeling; Labeling meets required legal standards
<b>Environmental Resource Use:</b> Maximize resource use efficiency
<b>Environmental Chemical Use:</b> Minimize chemical use; Chemical residues comply with industry or government standard.
<b>Environmental Energy Use:</b> Minimize energy use
<b>Environmental Nuisance Effects:</b> Minimize adverse effects on neighbors, eg. Noise, dust, spray drift; No continuing or unsatisfactorily addressed complaints from neighbors about nuisances in past 12 months.
<b>Environmental Contaminant Discharges:</b> Minimize contaminant discharges to air, land, freshwaters and sea
<b>Environmental Waste Management :</b> Waste minimization, dispose of wastes correctly ; Waste minimization and recycling program in place with defined performance targets; Wastes reduced, re-used, recycled, or properly disposed of to authorized facilities
<b>Environmental Management System:</b> Environmental Management System (EMS) ; Environmental management program in place with defined performance targets consistent with industry or government standards
<b>Environmental Legal Compliance:</b> Legal compliance and enforcement
<b>Newsweek Green Rankings</b>
<b>Environmental impacts score:</b> including emissions of nine key greenhouse gases, water use, solid-waste disposal, and emissions that contribute to acid rain and smog
<b>Global 100 Most Sustainable Corporations in the world</b>
Energy
Greenhouse gas (GHG)
Water productivity
Waste productivity
<b>The Green Grid Data Center Maturity Model (TGG 2011)</b>
<b>Facility:</b> power; cooling; management; other
<b>IT:</b> compute; storage; network; Other IT
<b>Innovation in Sustainability Criteria</b>
<b>Dow Jones Sustainability Index</b>
<b>Innovation management:</b> under economic sector specific indicators Investment in Research & Development
<b>LEED (USGBC 2011)</b>
<b>Innovative approach:</b> Older versions of LEED had bonus credit under each main area of LEED. Latest version of LEED gives extra credit under a separate credit area for innovation.
<b>Global 100 Most Sustainable Corporations in the world</b>
<b>Innovation Capacity</b> The Innovation Capacity score ranges from 0-100%. It represents the ratio of 3-year average Research & Development expenditures to 3-year average total revenue.

Tomorrow's Value Rating
<b>Innovation and leadership:</b> Effectiveness of work to develop products and services that address social and environmental challenges in a profitable and scalable way and extent of sustainability leadership in the sector.

## APPENDIX F

### Summary of the Preliminary Set of ICT Sustainability Criteria, Intent, and Possible Indicators

Criteria	Intent	Possible Indicators
<b>Social</b>		
<b>Cat1: Sustainability Governance</b>		
C1: Vision	Have a clear vision for how sustainability relates to the organization's mission	<ul style="list-style-type: none"> <li>- There is a vision for sustainability within the organization and the company at large</li> <li>- There is a clear business case for pursuing sustainability</li> </ul>
C2: Commitment	Demonstrated commitment to sustainability issues	<ul style="list-style-type: none"> <li>- There is a clear set of sustainability commitments publicly communicated</li> <li>- Formal strategic sustainability plan/ initiative in place</li> <li>- Consideration of sustainability in the planning process and method or a sustainability planning process is in place and is engaging, transparent, and solicits feedback from all levels of employees</li> <li>- Sustainability is integrated as the decision criteria on projects and actions</li> <li>- Allocated resources for sustainability efforts with clear measures of accountability</li> <li>- Executive leadership support, sponsorship and advocacy within the sector for sustainability</li> </ul>
C3: Transparency	Operating in a transparent manner with investors, regulators, and the public	<ul style="list-style-type: none"> <li>- Provide access to complete and accurate sustainability performance data to investors, regulators, and the public</li> <li>- Produce a publicly available formal annual sustainability report</li> <li>- Provide timely, accurate, and complete information to authorities and the public when a crisis does occur (e.g. environmental, privacy breach), and provide access for the media and public about such incidents and responses</li> </ul>
C4: Stakeholders Engagement	Actively assessing stakeholders trust and perception, and educating them and promoting sustainability as part of the organization image	<ul style="list-style-type: none"> <li>- Regular assessment of stakeholders' expectations and satisfaction levels within the organization sustainability performance</li> <li>- Educate stakeholders about sustainability efforts and promote sustainability as part of the organization's image to those stakeholders and markets</li> </ul>
C5: Compliance	Minimize risks by compliance with mandates, regulations, and industry standards related to environment, workforce, and the public	<ul style="list-style-type: none"> <li>- Keep up to date with mandates, regulations, and standards set by the federal, state/local governments and the industry</li> <li>- Voluntarily endorsement and participation in government, international, and sector initiatives, standards, and recommendations</li> </ul>
C6: Code of Conduct	Acts and operates ethically and responsibly	<ul style="list-style-type: none"> <li>- The organization has its own policy or code of conduct or endorse an industry code of conduct for ethical and environmental responsibility with mechanisms in place to assure effective implementation of such policy</li> </ul>
C7: Reporting	Regular reporting on sustainability efforts internally and to stakeholders	<ul style="list-style-type: none"> <li>- Report to management and other stakeholders on sustainability performance</li> <li>- Regular internal communication to all staff with updates on sustainability goals and achievements</li> </ul>
<b>Cat2: Workforce</b>		
C8: Benefits & Wages	Provide fair living wages and benefits	<ul style="list-style-type: none"> <li>- Fair living wages and benefits and compliance with all labor regulations and policies regarding equal remuneration on diverse groups, regular payments, minimum wages, and working hours</li> </ul>
C9: Performance Evaluation	Integrate sustainability in employees performance evaluation	<ul style="list-style-type: none"> <li>- Performance evaluation conducted regularly and employee's contributions to sustainability efforts are recognized and rewarded</li> </ul>

C10: Diversity	Diversity in the composition of employees on all levels	- Diversity (e.g. gender) of composition on all levels of employment (including leadership and management)
C11: Job Opportunities	Provide job opportunities for people from disadvantaged groups and populations	- Recruitment of new talents from diverse groups and make job opportunities available for disadvantaged groups - people with disabilities, minorities, at-risk youth
C12: Employees Awareness	Educate employees and raise their awareness on sustainability issues	- Employees Sustainability Awareness program in place and/or sustainability is integrated in new employee orientation programs
C13: Professional Development	Provide opportunities for professional development in general and in sustainability practices	- Routinely offer trainings on sustainable practices and provide opportunities for advanced and specialized training to employees involved in leading and implementing sustainability efforts (e.g. sustainable procurement, e-waste management)
C14: Workplace Safety	Provide and maintain a safe physical working environment	- Compliance with operational safety and health measures and mandates, and a policy is in place for occupational health and safety - Employee safety program is part of new employee orientation
C15: Healthy Environment	Maintain a healthy work environment and promote work-life balance	- Compliance with operational safety and health measures and mandates, and a policy is in place for occupational health and safety - Have employees wellness program
C16: Recruitment	Actively recruit for new talents from diverse groups and disadvantaged ones	
C17: Employees Engagement	Empower employees to take active role in sustainability initiatives	- Employees are empowered and encouraged to come up with ways to improve sustainability performance and have a voice or channel to communicate with leadership
C18: Employees Satisfaction	Maintain a high rate of talent retention and employee satisfaction	- Overall employee satisfaction with the workplace - High retention rates
C19: Work Environment	Provide and maintain a respectful and productive work environment	
C20: Organization Culture	Create and maintain a positive value-based organizational culture	
<b>Cat3: Value Chain</b>		
C21: Privacy	Respect and responsibly manage consumer's privacy	- A formal consumer privacy policy exists - Mechanisms in place to ensure effective implementation of the privacy policy (e.g. disciplinary actions)
C22: Data	Ensure that consumer's data is responsibly managed and secured	- Clear accountability and measures of privacy and data protection - Have a clear communication plan to provide timely, accurate and complete information to affected consumers, authorities, media, and the public when a privacy or data security breach does occur
C23: Information Sharing	Ensure that consumers are aware of the information collected or shared about them	- There is a communication method in place to inform consumers about the type of data collected and shared
C24: Consumer Health & Safety	Integration of consumer health and safety concern in any services or products	- Information about products and services' components, origin, side effects, threats to consumer health and safety are clearly communicated (or labeled in the case of products) - Have a consumer compliant handling and resolution system
C25: Consumer communication	Promote and communicate the concepts of sustainability through consumer's communication channels	- Sustainability efforts and issues are highlighted in all marketing and communication venues to consumers
C26: Consumer outreach	Educate customers about sustainability and identify ways that they can engage and contribute	- Practical guidelines and actions are provided to consumers (e.g. how they can reduce their energy consumption, or how they can use the organization's services or products in an efficient way)
C27: Customer marketing	Responsible and ethical marketing practices towards customers	- Ethical guidelines for advertisement of services and products exist (e.g. accurate information and descriptions of benefits & value)
C28: Consumers Optionality	Optionality and easy methods to move their services and/or data between providers	- Terms of services to consumers are clear and don't lock consumer with long contracts or high penalties for breaking a contract
C29: Influence Suppliers	Integrate sustainability performance into the selection criteria of suppliers	- Sustainability criteria and requirements are integrated into contract and agreement language for all contractors

C30: Supplier Outreach	Raise awareness among suppliers about sustainability and encourage their sustainable practices	- Outreach to suppliers to express the organization's commitment to sustainability and intent to give preference to suppliers with sustainable practices
C31: Supply Chain Management	Establish sustainable processes and procedures of acquiring ICT goods and services	- Use contractors/ suppliers/ service providers that share a commitment to sustainability - Opt out of paper statements where possible and switch to paperless billing and invoicing - A formal sustainable or environmentally preferable and socially responsible purchasing policy exists with guidelines for products and services purchased with mechanisms to assure compliance with such policy - regular audit
C32: Supplier health & safety	Consideration of suppliers health and safety in the acquired services and products from the supplier products	
<b>Cat4: Local Community and Society</b>		
C33: Jobs creation	Contribute to economic development in society by creating new jobs	- Invest in areas that can create new job opportunities
C34: Support of local suppliers & businesses	Priority and support to local businesses and suppliers	- Gives priority to local suppliers/ distributors and service providers
C35: Education & Infrastructure in local community	Investment in development of infrastructure and education programs in the local community	- Support of local schools and universities and engagement and partnership with local research institutes and universities
C36: Acceptance by local community	Outreach and acceptance of local community	- Local community outreach, communication, and assessment of operations and business impacts on the local community
C37: Support of programs that benefit local community	Investment and support of programs that benefit the local community	- Sponsorship and support of projects and initiatives that benefit the community
C38: Volunteerism & Philanthropy	Availability and affordability of services and products for low income communities and nonprofit organizations	- Have programs in place that encourage employees to donate to charities and to volunteer for community service - Make services affordable to low income communities and provide discounts and free services, support, or products to nonprofit and charitable organizations
C39: Corruption	Corruption and Bribery prevention	- Policy in place for responsible code of conduct with clear procedures and disciplinary actions concerning fraud, corruption, and violations of property rights
C40: Reputation	Positive reputation and opinion about the organization with the sector, sustainability professionals, academics and NGOs	- The organization has a good professional ranking in the sector (e.g. awards, top ten, top 100s)
C41: Global Issues	General support of global issues and developing countries	- Commitment to global issues and support and endorsement of international efforts to address issues like poverty, health, and natural disasters
<b>Economic</b>		
<b>Cat5: Financial and Risk Management</b>		
C42: Budget	Integrate sustainability in budgeting and accounting processes	- Sustainability is one of the criteria assessed before money is spent or allocated to a project budget - Method in place to account for sustainability benefits to the organization's bottom line (savings from the green IT initiatives) - Program in place to return some of the savings from green/ sustainability actions to the budget as an incentive or to support additional sustainability actions
C43: Financial Analysis	Integrate sustainability in financial analysis and management	- Use of total cost of ownership and full life cycle assessment that includes the externalities related to the lifecycle of a product or investment in an ICT solution - Assessment of risks and intangible benefits (triple bottom line) when assessing options for IT solutions.
C44: Key Performance	Have a set of financial key performance indicators KPIs	- Have metrics to assess the benefits and costs of pursuing sustainable options

Indicators		- Regular reporting on the financial sustainability metrics and benchmarking with other organizations
C45: Risk Management:	Ongoing risk assessment and minimize risks of environmental accidents	- Formal policy and measures in place to address risks of environmental accidents - Risk assessment using a uniform risk analysis framework (risk maps, risk ranking based on probability and magnitude)
<b>Cat6: Marketing</b>		
C46: Marketing Strategy	Strategic promotion of sustainability and encourages customers to choose more sustainable options	- A marketing strategy and plan in place that includes assessment of market segments and their opinions about sustainability and marketing messages that target each segment to encourage them to make sustainable choices
C47: Branding	Promote products and services with the most sustainable performance	- Customer education campaign centered around sustainability – to build demand for sustainable products and services - Seeks credible eco-labeling and certification for products/services where possible
C48: Internal Marketing	Educate employees and internally promote the organization's sustainability efforts	- Sustainability is incorporated into employee communications and via different types (all staff updates, newsletters, and social media).
C49: Marketing materials & giveaways	Reduce environmental impact associated with marketing processes, materials and giveaways	- Use of high-recycled content paper and environmentally friendly inks to print marketing materials - Reduce the use of material giveaways or choose products that are sustainable or exemplify sustainability - Method in place to eliminate duplicate mailings and provide options to customers to choose electronic mailing notification and marketing
<b>Cat7: Compensation and Financial Incentives</b>		
C50: Employees compensations	Maintain fair living wages and benefits to all employees and contractors	- Fair wages compliance (compared to market averages) - Fair ratio between highest and lowest paid employees
C5: Performance Evaluations and Incentives	Link rewards to sustainability performance	- Encourage employees sustainability-related certifications and training - Awards program to encourage and recognize employees and team sustainability initiatives
<b>Environmental</b>		
<b>Cat8: General Facilities</b>		
C52: Energy	Reduce environmental impacts associated with energy use-conservation, efficiency, use and production of energy	- Programs in place to reduce energy use with defined performance targets - Policy/ plan in place to shift to 100% renewable energy - Use of energy efficient appliances, tools, lights, and equipment (EnergyStar) - At least 50% of energy purchased or produced is renewable - Systems are in place for monitoring and reducing energy use by both equipment and human behavior
C53: Waste	Minimizing and proper disposal of waste - move toward a zero waste facility	- Programs in place for waste minimization with defined performance targets. - Program in place for waste re-use and recycle, and waste is properly disposed to authorized facilities - There are incentives for employees to divert resources from the waste stream - At least 90% reduction in solid waste going to the landfill while directing residual products to the “next best use” whenever practical
C54: Water	Maximize water use efficiency	- Program in place for water conservation and efficient use with identified performance targets
C55: Parking & Transportation Facilities	Reduce environmental impacts associated with transportation and parking facilities	- Free parking for carpoolers, bike parking, and shower facilities - Provide incentives for alternative transportation: subsidized bus/ metro passes/ shuttle services to metro/bus stations - The organization site permits commuting choices, including convenient alternative transportation (public transportation, train line) - 50% or more of the cleaning/ maintenance products are green certified (e.g. green seal, green cross, UGCA or equivalent)
C56: Material Use	Minimize toxics and exposure to hazardous material by using greener and environmentally	- Janitorial paper products with high recycled content is selected - Nontoxic pest control and management practices and methods are used

	safe products	
<b>Cat9: Data Center and Computing</b>		
C57: Data center facility	Minimize environmental impact associated with use of the data center facility - efficiency and conservation of resources	<ul style="list-style-type: none"> <li>- Efficient floor space design and utilization</li> <li>- Sustainability criteria are taken into consideration in the DC site selection: energy sources, environmental impact, water, rural areas</li> <li>- Consolidation of Physical Infrastructure (servers and storage) - Virtualization</li> <li>- Monitoring and control system of air quality - particulates and pollution - e.g. the Data Center Profiler from DOE</li> </ul>
C58: Systems & Asset Management	Systems and assets of DC are managed for reliability	<ul style="list-style-type: none"> <li>- Maintain systems and assets security and disaster recovery plan in place for critical systems</li> <li>- Policy in place to buy green certified IT assets for the data center like EPEAT, EnergyStar, and the Climate Saver recommendations</li> </ul>
C59: Design & Architecture	Optimize DC architecture and design to increase effectiveness	<ul style="list-style-type: none"> <li>- Design and architecture that enhances power distribution and efficiency e.g. Energy reuse, operating at higher temperatures, eliminate chillers and equipment fighting, air curtain, hot/cold aisles</li> <li>- Maintain Power Usage Effectiveness (PUE) rates within EPA and the Green Grid data center maturity model at or above the average recommended ranges (2.0 or less)</li> <li>- Data Center Infrastructure Efficiency (DCiE) - calculated as 1/PUE, is 50% or more</li> </ul>
C60: Servers	Increase efficiency at the server level to reduce the burden on power and cooling infrastructure	<ul style="list-style-type: none"> <li>- Use energy efficient servers - recommendations in the Climate Savers Initiative Catalog</li> <li>- Minimize energy consumption by servers through consolidation and virtualization</li> </ul>
C61: Storage	Increase efficiency at the storage level to reduce burden on power and cooling infrastructure	<ul style="list-style-type: none"> <li>- Minimize energy consumption by storage units through consolidation and virtualization or moving to cloud-based storage</li> <li>- Use energy efficient storage units - recommendations in the Climate Savers Initiative Catalog</li> </ul>
C62: Network & Power distribution	Increase efficiency of the network to reduce the burden on power and cooling infrastructure and to ensure security and reliability of network	<ul style="list-style-type: none"> <li>- Maintain network security, high availability, and uptime</li> <li>- Use energy efficient UPS and cooling systems and maintain high efficiency and utilization rates</li> <li>- Utilize innovative technology and design that limits loss of power in current conversion</li> <li>- Network power management systems in place</li> </ul>
C63: Applications Portfolio Management	Reduce redundancy of business apps and improve how systems integrate and operate with each other	<ul style="list-style-type: none"> <li>- Include sustainability criteria and environmental and energy considerations in negotiating Service Level Agreements with data center services and other service providers</li> </ul>
<b>Cat10: IT Office Equipment and Supplies Management</b>		
C64: PC and monitor devices & their accessories	Minimize environmental impact from excessive numbers of PCs, laptops, monitors, and their accessories and reduce unused equipment	<ul style="list-style-type: none"> <li>- Have a policy in place for procurement of standard models of PCs and laptops where parts can be swapped and re-used</li> <li>- Have a program in place to extend the lifetime of older PCs or laptops by turning them into thin clients - using desktop virtualization, cloud-based applications</li> <li>- Have procurement policy to buy green certified (EPEAT, EnergyStar) PCs, laptops, monitors, and other computing devices</li> </ul>
C65: power usage of PC monitors & equipment	Manage PCs, laptops, and monitors power usage to reduce wasteful power use	<ul style="list-style-type: none"> <li>- Have a power management policy for power saving settings for PCs and laptops</li> </ul>
C66: Telephony & Wireless power consumption	Reduce power consumption and use more energy efficient telephony, mobile phones, and other small user electronics and wireless systems	<ul style="list-style-type: none"> <li>- Have policy to purchase telephony electronics that are energy efficient or green certified (Good Guide for electronics, Greenpeace electronics guide)</li> </ul>
C67: Telephony & wireless electronic waste	Minimize environmental impact of small electronics like mobile phones	<ul style="list-style-type: none"> <li>- Have policy in place to procure standard mobile phone models and to control the frequency of mobile phones replacement</li> </ul>
C68: Printing	Reduce environmental impact associated with printing and copying	<ul style="list-style-type: none"> <li>- Have policy in place for printing less and printing efficiently: adopting paperless processes, and print efficiency (make the default settings energy efficient and paper reducing: duplex, font, gray/bw, power saving settings). Use of recycled paper</li> <li>- Program in place for proper recycle and reuse of printing cartridges</li> </ul>
C69: Office Supplies	Minimize environmental impacts	<ul style="list-style-type: none"> <li>- 80% or more of the office supplies and equipment come from</li> </ul>

	associated with office supplies, furnishings, and office equipment	sustainable source (e.g. 100% post-consumer waste, recyclable, part of take-back program)
C70: Service Contracts Management	Work and select contractors and service providers with sustainable practices that share a commitment to sustainability	<ul style="list-style-type: none"> <li>- There is a program or initiative in place for routinely checking the impact of purchasing different supplies and evaluation of options to select more sustainable ones</li> <li>- A program in place for evaluating contractors based on their sustainability practices and integrating sustainability criteria and requirements in the contracts language</li> </ul>
C71: Influence contractors	Actively influence contractors and service providers to adopt more sustainable practices	<ul style="list-style-type: none"> <li>- Organization sustainability requirements and commitments are shared with contractors and suppliers</li> <li>- A collaborative purchasing program with other tenants of building to consolidate shipments and delivery</li> </ul>
C72: Transportation & Shipping	Minimize environmental impact associated with transportation of people and shipping of material and purchases	<ul style="list-style-type: none"> <li>- Minimize impact from shipment and delivery transportation by selecting local suppliers, or consolidate purchases</li> </ul>
C73: eWaste Management:	Minimize electronic waste and proper disposing of eWaste	<ul style="list-style-type: none"> <li>- Program in place for e-waste minimization with defined performance targets</li> <li>- Program in place for proper disposing of e-waste with certified e-waste recycling and management group</li> </ul>
<b>Cat11: Environmental Management and Reporting Systems</b>		
C74: Environmental Sustainability Management System	Actively promote and support industry-wide practices and standards that protect the public health and environment	<ul style="list-style-type: none"> <li>- Have ISO-14001 conformant environmental systems</li> <li>- Goals associated with customer and supplier impacts are included in the EMS</li> </ul>
C75: Environmental Policies	Have a corporate environmental policy	<ul style="list-style-type: none"> <li>- Environmental policies in place and impacts of products and services are measured and assessed on a regular basis</li> <li>- Organization is enrolled (or adopts) third party sustainability programs (e.g. The Natural Step)</li> </ul>
C76: Environmental Reporting	Publicly reporting and sharing environmental impacts	<ul style="list-style-type: none"> <li>- Internal report highlighting accomplishments and areas for improvement</li> <li>- Sustainability reporting is included as part of existing public reports. Publishing a detailed and audited sustainability report</li> </ul>
C77: Carbon Management:	Reduce carbon emissions and have ability to monitor progress and impact	<ul style="list-style-type: none"> <li>- CO<sub>2</sub> emissions registry in place , voluntarily disclosure of carbon emissions</li> <li>- Carbon management and reporting system in place with performance targets identified</li> </ul>
<b>Cat12: Green Enterprise IT</b>		
C78: Enterprise IT design & architecture	Adoption of sustainable architecture and design of IT solutions	<ul style="list-style-type: none"> <li>- Flexible architecture models (easy integration, open standards)</li> <li>- Efficiency and environmental impact is taken into consideration - Enterprise IT Architecture integrates easily (e.g. the systems integrate easily with each other, standardized, optimized architecture)</li> </ul>
C79: Lean IT	Introduce Lean IT system concepts to minimize waste	<ul style="list-style-type: none"> <li>- Consolidated purchases for inventory control and management</li> <li>- Lean IT initiative/ program in place to continuously improve IT processes around efficiency and sustainability goals</li> <li>- Takes a leaner approach to enterprise IT operations and processes</li> </ul>
C80: Virtual meetings & virtual offices	Reduce environmental impact associated with transportation and physical office real estate	<ul style="list-style-type: none"> <li>- Paperless business processes initiative in place</li> <li>- Virtual Meeting capability is in place and staffs are aware of it and are trained to use it. A program in place for reducing the carbon foot print associated with travel to meetings, with identified performance targets</li> <li>- Reporting system in place that provides visibility of utilization of virtual meetings, travel eliminated and impacts recorded</li> <li>- Tele-work policy in place and capability to work remotely from anywhere</li> </ul>
<b>Innovation</b>		
<b>Cat13: Research and Development</b>		
C81: Investment in R&D	Invest in the design and development of sustainable solutions	<ul style="list-style-type: none"> <li>- Budget/ Investment in sustainability research and development.</li> </ul>
C82: Incentives & Innovation awards	Support innovative designs and solutions and participate in sector-wide and global efforts to tackle sustainability challenges	<ul style="list-style-type: none"> <li>- Participation and support of sector wide, national, and global sustainability initiatives</li> <li>- Award program for innovative sustainable designs or solutions</li> </ul>

## **APPENDIX G**

GMU Office of Research Subject Protection, approved protocol for the Sustainable IT Rating Survey.



Office of Research Subject Protections

Research Hall  
4400 University Drive, MS 6D5, Fairfax, Virginia 22030  
Phone: 703-993-4121; Fax: 703-993-9590

TO: Sharon deMonsabert, The Volgenau School of Information  
FROM: Keith R. Bushey *KRB*  
Chief of Staff, Office of Research

PROTOCOL NO.: 7869

PROPOSAL NO.: N/A

TITLE: Survey for Framework for Sustainable/Green Rating of the IT Organization

DATE: December 21, 2011

Cc: Khuloud Odeh

Under George Mason University (GMU) procedures, this project was determined to be exempt by the Office of Research Subject Protections since it falls under DHHS Exempt Category 2, research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior.

**You may proceed with data collection. Please note that all modifications in your protocol must be submitted to the Office of Research Subject Protections for review and approval prior to implementation.** Any unanticipated problems involving risks to participants or others, including problems regarding data confidentiality must be reported to the GMU Office of Research Subject Protections.

GMU is bound by the ethical principles and guidelines for the protection of human subjects in research contained in The Belmont Report. Even though your data collection procedures are exempt from review by the GMU HSRB, GMU expects you to conduct your research according to the professional standards in your discipline and the ethical guidelines mandated by federal regulations.

Thank you for cooperating with the University by submitting this protocol for review. Please call me at 703/993-3088 if you have any questions.

### ***Survey for Sustainable (Green) IT Rating System***

Dear Respondent,

I am inviting you to participate in a research project to study sustainability assessment and rating of Information and Communication Technology (ICT) organizations. Along with this message is a survey that asks a variety of questions about potential *relevance*, *practicality* (measurability), *reliability* (availability of data), and *significance* (importance) of a set of social, economic, and environmental factors. It is expected that completion of the survey will take approximately twenty minutes. If you accept to participate in this survey, you can complete it and submit online at the following link:

<https://www.surveymonkey.com/s/8M6LV86>

The answers to the survey will be used to establish a baseline weighting for the sustainability measures in Sustainable IT Rating Model to attempt to balance economic, environmental and social aspects of sustainability in ICT. I plan to incorporate the results into my doctoral thesis and will share them in a conference/ Journal paper.

I don't know of any risks to you if you decide to participate in this survey. The data in this study will be confidential. All results will be presented in aggregate and no data will be directly related to an individual respondent. I promise not to share any information that identifies you with anyone outside my research group, which consists of my PhD advisory committee and me.

The survey should take you approximately twenty minutes to complete. I hope you will take the time to complete it and submit it online. Your participation is voluntary. I will be happy to send you a copy of my public presentations if you desire – there is a checkbox on the survey form to indicate your preference.

If you have any questions or concerns about completing the survey or about being in this research/ study, you may contact me at [kodeh@gmu.edu](mailto:kodeh@gmu.edu) or +1-301-768-1886.

I would appreciate it if you check the agree checkbox of the informed consent form in the survey, complete and submit the survey online at your earliest convenience. I thank you in advance for your participation.

Sincerely,  
Khuloud Odeh  
PhD Candidate

**APPROVED**  
  
George Mason University

*Framework for Sustainable (Green) IT Rating System*

**INFORMED CONSENT FORM**

APPROVED  
7869  
George Mason University

**RESEARCH PROCEDURES**

This research is being conducted to help identify the key criteria that should be considered when rating and assessing the sustainability (greenness) of Information and Communication Technology (ICT) organization. If you agree to participate, you will be asked to complete a survey about potential *relevance*, *practicality* (measurability), *reliability* (availability of data), and *significance* (importance) of a set of social, economic, and environmental factors. The answers to the survey will be used to establish a baseline weighting for the sustainability measures in the Sustainable IT rating model. It is expected that completion of the survey will take approximately twenty minutes.

**RISKS**

There are no foreseeable risks for participating in this research.

**BENEFITS**

There are no benefits to you as a participant other than to further research in the area of sustainability in ICT.

**CONFIDENTIALITY**

The data in this study will be confidential. The results of this survey will be integrated into the Sustainable IT rating model and will be included in a graduate dissertation, presented at conferences, and may also be published in journal articles. All results will be presented in aggregate and no data will be directly related to a respondent. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission.

**PARTICIPATION**

Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

**CONTACT**

This research is being conducted by Khuloud Odeh, a doctoral student at the Volgenau School of IT and Engineering at George Mason University. She may be reached at +1-301-768-1886 or via email [kodeh@gmu.edu](mailto:kodeh@gmu.edu) for questions or to report a research-related problem. Dr. Sharon deMonsabert, Assistant Professor at the Civil, Environmental, and Infrastructure Engineering Department is directing this research project and may be reached at +1- 703-993-1747 or via email [sdemonsa@gmu.edu](mailto:sdemonsa@gmu.edu). You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as

a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

**CONSENT**

I have read this form and agree to participate in this study.

☐ I Agree

---

APPROVED  
7869  
George Mason University

## **APPENDIX H**

Copy of the Experts' Survey for Sustainable/ Green IT Rating Framework.

# Sustainable-Green IT Rating System

## 1. INFORMED CONSENT

Framework for Sustainable (Green) IT Rating System

### RESEARCH PROCEDURES

This research is being conducted to help identify the key criteria that should be considered when rating and assessing the sustainability (greenness) of Information and Communication Technology (ICT) organization. If you agree to participate, you will be asked to complete a survey about potential relevance, practicality (measurability), reliability (availability of data), and significance (importance) of a set of social, economic, and environmental factors. The answers to the survey will be used to establish a baseline weighting for the sustainability measures in the Sustainable IT rating model. It is expected that completion of the survey will take approximately twenty minutes.

### RISKS

There are no foreseeable risks for participating in this research.

### BENEFITS

There are no benefits to you as a participant other than to further research in the area of sustainability in ICT.

### CONFIDENTIALITY

The data in this study will be confidential. The results of this survey will be integrated into the Sustainable IT rating model and will be included in a graduate dissertation, presented at conferences, and may also be published in journal articles. All results will be presented in aggregate and no data will be directly related to a respondent. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission.

### PARTICIPATION

Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

### CONTACT

This research is being conducted by Khuloud Odeh, a doctoral student at the Volgenau School of IT and Engineering at George Mason University. She may be reached at +1-301-768-1886 or via email [kodeh@gmu.edu](mailto:kodeh@gmu.edu) for questions or to report a research-related problem. Dr. Sharon deMonsabert, Assistant Professor at the Civil, Environmental, and Infrastructure Engineering Department is directing this research project and may be reached at +1- 703-993-1747 or via email [sdemonsa@gmu.edu](mailto:sdemonsa@gmu.edu). You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

NOTE 1: If you would like to have a copy of this consent form, please print this page prior to proceeding to the survey.

NOTE 2: If you would like to receive a copy of the public report of this research please check the box below and provide your email address.

### 1. Research public report

☐ I'd like to receive a copy of the public report of this research project

My email address

## Sustainable-Green IT Rating System

### 2. CONSENT

**I have read this form and agree to participate in this study.**

☐ I agree

## Sustainable-Green IT Rating System

### 2. Definitions

The goal of this survey is to identify the key criteria that should be considered when rating and assessing the sustainability (greenness) of Information and Communication Technology (ICT) organization and the potential relevance, practicality (measurability), reliability (availability of data), and significance (importance) of each of the social, economic, and environmental factors. The answers to the survey will be used to establish a baseline weighting for the sustainability measures in the Sustainable IT rating model.

Definitions of Sustainability/ Sustainable Development, Sustainable/Green IT, and Sustainability Impact Assessment (SIA) are presented below for background information of the survey:

#### SUSTAINABILITY/ SUSTAINABLE DEVELOPMENT:

Sustainable development is development, which meets the needs of the present without compromising the ability of future generations to meet their own needs. (WCED and Brundtland 1987)

#### SUSTAINABLE/GREEN ICT:

The study and practice of designing, manufacturing, using and disposing of computers, servers, and associated subsystems efficiently and effectively with minimal or no impact on the environment, and achieving economic viability and improved system performance and use, while abiding by our social and ethical responsibilities. (Murugesan 2008)

#### SUSTAINABILITY IMPACT ASSESSMENT (SIA):

A systematic and iterative process for the ex ante assessment of the likely economic, social and environmental impacts of policies, plans, programs and strategic projects, which is undertaken during the preparation of them and where the stakeholders concerned participate pro-actively. The main aim is to improve the performance of the strategies by enhancing positive effects, mitigating negative ones and avoiding that negative impacts are transferred to future generations. (Arbter 2003)

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### 3. General Information

#### 1. What best describes your main area of expertise or professional role:

- ☐ IT Executive Leadership (e.g. CIO, VP for IT, Director of IT or similar)
- ☐ IT Professional
- ☐ Sustainability-related Professional
- ☐ Green IT Specialist
- ☐ Other

Other (please specify)

#### 2. How many years of experience do you have in the above professional role or area of expertise?

- ☐ Less than 2 year
- ☐ 2- 5 years
- ☐ 6 -10 years
- ☐ More than 10 years

#### 3. In which sector do you work?

- ☐ Self-employed
- ☐ Private
- ☐ Public/ Government (municipal, state or federal)
- ☐ Academia/ Research
- ☐ Non-profit/ NGO
- ☐ Regulatory/ Industry standards

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### 4. How familiar are you with the following eco-labels, green rating, and sustainability reporting systems and methods (1: Slightly Familiar, 3: Somewhat familiar, 5:Very familiar)

	Not Familiar	1 (Slightly Familiar)	2	3 (Somewhat Familiar)	4	5 (Very Familiar)
EnergyStar	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronic Product Environmental Assessment Tool (EPEAT)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leadership in Energy and Environmental Design (LEED)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global Reporting Initiative (GRI)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Newsweek Green Rankings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Green Grid Data Center Maturity Model	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global 100 most sustainable corporations in the world	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tomorrow's Value Rating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Greenpeace IT Leaderboard	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Greenpeace Guide to Greener Electronics	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GoodGuide for Electronics-Cell Phones	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Cycle Assessment (LCA)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 4. Categories for Social, Environmental, and Economic Sustainability

#### INSTRUCTIONS FOR THIS SECTION:

Assuming that you are involved in assessing and rating sustainability of an IT organization; for each sustainability area, the following categories should be considered in rating sustainability of IT organization. On scale from 1 to 5 where 1: Don't Agree, 3: Somewhat Agree, and 5: Strongly Agree, express your level of agreement that such category should be considered.

#### 1. The following categories should be considered for Social Sustainability:

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)
Sustainability Governance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Workforce (Employees)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Value Chain (Consumers, Suppliers, and Distributors)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Local Community and Society	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. The following categories should be considered for Environmental Sustainability:

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)
Facilities (Energy, Water, Waste, Material Use)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Data Centers and Computing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Office and Equipment Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental Management and Reporting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green Enterprise IT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. The following categories should be considered for Economic Sustainability:

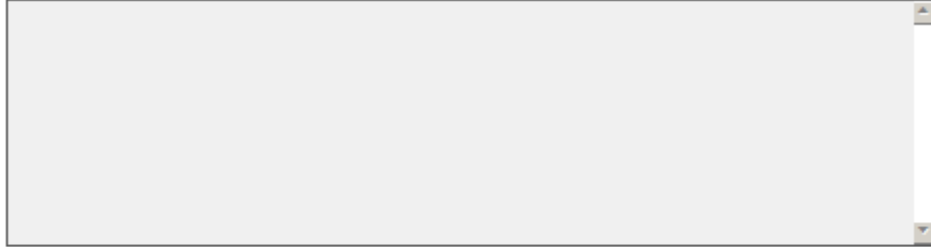
	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)
Accounting and Financial Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Marketing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Risks and Crisis Management	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compensations and Financial Incentives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. The following Innovation categories should be considered for Sustainability:

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)
Research and Development of sustainability solutions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Comments and additional categories to consider



## Sustainable-Green IT Rating System

### 5. Criteria for Social, Environmental and Economic Sustainability Categories R...

#### INSTRUCTIONS FOR THE NEXT SUB SECTIONS:

For each category, you will be presented with a number of criteria to rate. Please rate the Relevance to sustainability, Practicality (measurability), Reliability (availability of data), and Significance (importance) of the proposed social, economic and environmental sustainability criteria and factors. Your rating will be between 1 and 5, where 1 is least, 3 is somewhat and 5 is most relevant, practical, reliable or significant factor or criteria.

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### 6. Environmental Criteria 1: General-Facilities

**1. Energy: Reduce environmental impacts associated with energy use through conservation (reduce use of energy), efficiency (use the lowest practical amount possible of energy), use and production of energy from renewable resource**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**2. Waste: Move toward a zero waste facility by minimizing and proper disposition of waste**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**3. Water: Maximize water use efficiency**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4. Parking and Transportation Facilities: Reduce environmental impacts (carbon footprint) associated with transportation and parking facilities**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Material Use in maintenance and janitorial: Minimize toxics by using green cleaning and pest control products and methods

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Comments and additional criteria to consider under General - Facilities

## Sustainable-Green IT Rating System

### 7. Environmental Criteria 2: Data Center and Computing

**1. Data center facility and resource efficiency: Minimize the environmental impact and carbon footprint associated with the use of the data center facility through efficiency and conservation of resources used**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**2. Systems and Asset Management: Systems and assets of the data center are managed for reliability, including disaster recovery plan, and pollution / emissions control**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**3. Data Center Design and Architecture: Optimizing the data center architecture to increase effectiveness of Data Center architecture to reduce burden on cooling and power infrastructure**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**4. Servers: To increase efficiency at the server level to reduce burden on power and cooling infrastructure**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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### 5. Storage: To increase efficiency at the storage level to reduce burden on power and cooling infrastructure

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Network: To increase efficiency of the Network to reduce burden on power and cooling infrastructure, and to assure security and reliability of the network

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Applications Portfolio Management: To reduce redundancy of business applications and improve how the systems work and communicate with each other

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Comments and additional criteria to consider under Data Center and Computing

## Sustainable-Green IT Rating System

### 8. Environmental Criteria 3: Office and Equipment Management

#### 1. Distributed IT: Limit PC and monitor devices and their accessories and reduce unused equipment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Distributed IT: Reduce wasteful power usage of PC monitors and equipment being on and unused

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Telephony and Wireless: Reduce power consumption and use more energy power efficient Telephony systems (VoIP)

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Telephony and wireless: reducing electronic waste coming from small wireless devices

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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### 5. Printing:reduce environmental impact associated with printing by reducing printing and using efficient printers and recycled materials

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Office Supplies:Minimize impacts associated with office supplies, furnishings and equipment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Service Contracts Management:work with and select contractors that share commitment to sustainability (e.g. banks, courier, catering, offsite backup, etc)

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Service Contracts Management:Actively influence contractors not hired directly

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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### 9. Transportation: Actively promote the reduction of climate impacts associated with transportation of people/ material

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 10. eWaste Management: Minimize electronic waste and proper disposition of ewaste

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 11. Comments and additional criteria to consider under Office and Equipment Management

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### 9. Environmental Criteria 4: Environmental Management and Reporting

#### 1. Environmental Sustainability Management System: Actively promote and support industry-wide practices and standards that protect public health and the environment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Environmental Policies: Adopt a corporate environmental policy

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Environmental Reporting: Make available and use qualitative and quantitative data on the organization's progress towards sustainability

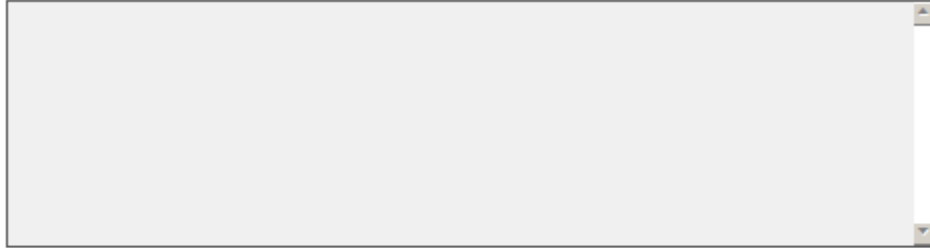
	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Carbon Management: Reduce carbon emissions and ability to monitor progress and impact

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Comments and additional criteria to consider under Environmental Management and Reporting



## Sustainable-Green IT Rating System

### 10. Environmental Criteria 5: green Enterprise IT

#### 1. Enterprise IT solutions design, architecture, and methods: Adopt sustainable architecture design and methods

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Adopt Lean IT approach to enterprise IT operations processes

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Virtual meetings and virtual offices: Reduce environmental impact (carbon footprint) associated with transportation and physical offices -real estate)

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Comments and additional criteria to consider under Green Enterprise IT

## Sustainable-Green IT Rating System

### 11. Social Criteria 1: Sustainability Governance

#### 1. Vision: Have a clear vision for how sustainability relates to the organization's mission

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Commitment: Demonstrated Commitment to sustainability issues

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Transparency: The organization operates in transparent manner

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Stakeholders Engagement: The organization actively engage the different stakeholders in its sustainability initiatives and programs

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Regulatory compliance and sustainability reporting: Minimize risks and comply with mandates, regulations and industry standards related to sustainability

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Regulatory compliance and sustainability reporting: Responsible and ethical Code of Conduct

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Regulatory compliance and sustainability reporting: Regularly report on the results of sustainability efforts

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Comments and additional criteria to consider under Sustainability Governance

## Sustainable-Green IT Rating System

### 12. Social Criteria 2: Workforce/ Employees

#### 1. Benefits and Wages: Provide fair living wages and benefits

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Benefits and Wages: Integrate sustainability in employees performance evaluation

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Diversity: Actively recruit and provide job opportunities to people from disadvantaged populations

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Diversity in the composition of employees on all levels

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Change Management and Training: Raise Employees Awareness and educate them on sustainability issues

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Change Management and Training: Provide opportunities for professional development in sustainability practices

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Workplace safety and employees health and well-being: Maintain safe physical working conditions

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Workplace safety and employees health and well-being: promote work-life balance and healthy environment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 9. Talent attraction and retention: Actively recruit and provide job opportunities for people from disadvantaged Diversity

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 10. Talent attraction and retention: Empower employees to take active role in sustainability initiatives

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 11. Talent attraction and retention: employees satisfaction

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 12. Workplace integrity and organization culture: Provide respectful and productive work environment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 13. Workplace integrity and organization culture: Psychological and organizational working conditions

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 14. Comments and additional criteria to consider under Workforce (Employees)

## Sustainable-Green IT Rating System

### 13. Social Criteria 3: Consumers, Suppliers, Distributors (Value Chain)

#### 1. Consumer Data and Privacy Protection: To respect consumers privacy and ensure consumers data is properly managed and secured

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Consumer Data and Privacy Protection: Ensure that consumers are aware of the kind of information collected about them, its use, and the

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Consumer Data and Privacy Protection: Responsible management of privacy or data security breaching incidents

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Consumer Health and Safety and Products Responsibility: Integration of customer health and safety concerns in products

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Consumer outreach and marketing communication: Promote the concepts of sustainability in marketing communication channels to consumers

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. Consumer outreach and marketing communication: Educate customers about the organization sustainability efforts and identify ways on how they can engage and contribute to those efforts

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Customer outreach and marketing communication: Responsible marketing practices

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Supplier outreach and influence: Integrate sustainability performance into selection criteria of suppliers

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 9. Supplier outreach and influence: Raise awareness about sustainability among suppliers and encourage sustainable practices

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 10. Sustainable Supply Chain Management: Establish sustainable processes and procedures of acquiring goods and services needed to run IT

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 11. Supplier health and safety

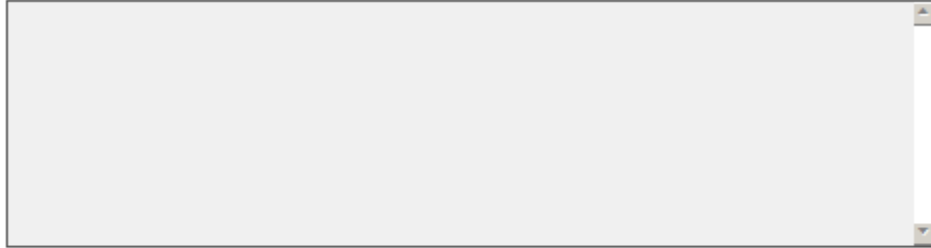
	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 12. Consumers options: Optionality and ease to move services and data between providers

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 13. Comments and additional criteria to consider under Value Chain (Consumers, Suppliers and Distributors)



## Sustainable-Green IT Rating System

### 14. Social Criteria 4: Community and Society

#### 1. Development support and positive actions towards society: Jobs creation

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Development support and positive actions towards society: Support of local suppliers and businesses

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Development support and positive actions towards society: general support of developing countries

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Development support and positive actions towards society: Investment in research and development, infrastructure and local community education programs

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Support local community: Acceptance by local community

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 6. support local community: Investment and support of programs that benefit local community

	1	2	3	4	5
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 7. Support local community:Availability and affordability of services and products for low income communities

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 8. Corruption:Corruption and bribery prevention

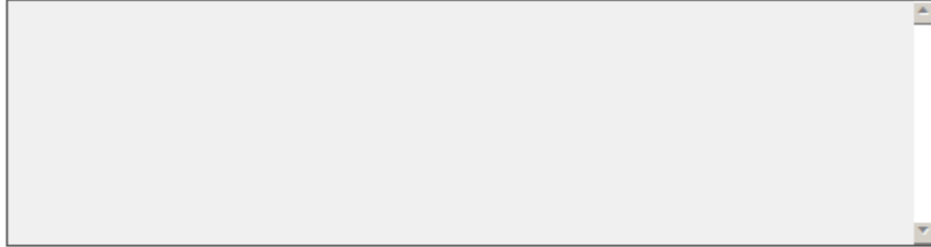
	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 9. Corruption:Positive reputation and opinion about the organization by the sector, sustainability professional, and academics

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 10. Comments and additional criteria to consider under Community and Society



## Sustainable-Green IT Rating System

### 15. Economic Criteria 1: Accounting, Financial and Risk Management

#### 1. Budget: Integrate sustainability in budgeting and accounting process

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Financial Analysis: Integrate sustainability in financial analysis

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Key Performance Indicators: Develop a set of financial sustainability metrics

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Risk Management: minimize risks of environmental accidents

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Comments and additional criteria to consider under Accounting, Financial and Risk Management



## Sustainable-Green IT Rating System

### 16. Economic Criteria 2: Marketing

#### 1. Marketing Strategy: Promote sustainability and encourage customers to choose the more sustainable options

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Product/ Service and Branding: Promote products/services with most sustainable performance

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Internal Marketing: Educate employees about the organization's sustainability efforts

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 4. Marketing materials and give-aways: Reduce environmental impact associated with the marketing material

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Sustainable-Green IT Rating System

### 5. Comments and additional criteria to consider under Marketing



## Sustainable-Green IT Rating System

### 17. Economic Criteria 3: Compensations and Financial Incentives

#### 1. Employees compensations: Maintain fair living wages to all employees

	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 2. Performance Evaluations and Incentives: Link rewards to sustainability performance

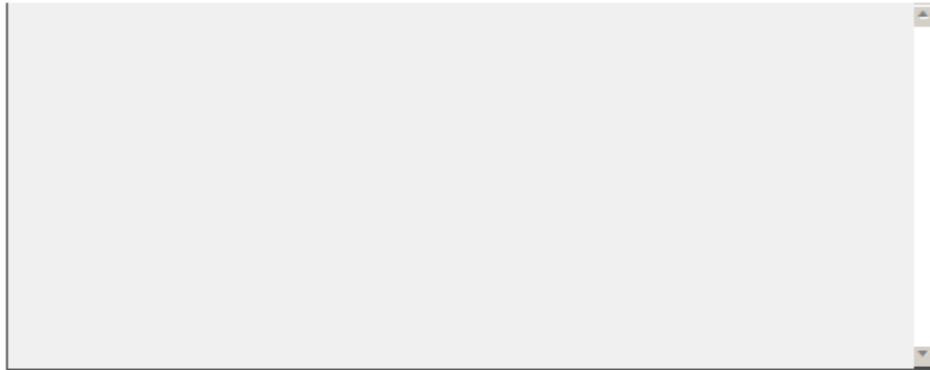
	1 (Least)	2	3 (Somewhat)	4	5 (Most)
Relevance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Practicality (Measurability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (Data Availability)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Significance (Importance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### 3. Comments and additional criteria to consider under Compensations and Financial Incentives

## Sustainable-Green IT Rating System

### 18. Additional Comments


#### 1. Comments




## **APPENDIX I**

Sustainable-Green IT Rating Survey Results.






1. Research public report

		Response Percent	Response Count
I'd like to receive a copy of the public report of this research project		100.0%	40
	My email address		41
	answered question		40
	skipped question		20





2. CONSENT I have read this form and agree to participate in this study.

		Response Percent	Response Count
I agree		100.0%	60
	answered question		60
	skipped question		0






### 3. What best describes your main area of expertise or professional role:

		Response Percent	Response Count
IT Executive Leadership (e.g. CIO, VP for IT, Director of IT or similar)		30.4%	17
IT Professional		16.1%	9
Sustainability-related Professional		42.9%	24
Green IT Specialist		5.4%	3
Other		5.4%	3
Other (please specify)			3
answered question			56
skipped question			4

### 4. How many years of experience do you have in the above professional role or area of expertise?

		Response Percent	Response Count
Less than 2 year		5.3%	3
2- 5 years		26.3%	15
6 -10 years		21.1%	12
More than 10 years		47.4%	27
answered question			57
skipped question			3

### 5. In which sector do you work?

		Response Percent	Response Count
Self-employed		15.8%	9
Private		47.4%	27
Public/ Government (municipal, state or federal)		10.5%	6
Academia/ Research		10.5%	6
Non-profit/ NGO		35.1%	20
Regulatory/ Industry standards		0.0%	0
answered question			57
skipped question			3

**6. How familiar are you with the following eco-labels, green rating, and sustainability reporting systems and methods (1: Slightly Familiar, 3: Somewhat familiar, 5:Very familiar)**

	Not Familiar	1 (Slightly Familiar)	2	3 (Somewhat Familiar)	4	5 (Very Familiar)	Response Count
EnergyStar	3.6% (2)	7.1% (4)	5.4% (3)	28.8% (15)	21.4% (12)	35.7% (20)	56
Electronic Product Environmental Assessment Tool (EPEAT)	47.4% (27)	17.5% (10)	0.0% (0)	12.3% (7)	12.3% (7)	10.5% (6)	57
Leadership in Energy and Environmental Design (LEED)	12.3% (7)	10.5% (6)	7.0% (4)	17.5% (10)	24.6% (14)	28.1% (16)	57
Global Reporting Initiative (GRI)	33.3% (19)	12.3% (7)	5.3% (3)	10.5% (6)	22.8% (13)	15.8% (9)	57
Newsweek Green Rankings	58.9% (33)	17.9% (10)	1.8% (1)	7.1% (4)	7.1% (4)	7.1% (4)	56
The Green Grid Data Center Maturity Model	59.6% (34)	10.5% (6)	7.0% (4)	10.5% (6)	7.0% (4)	5.3% (3)	57
Global 100 most sustainable corporations in the world	36.8% (21)	21.1% (12)	7.0% (4)	17.5% (10)	10.5% (6)	7.0% (4)	57
Tomorrow's Value Rating	68.4% (39)	12.3% (7)	12.3% (7)	5.3% (3)	1.8% (1)	0.0% (0)	57
Greenpeace IT Leaderboard	50.9% (29)	12.3% (7)	12.3% (7)	10.5% (6)	5.3% (3)	8.8% (5)	57
Greenpeace Guide to Greener Electronics	54.4% (31)	8.8% (5)	7.0% (4)	7.0% (4)	10.5% (6)	12.3% (7)	57
GoodGuide for Electronics- Cell Phones	57.1% (32)	16.1% (9)	8.9% (5)	7.1% (4)	7.1% (4)	3.6% (2)	56
Life Cycle Assessment (LCA)	26.3% (15)	12.3% (7)	7.0% (4)	15.8% (9)	19.3% (11)	19.3% (11)	57
answered question							57
skipped question							3

**7. The following categories should be considered for Social Sustainability:**

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)	Response Count
Sustainability Governance	3.8% (2)	1.9% (1)	21.2% (11)	23.1% (12)	50.0% (26)	52
Workforce (Employees)	3.8% (2)	1.9% (1)	15.4% (8)	21.2% (11)	57.7% (30)	52
Value Chain (Consumers, Suppliers, and Distributors)	1.9% (1)	3.8% (2)	9.6% (5)	30.8% (16)	53.8% (28)	52
Local Community and Society	3.8% (2)	1.9% (1)	11.5% (6)	25.0% (13)	57.7% (30)	52
answered question						52
skipped question						8

**8. The following categories should be considered for Environmental Sustainability:**

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)	Response Count
Facilities (Energy, Water, Waste, Material Use)	0.0% (0)	1.9% (1)	5.8% (3)	11.5% (6)	80.8% (42)	52
Data Centers and Computing	1.9% (1)	1.9% (1)	9.6% (5)	21.2% (11)	65.4% (34)	52
Office and Equipment Management	1.9% (1)	0.0% (0)	15.4% (8)	21.2% (11)	61.5% (32)	52
Environmental Management and Reporting	1.9% (1)	1.9% (1)	5.8% (3)	23.1% (12)	67.3% (35)	52
Green Enterprise IT	3.8% (2)	1.9% (1)	19.2% (10)	19.2% (10)	55.8% (29)	52
answered question						52
skipped question						8

**9. The following categories should be considered for Economic Sustainability:**

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)	Response Count
Accounting and Financial Management	1.9% (1)	1.9% (1)	25.0% (13)	30.8% (16)	40.4% (21)	52
Marketing	7.8% (4)	9.8% (5)	31.4% (16)	23.5% (12)	27.5% (14)	51
Risks and Crisis Management	2.0% (1)	7.8% (4)	23.5% (12)	19.6% (10)	47.1% (24)	51
Compensations and Financial Incentives	9.6% (5)	5.8% (3)	25.0% (13)	25.0% (13)	34.6% (18)	52
answered question						52
skipped question						8

**10. The following Innovation categories should be considered for Sustainability:**

	1 (Don't Agree)	2	3 (Somewhat Agree)	4	5 (Strongly Agree)	Response Count
Research and Development of sustainability solutions	0.0% (0)	7.8% (4)	13.7% (7)	17.6% (9)	60.8% (31)	51
answered question						51
skipped question						9

**11. Comments and additional categories to consider**

Response Count
13
answered question 13
skipped question 47

**12. Energy: Reduce environmental impacts associated with energy use through conservation (reduce use of energy), efficiency (use the lowest practical amount possible of energy), use and production of energy from renewable resource**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	4.4% (2)	11.1% (5)	28.9% (13)	55.6% (25)	45
Practicality (Measurability)	0.0% (0)	0.0% (0)	28.9% (13)	31.1% (14)	40.0% (18)	45
Reliability (Data Availability)	0.0% (0)	2.3% (1)	27.3% (12)	34.1% (15)	36.4% (16)	44
Significance (Importance)	0.0% (0)	2.2% (1)	11.1% (5)	20.0% (9)	66.7% (30)	45
answered question						45
skipped question						15

**13. Waste: Move toward a zero waste facility by minimizing and proper disposition of waste**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	6.7% (3)	13.3% (6)	40.0% (18)	40.0% (18)	45
Practicality (Measurability)	2.2% (1)	11.1% (5)	28.9% (13)	35.6% (16)	22.2% (10)	45
Reliability (Data Availability)	2.2% (1)	11.1% (5)	35.6% (16)	26.7% (12)	24.4% (11)	45
Significance (Importance)	2.2% (1)	0.0% (0)	11.1% (5)	46.7% (21)	40.0% (18)	45
answered question						45
skipped question						15

#### 14. Water:Maximize water use efficiency

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.2% (1)	4.4% (2)	22.2% (10)	31.1% (14)	40.0% (18)	45
Practicality (Measurability)	0.0% (0)	9.1% (4)	18.2% (8)	50.0% (22)	22.7% (10)	44
Reliability (Data Availability)	0.0% (0)	13.3% (6)	26.7% (12)	40.0% (18)	20.0% (9)	45
Significance (Importance)	2.2% (1)	4.4% (2)	22.2% (10)	31.1% (14)	40.0% (18)	45
answered question						45
skipped question						15

#### 15. Parking and Transportation Facilities:Reduce environmental impacts (carbon footprint) associated with transportation and parking facilities

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	4.4% (2)	8.9% (4)	31.1% (14)	26.7% (12)	28.9% (13)	45
Practicality (Measurability)	0.0% (0)	6.7% (3)	44.4% (20)	37.8% (17)	11.1% (5)	45
Reliability (Data Availability)	2.2% (1)	13.3% (6)	42.2% (19)	28.9% (13)	13.3% (6)	45
Significance (Importance)	6.7% (3)	4.4% (2)	31.1% (14)	33.3% (15)	24.4% (11)	45
answered question						45
skipped question						15

**16. Material Use in maintenance and janitorial: Minimize toxics by using green cleaning and pest control products and methods**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.2% (1)	17.8% (8)	33.3% (15)	11.1% (5)	35.6% (16)	45
Practicality (Measurability)	6.7% (3)	4.4% (2)	35.6% (16)	24.4% (11)	28.9% (13)	45
Reliability (Data Availability)	6.7% (3)	13.3% (6)	26.7% (12)	28.9% (13)	24.4% (11)	45
Significance (Importance)	6.7% (3)	15.6% (7)	15.6% (7)	31.1% (14)	31.1% (14)	45
answered question						45
skipped question						15

**17. Comments and additional criteria to consider under General - Facilities**

	Response Count
	10
answered question	10
skipped question	50

**18. Data center facility and resource efficiency: Minimize the environmental impact and carbon footprint associated with the use of the data center facility through efficiency and conservation of resources used**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.6% (1)	0.0% (0)	10.5% (4)	21.1% (8)	65.8% (25)	38
Practicality (Measurability)	2.6% (1)	2.6% (1)	18.4% (7)	31.6% (12)	44.7% (17)	38
Reliability (Data Availability)	2.6% (1)	2.6% (1)	18.4% (7)	28.9% (11)	47.4% (18)	38
Significance (Importance)	2.6% (1)	2.6% (1)	10.5% (4)	26.3% (10)	57.9% (22)	38
answered question						38
skipped question						22

**19. Systems and Asset Management: Systems and assets of the data center are managed for reliability, including disaster recovery plan, and pollution / emissions control**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	2.7% (1)	13.5% (5)	27.0% (10)	54.1% (20)	37
Practicality (Measurability)	2.7% (1)	0.0% (0)	32.4% (12)	32.4% (12)	32.4% (12)	37
Reliability (Data Availability)	2.7% (1)	0.0% (0)	32.4% (12)	32.4% (12)	32.4% (12)	37
Significance (Importance)	2.7% (1)	0.0% (0)	18.9% (7)	35.1% (13)	43.2% (16)	37
answered question						37
skipped question						23

**20. Data Center Design and Architecture:Optimizing the data center architecture to increase effectiveness of Data Center architecture to reduce burden on cooling and power infrastructure**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.6% (1)	2.6% (1)	15.8% (6)	23.7% (9)	55.3% (21)	38
Practicality (Measurability)	2.6% (1)	5.3% (2)	13.2% (5)	38.8% (14)	42.1% (16)	38
Reliability (Data Availability)	2.6% (1)	5.3% (2)	15.8% (6)	44.7% (17)	31.6% (12)	38
Significance (Importance)	2.7% (1)	0.0% (0)	16.2% (6)	27.0% (10)	54.1% (20)	37
answered question						38
skipped question						22

**21. Servers:To increase efficiency at the server level to reduce burden on power and cooling infrastructure**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.6% (1)	2.6% (1)	13.2% (5)	31.6% (12)	50.0% (19)	38
Practicality (Measurability)	2.6% (1)	2.6% (1)	7.9% (3)	44.7% (17)	42.1% (16)	38
Reliability (Data Availability)	2.6% (1)	0.0% (0)	18.4% (7)	44.7% (17)	34.2% (13)	38
Significance (Importance)	2.6% (1)	0.0% (0)	10.5% (4)	42.1% (16)	44.7% (17)	38
answered question						38
skipped question						22

**22. Storage: To increase efficiency at the storage level to reduce burden on power and cooling infrastructure**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.8% (1)	5.6% (2)	16.7% (6)	27.8% (10)	<b>47.2% (17)</b>	36
Practicality (Measurability)	2.8% (1)	2.8% (1)	25.0% (9)	<b>38.9% (14)</b>	30.6% (11)	36
Reliability (Data Availability)	2.8% (1)	0.0% (0)	30.6% (11)	<b>38.9% (14)</b>	27.8% (10)	36
Significance (Importance)	2.9% (1)	0.0% (0)	17.1% (6)	<b>40.0% (14)</b>	<b>40.0% (14)</b>	35
answered question						36
skipped question						24

**23. Network: To increase efficiency of the Network to reduce burden on power and cooling infrastructure, and to assure security and reliability of the network**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	5.4% (2)	29.7% (11)	21.6% (8)	<b>40.5% (15)</b>	37
Practicality (Measurability)	2.7% (1)	8.1% (3)	<b>32.4% (12)</b>	27.0% (10)	29.7% (11)	37
Reliability (Data Availability)	5.4% (2)	5.4% (2)	<b>37.8% (14)</b>	24.3% (9)	27.0% (10)	37
Significance (Importance)	2.7% (1)	5.4% (2)	<b>35.1% (13)</b>	21.6% (8)	<b>35.1% (13)</b>	37
answered question						37
skipped question						23

**24. Applications Portfolio Management: To reduce redundancy of business applications and improve how the systems work and communicate with each other**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.4% (2)	10.8% (4)	32.4% (12)	29.7% (11)	21.6% (8)	37
Practicality (Measurability)	10.8% (4)	8.1% (3)	37.8% (14)	24.3% (9)	18.9% (7)	37
Reliability (Data Availability)	10.8% (4)	13.5% (5)	29.7% (11)	29.7% (11)	16.2% (6)	37
Significance (Importance)	10.8% (4)	10.8% (4)	21.6% (8)	35.1% (13)	21.6% (8)	37
answered question						37
skipped question						23

**25. Comments and additional criteria to consider under Data Center and Computing**

	Response Count
	8
answered question	8
skipped question	52

**26. Distributed IT: Limit PC and monitor devices and their accessories and reduce unused equipment**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.6% (2)	8.3% (3)	25.0% (9)	22.2% (8)	38.9% (14)	36
Practicality (Measurability)	8.3% (3)	11.1% (4)	22.2% (8)	30.6% (11)	27.8% (10)	36
Reliability (Data Availability)	5.6% (2)	19.4% (7)	25.0% (9)	22.2% (8)	27.8% (10)	36
Significance (Importance)	2.8% (1)	11.1% (4)	22.2% (8)	30.6% (11)	33.3% (12)	36
answered question						36
skipped question						24

**27. Distributed IT:Reduce wasteful power usage of PC monitors and equipment being on and unused**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	10.8% (4)	8.1% (3)	27.0% (10)	51.4% (19)	37
Practicality (Measurability)	5.6% (2)	5.6% (2)	22.2% (8)	27.8% (10)	38.9% (14)	36
Reliability (Data Availability)	5.6% (2)	8.3% (3)	30.6% (11)	25.0% (9)	30.6% (11)	36
Significance (Importance)	2.7% (1)	10.8% (4)	10.8% (4)	29.7% (11)	45.9% (17)	37
answered question						37
skipped question						23

**28. Telephony and Wireless:Reduce power consumption and use more energy power efficient Telephony systems (VoIP)**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	21.6% (8)	27.0% (10)	21.6% (8)	27.0% (10)	37
Practicality (Measurability)	2.7% (1)	18.9% (7)	35.1% (13)	24.3% (9)	18.9% (7)	37
Reliability (Data Availability)	2.7% (1)	18.9% (7)	37.8% (14)	24.3% (9)	16.2% (6)	37
Significance (Importance)	2.8% (1)	16.7% (6)	25.0% (9)	30.6% (11)	25.0% (9)	36
answered question						37
skipped question						23

### 29. Telephony and wireless: reducing electronic waste coming from small wireless devices

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	18.9% (7)	24.3% (9)	18.9% (7)	35.1% (13)	37
Practicality (Measurability)	2.7% (1)	16.2% (6)	35.1% (13)	24.3% (9)	21.6% (8)	37
Reliability (Data Availability)	5.6% (2)	19.4% (7)	27.8% (10)	19.4% (7)	27.8% (10)	36
Significance (Importance)	8.3% (3)	11.1% (4)	25.0% (9)	22.2% (8)	33.3% (12)	36
answered question						37
skipped question						23

### 30. Printing: reduce environmental impact associated with printing by reducing printing and using efficient printers and recycled materials

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.7% (2)	0.0% (0)	14.3% (5)	28.6% (10)	51.4% (18)	35
Practicality (Measurability)	2.9% (1)	2.9% (1)	20.0% (7)	34.3% (12)	40.0% (14)	35
Reliability (Data Availability)	2.9% (1)	0.0% (0)	25.7% (9)	34.3% (12)	37.1% (13)	35
Significance (Importance)	5.7% (2)	0.0% (0)	8.6% (3)	40.0% (14)	45.7% (16)	35
answered question						35
skipped question						25

**31. Office Supplies: Minimize impacts associated with office supplies, furnishings and equipment**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	8.3% (3)	5.6% (2)	38.9% (14)	27.8% (10)	19.4% (7)	36
Practicality (Measurability)	5.6% (2)	11.1% (4)	36.1% (13)	27.8% (10)	19.4% (7)	36
Reliability (Data Availability)	5.6% (2)	11.1% (4)	36.1% (13)	30.6% (11)	16.7% (6)	36
Significance (Importance)	8.3% (3)	8.3% (3)	36.1% (13)	25.0% (9)	22.2% (8)	36
answered question						36
skipped question						24

**32. Service Contracts Management: work with and select contractors that share commitment to sustainability (e.g. banks, courier, catering, offsite backup, etc)**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.7% (1)	5.4% (2)	13.5% (5)	35.1% (13)	43.2% (16)	37
Practicality (Measurability)	10.8% (4)	18.9% (7)	27.0% (10)	21.6% (8)	21.6% (8)	37
Reliability (Data Availability)	5.4% (2)	18.9% (7)	37.8% (14)	10.8% (4)	27.0% (10)	37
Significance (Importance)	5.4% (2)	8.1% (3)	24.3% (9)	24.3% (9)	37.8% (14)	37
answered question						37
skipped question						23

### 33. Service Contracts Management:Actively influence contractors not hired directly

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	10.8% (4)	13.5% (5)	43.2% (16)	10.8% (4)	21.6% (8)	37
Practicality (Measurability)	16.2% (6)	24.3% (9)	37.8% (14)	10.8% (4)	10.8% (4)	37
Reliability (Data Availability)	13.5% (5)	27.0% (10)	40.5% (15)	5.4% (2)	13.5% (5)	37
Significance (Importance)	10.8% (4)	24.3% (9)	32.4% (12)	13.5% (5)	18.9% (7)	37
answered question						37
skipped question						23

### 34. Transportation:A Actively promote the reduction of climate impacts associated with transportation of people/ material

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.4% (2)	13.5% (5)	8.1% (3)	35.1% (13)	37.8% (14)	37
Practicality (Measurability)	5.4% (2)	18.9% (7)	21.6% (8)	40.5% (15)	13.5% (5)	37
Reliability (Data Availability)	8.1% (3)	16.2% (6)	24.3% (9)	32.4% (12)	18.9% (7)	37
Significance (Importance)	5.4% (2)	13.5% (5)	16.2% (6)	29.7% (11)	35.1% (13)	37
answered question						37
skipped question						23

### 35. eWaste Management: Minimize electronic waste and proper disposition of ewaste

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.8% (1)	0.0% (0)	22.2% (8)	38.9% (14)	36.1% (13)	36
Practicality (Measurability)	5.4% (2)	13.5% (5)	16.2% (6)	32.4% (12)	32.4% (12)	37
Reliability (Data Availability)	2.8% (1)	16.7% (6)	19.4% (7)	30.6% (11)	30.6% (11)	36
Significance (Importance)	2.7% (1)	2.7% (1)	21.6% (8)	32.4% (12)	40.5% (15)	37
answered question						37
skipped question						23

### 36. Comments and additional criteria to consider under Office and Equipment Management

	Response Count
	6
answered question	6
skipped question	54

### 37. Environmental Sustainability Management System: Actively promote and support industry-wide practices and standards that protect public health and the environment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	0.0% (0)	20.0% (7)	28.6% (10)	51.4% (18)	35
Practicality (Measurability)	2.9% (1)	2.9% (1)	20.6% (7)	32.4% (11)	41.2% (14)	34
Reliability (Data Availability)	3.0% (1)	6.1% (2)	27.3% (9)	30.3% (10)	33.3% (11)	33
Significance (Importance)	0.0% (0)	0.0% (0)	17.1% (6)	37.1% (13)	45.7% (16)	35
answered question						35
skipped question						25

### 38. Environmental Policies: Adopt a corporate environmental policy

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	0.0% (0)	17.1% (6)	37.1% (13)	45.7% (16)	35
Practicality (Measurability)	2.9% (1)	0.0% (0)	22.9% (8)	34.3% (12)	40.0% (14)	35
Reliability (Data Availability)	5.9% (2)	2.9% (1)	26.5% (9)	29.4% (10)	35.3% (12)	34
Significance (Importance)	0.0% (0)	0.0% (0)	17.1% (6)	42.9% (15)	40.0% (14)	35
answered question						35
skipped question						25

### 39. Environmental Reporting: Make available and use qualitative and quantitative data on the organization's progress towards sustainability

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	2.9% (1)	11.4% (4)	42.9% (15)	42.9% (15)	35
Practicality (Measurability)	0.0% (0)	17.1% (6)	17.1% (6)	28.6% (10)	37.1% (13)	35
Reliability (Data Availability)	2.9% (1)	11.4% (4)	20.0% (7)	34.3% (12)	31.4% (11)	35
Significance (Importance)	0.0% (0)	5.7% (2)	17.1% (6)	34.3% (12)	42.9% (15)	35
answered question						35
skipped question						25

#### 40. Carbon Management: Reduce carbon emissions and ability to monitor progress and impact

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	0.0% (0)	28.6% (10)	22.9% (8)	48.6% (17)	35
Practicality (Measurability)	0.0% (0)	14.3% (5)	34.3% (12)	25.7% (9)	25.7% (9)	35
Reliability (Data Availability)	2.9% (1)	8.6% (3)	34.3% (12)	28.6% (10)	25.7% (9)	35
Significance (Importance)	0.0% (0)	2.9% (1)	22.9% (8)	37.1% (13)	37.1% (13)	35
answered question						35
skipped question						25

#### 41. Comments and additional criteria to consider under Environmental Management and Reporting

	Response Count
	4
answered question	4
skipped question	56

#### 42. Enterprise IT solutions design, architecture, and methods: Adopt sustainable architecture design and methods

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.9% (1)	2.9% (1)	23.5% (8)	32.4% (11)	38.2% (13)	34
Practicality (Measurability)	2.9% (1)	14.7% (5)	20.6% (7)	29.4% (10)	32.4% (11)	34
Reliability (Data Availability)	2.9% (1)	17.6% (6)	23.5% (8)	26.5% (9)	29.4% (10)	34
Significance (Importance)	6.1% (2)	0.0% (0)	24.2% (8)	30.3% (10)	39.4% (13)	33
answered question						34
skipped question						26

#### 43. Adopt Lean IT approach to enterprise IT operations processes

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.9% (2)	5.9% (2)	20.6% (7)	29.4% (10)	38.2% (13)	34
Practicality (Measurability)	8.8% (3)	5.9% (2)	32.4% (11)	29.4% (10)	23.5% (8)	34
Reliability (Data Availability)	11.8% (4)	2.9% (1)	29.4% (10)	35.3% (12)	20.6% (7)	34
Significance (Importance)	8.8% (3)	2.9% (1)	23.5% (8)	35.3% (12)	29.4% (10)	34
answered question						34
skipped question						26

**44. Virtual meetings and virtual offices: Reduce environmental impact (carbon footprint) associated with transportation and physical offices -real estate)**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.9% (1)	5.9% (2)	14.7% (5)	23.5% (8)	52.9% (18)	34
Practicality (Measurability)	8.8% (3)	5.9% (2)	17.6% (6)	26.5% (9)	41.2% (14)	34
Reliability (Data Availability)	8.8% (3)	8.8% (3)	17.6% (6)	26.5% (9)	38.2% (13)	34
Significance (Importance)	5.9% (2)	5.9% (2)	20.6% (7)	17.6% (6)	50.0% (17)	34
answered question						34
skipped question						26

**45. Comments and additional criteria to consider under Green Enterprise IT**

	Response Count
	4
answered question	4
skipped question	56

**46. Vision: Have a clear vision for how sustainability relates to the organization's mission**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	2.9% (1)	0.0% (0)	14.7% (5)	20.6% (7)	61.8% (21)	34
Practicality (Measurability)	5.9% (2)	8.8% (3)	17.6% (6)	20.6% (7)	47.1% (16)	34
Reliability (Data Availability)	5.9% (2)	5.9% (2)	17.6% (6)	26.5% (9)	44.1% (15)	34
Significance (Importance)	2.9% (1)	5.9% (2)	14.7% (5)	23.5% (8)	52.9% (18)	34
answered question						34
skipped question						26

#### 47. Commitment: Demonstrated Commitment to sustainability issues

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	0.0% (0)	20.6% (7)	17.6% (6)	61.8% (21)	34
Practicality (Measurability)	0.0% (0)	15.2% (5)	18.2% (6)	27.3% (9)	39.4% (13)	33
Reliability (Data Availability)	0.0% (0)	18.2% (6)	24.2% (8)	21.2% (7)	36.4% (12)	33
Significance (Importance)	0.0% (0)	3.1% (1)	25.0% (8)	21.9% (7)	50.0% (16)	32
answered question						34
skipped question						26

#### 48. Transparency: The organization operates in transparent manner

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	2.9% (1)	20.6% (7)	17.6% (6)	58.8% (20)	34
Practicality (Measurability)	0.0% (0)	8.8% (3)	35.3% (12)	17.6% (6)	38.2% (13)	34
Reliability (Data Availability)	0.0% (0)	11.8% (4)	35.3% (12)	23.5% (8)	29.4% (10)	34
Significance (Importance)	0.0% (0)	8.8% (3)	20.6% (7)	29.4% (10)	41.2% (14)	34
answered question						34
skipped question						26

**49. Stakeholders Engagement: The organization actively engage the different stakeholders in its sustainability initiatives and programs**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	0.0% (0)	23.5% (8)	20.6% (7)	55.9% (19)	34
Practicality (Measurability)	0.0% (0)	11.8% (4)	38.2% (13)	14.7% (5)	35.3% (12)	34
Reliability (Data Availability)	0.0% (0)	11.8% (4)	35.3% (12)	14.7% (5)	38.2% (13)	34
Significance (Importance)	0.0% (0)	5.9% (2)	20.6% (7)	20.6% (7)	52.9% (18)	34
answered question						34
skipped question						26

**50. Regulatory compliance and sustainability reporting: Minimize risks and comply with mandates, regulations and industry standards related to sustainability**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.0% (1)	6.1% (2)	15.2% (5)	36.4% (12)	39.4% (13)	33
Practicality (Measurability)	0.0% (0)	15.2% (5)	18.2% (6)	30.3% (10)	36.4% (12)	33
Reliability (Data Availability)	0.0% (0)	18.2% (6)	12.1% (4)	33.3% (11)	36.4% (12)	33
Significance (Importance)	3.0% (1)	9.1% (3)	21.2% (7)	30.3% (10)	36.4% (12)	33
answered question						33
skipped question						27

### 51. Regulatory compliance and sustainability reporting: Responsible and ethical Code of Conduct

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	6.1% (2)	0.0% (0)	21.2% (7)	30.3% (10)	42.4% (14)	33
Practicality (Measurability)	0.0% (0)	9.1% (3)	30.3% (10)	30.3% (10)	30.3% (10)	33
Reliability (Data Availability)	0.0% (0)	9.1% (3)	36.4% (12)	33.3% (11)	21.2% (7)	33
Significance (Importance)	6.1% (2)	0.0% (0)	30.3% (10)	30.3% (10)	33.3% (11)	33
answered question						33
skipped question						27

### 52. Regulatory compliance and sustainability reporting: Regularly report on the results of sustainability efforts

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.0% (1)	3.0% (1)	21.2% (7)	36.4% (12)	36.4% (12)	33
Practicality (Measurability)	0.0% (0)	6.1% (2)	30.3% (10)	33.3% (11)	30.3% (10)	33
Reliability (Data Availability)	0.0% (0)	6.1% (2)	30.3% (10)	36.4% (12)	27.3% (9)	33
Significance (Importance)	3.1% (1)	0.0% (0)	28.1% (9)	31.3% (10)	37.5% (12)	32
answered question						33
skipped question						27

### 53. Comments and additional criteria to consider under Sustainability Governance

	Response Count
	6
answered question	6
skipped question	54

#### 54. Benefits and Wages: Provide fair living wages and benefits

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	5.9% (2)	2.9% (1)	23.5% (8)	26.5% (9)	<b>41.2% (14)</b>	34
Practicality (Measurability)	5.9% (2)	2.9% (1)	23.5% (8)	26.5% (9)	<b>41.2% (14)</b>	34
Reliability (Data Availability)	5.9% (2)	2.9% (1)	23.5% (8)	26.5% (9)	<b>41.2% (14)</b>	34
Significance (Importance)	5.9% (2)	2.9% (1)	23.5% (8)	23.5% (8)	<b>44.1% (15)</b>	34
answered question						34
skipped question						26

#### 55. Benefits and Wages: Integrate sustainability in employees performance evaluation

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	8.8% (3)	20.6% (7)	<b>47.1% (16)</b>	23.5% (8)	34
Practicality (Measurability)	0.0% (0)	14.7% (5)	29.4% (10)	<b>35.3% (12)</b>	20.6% (7)	34
Reliability (Data Availability)	2.9% (1)	11.8% (4)	<b>35.3% (12)</b>	32.4% (11)	17.6% (6)	34
Significance (Importance)	2.9% (1)	11.8% (4)	17.6% (6)	<b>47.1% (16)</b>	20.6% (7)	34
answered question						34
skipped question						26

#### 56. Diversity: Actively recruit and provide job opportunities to people from disadvantaged populations

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	8.8% (3)	8.8% (3)	35.3% (12)	32.4% (11)	14.7% (5)	34
Practicality (Measurability)	8.8% (3)	5.9% (2)	38.2% (13)	26.5% (9)	20.6% (7)	34
Reliability (Data Availability)	8.8% (3)	5.9% (2)	38.2% (13)	26.5% (9)	20.6% (7)	34
Significance (Importance)	11.8% (4)	8.8% (3)	29.4% (10)	32.4% (11)	17.6% (6)	34
answered question						34
skipped question						26

#### 57. Diversity in the composition of employees on all levels

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	6.1% (2)	12.1% (4)	27.3% (9)	33.3% (11)	21.2% (7)	33
Practicality (Measurability)	6.1% (2)	12.1% (4)	30.3% (10)	33.3% (11)	18.2% (6)	33
Reliability (Data Availability)	6.1% (2)	12.1% (4)	30.3% (10)	27.3% (9)	24.2% (8)	33
Significance (Importance)	6.1% (2)	12.1% (4)	21.2% (7)	39.4% (13)	21.2% (7)	33
answered question						33
skipped question						27

**58. Change Management and Training: Raise Employees Awareness and educate them on sustainability issues**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	2.9% (1)	14.7% (5)	29.4% (10)	52.9% (18)	34
Practicality (Measurability)	0.0% (0)	11.8% (4)	29.4% (10)	20.6% (7)	38.2% (13)	34
Reliability (Data Availability)	0.0% (0)	14.7% (5)	23.5% (8)	26.5% (9)	35.3% (12)	34
Significance (Importance)	0.0% (0)	2.9% (1)	17.6% (6)	32.4% (11)	47.1% (16)	34
answered question						34
skipped question						26

**59. Change Management and Training: Provide opportunities for professional development in sustainability practices**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	8.8% (3)	11.8% (4)	29.4% (10)	50.0% (17)	34
Practicality (Measurability)	2.9% (1)	8.8% (3)	23.5% (8)	26.5% (9)	38.2% (13)	34
Reliability (Data Availability)	0.0% (0)	14.7% (5)	23.5% (8)	26.5% (9)	35.3% (12)	34
Significance (Importance)	0.0% (0)	5.9% (2)	14.7% (5)	26.5% (9)	52.9% (18)	34
answered question						34
skipped question						26

**60. Workplace safety and employees health and well-being: Maintain safe physical working conditions**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.0% (1)	6.1% (2)	12.1% (4)	36.4% (12)	42.4% (14)	33
Practicality (Measurability)	3.0% (1)	9.1% (3)	15.2% (5)	30.3% (10)	42.4% (14)	33
Reliability (Data Availability)	3.0% (1)	9.1% (3)	15.2% (5)	33.3% (11)	39.4% (13)	33
Significance (Importance)	3.0% (1)	6.1% (2)	15.2% (5)	30.3% (10)	45.5% (15)	33
answered question						33
skipped question						27

**61. Workplace safety and employees health and well-being: promote work-life balance and healthy environment**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.0% (1)	12.1% (4)	18.2% (6)	21.2% (7)	45.5% (15)	33
Practicality (Measurability)	3.0% (1)	9.1% (3)	33.3% (11)	24.2% (8)	30.3% (10)	33
Reliability (Data Availability)	3.0% (1)	12.1% (4)	27.3% (9)	27.3% (9)	30.3% (10)	33
Significance (Importance)	3.0% (1)	6.1% (2)	21.2% (7)	21.2% (7)	48.5% (16)	33
answered question						33
skipped question						27

**62. Talent attraction and retention: Actively recruit and provide job opportunities for people from disadvantaged Diversity**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	9.1% (3)	12.1% (4)	33.3% (11)	33.3% (11)	12.1% (4)	33
Practicality (Measurability)	9.1% (3)	9.1% (3)	30.3% (10)	42.4% (14)	9.1% (3)	33
Reliability (Data Availability)	9.1% (3)	12.1% (4)	33.3% (11)	30.3% (10)	15.2% (5)	33
Significance (Importance)	9.1% (3)	12.1% (4)	24.2% (8)	36.4% (12)	18.2% (6)	33
answered question						33
skipped question						27

**63. Talent attraction and retention: Empower employees to take active role in sustainability initiatives**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	6.1% (2)	3.0% (1)	12.1% (4)	18.2% (6)	60.6% (20)	33
Practicality (Measurability)	6.1% (2)	9.1% (3)	21.2% (7)	21.2% (7)	42.4% (14)	33
Reliability (Data Availability)	6.1% (2)	15.2% (5)	21.2% (7)	15.2% (5)	42.4% (14)	33
Significance (Importance)	3.1% (1)	3.1% (1)	18.8% (6)	21.9% (7)	53.1% (17)	32
answered question						33
skipped question						27

#### 64. Talent attraction and retention: employees satisfaction

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	6.3% (2)	3.1% (1)	21.9% (7)	31.3% (10)	37.5% (12)	32
Practicality (Measurability)	6.5% (2)	9.7% (3)	25.8% (8)	35.5% (11)	22.6% (7)	31
Reliability (Data Availability)	6.5% (2)	9.7% (3)	25.8% (8)	35.5% (11)	22.6% (7)	31
Significance (Importance)	6.5% (2)	3.2% (1)	19.4% (6)	32.3% (10)	38.7% (12)	31
answered question						32
skipped question						28

#### 65. Workplace integrity and organization culture: Provide respectful and productive work environment

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	9.1% (3)	3.0% (1)	12.1% (4)	30.3% (10)	45.5% (15)	33
Practicality (Measurability)	15.2% (5)	6.1% (2)	18.2% (6)	30.3% (10)	30.3% (10)	33
Reliability (Data Availability)	15.6% (5)	6.3% (2)	21.9% (7)	31.3% (10)	25.0% (8)	32
Significance (Importance)	6.1% (2)	3.0% (1)	12.1% (4)	30.3% (10)	48.5% (16)	33
answered question						33
skipped question						27

#### 66. Workplace integrity and organization culture: Psychological and organizational working conditions

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	12.5% (4)	3.1% (1)	15.6% (5)	18.8% (6)	50.0% (16)	32
Practicality (Measurability)	18.8% (6)	9.4% (3)	18.8% (6)	21.9% (7)	31.3% (10)	32
Reliability (Data Availability)	18.8% (6)	12.5% (4)	18.8% (6)	21.9% (7)	28.1% (9)	32
Significance (Importance)	9.7% (3)	6.5% (2)	9.7% (3)	29.0% (9)	45.2% (14)	31
answered question						32
skipped question						28

#### 67. Comments and additional criteria to consider under Workforce (Employees)

	Response Count
	10
answered question	10
skipped question	50

#### 68. Consumer Data and Privacy Protection: To respect consumers privacy and ensure consumers data is properly managed and secured

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	13.8% (4)	3.4% (1)	10.3% (3)	20.7% (6)	51.7% (15)	29
Practicality (Measurability)	10.3% (3)	10.3% (3)	10.3% (3)	20.7% (6)	48.3% (14)	29
Reliability (Data Availability)	10.3% (3)	10.3% (3)	13.8% (4)	17.2% (5)	48.3% (14)	29
Significance (Importance)	10.3% (3)	3.4% (1)	3.4% (1)	31.0% (9)	51.7% (15)	29
answered question						29
skipped question						31

**69. Consumer Data and Privacy Protection: Ensure that consumers are aware of the kind of information collected about them, its use, and the**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	13.8% (4)	3.4% (1)	6.9% (2)	20.7% (6)	55.2% (16)	29
Practicality (Measurability)	13.8% (4)	10.3% (3)	6.9% (2)	17.2% (5)	51.7% (15)	29
Reliability (Data Availability)	13.8% (4)	6.9% (2)	10.3% (3)	20.7% (6)	48.3% (14)	29
Significance (Importance)	10.3% (3)	3.4% (1)	3.4% (1)	27.6% (8)	55.2% (16)	29
answered question						29
skipped question						31

**70. Consumer Data and Privacy Protection: Responsible management of privacy or data security breaching incidents**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	14.3% (4)	3.6% (1)	14.3% (4)	17.9% (5)	50.0% (14)	28
Practicality (Measurability)	10.7% (3)	14.3% (4)	7.1% (2)	21.4% (6)	46.4% (13)	28
Reliability (Data Availability)	10.7% (3)	10.7% (3)	14.3% (4)	17.9% (5)	46.4% (13)	28
Significance (Importance)	10.7% (3)	3.6% (1)	7.1% (2)	25.0% (7)	53.6% (15)	28
answered question						28
skipped question						32

**71. Consumer Health and Safety and Products Responsibility: Integration of customer health and safety concerns in products**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	3.6% (1)	10.7% (3)	21.4% (6)	57.1% (16)	28
Practicality (Measurability)	7.1% (2)	7.1% (2)	21.4% (6)	21.4% (6)	42.9% (12)	28
Reliability (Data Availability)	7.1% (2)	7.1% (2)	25.0% (7)	17.9% (5)	42.9% (12)	28
Significance (Importance)	7.1% (2)	3.6% (1)	7.1% (2)	28.6% (8)	53.6% (15)	28
answered question						28
skipped question						32

**72. Consumer outreach and marketing communication: Promote the concepts of sustainability in marketing communication channels to consumers**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	3.6% (1)	21.4% (6)	42.9% (12)	28.6% (8)	28
Practicality (Measurability)	3.6% (1)	7.1% (2)	28.6% (8)	35.7% (10)	25.0% (7)	28
Reliability (Data Availability)	3.6% (1)	10.7% (3)	28.6% (8)	35.7% (10)	21.4% (6)	28
Significance (Importance)	3.6% (1)	7.1% (2)	25.0% (7)	39.3% (11)	25.0% (7)	28
answered question						28
skipped question						32

**73. Consumer outreach and marketing communication: Educate customers about the organization sustainability efforts and identify ways on how they can engage and contribute to those efforts**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	0.0% (0)	21.4% (6)	28.6% (8)	<b>42.9% (12)</b>	28
Practicality (Measurability)	10.7% (3)	7.1% (2)	25.0% (7)	<b>32.1% (9)</b>	25.0% (7)	28
Reliability (Data Availability)	10.7% (3)	10.7% (3)	<b>32.1% (9)</b>	25.0% (7)	21.4% (6)	28
Significance (Importance)	7.1% (2)	3.6% (1)	17.9% (5)	32.1% (9)	<b>39.3% (11)</b>	28
answered question						28
skipped question						32

**74. Customer outreach and marketing communication: Responsible marketing practices**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	3.6% (1)	17.9% (5)	<b>42.9% (12)</b>	32.1% (9)	28
Practicality (Measurability)	10.7% (3)	3.6% (1)	21.4% (6)	<b>39.3% (11)</b>	25.0% (7)	28
Reliability (Data Availability)	10.7% (3)	3.6% (1)	<b>28.6% (8)</b>	<b>28.6% (8)</b>	<b>28.6% (8)</b>	28
Significance (Importance)	3.6% (1)	3.6% (1)	21.4% (6)	<b>35.7% (10)</b>	<b>35.7% (10)</b>	28
answered question						28
skipped question						32

**75. Supplier outreach and influence: Integrate sustainability performance into selection criteria of suppliers**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	3.6% (1)	7.1% (2)	42.9% (12)	46.4% (13)	28
Practicality (Measurability)	0.0% (0)	3.6% (1)	28.6% (8)	35.7% (10)	32.1% (9)	28
Reliability (Data Availability)	0.0% (0)	10.7% (3)	25.0% (7)	32.1% (9)	32.1% (9)	28
Significance (Importance)	0.0% (0)	3.6% (1)	10.7% (3)	35.7% (10)	50.0% (14)	28
answered question						28
skipped question						32

**76. Supplier outreach and influence: Raise awareness about sustainability among suppliers and encourage sustainable practices**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	3.7% (1)	11.1% (3)	40.7% (11)	44.4% (12)	27
Practicality (Measurability)	7.4% (2)	11.1% (3)	11.1% (3)	44.4% (12)	25.9% (7)	27
Reliability (Data Availability)	7.4% (2)	11.1% (3)	14.8% (4)	40.7% (11)	25.9% (7)	27
Significance (Importance)	0.0% (0)	3.7% (1)	11.1% (3)	37.0% (10)	48.1% (13)	27
answered question						27
skipped question						33

**77. Sustainable Supply Chain Management: Establish sustainable processes and procedures of acquiring goods and services needed to run IT**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	3.6% (1)	10.7% (3)	35.7% (10)	50.0% (14)	28
Practicality (Measurability)	7.1% (2)	3.6% (1)	17.9% (5)	35.7% (10)	35.7% (10)	28
Reliability (Data Availability)	3.6% (1)	3.6% (1)	25.0% (7)	32.1% (9)	35.7% (10)	28
Significance (Importance)	0.0% (0)	3.6% (1)	10.7% (3)	35.7% (10)	50.0% (14)	28
answered question						28
skipped question						32

**78. Supplier health and safety**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	14.3% (4)	17.9% (5)	35.7% (10)	28.6% (8)	28
Practicality (Measurability)	10.7% (3)	14.3% (4)	28.6% (8)	28.6% (8)	17.9% (5)	28
Reliability (Data Availability)	10.7% (3)	17.9% (5)	32.1% (9)	21.4% (6)	17.9% (5)	28
Significance (Importance)	3.6% (1)	10.7% (3)	28.6% (8)	28.6% (8)	28.6% (8)	28
answered question						28
skipped question						32

#### 79. Consumers options: Optionality and ease to move services and data between providers

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	10.7% (3)	7.1% (2)	28.6% (8)	39.3% (11)	14.3% (4)	28
Practicality (Measurability)	10.7% (3)	10.7% (3)	32.1% (9)	35.7% (10)	10.7% (3)	28
Reliability (Data Availability)	14.3% (4)	10.7% (3)	32.1% (9)	28.6% (8)	14.3% (4)	28
Significance (Importance)	11.1% (3)	7.4% (2)	37.0% (10)	29.6% (8)	14.8% (4)	27
answered question						28
skipped question						32

#### 80. Comments and additional criteria to consider under Value Chain (Consumers, Suppliers and Distributors)

	Response Count
	5
answered question	5
skipped question	55

#### 81. Development support and positive actions towards society: Jobs creation

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	3.6% (1)	35.7% (10)	39.3% (11)	17.9% (5)	28
Practicality (Measurability)	7.1% (2)	7.1% (2)	39.3% (11)	39.3% (11)	7.1% (2)	28
Reliability (Data Availability)	10.7% (3)	3.6% (1)	39.3% (11)	35.7% (10)	10.7% (3)	28
Significance (Importance)	3.6% (1)	7.1% (2)	39.3% (11)	32.1% (9)	17.9% (5)	28
answered question						28
skipped question						32

### 82. Development support and positive actions towards society: Support of local suppliers and businesses

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	7.1% (2)	21.4% (6)	35.7% (10)	32.1% (9)	28
Practicality (Measurability)	3.6% (1)	14.3% (4)	25.0% (7)	35.7% (10)	21.4% (6)	28
Reliability (Data Availability)	3.6% (1)	14.3% (4)	28.6% (8)	32.1% (9)	21.4% (6)	28
Significance (Importance)	3.7% (1)	7.4% (2)	33.3% (9)	25.0% (7)	29.6% (8)	27
answered question						28
skipped question						32

### 83. Development support and positive actions towards society: general support of developing countries

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.7% (1)	14.8% (4)	22.2% (6)	25.0% (7)	33.3% (9)	27
Practicality (Measurability)	3.6% (1)	21.4% (6)	25.0% (7)	32.1% (9)	17.9% (5)	28
Reliability (Data Availability)	3.6% (1)	25.0% (7)	25.0% (7)	28.6% (8)	17.9% (5)	28
Significance (Importance)	3.6% (1)	14.3% (4)	21.4% (6)	35.7% (10)	25.0% (7)	28
answered question						28
skipped question						32

**84. Development support and positive actions towards society: Investment in research and development, infrastructure and local community education programs**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	3.6% (1)	25.0% (7)	39.3% (11)	25.0% (7)	28
Practicality (Measurability)	7.1% (2)	17.9% (5)	17.9% (5)	39.3% (11)	17.9% (5)	28
Reliability (Data Availability)	7.1% (2)	14.3% (4)	32.1% (9)	25.0% (7)	21.4% (6)	28
Significance (Importance)	7.1% (2)	7.1% (2)	17.9% (5)	42.9% (12)	25.0% (7)	28
answered question						28
skipped question						32

**85. Support local community: Acceptance by local community**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	7.1% (2)	17.9% (5)	50.0% (14)	21.4% (6)	28
Practicality (Measurability)	7.1% (2)	14.3% (4)	25.0% (7)	39.3% (11)	14.3% (4)	28
Reliability (Data Availability)	7.1% (2)	10.7% (3)	28.6% (8)	39.3% (11)	14.3% (4)	28
Significance (Importance)	3.6% (1)	7.1% (2)	17.9% (5)	46.4% (13)	25.0% (7)	28
answered question						28
skipped question						32

**86. support local community: Investment and support of programs that benefit local community**

	1	2	3	4	5	Response Count
Relevance	3.6% (1)	3.6% (1)	25.0% (7)	<b>46.4% (13)</b>	21.4% (6)	28
Practicality (Measurability)	3.7% (1)	7.4% (2)	<b>37.0% (10)</b>	33.3% (9)	18.5% (5)	27
Reliability (Data Availability)	3.6% (1)	10.7% (3)	<b>35.7% (10)</b>	32.1% (9)	17.9% (5)	28
Significance (Importance)	3.6% (1)	3.6% (1)	21.4% (6)	<b>50.0% (14)</b>	21.4% (6)	28
answered question						28
skipped question						32

**87. Support local community:Availability and affordability of services and products for low income communities**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	7.1% (2)	25.0% (7)	<b>35.7% (10)</b>	28.6% (8)	28
Practicality (Measurability)	3.6% (1)	21.4% (6)	25.0% (7)	<b>28.6% (8)</b>	21.4% (6)	28
Reliability (Data Availability)	3.6% (1)	21.4% (6)	<b>32.1% (9)</b>	21.4% (6)	21.4% (6)	28
Significance (Importance)	3.6% (1)	7.1% (2)	28.6% (8)	28.6% (8)	<b>32.1% (9)</b>	28
answered question						28
skipped question						32

### 88. Corruption:Corruption and bribery prevention

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	10.7% (3)	3.6% (1)	21.4% (6)	17.9% (5)	46.4% (13)	28
Practicality (Measurability)	14.3% (4)	14.3% (4)	28.6% (8)	17.9% (5)	25.0% (7)	28
Reliability (Data Availability)	14.3% (4)	21.4% (6)	25.0% (7)	14.3% (4)	25.0% (7)	28
Significance (Importance)	10.7% (3)	3.6% (1)	17.9% (5)	17.9% (5)	50.0% (14)	28
answered question						28
skipped question						32

### 89. Corruption:Positive reputation and opinion about the organization by the sector, sustainability professional, and academics

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	0.0% (0)	25.0% (7)	28.6% (8)	39.3% (11)	28
Practicality (Measurability)	10.7% (3)	0.0% (0)	32.1% (9)	28.6% (8)	28.6% (8)	28
Reliability (Data Availability)	7.1% (2)	7.1% (2)	32.1% (9)	25.0% (7)	28.6% (8)	28
Significance (Importance)	7.1% (2)	0.0% (0)	21.4% (6)	28.6% (8)	42.9% (12)	28
answered question						28
skipped question						32

### 90. Comments and additional criteria to consider under Community and Society

	Response Count
	2
answered question	2
skipped question	58

### 91. Budget: Integrate sustainability in budgeting and accounting process

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	7.1% (2)	14.3% (4)	35.7% (10)	<b>42.9% (12)</b>	28
Practicality (Measurability)	3.6% (1)	14.3% (4)	25.0% (7)	17.9% (5)	<b>39.3% (11)</b>	28
Reliability (Data Availability)	7.4% (2)	11.1% (3)	18.5% (5)	22.2% (6)	<b>40.7% (11)</b>	27
Significance (Importance)	0.0% (0)	7.1% (2)	17.9% (5)	28.6% (8)	<b>46.4% (13)</b>	28
answered question						28
skipped question						32

### 92. Financial Analysis: Integrate sustainability in financial analysis

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	7.1% (2)	17.9% (5)	<b>39.3% (11)</b>	35.7% (10)	28
Practicality (Measurability)	7.1% (2)	14.3% (4)	17.9% (5)	28.6% (8)	<b>32.1% (9)</b>	28
Reliability (Data Availability)	7.1% (2)	14.3% (4)	17.9% (5)	28.6% (8)	<b>32.1% (9)</b>	28
Significance (Importance)	0.0% (0)	7.1% (2)	25.0% (7)	28.6% (8)	<b>39.3% (11)</b>	28
answered question						28
skipped question						32

### 93. Key Performance Indicators: Develop a set of financial sustainability metrics

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	7.1% (2)	10.7% (3)	35.7% (10)	46.4% (13)	28
Practicality (Measurability)	7.1% (2)	0.0% (0)	17.9% (5)	39.3% (11)	35.7% (10)	28
Reliability (Data Availability)	7.1% (2)	10.7% (3)	21.4% (6)	25.0% (7)	35.7% (10)	28
Significance (Importance)	0.0% (0)	10.7% (3)	14.3% (4)	28.6% (8)	46.4% (13)	28
answered question						28
skipped question						32

### 94. Risk Management: minimize risks of environmental accidents

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	0.0% (0)	17.9% (5)	35.7% (10)	42.9% (12)	28
Practicality (Measurability)	3.6% (1)	3.6% (1)	21.4% (6)	35.7% (10)	35.7% (10)	28
Reliability (Data Availability)	3.6% (1)	3.6% (1)	32.1% (9)	32.1% (9)	28.6% (8)	28
Significance (Importance)	3.6% (1)	3.6% (1)	14.3% (4)	32.1% (9)	46.4% (13)	28
answered question						28
skipped question						32

### 95. Comments and additional criteria to consider under Accounting, Financial and Risk Management

	Response Count
	3
answered question	3
skipped question	57

**96. Marketing Strategy: Promote sustainability and encourage customers to choose the more sustainable options**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	10.3% (3)	24.1% (7)	27.6% (8)	37.9% (11)	29
Practicality (Measurability)	0.0% (0)	13.8% (4)	24.1% (7)	41.4% (12)	20.7% (6)	29
Reliability (Data Availability)	0.0% (0)	17.2% (5)	31.0% (9)	31.0% (9)	20.7% (6)	29
Significance (Importance)	0.0% (0)	10.7% (3)	21.4% (6)	28.6% (8)	39.3% (11)	28
answered question						29
skipped question						31

**97. Product/ Service and Branding: Promote products/services with most sustainable performance**

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	0.0% (0)	7.1% (2)	21.4% (6)	32.1% (9)	39.3% (11)	28
Practicality (Measurability)	0.0% (0)	14.3% (4)	21.4% (6)	42.9% (12)	21.4% (6)	28
Reliability (Data Availability)	0.0% (0)	10.7% (3)	35.7% (10)	28.6% (8)	25.0% (7)	28
Significance (Importance)	0.0% (0)	7.1% (2)	25.0% (7)	32.1% (9)	35.7% (10)	28
answered question						28
skipped question						32

#### 98. Internal Marketing: Educate employees about the organization's sustainability efforts

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	3.6% (1)	3.6% (1)	17.9% (5)	39.3% (11)	35.7% (10)	28
Practicality (Measurability)	3.6% (1)	3.6% (1)	17.9% (5)	50.0% (14)	25.0% (7)	28
Reliability (Data Availability)	3.6% (1)	10.7% (3)	21.4% (6)	39.3% (11)	25.0% (7)	28
Significance (Importance)	3.6% (1)	3.6% (1)	17.9% (5)	39.3% (11)	35.7% (10)	28
answered question						28
skipped question						32

#### 99. Marketing materials and give-aways: Reduce environmental impact associated with the marketing material

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	10.7% (3)	17.9% (5)	39.3% (11)	25.0% (7)	28
Practicality (Measurability)	7.1% (2)	14.3% (4)	17.9% (5)	39.3% (11)	21.4% (6)	28
Reliability (Data Availability)	7.1% (2)	14.3% (4)	28.6% (8)	28.6% (8)	21.4% (6)	28
Significance (Importance)	11.1% (3)	7.4% (2)	14.8% (4)	37.0% (10)	29.6% (8)	27
answered question						28
skipped question						32

#### 100. Comments and additional criteria to consider under Marketing

	Response Count
	3
answered question	3
skipped question	57

### 101. Employees compensations: Maintain fair living wages to all employees

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	0.0% (0)	25.0% (7)	25.0% (7)	42.9% (12)	28
Practicality (Measurability)	7.1% (2)	3.6% (1)	21.4% (6)	32.1% (9)	35.7% (10)	28
Reliability (Data Availability)	7.1% (2)	3.6% (1)	25.0% (7)	28.6% (8)	35.7% (10)	28
Significance (Importance)	7.7% (2)	3.8% (1)	15.4% (4)	30.8% (8)	42.3% (11)	26
answered question						28
skipped question						32

### 102. Performance Evaluations and Incentives: Link rewards to sustainability performance

	1 (Least)	2	3 (Somewhat)	4	5 (Most)	Response Count
Relevance	7.1% (2)	3.6% (1)	28.6% (8)	35.7% (10)	25.0% (7)	28
Practicality (Measurability)	7.1% (2)	17.9% (5)	17.9% (5)	35.7% (10)	21.4% (6)	28
Reliability (Data Availability)	7.1% (2)	21.4% (6)	17.9% (5)	32.1% (9)	21.4% (6)	28
Significance (Importance)	7.1% (2)	10.7% (3)	17.9% (5)	42.9% (12)	21.4% (6)	28
answered question						28
skipped question						32

### 103. Comments and additional criteria to consider under Compensations and Financial Incentives

	Response Count
	4
answered question	4
skipped question	56

## APPENDIX J

Example of ICT Organization Sustainability Achievement Profile for Rating Model Validation.

### Example of Full ICT Organization Profile

Case#1	SOCIAL	
	Sustainability Governance	
	<b>C1. Vision</b> <b>C2. Commitment</b> <b>C3. Transparency</b> <b>C4. Stakeholder Engagement</b>	<b>C5. Compliance</b> <b>C6. Code of Conduct</b> <b>C7. Reporting</b>
x	There is a vision for sustainability within the organization and the company at large.	
x	There is a clear business case for pursuing sustainability	
x	Clear set of sustainability commitments publicly communicated	
	Formal strategic sustainability plan/ Initiative	
x	Consideration of sustainability in the planning process and method or a sustainability planning process is in place and is engaging, transparent and solicits feedback from all levels of employees	
	Sustainability is integrated as the decision criteria on projects and actions	
x	Allocated resources for sustainability efforts with clear measures of accountability	
x	Executive leadership support, sponsorship and advocacy within sector for sustainability	
x	Provide access to complete and accurate sustainability performance data to investors, regulators, and the public	
x	Produce a publicly available formal annual sustainability report	
x	Provide timely, accurate and complete information to authorities and the public when a crisis does occur (e.g. environmental, privacy breach), and provide access for the media and public about such incidents and responses	
x	Regular assessment of stakeholders' expectations and satisfaction levels with the organization sustainability performance	
x	Educate stakeholders about sustainability efforts and promote sustainability as part of organization image to those stakeholders and markets that will care	
x	Keep up to date with mandates, regulations, and standards set by the federal, state/local governments and the industry	
x	Voluntarily endorsement and participation in government, international, and sector initiatives, standards and recommendations	
x	The organization has its own policy or code of conduct or endorse an industry code of conduct for ethical and environmental responsibility with mechanisms in place to assure effective implementation of such policy	
x	Report to management and other stakeholders on sustainability performance	
x	Regular internal communication to all staff with updates on sustainability goals and achievements	
CASE#1	SOCIAL	
	Workforce (employees)	
	<b>C8. Wages &amp; Benefits</b> <b>C9. Performance Evaluation</b> <b>C10. Diversity</b> <b>C11. Job Opportunities</b> <b>C12. Employee Awareness</b> <b>C13. Professional Development</b> <b>C14. Safety</b>	<b>C15. Health</b> <b>C16. Recruitment</b> <b>C17. Employee Engagement</b> <b>C18. Employee Satisfaction</b> <b>C19. Work Environment</b> <b>C20. Organization Culture</b>
x	Fair living wages and benefits and compliance with all labor regulations and policies regarding equal remuneration on diverse groups, regular payments, minimum wages, and working hours.	

CASE#1	x	Performance evaluation conducted regularly and employee's contributions to sustainability efforts are recognized and rewarded	
		Diversity (e.g. gender) of composition on all levels of employment (including leadership and management)	
	x	Recruitment of new talents from diverse groups and make job opportunities available for disadvantaged groups - people with disabilities, minorities, at-risk youth	
		Employees Sustainability Awareness program in place and/or Sustainability is integrated in new employees orientation programs	
	x	Routinely offer trainings on sustainable practices and provide opportunities for advanced and specialized trainings to employees involved in leading and implementing sustainability efforts (e.g. sustainable procurement, e-waste management)	
	x	Compliance with operational safety and health measures and mandates, and a policy is in place for occupational health and safety	
	x	Employee safety program is part of new employee orientation	
	x	Employees are empowered and encouraged to come up with ways to improve sustainability performance and have a voice or channel to communicate with leadership	
	x	Have employees wellness program	
	x	Overall employees' satisfaction with the workplace	
	x	High retention rates	
	SOCIAL		
	Value Chain (consumers, suppliers, distributors)		
	Consumer		Supplier and Distributer
	C21. Privacy C22. Data C23. Information Sharing C24. Health, Safety and products responsibility C25. Communication C26. Outreach and Engagement C27. Marketing C28. Optionality		C29. Influence C30. Outreach C31. Supply Chain C32. Health and Safety
	x	A formal consumer privacy policy exists.	
	x	Mechanisms in place to ensure effective implementation of the privacy policy (e.g disciplinary actions)	
	x	Clear accountability and measures of privacy and data protection	
	x	Have a clear communication plan to provide timely, accurate and complete information to affected consumers, authorities, media and public when a privacy or data security breach does occur.	
	x	There is a communication method in place to inform consumers about the type of data collected and shared	
x	Information about products and services' components, origin, side effects, threats to consumer health and safety are clearly communicated (or labeled in case of products).		
x	Have consumer compliant handling and resolution system.		
x	Sustainability efforts and issues are highlighted in all marketing and communication venues to consumers.		
	Practical guidelines and actions are provided to consumers (e.g. how they can reduce their energy consumption, or how they can use the organization services or products in an efficient way).		
x	Ethical guidelines for advertisement of services and products exist: e.g. accurate information and descriptions of benefits & value		
x	Terms of services to consumers are clear and don't lock consumer with long contracts or high penalties for breaking a contract		
x	Sustainability criteria and requirements are integrated into contracts and agreements language for all contractors.		
	Use contractors/ suppliers/ service providers that share commitment to sustainability		
x	Opt out of paper statements where possible and switch to paperless billing and invoicing.		
x	A formal sustainable or environmentally preferable and socially responsible purchasing policy exists with guidelines for products and services purchased with mechanisms to assure compliance with such policy - regular audit		
	Outreach to suppliers to express the organization commitment to sustainability and intent to give preference to suppliers with sustainable practices.		
SOCIAL			
Community and Society			
Local Community		society	

CASE#1	C33. Jobs Creation C34. Local Suppliers & Businesses C35. Infrastructure and Education C36. Acceptance by Local Community C37. Programs benefiting L Community C38. Volunteerism and Philanthropy		C39. Corruption C40. Reputation C41. Global Issues
		Invest in areas that can create new job opportunities	
	x	Gives priority to local suppliers/ distributors and service providers.	
	x	Support of local schools, universities and engagement and partnership with local research institutes and universities.	
	x	Local community outreach, communication and assessment of operations and business impact on the local community	
	x	Sponsorship and support of projects and initiatives that benefit the community.	
	x	Have programs in place that encourage employees to donate to charities and to volunteer for community service.	
	x	Make services affordable to low income communities and provide discounts and free services, support or products to nonprofit and charitable organization	
	x	Policy in place for responsible code of conduct with clear procedures and disciplinary actions concerning fraud, corruption, and violations of property rights.	
		The organization has good professional ranking in the sector (e.g. awards, top ten, top 100s)	
x	Commitment to global issues and support and endorsement of international efforts to address issues like poverty, health, and natural disasters		
ECONOMIC			
Financial & Risk Management			
C42. Budget C43. Financial Analysis		C44. Key Performance Indicators C45. Risk Management	
x	Sustainability is one of the criteria assessed before money is spent or allocated to a project budget		
x	Method in place to account for sustainability benefits to the organization bottom line (savings from the green IT initiatives)		
x	Program in place to return some of the savings resulted from green/ sustainability actions to the budget as an incentive or to support additional sustainability actions.		
x	Use of total cost of ownership and full life cycle assessment that include the externalities related to lifecycle of a product or investment in IT solution		
	Assessment of risks and intangible benefits (triple bottom line) when assessing options for IT solutions.		
	Have metrics to assess the benefits and costs of pursuing sustainable options		
x	Regular reporting on the financial sustainability metrics and benchmarking with other organizations		
x	Formal policy and measures in place to address risks of environmental accidents		
	Risk assessment using a uniform risk analysis framework (risk maps, risk ranking based on probability and magnitude)		
ECONOMIC			
Marketing			
C46. Strategy C47. Branding		C48. Internal marketing C49. Material and Give Aways	
x	A marketing strategy and plan in place that includes assessment of market segments and their opinions about sustainability and marketing messages that target each segment to encourage them making sustainable choices.		
	Customer education campaign around sustainability – to build demand for sustainable products and services.		
x	Seeks credible eco-labeling and certification for products/services where possible.		
x	Sustainability is incorporated into employee communications and via different types (all staff updates, newsletters, and social media).		
x	Use of high-recycled content paper and environmentally friendly inks for print marketing materials		
x	Reduce the use of material give-aways or choose products that are sustainable or exemplify sustainability.		
	Method in place to eliminate duplicate mailings and provide options to customers to choose electronic mailing notification and marketing		
ECONOMIC			
Compensations			
C50. Employees Compensations C51. Performance Incentives			
x	Fair wages compliance (compared to market averages).		
x	Fair ratio between highest and lowest paid employees.		
	Encourage employees sustainability-related certifications and training		

x	Awards program to encourage and recognize employees and teams sustainability initiatives
<b>ENVIRONMENTAL</b>	
<b>General Facilities</b>	
<b>C52. Energy</b> <b>C53. Waste</b> <b>C54. Water</b>	<b>C55. Parking &amp; Transportation</b> <b>C56. Material Use</b>
x	Programs in place to reduce energy use with defined performance targets
	Policy/ plan in place to shift to 100% renewable energy
x	Use of energy efficient appliances, tools, lights, and equipment (Energy Star).
x	At least 50% of energy purchased or produced is renewable.
x	Systems are in place for monitoring and reducing energy use by both equipment and human behavior
x	Programs in place for waste minimization with defined performance targets.
x	Program in place for waste re-use and recycle and waste is properly disposed to authorized facilities.
	There are incentives for employees to divert resources from the waste stream.
x	At least 90% reduction in solid waste going to the landfill while directing residual products to the "next best use" whenever practical.
x	Program in place for water and conservation and efficient use with identified performance targets.
x	Free parking for carpoolers, bike parking, and shower facilities.
x	Provide incentives for alternative transportation: subsidized bus/ metro passes/ shuttle services to metro/bus stations.
x	The organization site permits commute choices including convenient alternative transportation (public transportation, train line).
x	50% or more of the cleaning/ maintenance products are green certified types (e.g. green seal, green cross, UGCA or equivalent)
x	Janitorial papers products with high recycled content are selected.
x	Nontoxic pest control and management practices and methods are used
<b>ENVIRONMENTAL</b>	
<b>Data Center and Computing</b>	
<b>C57. Facility</b> <b>C58. Systems and Asset Management</b> <b>C59. Design and Architecture</b> <b>C60. Servers</b>	<b>C61. Storage</b> <b>C62. Network</b> <b>C63. Applications Portfolio Management</b>
x	Efficient floor space design and utilization
	Sustainability criteria are taken into consideration in the DC site selection: energy sources, environmental impact, water, rural areas.
x	Consolidation of Physical Infrastructure (servers and storage) - Virtualization
x	Monitoring and control system of air quality - particulates and pollution - e.g. the Data Center Profiler from DOE.
x	Maintain Systems and assets security and disaster recovery plan in place for critical systems.
x	Policy in place to buy green certified IT assets of the data center like EPEAT, Energy Star, and the Climate Saver recommendations
x	Designs and architecture that enhances power distribution and efficiency. e.g. Energy reuse, Operating at higher temperatures, Eliminate chillers and equipment fighting, Air curtain, Hot/cold aisles
x	Maintain Power Usage Effectiveness (PUE) rates within EPA and the Green Grid data center maturity model at or above the average recommended ranges (2.0 or less)
x	Data Center Infrastructure Efficiency (DCiE) - calculated as 1/PUE, is 50% or more
	Use energy efficient servers - recommendations in the Climate Savers Initiative Catalog
x	Minimize energy consumption by servers through consolidation and virtualization
x	Minimize energy consumption by storage units through consolidation and virtualization or moving to cloud-based storage
x	Use energy efficient storage units - recommendations in the Climate Savers Initiative Catalog
x	Maintain network security, high availability, and uptime
x	Use energy efficient UPS and cooling systems and maintain high efficiency and utilization rates.
x	Utilize innovative technology and design that limit loss of power in current conversion
	Network power management systems in place
x	Include Sustainability criteria and environmental and energy considerations in negotiating Service Level Agreements with data center service and other service providers
<b>ENVIRONMENTAL</b>	
<b>IT Office and equipment Management</b>	

	<b>C64. PCs, laptops, monitors and other computer Equipment</b> <b>C65. Computer Power Management</b> <b>C66. Telephony, Mobiles and small electronics Power Management</b> <b>C67. Telephony, mobile and small electronic equipments</b> <b>C68. Printing and copying</b>	<b>C69. Office supplies</b> <b>C70. Service contracts management</b> <b>C71. Influence contractors</b> <b>C72. Transportation and shipping</b> <b>C73. e-waste management</b>
x	Have a policy in place for procurement of standard models of PCs and laptops where parts can be swapped and re-used	
x	Have a program in place to extend the lifetime of older PCs or laptops by turning them to thin clients - using desktop virtualization, cloud-based applications.	
x	Have procurement policy to buy green certified (EPEAT, Energy Star) PCs, laptops, monitors and other computing devices.	
x	Have a power management policy for power saving settings PCs and Laptops.	
x	Have policy in place to procure standard mobile phone models and to control the frequency of mobile phones replacement	
x	Have policy to purchase telephony electronics that are energy efficient or green certified (Good Guide for electronics, Greenpeace electronics guide)	
x	Have policy in place for printing less and printing efficiently: adopting paperless processes, and print efficiency (make the default settings energy efficient and paper reducing: duplex, font, gray/bw, power saving settings). Use of recycled paper	
x	Program in place for proper recycle and reuse of printing cartridges	
x	80% or more of the office supplies and equipment come from sustainable source (e.g. 100% post-consumer waste, recyclable, part of take-back program)	
x	There is a program or initiative in place for routinely checking impact of purchasing different supplies and evaluation of options to select more sustainable	
x	A program in place for evaluating contractors based on their sustainability practices and integrating sustainability criteria and requirements in the contracts language.	
	Organization sustainability requirements and commitments are shared with contractors and suppliers	
	A collaborative purchasing program with other tenants of building to consolidate shipments and delivery.	
x	Minimize impact from shipment and delivery transportation by selecting local suppliers, or consolidate purchases	
x	Program in place for e-waste minimization with defined performance targets	
x	Program in place for proper disposition of e-waste with certified e-waste recycling and management group	
	<b>ENVIRONMENTAL</b>	
	<b>Environmental Management and Reporting</b>	
	<b>C74. Environmental Management Systems</b> <b>C75. Environmental Policies</b>	<b>C76. Environmental Reporting</b> <b>C77. Carbon Management</b>
x	Have ISO-14001 conformant environmental system.	
x	Goals associated with customer and supplier impact are included in the EMS	
x	Environmental policies in place and impacts of products and services are measured and assessed on regular basis	
x	Organization is enrolled (or adopts) third party sustainability programs (e.g. The Natural Step).	
x	Internal report highlighting accomplishments and areas for improvement.	
x	Sustainability reporting is included as part of existing public reports. Publishing a detailed and audited sustainability report.	
x	CO2 emissions registry in place , voluntarily disclosure of carbon emissions	
x	Carbon management and reporting system in place with performance targets identified	
	<b>ENVIRONMENTAL</b>	
	<b>Green Enterprise Operations</b>	
	<b>C78. IT Enterprise Architecture</b> <b>C79. Lean IT</b> <b>C80. Virtual Meetings and Offices</b>	
	Flexible architecture models (easy integration, open standards).	
x	Efficiency and environmental impact is taken into consideration in The Enterprise IT Architecture integrates (e.g. the systems integrate easily with each other, standardized, optimized architecture).	
x	Consolidated purchases for inventory control and management.	
x	Lean IT Initiative/ program in place to continuously improve IT processes around efficiency and sustainability goals	
x	Paperless business processes initiative in place	
x	Virtual Meeting capability is in place and staffs are aware of it and trained to use it. b. A program in place for reducing carbon foot print associated with travel to meetings, with identified performance targets	
	Reporting system in place that provides visibility of utilization of virtual meetings, travel eliminated and impact.	
x	Tele-work policy in place and capability to work remotely from anywhere	
	<b>INNOVATION</b>	

Research & Development	
<b>C81. Investment</b>	
<b>C82. Incentives and awards</b>	
x	Budget/ Investment in sustainability Research and development.
x	Participation and support of sector wide, national and global sustainability initiatives
x	Award program for innovative sustainable designs or solutions

## APPENDIX K

Summary of the thirteen ICT organizations profiles for model validation

SOCIAL Sustainability Governance	Organization												
	1	2	3	4	5	6	7	8	9	10	11	12	13
There is a vision for sustainability within the organization and the company at large.	x	x			x					x			x
There is a clear business case for pursuing sustainability	x					x				x	x		x
Clear set of sustainability commitments publicly communicated	x	x							x	x	x	x	x
Formal strategic sustainability plan/ Initiative		x		x						x			x
Consideration of sustainability in the planning process and method or a sustainability planning process is in place and is engaging, transparent, and solicits feedback from all levels of employees	x			x		x			x	x	x	x	x
Sustainability is integrated as the decision criteria on projects and actions										x			x
Allocated resources for sustainability efforts with clear measures of accountability	x	x							x	x	x	x	x
Executive leadership support, sponsorship and advocacy within sector for sustainability	x	x	x							x	x		x
Provide access to complete and accurate sustainability performance data to investors, regulators, and the public	x	x	x	x		x	x		x	x	x	x	x
Produce a publicly available formal annual sustainability report	x									x			x
Provide timely, accurate and complete information to authorities and the public when a crisis does occur (e.g. environmental, privacy breach), and provide access for the media and public about such incidents and responses	x	x	x	x	x			x		x	x	x	x
Regular assessment of stakeholders' expectations and satisfaction levels with the organization sustainability performance	x	x	x	x	x		x			x	x	x	x
Educate stakeholders about sustainability efforts and promote sustainability as part of organization image to stakeholders and markets	x									x	x		x
Keep up to date with mandates, regulations, and standards set by the federal, state/local governments and the industry	x	x	x	x	x	x	x	x	x	x	x	x	x
Voluntarily endorsement and participation in government, international, and sector initiatives, standards and recommendations	x									x	x		x
The organization has its own policy or code of conduct or endorse an industry code of conduct for ethical and environmental responsibility with mechanisms in place to assure effective implementation of such policy	x									x	x	x	x
Report to management and other stakeholders on sustainability performance	x	x				x			x	x	x	x	x
Regular internal communication to all staff with updates on sustainability goals and achievements	x		x	x	x					x			x
<b>Workforce (employees)</b>													
Fair living wages and benefits and compliance with all labor regulations and policies regarding equal remuneration on diverse groups, regular payments, minimum wages, and working hours.	x	x	x	x	x	x	x	x	x	x	x	x	x
Performance evaluation conducted regularly and employee's contributions to sustainability efforts are recognized and rewarded	x	x			x					x			
Diversity (e.g. gender) of composition on all levels of employment (including leadership and management)						x	x	x	x	x	x	x	x
Recruitment of new talents from diverse groups and make job opportunities available for disadvantaged groups - people with disabilities, minorities, at-risk youth	x			x		x			x	x			x
Employees Sustainability Awareness program in place and/or sustainability is integrated in new employees orientation programs										x	x		x
Routinely offer trainings on sustainable practices and provide opportunities for advanced and specialized trainings to employees involved in leading and implementing sustainability efforts (e.g. sustainable procurement, e-waste management)	x						x			x			x
Compliance with operational safety and health measures and mandates, and a policy is in place for occupational health and safety	x	x	x	x	x	x	x	x	x	x	x	x	x
Employee safety program is part of new employee orientation	x	x	x	x	x	x	x	x	x	x		x	
Employees are empowered and encouraged to come up with ways to improve sustainability performance and have a voice or channel to communicate with leadership	x								x	x	x	x	x

Have employee wellness program	x	x			x	x				x		x	
Overall employees' satisfaction with the workplace	x	x	x	x	x	x	x	x		x	x	x	x
High retention rates	x	x	x	x	x	x	x	x	x	x	x	x	x
<b>Value Chain (consumers, suppliers, distributors)</b>													
A formal consumer privacy policy exists.	x	x	x	x	x	x	x	x	x	x	x	x	x
Mechanisms in place to ensure effective implementation of the privacy policy (e.g. disciplinary actions)	x	x			x	x	x		x	x			x
Clear accountability and measures of privacy and data protection	x	x	x	x	x		x	x	x	x		x	x
Have a clear communication plan to provide timely, accurate and complete information to affected consumers, authorities, media and public when a privacy or data security breach does occur.	x									x	x		x
There is a communication method in place to inform consumers about the type of data collected and shared	x	x	x	x	x	x		x	x	x	x	x	x
Information about products and services' components, origin, side effects, threats to consumer health and safety are clearly communicated (or labeled in case of products).	x	x					x			x	x		x
Have consumer complaint handling and resolution system.	x	x							x	x	x	x	x
Sustainability efforts and issues are highlighted in all marketing and communication venues to consumers.	x					x				x	x	x	
Practical guidelines and actions are provided to consumers (e.g. how they can reduce their energy consumption, or how they can use the organization services or products in an efficient way).						x				x	x		
Ethical guidelines for advertisement of services and products exist: e.g. accurate information and descriptions of benefits & value	x			x		x				x	x	x	x
Terms of services to consumers are clear and don't lock consumer with long contracts or high penalties for breaking a contract	x									x	x	x	x
Sustainability criteria and requirements are integrated into contracts and agreements language for all contractors.	x									x	x		x
Use contractors/ suppliers/ service providers that share commitment to sustainability					x					x	x	x	x
Opt out of paper statements where possible and switch to paperless billing and invoicing.	x	x	x	x	x			x		x			x
A formal sustainable or environmentally preferable and socially responsible purchasing policy exists with guidelines for products and services purchased with mechanisms to assure compliance with such policy - regular audit	x	x								x	x	x	x
Outreach to suppliers to express the organization commitment to sustainability and intent to give preference to suppliers with sustainable practices.						x	x	x		x		x	
<b>Community and Society</b>													
Invest in areas that can create new job opportunities					x	x				x	x		x
Gives priority to local suppliers/ distributors and service providers.	x	x		x		x		x		x		x	x
Support of local schools, universities and engagement and partnership with local research institutes and universities.	x			x					x	x		x	x
Local community outreach, communication, and assessment of operations and business impact on the local community	x									x	x	x	x
Sponsorship and support of projects and initiatives that benefit the community.	x	x			x	x	x	x	x	x	x	x	
Have programs in place that encourage employees to donate to charities and to volunteer for community service.	x	x	x		x	x				x	x	x	x
Make services affordable to low income communities and provide discounts and free services, support or products to nonprofit and charitable organization	x			x		x		x	x	x	x	x	x
Policy in place for responsible code of conduct with clear procedures and disciplinary actions concerning fraud, corruption, and violations of property rights.	x	x	x	x	x	x	x	x	x	x	x	x	x
The organization has good professional ranking in the sector (e.g. awards, top ten, top 100s)		x	x	x	x		x	x	x	x	x	x	x
Commitment to global issues and support and endorsement of international efforts to address issues like poverty, health, and natural disasters	x							x		x	x		x
<b>ECONOMIC</b>													
<b>Financial &amp; Risk Management</b>													
Sustainability is one of the criteria assessed before money is spent or allocated to a project budget	x	x		x	x					x	x	x	x
Method in place to account for sustainability benefits to the organization bottom line (savings from the green IT initiatives)	x	x			x	x		x		x	x	x	x
Program in place to return some of the savings resulted from green/ sustainability actions to the budget as an incentive or to support additional sustainability actions.	x					x				x	x		
Use of total cost of ownership and full life cycle assessment that include the externalities related to lifecycle of a product or investment in IT solution	x	x			x				x	x	x	x	x
Assessment of risks and intangible benefits (triple bottom line) when assessing options for IT solutions.				x						x			
Have metrics to assess the benefits and costs of pursuing sustainable options		x		x	x	x				x	x	x	x

Regular reporting on the financial sustainability metrics and benchmarking with other organizations	x					x						x	x	x
Formal policy and measures in place to address risks of environmental accidents	x	x		x		x	x				x	x	x	x
Risk assessment using a uniform risk analysis framework (risk maps, risk ranking based on probability and magnitude)		x	x		x		x				x			x
<b>Marketing</b>														
A marketing strategy and plan in place that includes assessment of market segments and their opinions about sustainability and marketing messages that target each segment to encourage them making sustainable choices.	x	x	x			x					x	x	x	x
Customer education campaign around sustainability – to build demand for sustainable products and services.				x	x					x	x	x	x	
Seeks credible eco-labeling and certification for products/services where possible.	x	x	x			x					x	x		x
Sustainability is incorporated into employee communications and via different types (all staff updates, newsletters, and social media).	x	x	x	x	x	x	x			x	x	x	x	x
Use of high-recycled content paper and environmentally friendly inks for print marketing materials	x	x	x	x	x	x			x	x	x	x	x	x
Reduce the use of material giveaways or choose products that are sustainable or exemplify sustainability.	x	x	x	x	x		x				x		x	x
Method in place to eliminate duplicate mailings and provide options to customers to choose electronic mailing notification and marketing		x			x						x	x	x	
<b>Compensations</b>														
Fair wages compliance (compared to market averages).	x	x	x	x	x	x	x	x			x	x	x	x
Fair ratio between highest and lowest paid employees.	x				x		x	x	x	x	x	x	x	x
Encourage employees sustainability-related certifications and training		x	x	x	x						x	x	x	
Awards program to encourage and recognize employees and teams sustainability initiatives	x	x				x					x		x	x
<b>ENVIRONMENTAL</b>														
<b>General Facilities</b>														
Programs in place to reduce energy use with defined performance targets	x	x		x							x	x	x	x
Policy/ plan in place to shift to 100% renewable energy												x	x	x
Use of energy efficient appliances, tools, lights, and equipment (Energy Star).	x	x	x	x	x	x			x	x	x	x	x	x
At least 50% of energy purchased or produced is renewable.	x										x	x		
Systems are in place for monitoring and reducing energy use by both equipment and human behavior	x	x	x	x	x	x	x				x	x	x	x
Programs in place for waste minimization with defined performance targets.	x	x		x		x					x	x	x	x
Program in place for waste re-use and recycle and waste is properly disposed of at authorized facilities.	x		x	x	x	x					x		x	x
There are incentives for employees to divert resources from the waste stream.				x							x	x		
At least 90% reduction in solid waste going to the landfill while directing residual products to the “next best use” whenever practical.	x	x				x					x	x	x	x
Program in place for water and conservation and efficient use with identified performance targets.	x	x		x	x	x					x	x	x	x
Free parking for carpoolers, bike parking, and shower facilities.	x						x				x	x		x
Provide incentives for alternative transportation: subsidized bus/ metro passes/ shuttle services to metro/bus stations.	x	x			x	x			x	x	x	x	x	x
The organization site permits commute choices including convenient alternative transportation (public transportation, train line).	x	x		x	x	x	x				x		x	x
50% or more of the cleaning/ maintenance products are green certified types (e.g. green seal, green cross, UGCA or equivalent)	x	x									x			x
Janitorial paper products with high recycled content are selected.	x	x	x	x	x	x	x	x			x	x	x	x
Nontoxic pest control and management practices and methods are used	x				x						x	x	x	x
<b>Data Center and Computing</b>														
Efficient floor space design and utilization	x	x			x	x			x		x	x	x	x
Sustainability criteria are taken into consideration in the DC site selection: energy sources, environmental impact, water, rural areas.						x			x	x	x	x		x
Consolidation of Physical Infrastructure (servers and storage) - Virtualization	x	x	x	x	x	x	x				x	x	x	x
Monitoring and control system of air quality - particulates and pollution - e.g. the Data Center Profiler from DOE.	x						x			x	x	x		x
Maintain Systems and assets security and disaster recovery plan in place for critical systems.	x	x	x	x	x	x	x	x	x		x	x	x	x
Policy in place to buy green certified IT assets of the data center like EPEAT, Energy Star, and the Climate Saver recommendations	x	x				x	x	x			x		x	x
Designs and architecture that enhances power distribution and efficiency. e.g. Energy reuse, Operating at higher temperatures, Eliminate chillers and equipment fighting, Air curtain, Hot/cold aisles	x	x		x	x	x	x	x			x	x	x	x
Maintain Power Usage Effectiveness (PUE) rates within EPA and the Green Grid data center maturity model at or above the average recommended ranges (2.0 or less)	x						x				x	x		x
Data Center Infrastructure Efficiency (DCiE) - calculated as 1/PUE, is 50% or more	x						x				x	x		x

Use energy efficient servers - recommendations in the Climate Savers Initiative Catalog					x			x		x	x	x	x
Minimize energy consumption by servers through consolidation and virtualization	x	x	x	x		x	x		x	x		x	x
Minimize energy consumption by storage units through consolidation and virtualization or moving to cloud-based storage	x	x	x	x		x	x		x	x	x	x	x
Use energy efficient storage units - recommendations in the Climate Savers Initiative Catalog	x				x			x		x	x	x	
Maintain network security, high availability, and uptime	x	x	x	x	x	x	x	x	x	x	x	x	x
Use energy efficient UPS and cooling systems and maintain high efficiency and utilization rates.	x	x		x		x	x	x	x	x	x	x	x
Utilize innovative technology and design that limit loss of power in current conversion	x				x								
Network power management systems in place		x					x			x			x
Include Sustainability criteria and environmental and energy considerations in negotiating Service Level Agreements with data center service and other service providers	x				x	x				x	x	x	x
<b>IT Office and equipment Management</b>													
Have a policy in place for procurement of standard models of PCs and laptops where parts can be swapped and re-used	x	x	x	x	x	x	x	x		x	x	x	x
Have a program in place to extend the lifetime of older PCs or laptops by turning them to thin clients - using desktop virtualization, cloud-based applications.	x	x				x			x	x		x	x
Have procurement policy to buy green certified (EPEAT, Energy Star) PCs, laptops, monitors and other computing devices.	x	x		x	x	x		x		x	x	x	x
Have a power management policy for power saving settings PCs and Laptops.	x	x		x	x	x				x	x		x
Have policy in place to procure standard mobile phone models and to control the frequency of mobile phones replacement	x	x	x	x	x	x				x	x		x
Have policy to purchase telephony electronics that are energy efficient or green certified (Good Guide for electronics, Greenpeace electronics guide)	x	x				x				x	x	x	x
Have policy in place for printing less and printing efficiently: adopting paperless processes, and print efficiency (make the default settings energy efficient and paper reducing: duplex, font, gray/bw, power saving settings). Use of recycled paper	x	x	x	x	x	x	x	x	x	x	x	x	x
Program in place for proper recycle and reuse of printing cartridges	x	x		x		x	x	x	x	x		x	x
80% or more of the office supplies and equipment come from sustainable source (e.g. 100% post-consumer waste, recyclable, part of take-back program)	x				x	x	x		x	x	x	x	x
There is a program or initiative in place for routinely checking impact of purchasing different supplies and evaluation of options to select more sustainable	x	x								x	x		x
A program in place for evaluating contractors based on their sustainability practices and integrating sustainability criteria and requirements in the contracts language.	x				x	x			x	x	x		x
Organization sustainability requirements and commitments are shared with contractors and suppliers									x	x			
A collaborative purchasing program with other tenants of building to consolidate shipments and delivery.				x				x		x		x	x
Minimize impact from shipment and delivery transportation by selecting local suppliers, or consolidate purchases	x	x		x		x				x	x	x	x
Program in place for e-waste minimization with defined performance targets	x	x				x			x	x	x	x	x
Program in place for proper disposition of e-waste with certified e-waste recycling and management group	x	x			x	x			x	x	x	x	x
<b>Environmental Management and Reporting</b>													
Have ISO-14001 conformant environmental system.	x	x			x	x			x	x	x	x	x
Goals associated with customer and supplier impact are included in the EMS	x	x				x				x		x	x
Environmental policies in place and impacts of products and services are measured and assessed on regular basis	x	x		x	x	x			x	x	x		x
Organization is enrolled (or adopts) third party sustainability programs (e.g. The Natural Step).	x									x	x	x	x
Internal report highlighting accomplishments and areas for improvement.	x	x	x	x	x	x				x			x
Sustainability reporting is included as part of existing public reports. Publishing a detailed and audited sustainability report.	x	x			x		X			x	x	x	
CO2 emissions registry in place, voluntarily disclosure of carbon emissions	x			x					x		x	x	x
Carbon management and reporting system in place with performance targets identified	x	x		x	x	x		X		x	x	x	x
<b>Green Enterprise Operations</b>													
Flexible architecture models (easy integration, open standards).		x		x	x						x		x
Efficiency and environmental impact is taken into consideration in The Enterprise IT Architecture integrates (e.g. the systems integrate easily with each other, standardized, optimized architecture).	x		x	x		x		x	x	x			x

Consolidated purchases for inventory control and management.	x	x	x	x		x	x	x	x	x	x	x	x	x
Lean IT Initiative/ program in place to continuously improve IT processes around efficiency and sustainability goals	x				x	x				x		x	x	
Paperless business processes initiative in place	x	x	x	x	x	x	x	x	x	x	x			x
Virtual Meeting capability is in place and staffs are aware of it and trained to use it. A program in place for reducing carbon foot print associated with travel to meetings, with identified performance targets Reporting system in place that provides visibility of utilization of virtual meetings, travel eliminated and impact.	x	x	x	x		x	x	x	x	x	x	x	x	
Tele-work policy in place and capability to work remotely from anywhere	x			x	x		x	x	x	x	x			x
<b>INNOVATION</b>														
<b>Research &amp; Development</b>														
Budget/ Investment in sustainability Research and development.	x				X									x
Participation and support of sector wide, national and global sustainability initiatives	x	x				X				X	x	X		
Award program for innovative sustainable designs or solutions	x	x		x							x			x

## APPENDIX L

### Experts Focus Group

Name	Area of Expertise	Bio
<b>1. Cate Berard</b> Program Manager for Federal Electronics Challenge Office of Pollution Prevention and Toxics U.S. Environmental Protection Agency Washington, DC	<i>Federal electronics stewardship, sustainable acquisition, power management, electronics reuse and recycling</i>	Cate Berard is an Environmental Protection Specialist in the Pollution Prevention Division at the U.S. Environmental Protection Agency (EPA). Cate is the Program Manager for the Federal Electronics Challenge (FEC), a partnership program that encourages federal agencies and their facilities to purchase greener electronics, reduce impacts of electronic products during use, and manage obsolete electronics in an environmentally sound manner. As a member of EPA's Environmentally Preferable Purchasing team, Cate also supports work related to green purchasing. Cate holds a B.S. from James Madison University and an M.S. from Johns Hopkins University.
<b>2. Daniel Bén��at</b> Director of Research and Investments Daiwa Asset Management (America) Ltd New York, NY	<i>Global economics and strategy, global equities and global industry and sector analysis, new product development and risk management, sustainability area covering aspects such as: governance, ethics, workplace issues, environmental performance and community outreach programs</i>	Financial Services Executive with superior investment results and strong marketing skills creating and selling investment products to onshore/offshore institutional clients and ultra high net worth individuals • Ability to write and clearly communicate strategy and economic pieces, and articulate investments ideas and diversification possibilities with: clients, prospects, consultants and the press • Accumulated extensive global macroeconomic analysis experience and researched companies across all industries and sectors globally • Superior track record managing: U.S. balanced and equity portfolios, emerging markets assets, and a global long/short equity product • Strong knowledge of operational aspects of wealth management business

		and extensive experience utilizing information services platforms • Have outstanding qualitative and quantitative skills • Language ability in French and Spanish and scaling up ability in Portuguese.
<b>3. Tony Habash</b> Chief Information Officer American Psychological Association Washington, DC	<i>technology strategy, program management, strategic planning, contract negotiations, requirements analysis, solution selection, project management, outsourcing strategies, ERP, IT governance, collaborative technologies, non-profit, enterprise architecture, publications, marketing, and scholarly publishing</i>	<p>Tony F. Habash, DSc, is chief information officer of the American Psychological Association. He is responsible for APA's information technology strategy and operations, including all core business systems development.</p> <p>Before coming to APA in 2007, Habash spent 15 years with AARP as its director of information technology strategy and planning. He was responsible for directing technology projects across the organization.</p> <p>Habash has been recognized in the information technology industry through several citations. These include a 2008 CIO 100 Award, presented by <i>CIO Magazine</i> for his work on <u>PsycNET</u>, the platform that allows users to search all of APA's publications databases. Habash received his doctorate in science in information management and information systems from George Washington University, where he is also an adjunct graduate instructor at the School of Engineering and Applied Science.</p>
<b>4. Kevin McDonald</b> Sr. Infrastructure and Cloud Strategist, ICF International, Inc. Instructor - Cloud Computing and Virtual Data centers, Georgetown University Vice President of Technology, <u>PMIWDC</u> Washington, DC	<i>Data Center Modernization, Security &amp; Facility Management, Certified Information Systems Security Professional (CISSP), Certified Information Systems Auditor (CISA), Certified Project Management Professional (PMP), Certified Business Continuity Professional (CBCP), Certified in Risk and Information Systems Control (CRISC)</i>	<p>Kevin T. McDonald is senior infrastructure and cloud strategist for ICF International based in Washington, D.C. and author of <i>Above the Clouds: Managing Risk in the World of Cloud Computing</i>. He works with a wide variety of public and private sector entities. Mr. McDonald was elected as Vice President of Technology to the Project Management Institute Washington D.C. Chapter and also serves as the International representative to PMI UK and Italy chapters. He is a member of the Tech America Cloud Computing Committee, the IAC-ACT Cloud Computing in Government committee and the Cloud Security Alliance. He has published on a wide array of issues ranging from project risk to enterprise</p>

		modernization. McDonald also teaches Cloud Computing and Virtual Data Centers for the University of Georgetown Technology Management Master's program.
<b>5. George Goodman</b> Executive Director Climate Savers Computing Initiative Portland, Oregon	<i>Information and Communication Technology energy consumption and management. Microprocessor and system power delivery, conversion, and management.</i>	George O. Goodman has served as the Executive Director of Climate Savers Computing Initiative since November of 2010, stepping into the computing industry non-profit world after a 30 year career in technology product R&D leadership.
<b>6. Fiona Wright</b> Principal, SystemsLens Ottawa, Canada	<i>Socio-Ecological Sustainability Analysis, Environmental Science</i>	Fiona Wright is a systems analyst in the field of socio-ecological sustainability education and research. She has 10 years of experience working with diverse actors internationally including universities, industry and grassroots organizations. She has advanced training in the theory and application of a science-based framework for strategic sustainable development planning, which has been the basis for her work in conflict resolution theory, social sustainability fundamentals, urban planning, supply-chain collaboration, citizen engagement and IT initiatives for climate change action. She supports people in combining visionary thinking with vigorous analysis. She is also a writer and is currently engaged in working with the journey of individual change within greater societal shifts.
<b>7. Telma Gomes</b> IT Business Planning Manager & Sustainability Strategist Campinas, Brazil Karlskrona, Sweden	<i>Strategic planning, leadership development, sustainability, IT Business planning</i>	Telma graduated in Translation and Interpretation with an MBA in Social Entrepreneurship Management. After twenty years working for large transnational companies, such as Caterpillar, Bayer and HP, being deeply involved with CSR projects, she participated in her city's election process and in 2009, she was invited by the elected mayor to be the Secretary of Institutional Relations at Jaguariúna, a 40,000 Inhabitant city. With this public administration experience, she developed a strong belief that municipalities are key

		<p>players to reach world sustainability. Her willingness to be a change agent within this process brought her to MSLS program. Her aspiration is to be part of a worldwide change process to involve people, companies, organizations and governments to move society towards a sustainable world.</p>
<p><b>8. Stanley Nyoni</b> Senior Sustainability Advisor S2 International Geneva, Switzerland</p>	<p><i>Sustainability Planning, Trainer/Facilitator, Management Systems, Regional development. dialogue methods, U-Theory Art of Hosting, Moral Leadership</i></p>	<p>Stanley is a Senior Sustainability Advisor and President of S2 Sustainability Strategies. S2 is the Switzerland focal point of the Natural Step Global Network. Stanley's focus is on vision and strategy development within local governments and corporations and the development of learning courses for sustainability leaders.</p> <p>Stanley is currently coordinating a series of Global Conversations on the future we want and on a unifying Framework for sustainable development. These will provide input into the Rio+20 Conference.</p> <p>In the past, Stanley worked with infrastructure development, quality and environmental management systems, development programs for various communities through Local Agenda 21, and civil society programs.</p> <p>Stanley uses the TNS Framework because the approach provides a clear definition of sustainability and a systematic approach to sustainable development. By working with communities in India and Africa, and lately in Europe, Stanley has gained insight into what sustainable development means at the local level. He believes that more attention should be given to the development of whole communities using the sub-regions (such as bio-regions) as a starting point and creating strategic approaches for organizations and enterprises to serve this common purpose.</p> <p>"I believe that our consciousness needs to increase so that our individual aspirations merge with</p>

		<p>those of the society around us,” Stanley explains. “Then we can provide the leadership needed for our communities and organizations to invest in actions that improve the wellbeing of people and planet.”</p> <p>Stanley is a Zimbabwean currently living in Switzerland with his wife and their two sons. He holds a masters degree in environmental engineering and sustainable infrastructure from the Royal Institute of Technology Sweden, a bachelor of technology in civil engineering from the University of Zimbabwe and a certificate in cross-sector partnering from Cambridge University, UK.</p>
<p><b>9. Kara Davis</b> Sustainability Designer Loop Strategies Washington, DC</p>	<p><i>Sustainability strategy, web design and development</i></p>	<p>Kara Davis runs a sustainability design business in Washington, DC, consulting with neighborhood groups and small businesses on sustainability strategy, and building web sites for socially and environmentally progressive clients. She spent her early career as a web designer and information architect before going into the sustainability field. Kara earned her B.A. at William and Mary in International Relations and Studio Art, and an M.Sc. in Strategic Leadership Towards Sustainability from BTH in Karlskrona, Sweden.</p>
<p><b>10. Neeran Saraf</b> Senior IT Advisor and Monitoring and Evaluation (M&amp;E) Consultant Counterpart International Washington, DC</p>	<p><i>IT Strategic planning and leadership, IT Infrastructure and Software development, Knowledge Management, Monitoring and Evaluation systems, and Microfinance Management systems</i></p>	<p>Seasoned senior IT consultant with over twenty five years of demonstrated experience in planning and implementing IT strategies and enterprise wide IT solutions on a local and international scale.</p> <p>Extensive experience working in the public, private and non-profit international development and NGO sectors in the United States and internationally.</p> <p>Researched, designed and managed enterprise wide IT projects in various sectors including Education, Finance, Micro Finance and Banking, Telecommunications, and Professional and Workforce Development.</p> <p>Visionary and creative thinker with</p>

		<p>strengths in using existing and emerging technologies when planning IT strategies and designing IT solutions. Strength in defining the enterprise business requirements, strategic IT planning, monitoring and evaluation, and the application of appropriate technologies to deliver IT products and solutions aligned with immediate and future growing business needs.</p> <p>Solid experience in defining the enterprise business requirements, strategic IT planning and governance, designing business applications such as registration systems, assessment, impact and monitoring and evaluation systems, knowledge management and collaboration and use of technology for development (ICT for development).</p> <p>Hands-on experience working with the executive team and senior management to deliver working IT applications aligned with the business needs of the enterprise. Worked in various environments mentoring and leading teams locally and overseas, bridging the business culture and language gap.</p> <p>Language: Fluent in English, Arabic, and French</p> <p>Holder of US Patent number 7299299 for Shared registration system for registering domain names</p>
<b>11. Elvie Soeprapto</b> Architect, LEED AP Washington, DC	<i>Environmental design and architecture,  LEED, Green Architecture</i>	

## APPENDIX M

Summary of the expert ratings of sustainability assessment categories of the organizations profiles

Expert#	Sustainability Governance	Workforce	Value Chain	Local Community and Society	Financial and Risk Management	Marketing	Compensation & Financial Incentives	General Facilities	Data Center and Computing	IT Office Equipment Management	Env. Management & Reporting	Green Enterprise IT	Research and Development
<b>Profile 1</b>													
1	4	2	2	3	3	3	2	4	3	3	5	4	5
2	4	2	1	4	2	3	4	4	4	3	5	4	5
3	4	3	4.5	5	3	3	4.5	4.5	4.5	4.5	5	4	5
4	4	4	3.7	4	3.4	3.5	3.5	4	4.2	4.4	5	4	5
5	4.4	4.3	3.6	4.3	3.5	3.6	3.2	4.4	4.6	4.5	5	4.5	5
6	4	4	4	4	3.5	4	4.75	4.75	4	4.75	5	4.75	5
7	5	5	5	5	5	5	5	5	5	5	5	5	5
8	4	4	4	3	4	4	4	3	4	4	4	4	4
9	5	5	5	5	5	4	4	5	5	5	5	5	5
10	4.5	4	4	4	3	5	4	5	4	5	5	5	5
11	4	4	4	1	3	3	2	4	1	2	5	5	5
<b>Profile 2</b>													
1	1	1	1	1	1	4	3	1	2	2	3	2	2
2	2	1	1	1	1	3	3	3	2	3	3	3	3
3	2.5	1.5	2.5	3	3.5	4.5	4	3	3	4	4	3.5	2
4	3	3	2.5	2.8	3.5	4.4	4	3	3	3.5	3.9	3	3
5	2.5	2.6	2.2	2.2	3.3	4.3	3.2	3.1	2.3	3.5	3.5	2	4.4
6	2.5	2	2	2.5	3.5	4.75	2	3	3	4	4.5	3	3
7	4	3	3	4	5	4	3	4	4	5	4	4	3
8	2	1	3	3	3	3	2	3	3	2	2	3	3
9	4	4	3	4	4	4	5	4	3	4	4	4	4
10	3.5	3.5	2.5	3.5	3.5	4.5	3.9	2.5	3	4	4	3.5	3.5
11	3	3	2	3	4	4	4	3	2	3	4	4	4
<b>Profile 3</b>													
1	2	2	1	2	1	3	2	1	1	1	1	1	1
2	1	1	1	1	1	2	1	1	1	1	1	2	1
3	1	1	1	1	1	3.5	2.5	2	1.5	1	1	2.5	1
4	2	2	1.5	1.5	1	3.8	3	1.5	1.5	1	1	3	1
5	1.5	1.7	0.9	0.9	0.4	3.6	2.5	1.2	0.8	0.8	0.4	2.5	0
6	1.5	1.5	1.5	1.5	1	4	1.5	2	1.5	2	1	3	1
7	3	2	2	2	1	3	2	2	2	1	1	2	1
8	2	2	2	1	3	2	2	1	1	1	3	1	1
9	2	2	2	2	1	3	2	2	2	2	1	3	1
10	2	1	1	1.5	1	4	3	1.5	1.5	1.5	1	3.5	1
11	2	2	2	1	1	3	3	2	2	1	1	4	1
<b>Profile 4</b>													
1	3	2	2	3	2	2	3	3	2	2	3	3	2
2	1	1	1	2	1	3	2	3	2	2	2	4	1
3	3	1.5	1	3	2	3	4	3.5	2	3	3.5	4	2
4	2	2.5	2	2.5	2.5	3	4	3	2	2.5	2.5	4.4	2
5	1.8	2	1.1	2.5	2.1	3.2	4.3	2.9	1.5	2.2	2.5	3.9	1.7

6	2.5	1.75	1.75	2	2	2.5	4.75	3.5	2	2.75	2.5	4.5	2.5
7	2	3	2	2	2	2	3	3	3	3	2	4	2
8	3	3	2	3	3	3	4	3	3	2	2	4	2
9	3	2	2	3	3	3	3	3	2	3	3	4	4
10	2	1.5	1.5	3	3	2.5	3	2.5	2	2	3	4	2.5
11	1	3	1	3	2	1	3	3	3	2	1	3	1
Profile 5													
1	2	2	3	3	3	2	2	2	3	3	3	3	2
2	1	1	1	2	2	2	2	3	2	2	2	2	1
3	1	2	1	2	2	4.5	3	3	3	3.5	4	3	3
4	1.5	3	2.4	2.5	3	3.8	2.5	2.5	3	2.5	3	3	2
5	1.2	2.6	1.5	1.9	2.9	3.9	2.5	2.1	2.9	2.5	3.1	3	0.6
6	1.5	2	2	2	3	3	1.5	2.5	2.5	3	3.5	3.5	3
7	2	2	2	2	3	3	2	2	3	3	3	2	2
8	2	2	2	2	2	4	2	3	3	2	3	3	2
9	2	4	4	3	3	3	2	3	4	4	4	3	3
10	1.5	2.5	1.5	2.5	3	3	3	2	2.5	3	3.5	3.5	3
11	2	2	2	2	3	2	2	2	2	2	2	1	3
Profile 6													
1	2	3	2	2	3	2	3	2	3	2	2	3	2
2	1	3	1	2	3	3	4	4	4	4	3	3	3
3	1.5	3	3	3.5	2	2	4	3.5	3	4	4	4	2
4	1.5	3.5	2.4	3	3	3	4	3.4	4	4.7	3	3.5	2
5	1.3	2.7	2	3.1	2.3	2.7	3.2	3.3	3.9	4	2.9	3.6	2.8
6	1.5	2.5	2.5	2.5	2.5	2	4.75	3	4.5	4.5	3	4	2
7	3	3	3	3	4	4	4	3	4	4	3	4	2
8	2	3	2	3	2	2	3	3	4	3	3	3	2
9	4	3	3	3	4	5	4	5	5	5	5	5	4
10	1	2.5	2	2.5	3	3	3.5	2.5	3.5	4.5	3	4	2
11	1	2	2	3	1	1	2	2	2	2	3	4	1
Profile 7													
1	1	2	2	1	1	1	1	1	2	1	1	2	0
2	1	2	1	1	1	1	1	2	2	2	1	3	1
3	1	2	2	1	1	1	3	1	2	1	1	3.5	1
4	1	3	1.8	1.5	1.5	1.8	2.5	1.5	2.5	1.5	1	3	1
5	0.6	2.7	1.5	1.2	0.8	1.8	2.5	1.4	2	1.3	0.6	2.5	0
6	1.25	2	2	1.5	1.25	1.5	3	2	2.5	2	1.5	3.5	1
7	1	2	1	1	1	1	2	2	3	2	1	3	1
8	2	3	2	3	2	2	3	2	3	2	2	3	1
9	3	4	2	3	2	3	2	2	3	3	2	4	1
10	1.2	3	1.5	1.5	1	1.5	2	1.5	2	1	1	3.5	1
11	1	1	2	1	1	1	2	1	1	1	1	2	1
Profile 8													
1	1	1	2	2	1	1	1	1	2	1	1	2	1
2	1	3	1	3	1	1	1	1	2	2	1	3	1
3	1	1	1	3	1	1	3	1	1.5	1.5	1	4.5	1
4	1	2.5	2	3	1	1	2.5	1	2.5	2	1	3.8	1
5	0.4	2	1.3	3.2	0.4	0.7	2.5	0.7	2.3	1.3	0.6	3.4	0
6	1	1.5	1.5	2.5	1	1	3	2	2.5	2	1.5	4	1
7	1	2	2	2	1	1	2	2	3	2	1	4	1
8	2	3	3	3	1	1	3	2	3	2	2	4	1
9	2	2	3	5	3	1	2	2	2	3	2	4	1
10	1	1.5	1	3.5	1.5	1	2	1	2	1	1.5	3.5	1
11	1	1	1	1	1	1	2	2	1	1	1	3	1
Profile 9													
1	2	2	1	1	1	1	2	2	2	2	2	2	1
2	1	1	1	2	1	3	2	3	3	3	2	4	1
3	2	2	1	2	1	1	2	3	3.5	2.5	3.5	4	1
4	2	3	1.5	2.7	1	2	2.5	3	3.8	2.5	2.5	3.7	1
5	1.6	2.6	1	2.4	1	2.3	3.6	2.7	2.8	2.5	2.7	3.4	0
6	2.5	2	1.5	2	1	1.75	2.5	3.5	2.5	2.5	2.5	4	1
7	3	3	2	2	1	2	2	3	4	3	2	4	1
8	2	3	3	3	2	3	2	3	3	3	3	3	1
9	3	3	2	3	2	3	3	3	3	4	4	5	1
10	2.5	2.5	1	3	1	2	1.5	3	2.5	2	3	3.5	1
11	1	1	2	1	1	1	1	3	1	1	2	5	1
Profile 10													
1	5	5	5	5	4	5	5	5	4	5	4	4	1
2	5	5	5	5	4	5	5	5	4	5	5	4	2

3	5	5	5	5	5	5	5	5	4.5	5	4.5	4.5	2
4	5	5	5	5	4.5	5	5	5	4.8	5	4.5	4.5	2
5	5	5	5	5	4.4	5	5	5	4.5	5	4	4.5	2.8
6	5	5	5	5	4.75	5	5	5	4.75	5	4.75	4.75	2
7	5	5	5	5	5	5	5	5	5	5	5	5	3
8	5	5	5	5	4	5	5	5	5	5	5	5	5
9	5	5	5	5	5	5	5	5	5	5	5	5	3
10	5	5	5	5	4	5	5	5	4.8	5	4.5	4	2.5
11	5	5	5	5	4	5	5	5	4	5	4	5	1
<b>Profile 11</b>													
1	2	3	2	3	2	3	3	2	1	2	2	1	2
2	4	3	4	4	4	4	4	3	3	3	4	4	4
3	3.5	3	3.5	3.5	3.5	4	4	4	3.5	3.5	4	4	3
4	3.8	3	3.9	4	4	4.4	3.9	3.9	3.5	3.9	3.9	3.9	3.5
5	3.6	2.9	3.8	3.8	4	4.1	4.3	3.8	3.2	3.9	3.8	3	4.4
6	3.5	3	3.75	4	4.5	4.75	4.75	4.5	2.5	4	3.75	4	3
7	4	3	4	4	4	5	5	4	4	4	4	4	4
8	3	4	4	4	4	4	4	3	3	4	3	3	3
9	4	3	4	4	4	4	5	4	4	3	4	4	3
10	4	3	3	4	4	4	3.5	4	3	4	4	3.5	3
11	2	1	1	2	3	4	3	3	1	2	2	2	2
<b>Profile 12</b>													
1	2	1	2	2	2	3	2	2	2	2	2	2	1
2	2	3	3	4	3	4	4	3	4	3	3	2	1
3	3	2.5	3	4	4	4.5	4	4	4	4	4	3	2
4	2.5	3.5	3.4	4	3.5	4.4	3.9	3.9	3.9	3.5	3	2.5	2
5	2.4	3.1	2.9	4	3.5	4.3	3.2	3.9	3.6	3.2	3.5	2.3	3.3
6	2.5	3	3.5	4.5	4	4.5	4.75	4.5	3.5	3.5	3.5	2.5	2
7	3	3	3	4	4	4	4	4	4	4	4	3	2
8	3	3	3	4	3	4	4	3	3	3	4	3	2
9	3	3	3	4	4	5	4	4	3	3	3	3	3
10	3.5	3.5	3.5	4	3.5	3.5	3.5	4	4	3.5	3.5	3	2.5
11	1	1	1	1	3	2	2	3	2	1	2	2	2
<b>Profile 13</b>													
1	5	2	2	3	2	2	5	3	3	4	3	5	1
2	5	4	4	4	4	3	5	4	4	4	4	5	3
3	5	4	4	4.5	4	3.5	5	4	4.5	5	4.5	5	3.5
4	5	4	4.7	4.5	4	3.5	5	4.5	4.5	4.7	4.5	5	3.5
5	5	4	3.9	4.4	4	3.6	5	4.6	4.3	4.7	4.4	5	2.2
6	5	4	4	4.75	4.25	4	5	4.75	4.75	4.75	4	5	4
7	5	4	4	4	4	4	5	5	5	5	5	5	4
8	5	4	4	4	4	4	5	4	5	4	5	5	4
9	5	4	4	4	4	4	5	4	5	4	4	5	4
10	5	4	4	4	3.9	3	5	4.5	4.5	5	5	5	3.5
11	5	1	3	4	3	1	5	3	3	2	4	5	3

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## **CURRICULUM VITAE**

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