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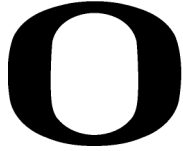
UNIVERSITY OF OREGON

APPLIED INFORMATION MANAGEMENT

How to Modify Technology and Business Practices within the Mid-Sized Service Organization as a Way to Mitigate the Carbon Footprint

CAPSTONE REPORT

Ryan Hogan
Sedgwick Claims Management
Services, Inc.

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CARBONFOOTPRINT MITIGATION

Approved by

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Dr. Linda F. Ettinger
Senior Academic Director, AIM Program

How to Modify Technology and Business Practices within the Mid-Sized Service Organization

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Abstract

The purpose of this study is to identify a set of selected modifications that can be made in relation to both technology and business in mid-sized service organization, as a way to mitigate the size of an organization's carbon footprint. Literature published from 2000 to 2011 is examined to identify carbon footprint reduction activities and related practices that are deemed socially responsible, that when implemented can strengthen the triple bottom line sustainability business model.

Keywords: triple bottom line, virtualization, green IT, green computing, green technology, corporate social responsibility, carbon footprint, carbon emissions

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Introduction to the Literature Review

Problem Area

Carbon footprint. In the book "Greening IT", Sobotta (2009) states "…scientists today believe that climate change is caused by human-induced emission of greenhouse gases to the atmosphere" (p. 16). The most common greenhouse gas is carbon dioxide emissions (CO2) (p. 16). All sectors of society contribute to the climate change (and global warming) because all sectors require energy to perform its function (p.16). "Climate change and global warming are the effects of unsustainable consumption patterns in an industrialized world" (Sobotta, 2009, p. 16).

CO2 emissions in the United States have increased by almost 1% each year since 1980 (Brown, Sarzynski, & Southworth, 2008). In addition, the emissions produced from commercial and general transportation have also increased in the past 25 years by more than 25% (Brown, Sarzynski, & Southworth, 2008). According to Brown, Sarzynski, and Southworth (2008), carbon emissions in the United States are "…projected to grow by 16 percent between 2006 and 2030" (p. 7). "…Carbon dioxide (CO2) is a contributing factor in global warming, and humans are responsible for a large portion of these emissions" (Summ & Newell, 2010, p. 44). CO2 "…accounted for 84 percent of U.S. greenhouse gas (GHG) emissions in 2005, and is one of the most important contributors to climate change" (Brown, Sarzynski, & Southworth, 2008, p. 5). Of the 84%, residential and commercial buildings cause 39%. Transportation alone is responsible for over one-third of United States carbon dioxide emissions (Brown, Sarzynski, & Southworth, 2008).

Data center emissions. Muirhead (2006) notes that even the largest of the global financial services organizations have carbon footprints that produce around 500,000 metric tons

of CO2 per year. Of the 500,000 metric tons, 65% is generated from the institution's IT electricity consumption. In the United States alone, data center energy use has nearly doubled from 2000 to 2006 (Horvath, Masanet, Nazaroff, Price, & Shehabi, 2010). This increase in energy use is a direct effect of increased reliance on data storage, data transfer, and processing of digital information. Enterprise Rent-A-Car Co. found that only 40% of the energy consumed within the data center is being used by IT equipment, as opposed to air handlers, cooling systems and uninterruptible power supplies (Thibodeau, 2008). By turning off unused equipment and better managing its cooling processes, the company increased that percentage to 44% (Thibodeau, 2008). Over half of the data center electrical demands are caused by non-IT components, such as heating ventilation and air-conditioning equipment, uninterruptable power supplies, and even building lighting (Horvath, Masanet, Nazaroff, Price, & Shehabi, 2010).

Recycling. According to the government advice group Envirowise, paper is the largest source of waste in most offices, with the average employee using upwards of 50 sheets of paper every single day (Young, 2006). Paper products are not the only recyclable item. Products such as computers, monitors, printers and mobile phones are also not being recycled. Kaestner (2009) states that over "…80% of electronic equipment ends up in landfills as toxic waste, taking up space and leaking mercury and lead into the soil and water supply" (p. 19). Some 20-50 million tons of "e-waste" is produced each year, most of which ends up in the developing world (Business, 2006). These figures are only poised to grow unless businesses implement more efficient technologies and robust recycling policies (Kaestner, 2009). Based on the figures above, the assumption underlying this study is that more energy efficient technology and organizational recycling initiatives can help to reduce the carbon dioxide release and wasted products in corporate America.

Purpose

The purpose of this study is to identify a set of selected modifications that can be made in relation to both technology and business in mid-sized service organization, as a way to mitigate the size of an organization's carbon footprint, and adopt related practices that are deemed socially responsible (Taylor, 2006). For the purpose of this study, modifications of a non-technical nature are described as *green business*. Potential green business practice modifications include such things as reducing travel, reducing hardcopy handouts or using recycled paper for handouts, and installing energy-saving light bulbs (Iwata, 2007). Also for the purpose of this study, modifications of a technical nature are described as green computing. Potential green computing modifications include such things as reducing ongoing power consumption, proper disposal of electronic waste (e-waste), and virtualization of server resources as well as energy-efficient central processing units and servers (Tyson, 2010).

Green computing. Green computing is systematic in nature, and is defined as the environmentally responsible use of computers and related resources (Kaplan, 2002). One way that green computing can be brought to an organization is by utilizing virtualization technologies because less material is needed and the overall use of power is also minimized (Tyson, 2010). Virtualization of server resources creates a single platform from which multiple servers can run (Tyson, 2010). Virtualization can also eliminate duplicate copies of data on the real storage devices and maintain a single storage device managed from a central console (Pepper, 2008). Because of this, performing tasks such as backup, archiving, and recovery become more efficient and effective (Pepper, 2008). Not to mention removing duplicate data further increases cost savings over multiple storage devices and media (Tyson, 2010).

Green business. Green business is defined as business processes that attend "…not only to financial results but also to social and environmental outcomes" (Taylor, 2006, p. 26). Many companies have successfully experienced the benefits of going green without "…adding to their capital budgets" (Pepper, 2008, p.1). Green business practice modifications include such things as reducing travel, reducing hardcopy handouts or using recycled paper for handouts, and installing energy-saving light bulbs (Iwata, 2007). For example, by reducing the use of its shipping containers, Wal-Mart saved over 1,000 barrels of oil and thousands of trees while saving $2 million in annual costs (Seidman, 2008). Both Nike and Nestle Waters experienced a decline in manufacturing and shipping costs by reducing the amount of plastic and other waste materials used in products and shipping (Seidman, 2008). By reducing waste material used in manufacturing and shipping, the amount of materials deposited in the landfills also decreased (Seidman, 2008).

Social responsibility and the environment. The concept of going green refers to an organization's decision-making process; are the long term and short term decisions made by an organization "supporting environmentalism…tending to preserve environmental quality (as by being recyclable, biodegradable, or nonpolluting)" (Going green, 2010, p.1). Companies in the 21st century are beginning to "…accept and acknowledge their responsibility in protecting the environment" (Berthon, Crittenden, Desautels & Pitt, 2010, p. 14). According to Fox (2010), more and more businesses-to-business customers are requiring that partnering suppliers and vendors (e.g., RMIS Providers, shippers, waste management company, office cleaning company) are either green or implementing initiatives to be green (p. 149). Organizations are including eco-friendliness as a determining factor when deciding whether or not they utilize a vendor's services or resources (Taylor, 2006). The importance of implementing the positive aspects of

environmentalism is highly significant and more important now than ever **(**Boyes, 2008).

Organizations such as Wal-Mart created a green requirement that products must pass before the

product reaches the retail shelves **(**Boyes, 2008). Ninety-five percent of Wal-Mart's future

production source will come from "…factories receiving the highest rating on environmental and

social practice" (Berthon et al, 2010).

Significance

In 1994, the concept of The Triple Bottom Line (3BL) was introduced by sustainability

guru John Elkington. Issues surround sustainability has been in existence for quite some time;

however connecting sustainability to business strategy has been difficult (Phillips, 2006, p. 52).

The basis of the 3BL "…aims to align the interests of the economy, society, and environment so

that any action that benefits one, benefits the others" (Gable & Shireman, 2005, p. 1). To be

successful as an organization, a healthy society and thriving environment are necessary (Gable &

Shireman, 2004). 3BL is not just reacting to wrong decisions, but a way of "…thinking and

acting when making decisions" (Cokins, 2009, p. 38).

Organizations that strive to achieve 3BL are often referred to as socially responsible

organizations (Taylor, 2006). Another term for a socially responsible organization is Corporate

Social Responsibility or CSR (Taylor, 2006). In the past ten years, CSR reports are produced by

half of the companies in the Fortune 500. These CSR reports discuss the companies'

sustainability approaches as well as the efforts taken to achieve their goals (Taylor, 2006).

The International Organization for Standardization (ISO) is also developing ISO 26000

standards, "…a voluntary social responsibility benchmark intended to assist organizations in

addressing and measuring their CSR approaches while respecting cultural, societal,

environmental and legal differences and economic development conditions" (Taylor, 2006,

p.27). The ISO 26000 standards are being developed in hopes to provide companies "practical

CSR guidance, while helping to increase customer confidence and satisfaction in organizations"

(Taylor, 2006, p.27).

Audience

Going green should be integrated with an organization's daily functions (Laff, 2009). A

green business "…develops and practices business strategies that go beyond regulation and

demonstrates commitment to a healthy and sustainable future" (EarthShare, 2010, p. 1). That

said, an organization might be considered a green business when the organization's goals include

having a positive impact on the environment and community (EarthShare, 2010). This positive

impact is related to the principles, policies, and practices that are developed and adopted by an

organization to directly improve the quality of life for its customers and employees (EarthShare,

2010). Because of this, the intended audience for this study is described to include all members

of typical upper management within a mid-sized service organization. Indirectly, this study

targets any professional who should be aware of the meaning and goals of going green,

including:

- Chief Operating Officer (COO)- Responsible for coordinating the achievement of the

   company's objectives in operations, program management, business development,

   finance, human resources and administration. The COO has the ability establish set key

   objectives in these areas of business to help the organization in meeting green goals. In

   operations for example, a document imaging system can be created to reduce the use of

   paper products. Document imaging also saves the organization money by minimizing

   physical document storage.

- Chief Executive Officer (CEO) – Responsible for providing overall corporate leadership in strategic development and growth. Consumers and business-to-business customers are consciously purchasing products and services from companies that are environmentally responsible. The CEO has the forum in which to establish strategic initiatives companywide that direct the organization to be environmentally responsible.

- Chief Information Officer (CIO) – Responsibility for the development and implementation of all technology programs and related vendor relationships. The CIO has the ability to review the 'current technological state' of the systems and processes used in IT.

- Chief Financial Officer – Responsible for the collection, validation, and reporting of data. The triple bottom line expands this fundamental role to "…nonfinancial and nonoperational information…" as the term *resource* is redefined by the business sector (Cokins, 2009, p. 37). In addition, new reporting methods for greenhouse gas and energy reporting introduced (Cokins, 2009).

- Director Colleague Resources (CR) – Responsible for all human resource activities including colleague relations, personnel policies, recruitment and training, reward and recognition programs including compensation and benefits, payroll and human resource information systems, and strategic workforce development. CR can create effective training tools and policies for all employees within the organizations. Providing these tools for the end users to learn effectively is very critical to successful implementation (Sharma & Yetton, 2003).

This group of individuals determines the direction of the organization. Not only does this group of upper management have a clear vision of the organization's future, but they can have

the assumed power to incorporate the ideas and strategies within the organization. Furthermore, by gaining a firm commitment from the executive committee, implementation of green strategies are met with less resistance throughout the organization (EarthShare, 2010). "The role of management support has been identified as a critical factor" (Sharma & Yetton, 2003, p. 542).

Outcome

As a way to encourage the adoption of modifications that are deemed socially responsible, the final outcome of this study is presented as a set of recommended modifications, framed by the core concepts known as 3BL, or The Triple Bottom Line. 3BL concepts are designed to improve profit, people, and the planet (GreenLivingTips, 2010). The notion of *3BL* as the phrase is used in this study is defined as (a) identifying opportunities to create a profit for shareholders while (b) protecting the environment, improving the lives of those that interact with the organization directly and indirectly, and (c) acting in the interest of the environment as well as society (GreenLivingTips, 2010).

The outcome of this study is designed in the form of a table that presents a set of proposed green computing and green business resource and process modifications to be made in a mid-sized service organization. Modifications are framed within the concepts outlined in the Triple Bottom Line (3BL) (Phillips, 2006). The modifications are designed to mitigate an organization's carbon footprint and increase their social responsibility. Social responsibility practices "are becoming more critical to business than ever before" (Taylor, 2006, p. 30). Taylor (2006) agrees that the relationship between an organization and its customers and community can be strengthened by active social responsibility practices.

The modifications will assist organizations in identifying specific resources, both green computing (hardware, data center, e-waste) and green business (physical file maintenance, travel,

etc) that are instrumental in the effort to achieve the triple bottom line, which in this case includes a reduction in the carbon footprint. Figure 1 below addresses the 3BL categories: (a) opportunities to create a profit for shareholders, (b) protecting the environment, and (c) acting in the interest of the environment as well as society (GreenLivingTips, 2010).

Modification Area	Sub-Category	Proposed Modification	Potential Results	3BL Framework		
				Shareholder	Environment	Society
Green Computing						

Figure 1. Template for summary of green computing modifications and related 3BL categories

Modification Area	Sub-Category	Proposed Modification	Potential Results	3BL Framework		
				Shareholder	Environment	Society
Green Business						

Figure 2. Template for summary of green business modifications and related 3BL categories

Delimitations

Topic definition. GreenLivingTips (2010) defines 3BL as organizational activity that (a) identifies opportunities to create a profit for shareholders while (b) protecting the environment,

improving the lives of those that interact with the organization directly and indirectly, and (c) acting in the interest of the environment as well as society (GreenLivingTips, 2010). This definition provides a full comprehensive definition over definitions found in other resources.

The following statement by Phillips (2006) summarizes the three basic 3BL principles: "The triple bottom line refers to an organization's societal, environmental and economic contribution" (p. 52). Simply put, "3BL stands for people, planet, and profit" (GreenLivingTips, 2010, p. 1).

Focus. This literature review is focused on areas addressing green IT technologies and green business practices that help an organization leverage current resources to reduce their carbon footprint. This researcher assumes that by reducing the carbon footprint, an organization can better reach green status (What we're watching in green business, 2010).

Time frame. Green technologies are not new to industry, but only until recently have companies begun to try to ensure the greatest environmental and economic return on each dollar (and hour) spent on sustainability (Linaweaver, 2009). In an effort to keep the information relevant to current technologies and business practices, only references published from 2000 to 2011 are considered for this review.

Research Questions

A set of research questions guides the selection of content and method in this study. The focus is the identification of modifications that can be made in relation to both technology and business in a mid-sized service organization, as a way to mitigate the size of an organization's carbon (Taylor, 2006).

The questions as they relate to purpose of the study are:

1) How should a mid-sized service organization modify technology in order to reduce the carbon footprint?

2) How should a mid-sized service organization modify business practice in order to reduce the carbon footprint?

3) How do these proposed modifications align within the 3BL framework, of socially responsible actions?

Data Analysis Plan Preview

This inquiry is designed as a review of the literature to "analyze, synthesize and interpret" existing knowledge of this topic (Busch, De Maret, Flynn, Kellum, Le, Meyers, Saunders & White, 2005, p. 1). As suggested by Creswell (2009), the tasks of data analysis, data collection and data interpretation are conducted simultaneously. Initially, a group of references that specifically address the purpose and research questions are collected and reviewed. From this review, categories are created as working categories that require additional data collection and analysis.

The categories provide a visual research map of literature as discussed by Creswell (2009). This map is used to create on overall theme and concept of the study while providing a concentrated theme and concept for each category (p. 30). From each category, a coding system is built to classify the relevancy of each reference to that specific information silo. Each reference is given a number that directly relates to the coding system.

The quality of the selected literature is reviewed prior to detailed analysis. Evaluating the quality of the literature is performed using the critical evaluation of information sources (Bell & Smith, 2007). Five key elements of information are reviewed for evaluation: (1) authority of the author and the publisher, (2) objectivity of the author, (3) the quality of work, (4) coverage of the

work, and (5) currency. Sources that "pass" the information source evaluation are then outlined

and briefly summarized to determine the level of relevancy. Literature with high levels of

relevancy is added to an annotated bibliography. These relevant sources are then coded using the

eight step conceptual analysis process, provided by Busch et al., (2005).

Writing Plan Preview

The organization and presentation of data follows a thematic approach. Busch et al.

(2005) describes a thematic review of literature as being "organized around a topic or issue" (p.

5). The primary themes of this study include (a) key elements of technology that are designed to

assist in the reduction of an IT department's carbon footprint, and (b) key business practices that

are designed to assist in the reduction of an organization's carbon footprint.

Definitions

Definitions presented in the section are identified in the selected literature. The definitions offer meaning to key concepts that allow the audience to better understand the terms used in this study (Creswell, 2009, p. 106).

Blade server – "A blade system consists of a blade enclosure and numerous blade servers" (Sobotta, 2009, p. 90)

Carbon dioxide emissions – "…is emitted naturally through the carbon cycle and through human activities like the burning of fossil fuels" (Environmental Protection Agency, 2010). Carbon dioxide is a climate changing greenhouse gas (Environmental Protection Agency, 2010).

Carbon footprint – "…a measure of the impact our activities have on the environment, and in particular climate change" (Carbonfootprint, n.d.). "It relates to the amount of greenhouse gases produced in our day-to-day lives through burning fossil fuels for electricity, heating and transportation etc" (Carbonfootprint, n.d.).

Cloud computing – "takes infrastructure and applications off site" (Tyson, 2010, p. 1)

Consolidation – "the act of migrating numerous small servers serving independent purposes to fewer powerful physical servers running multiple virtual machines concurrently" (Sobotta, 2009, p. 79)

Data center - is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression) and security devices.

Dematerialization - "the substitution of high carbon products and activities with low carbon alternatives" (The Climate Group, 2008, p. 29).

E-waste –E-waste or electronic waste consists of "…all desktops, laptops, servers, storage devices, and network equipment" (Kaestner, 2009, p. 18).

Global Warming - The gradual, long-term increase in the Earth's surface temperature (Sobotta, 2009).

Green – An expression commonly used for environmentally responsible (Sobotta, 2009).

Green business - is an organization that (a) identifies opportunities to create a profit for shareholders while (b) protecting the environment, improving the lives of those that interact with the organization directly and indirectly, and (c) acting in the interest of the environment as well as society (GreenLivingTips, 2010).

Green computing - The environmentally responsible use of computers and related resources (Kaplan, 2002).

Greenhouse Gas - Gas that is absorbs solar radiation and contributes to the greenhouse effect. Greenhouse gases include carbon dioxide, ozone, methane, and chlorofluorocarbons (Sobotta, 2009).

Information technology (IT) department - "…a collection of persons who are experts when it comes to electronic communications of all kinds" ("IT department", 2011).

Recycling - "…to reuse or make (a substance) available for reuse for biological activities through natural processes of biochemical degradation or modification" (Recycle, 2011, p. 1)

Social responsibility – "…making sure a company's actions live up to the needs of all stakeholders, including shareholders, community, environment, employees, customers, and suppliers" (Taylor, 2006, p. 29).

Stakeholder – "Stakeholders operate within a system or network of other stakeholders, interacting with one another both consciously and unconsciously" (Gable & Shireman, 2005, p. 1).

Sustainability – "The goal of sustainability, then, relates to the interconnectedness of economic, social, institutional, and environmental aspects of society and ecology," (Curran, 2009, p. 6). Additionally, "sustainability requires the consideration of the economic, environmental and social aspects of products and product systems" (Curran, 2009, p. 6).

Telecommuting - Utilizing new technologies such as web and video conferencing and voice-over-internet-protocol can enable employees to telecommute and provide a relatively pollution-free work space as well as reduce the amount of carbon emissions created when employees drive to and from physical work locations (Ghose, Hasen, & Spedding, 2008).

The triple bottom line (3BL) – BusinessDictionary.com describes the triple bottom line as "financial, social, and environmental effects of a firm's policies and actions that determine its viability as a sustainable organization.

Virtualization – Consolidation of server resources that "…creates a single platform from which multiple servers can run" (Tyson, 2010).

Research Parameters

This section identifies the research design of this study. Included in this section are (a) the search strategy report, (b) a list of the search terms used to collect the references, (c) reference evaluation criteria, (d) the data analysis plan, and (e) the writing plan.

Search Strategy Report

Literature collection and selection criteria. This study is designed as a literature review, as defined by Creswell (2009). The selected literature focuses on two areas of inquiry: green computing and green business. The literature selection is focused on two main ideas: (a) impacts of IT technologies and business on an organization's carbon footprint and (b) green business and green IT technologies that assist in the mitigation of an organization's carbon footprint. All results are initially evaluated by topic relevancy and publication date.

Search engines. Literary searches are performed using University of Oregon's Libraries, Google Scholar, EBSCO HOST Research Databases - Academic Search Premier, and Business Search Premier. As the results are refined, additional information is sought from SCIRUS, Dogpile, and Sage Journals Online.

Search strategies. The initial search strategy is to utilize the University of Oregon's Libraries search engine using a key word and key terms. The University of Oregon's Libraries website provided a large number of relevant results. A more rigorous set of parameters limit the references from the initial results. Selected literature examines the factors that make up a socially responsible organization as well as suggest the adoption of or improvement upon IT related components to help reduce the carbon footprint. For example, using the search term "Green business" may yield results for agricultural green technologies. These types of technologies are not within the context of this study, therefore these sources are eliminated from consideration.

This study also excludes documentation for specific technologies such as grid computing vs. cloud computing or competing power management software companies such as Numara vs. Intel.

The quantity of relevant information produced using single search terms is very high (by using "Green Business", Google Scholar search engine produced 2,570,000 'hits'). To further limit the accuracy of relevant information, search terms are combined. For example, combining "Green Business and The Triple Bottom Line" yielded 38,400 search results. While 38,400 search results is a high volume, there are fewer "false hits" to remove. Along with relevant keywords, acronyms referring to specific keywords are used (as in 3BL for The Triple Bottom Line) to better refine the quantity of relevant information.

Search results. The University of Oregon's Libraries web site, EBSCO HOST Research Databases –Academic Search Premier Index, and EBSCO HOST Research Databases – Business Search Premier Index provided the best relevant results. Google Scholar and Dogpile continued to provide duplicate results that are not as relevant as the databases above; those search engines are no longer used.

Documentation approach. Search results are captured in an Excel document. This document maintains the title of the article, abstract, and initial coding. Each resource is also categorized (tab A for green technology and tab B for green business) in the two key themes. Within each category are sub-categories; statistics or case study. The sub-categories are documented alphabetically by source title. This system provides a complete and effective tool for quick an easy resource location.

Key Terms

Key terms are taken from the initial search term of "green business". Key terms are determined relevant when each term is consistently used within the resources produced by the initial search term. Below are the key terms used:

- Carbon footprint

- Green business

- Green business practices

- Green circuit

- Green computing

- Green initiatives

- Green technology

- Electronic Waste

- Power management software

- Recycling hardware

- Reuse technical hardware

- Sustainability

- Sustainability Strategy

- The triple bottom line

- Virtualization

Data Analysis Plan

Busch et al. (2005) describe the conceptual analysis process as a thematic analysis. The focus of conceptual analysis is to review the occurrence of selected terms within texts to determine if the information is meaningful to the topic of the study (Busch et al. 2005). In the

initial stage of the data analysis process, the terms are used to locate references for the study. The terms address core themes including organizational carbon footprint, carbon footprint reduction requirements, and IT related triple bottom line initiatives. Each collected reference is given a code and input into an excel document for later use. The results are analyzed and synthesized to provide documentation to the research questions.

After the initial documentation of the references, each reference is analyzed further to create a more detailed guide for reviewing and retrieving the information. This step includes refining the categories and grouping the references. Then, the following eight step coding procedure is followed, derived Busch et al. (2005).

1. **Levels of analysis.** Relevant words are coded, such as *carbon footprint, e-waste, sustainability, environmental[ism], and telecommuting*, phrases such as *the triple bottom line, green business, green technology, green initiatives,* and *socially responsible*, and acronyms such as *3BL* and *CO2* as used in the search terms.

2. **Pre-defined set of concepts and categories.** This coding process is guided by two key concepts. Concepts include: (a) key elements of technology that are designed to assist in the success of reducing an organization's carbon footprint and (b) key business practices that are designed to assist in the success of reducing an organization's carbon footprint. The pre-defined categories relevant to the themes are: *green technology; reducing carbon footprint*; *and triple bottom line influence on carbon footprint*. Emerging relevant key themes are included in the coding process.

3. **Existence of a concept.** Themes are not coded for frequency, but rather for existence. For example, though the theme of *the triple bottom line* appears multiple times throughout the literature, it is only coded once. However, aspects of the triple bottom

line that are described in a unique manner are coded separately. Furthermore, the

context of the literature is reviewed for relevancy to the topic of this study.

4. **Level of generalization.** Coding rules are important to ensure the classifications of

the themes are clear. The coding is defined using a parent/child relationship. Both the

parent terms and child terms are coded. For example, *green computing* is identified as

the parent where as *power management software* and *e-waste* are identified as the

children to the *green computing* parent. Where *green business* is identified as the

parent, *recycling* and *telecommuting* are identified as the child.

5. **Translation rules.** Terms and phrases that have the same meaning are identified as

representatives of a single category, are recorded as the same. For example, *carbon*

dioxide and *greenhouse gases* or *sustainability* and *the triple bottom line*. For the

purposes of this study*, sustainability* and *the triple bottom line* ultimately refer to the

same things: people, profit, and planet. Thus, references with *sustainability* and *the*

triple bottom line can have the same meaning and are recorded as the same. Terms

and phrases that are similar but have different meanings are recorded separately; for

example, *power management software* and *green computing*.

6. **Irrelevant information.** Irrelevant information as determine by contextual reading is

not used for the coding.

7. **Code the texts.** In order to gather important information, coding is done by using

word and phrase recognition within the application. The words and phrases identified

are reviewed for definition and given an index number of 1, 1.1, or 1.1.1. For

example, phrases such as *green computing* and *social responsibility* are given an

index number of 1 because the information presented in the reference refers to the

concept as a whole; not focusing on one particular aspect of each. Phrases such as

management support or *telecommuting advantages* are sub-categories of an overall

theme of this study. These entries are given a 1.1. The given index number is

recorded in an Excel document along with the article's title, author's name, active

hyperlink to the resource (where applicable), and coding term. For example:

1. Green Technology
   1.1. E-waste habits – How green is your Apple? – Business –E-waste – "E-Waste"
   1.2. E-waste habits - Computers and the environment - Kaestner, R. – "E-Waste"

8. **Analyze results.** Results of coding process are examined and presented in relation to
   a set of themes that are further described in the Writing Plan below.

Writing Plan

This study focuses on the concept of how organizations can lower their carbon footprint

by modifying technology and business decisions within a mid-sized service organization. The

organization for the presentation of the results of the coding process during data analysis is

structured in a thematic approach, as described by The University of North Carolina's Writing

Center (Literature Reviews, n.d.). The thematic approach does not organize literature around a

progression of time (Literature Reviews, n.d.), but rather the thematic approach creates a way to

organize the information into a framework that supports the topic. The information is organized

addressing the main themes and sub-themes of this study. The first main theme relates to green

business modifications within a mid-sized service organization designed to lower the carbon

footprint. The second main theme relates to green technological modifications within a mid-sized

service organization designed to lower the carbon footprint. The third main theme examines the

relationship between lowering a mid-sized service organization's carbon footprint and social responsibility.

Obenzinger (2005) describes the Swiss cheese rhetorical pattern as the presentation of "a picture of current knowledge" (p. 5). This study follows this Swiss cheese rhetorical pattern by presenting a picture of current green business, green technology, and social responsibility as it relates to reducing a mid-sized service organization's carbon footprint. Similar in process is the synthesis of two fields (Busch et al., 2005). This review of literature presents a relationship specific to themes of both a mid-sized service organization's activities (business and technical) and carbon footprint. Organization of the concepts derived from the conceptual analysis is aligned in three pre-selected key themes:

1. Theme One: Green business strategies within a mid-sized service organization to lower carbon emissions

    a. Green business practices

        i. Dematerialization

        ii. Telecommuting

        iii. Office maintenance

        iv. Recycling

    b. Employee involvement

2. Theme Two: Green technology within a mid-sized service organization to lower carbon emissions

    a. Examination of technological modifications

        i. Data center

            1. Virtualization

2. Cloud Computing

   ii. Power management

   iii. E-waste

3. Theme Three: Impact on an organization's corporate social responsibility by lowering

   carbon emission activities

Annotated Bibliography

This section identifies the key selected references for this study. The references are

accompanied by both published abstracts and researcher comments. The researcher's comments

are an assessment of the reference's credibility and relevancy to this study.

Berthon, P, Crittenden, V, Desautels, P, & Pitt, L. (2010). Get the most out of green it.

Suite101.com. Retrieved from Retrieved from Business Source Premier database.

Abstract. 'Promise' paradoxes beset green IT. The promise of efficiency, the promise of

cleanliness, the promise of education, the promise of satisfaction, and the promise of

community are all 'promise' paradoxes. There are four models of IT that can offset these

promises. The four models are: traditional, efficiency, simplify, and transformation.

Comment. This article discusses the promise paradoxes that beset IT as well as activities

that offset those promises. Examples of Wal-Mart and CUTCO are used to support how

these models can be successful in any organization. The promise paradoxes and models

of IT are used in the Review of the Literature of this study. This reference is coded in all

three themes. Co-author Pierre Berthon is the Clifford Youse Professor of Marketing in

the McCallum Graduate School of Business at Bentley University in Waltham, Mass. Co-

author Victoria Crittenden is a faculty member in the Carroll School of Management at

Boston College and earned her Ph.D. in business administration at Harvard Business

School. Co-author Philip DesAutels is a Ph.D. candidate in the McCallum Graduate

School of Business at Bentley University in Waltham, Mass. And is building on

Bentley's long history of work in ethical and socially responsible enterprises to

understand the implications of sustainability on business in the 21st century. Co-author

Leyland Pitt is a professor of marketing and the Dennis F. Culver Executive M.B.A. Alumni Chair of Business at the Segal Graduate School of Business at Simon Fraser University in Vancouver, Canada.

Bortree, D. S. (2009). The impact of green initiatives on environmental legitimacy and admiration of the organization. *Public Relations Review, 35,* 2, 133. Retrieved from Business Source Premier database.

Abstract. Communication about environmental policies and practices has become a critical area of focus for corporations. Through an online experiment this study explored the impact of awareness of environmental initiatives on perceived environmental legitimacy and the subsequent impact of legitimacy on organizational admiration. Findings suggest that raising awareness of an organization's environmental initiatives improves environmental legitimacy; however, investigation of the relationship between legitimacy and admiration found that only one dimension of environmental legitimacy influences the level of admiration of an organization.

Comment. This reference is a peer reviewed article published within the last 10 years. The article provides discussion surrounding the social impact that an organization can have when an environmental initiative is implemented. This article is used to support the notion that an organization's action toward the environment has consequences for business operations. Furthermore, this study provides a case study that is referenced. This case study shows the legitimacy of environmental responsibility from the general public.

Boyes, J. (May, 2008). Why businesses are going green. *Suite101.com*. Retrieved from

Suite101.com Web site: http://www.suite101.com/content/why-businesses-are-going-

green-a47985

Abstract. This article initially discusses the reasons why organizations might be resistant

to organizational change toward a 'fad'. Initial expenses and time consumption seem to

be the larger concerns. However, those concerns are quickly extinguished by the positive

aspects of "going green". A healthier bottom line, customer satisfaction, and societal

perceptions are some of the main advantages discussed.

Comment. This article discusses examples of how organizations have become carbon

neutral. These impacts are positive on the environment. The examples in this article are

used in the Review of the Literature and Introduction of this study. This reference is

coded under green business as well as social responsibility. This author of this article is a

Senior Account Manager at Boyes Public Relations.

Brown, M, Sarzynski, A, & Southworth, A. Brookings Metropolitan police, (2008). *Shrinking

the carbon footprint of metropolitan America*. Retrieved from

http://www.brookings.edu/~/media/Files/rc/reports/2008/05_carbon_footprint_sarzynski/

carbonfootprint_report.pdf

Abstract. The authors discuss the widening carbon footprint in American Metropolitan

cities. The authors dissect the carbon footprint into carbon growth by residential versus

commercial.

Comment. This report discusses the challenges of the nation's carbon footprint. The

authors provide an in depth report on the growing concerns of the carbon footprint in

America's major metropolitan areas. The report breaks down the sources of carbon

emissions that increase the carbon footprint. This breakdown includes residential,

commercial and transportation by geographical area. This report provides statistics that

are used in the Review of the Literature and Introduction of this study. Given the carbon

footprint theme of this reference, it is coded under social responsibility theme. The

authors are professors at the Georgia Institute of Technology.

Business - E-waste - How green is your Apple? (2006). *The Economist, 380,* 8492, 53. Retrieved

from Retrieved from Business Source Premier database

Abstract. The author of this article discusses electronic manufacturer's electronic waste

scores. Further into the article, the recycling habits of these electronic manufacturers

(Nokia, Dell, Hewlett-Packard, etc.) are also discussed.

Comment. This reference provides a chart of electronic manufacturers' green scores.

This can be used to demonstrate that electronic manufacturers are taking e-waste

seriously. The author identifies California laws that are more stringent on certain types of

electronic manufacturers. For example: "In California mobile-phone retailers must now

take back and recycle old phones" (p. 1). The green scores identified in this reference are

used in the Review of the Literature. This reference is coded in e-waste, under green

technology. The Economist offers authoritative on international laws, business, science,

and technology.

Chieh-yu, L., & Yi-hui, H. (2010). The influences of environmental uncertainty on corporate

green behavior: An empirical study with small and medium-size enterprises. *Social*

Behavior & Personality: An International Journal, *38*(5), 691-696. Retrieved from

Academic Search Premier database.

Abstract. For the purpose of sustainable development, green management has become an

important social issue for many companies. Substantial scholarship has focused on

corporate green behavior. However, little is known concerning how corporate green

behavior is influenced by environmental uncertainty. This paper was aimed at analyzing

the influence of perceived environmental uncertainty on the adoption of green practices

for small and medium-size enterprises (SMEs). We conducted a questionnaire survey on

SMEs in Taiwan and concluded that environmental uncertainty has a significantly

negative influence on the decision to adopt green practices for SMEs.

Comment. The authors of this article are Associate Professors for the Department of

International Business at Chang Jung Christian University, Tainan, Taiwan. The article

describes social issues facing small and mid-sized organizations when implementing

green practices. The information from this article is used in the Review of the Literature

and Introduction of the study. This reference is coded under both social responsibility and

green business.

Cole, A. (2008). Manage your way to green. Message posted to ITBusinessEdge. Retrieved from

ITBusinessEdge Web site: http://www.itbusinessedge.com/cm/blogs/cole/manage-your-

way-to-green/?cs=12158

Abstract. Two ways to lower energy costs in the data center are: more efficient hardware

designs featuring low-power components and more efficient cooling systems, and new

software platforms that make better use of available resources. New, more robust

software packages are being released by IBM and Red Hat Enterprise. These new

software initiatives enhance energy-saving functions and have the ability to save

organizations money.

Comment. This article provides information about energy-saving functions within the

data center, being introduced by established organizations. The two examples of

organizations (IBM and Red Hat Enterprises) are used in the body of this study. The

author writes about networking and data centers for IT Business Edge. In the past, the

author has served as editor of numerous publications covering such things as audio/video

production and distribution, multimedia and the Internet to video gaming.

Curran, M. (2009). Wrapping our brains around sustainability. *Sustainability*, *1*(1). Retrieved

from http://www.mdpi.com/2071-1050/1/1/5/pdf

Abstract. As many of us begin to embrace the concept of sustainability, we realize that it

is not simply something that we 'do.' Rather, sustainability is a destination that we aspire

to reach with the selection of the sustainable pathways that we choose as we proceed

along the journey. We are embarking on a new journey with the creation of

Sustainability, an on-line, open access journal. As stated on the journal's website,

Sustainability is an international and cross-disciplinary scholarly journal of

environmental, cultural, economic and social sustainability of human beings, which

provides an advanced forum for studies that are related to sustainability and sustainable

development. To genuinely wrap our brains around the impact that our actions have on

the sustainability of our planet, we must first understand something of the big picture and

have a firm grasp of the terminology. To help further clarify the elusive term

'sustainability,' without attempting to provide an exact definition, this paper outlines

various, inter-related concepts and basic practices and approaches that are being used in

the name of sustainability, including: traditional end-of-pipe control strategies, life cycle,

environmental sustainability, urban sustainability, industrial ecology, business

sustainability, sustainable supply chain systems, sustainability indicators and metrics,

green chemistry and green engineering, design for the environment, sustainable

buildings, eco-tourism, and renewable and sustainable energy and fuels.

Comment. This report discusses how sustainability practices interact with one another.

These practices allow for positive outcomes for humans, the environment, and the

economy. The report is included in the sub-set of literature used for coding, and provides

figures and literature on sustainability that are used in the Review of the Literature of this

study. Furthermore, the author offers basic practices and approaches that can be used by

an organization to become more sustainable. The author is a chemical engineer at the

United States Environmental Protection Agency National Risk Management Research

Laboratory. The author has also been recognized as an international Life Cycle

Assessment (LCA) expert. This reference is coded under green business.

EarthShare. (2010). Greening business. Retrieved November 10, 2010 from

http://www.earthshare.org/greening-business.html#tp

Abstract. The EarthShare team identifies the concept of green business. Also identified

are: the values of green business, cost effective efforts for both a large and small

business, and overall larger sustainability initiatives. Green makes sense. Other than

positively affecting an organization's bottom line, green business can attract potential

customers and maintain current customers while improving the environment.

Comment. This reference provides examples of organizations that successfully

implemented green strategies. This reference also helps to clarify basic green business

terms. This reference is coded under green business. The authors of this reference are

certified by the BBB Wise Giving Alliance Accredited Charity, whose goal is to support

hundreds of environmental charities. EarthShare has also earned the 4-star rating for

sound fiscal management from Charity Navigator .

Environmental Protection Agency, Office of Environmental Information. (2010). *U.S.*

greenhouse gas inventory. Retrieved from

http://www.epa.gov/climatechange/emissions/usgginventory.html

Abstract. This website provides statistics about greenhouse gas emissions. The figures

included trending emissions from 1990 – 2008, emissions allocated to economic sectors

from 1990 – 2008 and emissions with electricity distributed to economic sectors from

1990 – 2008. Each figure has a description of the figure.

Comment. The EPA provides figures and statistics regarding green house gas emissions

and selected emissions by economic sector. This reference is coded under green

technology and social responsibility. The statistics provided on the website are retrieved

from the official *U.S. Inventory of Greenhouse Gas Emissions and Sinks.* The *U.S.*

Inventory of Greenhouse Gas Emissions and Sinks is created to meet compliance with

commitments under the United Nations Framework Convention on Climate Change.

Green Living Tips. (2010, January 19). *Triple bottom line*. Retrieved from

http://www.greenlivingtips.com/articles/264/1/Triple-bottom-line.html

Abstract. The triple bottom line (3BL) refers to People, Planet, and Profit. 3BL reporting

can help organizations identify ways to create profit, provide good working environments

for employees as well as reinvesting in the surrounding community, and minimize

ecological impact from day-to-day operations.

Comment. The information on this website provides basic definitions to terms that are

used in the introduction and the Review of the Literature of this study. The site owner of

Green Living Tips (Michael Block) has had several articles either published or referenced

by The Wall Street Journal, Entrepreneur, Inc., and The Washington Times. This

reference is coded under social responsibility.

GreenerComputing Staff. (2010). *Energy efficiency finds a home in it departments; pue not so*

much. Retrieved from http://www.greenbiz.com/news/2010/11/08/energy-efficiency-

finds-home-it-departments-pue-not-so-much

Abstract. This article discusses top practices that IT departments are deploying to reduce

their energy use. Also, the author includes survey results from the third annual Energy

Efficient IT report from CDW. The results illustrate a climb in energy reduction

awareness.

Comment. The article provides statistics from the annual Energy Efficient IT report that

is used in the introduction and the Review of the Literature of this study. Furthermore,

this article provides best practices used by IT departments to reduce energy. The

information is also used in the Review of the Literature of the study. This reference is

coded under green technology. The GreenerComputing staff writes articles for GreenBiz.com. GreenBiz.com was founded by Joel Makower and B-to-B publisher Pete May. Fair publications guidelines have been established by this organization.

Hildenbrand, D. (2009). The greening of the American workforce. *Suite101.com*. Retrieved from

http://www.suite101.com/content/the-greening-of-the-american-workforce-a134576

Abstract. As companies become more enviro-conscious they seek out more eco-friendly employees. The employees of the future are factoring in the organization's green practices in job hunting decisions.

Comment. This article discusses practices to encourage new hires to participate in green-related activities. Additionally, potential new hires are weighing an organizations green-habit before applying. This discusses a survey conducted by the National Environmental Education Foundation that is used in the Review of Literature in this study. This reference is coded under social responsibility. The author has published material that is currently being used by the Ontario, Canada, Ministry of Education for use in credit courses and learning resources. Her works have also been cited in the publication series *A Woman's Guide to Green Jobs* from the U.S. Department of Labor as well as in the book, *Management*, by Richard L. Daft (page 390).

Horvath, A, Masanet, E, Nazaroff, W, Price, H, & Shehabi, A. (2010). Data center design and location: consequences for electricity use and greenhouse-gas emissions. *Building and Environment*, Retrieved from www.elsevier.com/locate/buildenv

Abstract. The rapidly increasing electricity demand for data center operation has motivated efforts to better understand current data center energy use and to identify strategies that reduce the environmental impact of these buildings. This paper builds on previous data center energy modeling efforts by characterizing local climate and mechanical equipment differences among data centers and then evaluating their consequences for building energy use. Cities in the United States with significant data center activity are identified. Representative climate conditions for these cities are applied to data center energy models for several different prototypical space types. Results indicate that widespread, effective economizer use in data centers could reduce energy demand for data centers by about 20e25%, equivalent to an energy efficiency resource in the US of 13e17 billion kWh per year. Almost half of the potential savings would result from better airflow management and proper control sequences. The total energy savings potential of economizers, although substantial, is constrained by their limited potential for use in server closets and server rooms, which together are estimated to account for about 30% of all data center energy demand. Incorporating economizer use into the mechanical systems of larger data centers would increase the variation in energy efficiency among geographic regions, indicating that as data center buildings become more energy efficient, their locations will have an increasing effect on overall energy demand. Differences among regions become even more important when accounting for greenhouse-gas emissions. Future data center development could consider site location, along with efficiency measures, to limit the environmental impact attributable to this increasingly prominent economic sector.

Comment. The authors of this article describe effective ways to alter the design of a data center to increase efficiency. This is a peer reviewed article. Information from this article is in the Review of the Literature and Introduction of the study. This reference is coded under the green technology.

Kaestner, R. (2009). Computers and the environment: minimizing the carbon footprint. *CoSN Green Computing Publication*. Retrieved from

http://www.cosn.org/Default.aspx?id=39&tabid=4677

Abstract. The article discusses the impact computers have on the carbon footprint. Further, the author provides examples of recycling, disposal, and energy use that can be modified to reduce the carbon footprint.

Comment. This reference provides usable modifications that are used to discuss both green computing and green business. Energy use, computer disposal, and e-waste reduction are all identified as key modification deliverables in this study. The author is the Green Computing, TCO and VOI Project Director at Consortium for School Networking. The author provides workshops and designs green approaches for school districts across the United States. This reference is coded under green business, green technology, and social responsibility.

Kenney, B. (2007). Green manufacturing - continuous improvement gets a green makeover. Reducing waste, emissions and pollution is simply good business. *Industry Week, 256,* 12, 28.

Abstract. The article emphasizes the profitability of reducing waste, emissions and pollution to manufacturers in the U.S. A key aspect to these initiatives is the implementation of energy and carbon risk management strategies such as balancing environmental objectives with financial or economic sustainability. Employee participation and supplier engagement are also important aspects of these strategies.

Comment. This article discusses the general goodness in reducing waste, emissions, and pollution. Key aspects of green initiatives discussed in this article are the implementation of energy and carbon risk management strategies such as balancing environmental objectives with financial or economic sustainability. These initiatives are discussed in both the Introduction and Review of the Literature of this study. This reference is coded under green technology. The author is a project manager for a Big Four accounting firm in Cleveland, OH. Previously, the author oversaw IndustryWeek's coverage of IT hardware and software tools relating to increased manufacturing efficiency.

Laff, M. (2009). Triple bottom line. *T+D*, *63*(2), 34-39. Retrieved from Academic Search Premier database.

Abstract. The article discusses corporate social responsibility, examining the efforts of some business enterprises in 2009 to integrate a sustainable business philosophy into their business model. Commentary is provided by Erin Meezan, assistant vice president for sustainability at the Interface Carpet Company. Other topics of discussion include the increasing sophistication of responsible corporate behavior, the related nature for business enterprises of environmental concerns, community involvement, and profit.

Comment. This article focuses more on the social implications of an organization's green initiative rather than discussing actual green technologies. There are many key points the author discusses about the impact a socially responsible organization can have; positive community appearance and positive view from potential employees. Examples of socially responsible behavior as well as responsible behavior toward internal employees are also presented. This is a peer reviewed article. This reference is coded under social responsibility.

Marcus, A., & Fremeth, A. (2009). Green management matters regardless. *Academy of Management Perspectives*, *23*(3), 17-26. Retrieved from Business Source Premier database.

Abstract. Today, it is undeniable that a new enthusiasm exists for green management, not only among managers but among business school students, though this enthusiasm is just starting to be tapped in a more formal way in curriculum, instructional materials, and faculty careers and advancement. Green management matters for many reasons, but fundamentally it matters because people expect managers to use resources wisely and responsibly; protect the environment; minimize the amounts of air, water, energy, minerals, and other materials found in the final goods people consume; recycle and reuse these goods to the extent possible rather than drawing on nature to replenish them; respect nature's calm, tranquility, and beauty; and eliminate toxins that harm people in the workplace and communities. From a moral or normative perspective the obligation for green management is absolute, and whether it "pays" to be green is only partly relevant.

Comment. This paper discusses the expectations on managers regarding green initiatives. These expectations include using resources wisely, recycle and reuse wisely, protect the environment, and minimize amount of air, water, and gas. The paper also provides examples of 3M successful green initiatives. The 3M and management expectation examples from this article are included in both the Review of the Literature and Introduction of the study. This reference is coded under both green technology and social responsibility. This is a peer reviewed article.

Miller, J. (2009). 'Triple bottom line' taking over culture at many firms. *Crain's Cleveland Business*, *30*(35), 12. Retrieved from Business Source Corporate database.

Abstract. The article presents information on "triple bottom line" concept adopted by various business enterprises. Triple bottom line concept, which includes people, planet and profit, is not just enhances profitability of business enterprises but is also good for the environment.

Comment. This article provides information on organizations that adopted 3BL. For example, Eagle Creek Garden Center has set a goal of being 95% fossil-fuel independent by 2011. The company found that using biomass heating system reduces annual heating cost and saves nearly 50% more space. This reference is coded under green technology. This is a peer reviewed article.

Muirhead, R., (2006) Gaining steam to go green. *Bank Technology News*, *19*(12), 30-32. Retrieved from Business Source Corporate database.

Abstract. The article discusses the need for a more energy efficient financial service industry. Environmental education is the first step to help financial companies understand the economic impact of climatic changes caused by excessive carbon dioxide emission. Financial companies must have then an efficient information technology system that optimizes every devices or infrastructure catering to the needs of every financial institution.

Comment. This author of this article discusses not only the need for more energy efficient financial services, but also provides statistics to back findings. These statistics are used in the Review of the Literature and Introduction of the study. His reference is coded under *green technology* as *green waste habits*. The author of this article was the Chairman, CEO and Founder of Tideway Systems and holds a MA in Engineering from Cambridge University.

Pepper, L.(2008). Green and lean: four steps to improving data center efficiency without capital expenditures. *Greener Computing*. Retrieved from http://www.greenbiz.com/blog/2008/06/24/green-and-lean-four-steps-improving-data-center-efficiency-without-capital-expenditu

Abstract. Green technology is the buzz around the top CXO's priority. And it rightfully should be. But that does not mean strategies are being put in place to solve the issues. Power issues and capital investments are the main obstacles that must be overcome before green computing can have an opportunity. Fortunately, there are other steps organizations can take to become green. These steps do not carry the high price tags that new data centers or solar energy carry.

Comment. This reference briefly discusses a four-step methodology for cutting data center costs without severely increasing capital expenditures. The four-step methodology consists of: (1) measuring baseline and projects consumption, (2) freeing floor space, (3) analyzing power and cooling efficiencies, and (4) reducing ongoing power consumption. Components of these steps are used in the Review of the Literature and Introduction of this study. This reference is coded under green technology. This reference is published by GreenBiz.com. GreenBiz.com only considers literature that passes the established fair publications guidelines. The author is a senior practice manager for EMC Infrastructure Consulting. The author has been employed at large organizations such as Accenture, Compaq, Oracle, and IBM.

Phillips, P. (2006). Learning's contribution to the triple bottom line. *Chief Learning Officer*,
   5(10), 52-54. Retrieved from Business Source Corporate database.

   Abstract. The article discusses the learning's contribution to the triple bottom line that refers to an organization's societal, environmental and economic contribution. It is said that it is not enough that chief learning officers have to contend with showing bottom line value for the investment in their programs, they must have a renewed and in some cases new interest in the triple bottom line.

   Comment. The author discusses the value of implementing 3BL. A brief history and fundamentals of 3BL is also provided. Furthermore, the author provides examples of organizations (Wal-Mart and Herman Miller) that have implemented 3BL initiatives that are referenced on the Review of the Literature of this study. Also identified are training techniques and strategies that are referenced in the Review of the Literature and

Introduction of this study. This reference is coded under green business and social

responsibility. The author is the president and CEO of the ROI Institute. The author

published *Return on Investment Basics* and *The Bottom Line on ROI*, which won the 2003

ISPI Award of Excellence.

Sobotta, A. (2009). *Greening it*. Retrieved from http://greening.it/?page_id=109

Abstract. This book contains important information and contributions on green issues

from an international group of experts. The goal is to increase awareness of the potency

of IT as an enable of the transformation the society must undertake.

Comment. This book contains information about various ways to green IT. Reducing

CO_2, computing energy efficiency, and the green IT industry ecosystem are just some of

the topics discussed in this book. Information from this book is used in both the

Introduction and the Review of the Literature of this study. This reference is coded under

green technology. The author holds a master's of Science degree in Information

Technology from the IT University of Copenhagen (Denmark).

Taylor, S. (2006). The Triple Bottom Line. *Texas Magazine*, 28-32. Retrieved from Business

Source Corporate database.

Abstract. The article encourages companies to practice social responsibility that serve

the shareholders, community, environment, employees, customers and suppliers.

Activities that promote corporate social responsibility are described. The issue of

business ethics practiced by companies is discussed. The universal standards for

measuring ethical actions of companies are considered.

Comment. This article provides examples of what business practices organizations are implementing to reach and maintain Corporate Social Responsibility status. FedEx Kinko's, Nike, Ford, and L'Oreal are organizations that are identified as progressing CSR organizations. The examples range from customer satisfaction and social image to internal employee programs. Examples of FedEx Kinko's, Nike, Ford, and L'Oreal CSR efforts are referenced in the Introduction of this study. This article is peer reviewed and is also published at the McCombs School of business for the University of Texas at Austin website.

Thibodeau, P. (2008). Environmental impact: it sees the light on green computing. *Computerworld*. Retrieved from http://www.computerworld.com/s/article/321181/Environmental_Impact_IT_Sees_the_Light_on_Green_Computing

Abstract. Many organizations reduce the energy consumed by IT equipment. This activity is now becoming a selling point with customers and even potential new hires. Enterprise Rent-A-Car Co and the municipal government in San Francisco have experienced cost saving from reducing the energy consumed by IT.

Comment. This article discusses energy reducing activities by Enterprise Rent-A-Car Co and the municipal government in San Francisco that have resulted in cost savings. Turning off unused equipment and consolidating servers are just two energy reducing activities that are listed in this article. The energy reducing activities are used in the Review of the Literature and Introduction of this study. This reference is coded under green business and social responsibilities. The author is senior editor at Computerworld.

Computerworld is the leading source of technology news and information for IT

influencers worldwide. Computerworld has won over 100 awards in the past five years.

Some of those awards include: Jesse H. Neal Awards (from American Business Media) in

2008 for Best Web Site, Best Online Articles or Series, and Best Blog; and the Magazine

of the Year Award from the American Society of Business Publication Editors in 2004

and 2006.

Wenzel, E. (2008). Research: old data centers can be nearly as 'green' as new ones. *Green Tech*.

Retrieved from http://news.cnet.com/8301-11128_3-9978643-54.html

Abstract. The author of this article discusses how revamping existing data centers can

achieve almost as much energy efficiency as a new data center. With the possibility of

energy costs nearly doubling in the next year, organizations might not have enough time

to develop and implement a new data center. Revamped data centers are achieving almost

as much infrastructure efficiency than new data centers using greener technologies.

Revamping current centers can be just as effective. Links are provided to research data

center efficiency publications.

Comment. This article discusses key points about the benefits of retro-fitting an IT data

center. The information in this article is used in the Review of the Literature of this study.

This reference is coded under green technology. The author is a former CNET editor and

publishes product reviews for organizations such as Adobe and Microsoft.

Young, T. (2006). Put Staff on a Green Learning Curve. *Computing*. Retrieved

from Computing.co.uk Web site: http://www.computing.co.uk/ctg/analysis/1837459/put-staff-green-learning-curve

Abstract. Educating staff about the benefits of greener working practices is key to reducing energy consumption and reducing costs. A survey conducted by Npower shows that 75 per cent of companies do not get staff to turn the lights off when they leave the office, and 50 per cent do not encourage staff to switch off monitors when they leave at the end of the day.

Comment. This article provides information on educating staff on green initiatives. Also provided is statistical data from a survey regarding employee habits. This information is used in the Review of the Literature and Introduction of the study. This reference is coded under social responsibility and green business. The author is a senior reporter for Computing magazine, Computing.co.uk and BusinessGreen.com

Review of the Literature

Earth "…is getting warmer" due to greenhouse gas emissions (Summ & Newell, 2010, p. 44). The EPA (2010) states "the relative contribution of the direct greenhouse gases to total U.S. emissions for the period 1990-2008" (p. 1).The EPA (2010) reports the most primary greenhouse gas emitted in the United States by human activity is carbon dioxide. The carbon dioxide represents "…85 percent of total greenhouse gas emissions" (Environmental Protection Agency, 2010, p. 1). The amount of greenhouse gases is "…a measure of the impact our activities have on the environment, and in particular climate change," (Carbonfootprint, n.d., p. 2). "It relates to the amount of greenhouse gases produced in our day-to-day lives through burning fossil fuels for electricity, heating and transportation etc." (Carbonfootprint, n.d., p. 2).

The United States releases close to 1.6 billion metric tons of CO2 annually (Toomey, 2008). The Climate Group (2008) presents the breakdown to total emissions by human activity as 24% of emissions is from the power sector, 23% of emissions is from industry, 17% of emissions is from agriculture and waste management, 14% of emissions is from land use, 14% of emissions is from transport and 8% of emissions is from buildings. As a result, organizations are recognizing and embracing terms such as *sustainability* and *going green* (Cokins, 2009). There is an urgent need to mitigate emissions of greenhouse gases (Sobotta, 2009).

The terms *sustainability* and *going green* "embrace environmental and climate change responsibility, as well as corporate social interests" (Cokins, 2009, p. 37). Many organizations are now beginning to accept the social responsibility of protecting the environment as well as human needs and company profits (Berthon et al, 2010). Accepting social responsibility means talking more holistically with the realization that business has a responsibility to return profits to shareholders while addressing the needs and concerns of the environment and community

(Taylor, 2006). Ultimately, this becomes an organization's triple bottom line focus; People, Plant, and Profit (GreenLivingTips, 2010). While the reduction of carbon emissions is critical, the gap between society and nature still exists (Berthon et al., 2010). The responsibility to preserve the environment falls upon society (Berthon et al., 2010). Through 3BL efforts such as green business and green IT, the gap between society and nature can be minimized.

Green Business

Taylor (2006) defines green business as business processes that attend "…not only to financial results but also to social and environmental outcomes" (p. 26). GreenLivingTips (2010) describes green business as any organization that (a) identifies opportunities to create a profit for shareholders while (b) protecting the environment, improving the lives of those that interact with the organization directly and indirectly, and (c) acting in the interest of the environment as well as society.

The ultimate green business is an organization that achieves carbon neutrality (Kain, 2010). Carbon neutrality is a net zero carbon footprint (Kain, 2010). To achieve carbon neutrality, Google has implemented several internal policies (Sobotta, 2009). Some of these policies are centered on reducing business travel and offering telecommuting opportunities (Sobotta, 2009).

Green business practices. A green business practice is defined as a simple process change that saves energy costs and reduces carbon emissions (SBA, 2010). Participation in green business practices is open to all employees of an organization. Unfortunately, green business practices are still viewed as just another cost to the business (Muirhead, 2006).

Some companies incorporate green practices to attract and retain workers (Underwood, 2008). Within the IT department, these practices include such activities as recycling office waste,

personal computer (PC) maintenance techniques, and overhead considerations (Globalwarning, 2010). These practices also do not have to be limited strictly to the IT department. All areas of an organization can partake in these practices. The following section identifies green business practices that can mitigate an organization's carbon footprint such as dematerialization, telecommuting, office maintenance, and recycling.

Dematerialization. The Climate Group (2008) describes dematerialization as "the substitution of high carbon products and activities with low carbon alternatives" (p. 29). The Climate Group (2008) offers the following examples as dematerialization activities: (a) replacing paper with document management systems, (b) utilizing more video conferencing and telecommuting instead of printing emails and meeting handouts or requiring in-person work attendance.

Telecommuting. Of the 25% of the world's annual CO2 emissions, 16% is from commuting (Toomey, 2008). Utilizing new technologies such as web and video conferencing and voice-over-internet-protocol can enable employees to telecommute and reduce the amount of carbon emissions created when employees drive to and from physical work locations (Ghose, Hasen, & Spedding, 2008). Gajendran and Harrison (2007) state "an estimated 45 million American employees telecommuted in 2006, up from 41 million in 2003" (p. 1524).

The American workforce travels and average of 16 miles to and from work each day (Toomey, 2008). By telecommuting, employees have the ability to reduce or eliminate work travel by working from home or somewhere other than the physical work location (Ghose, Hasen, & Spedding, 2008). The obvious benefit is the reduction of emissions from traditional commuters (Ghose, Hasen, & Spedding, 2008). Furthermore, decreasing the number of

commuters during key peak hours can help the rest of the traffic to move more freely and reducing their emissions as well (Ghose, Hasen, & Spedding, 2008).

Better technology and more tech-literate workforce help to establish a growing telecommuting workforce (The Climate Group, 2008). The 2005 Dieringer Research Group Survey discovered that roughly 22.2 million Americans continue to work from home at least once a week (Toomey, 2008). The Climate Group (2008) states "if a significant number of people worked from home more than three days a week, this could lead to energy savings of 20-50%" (p. 31). This figure takes into consideration the increase of energy used at the telecommuter's home (The Climate Group, 2008). A positive side effect of employing a greater number of telecommuters is smaller offices for organizations (The Climate Group, 2008). With less space needed to maintain workstations for employees, organizations can downsize physical operations saving energy used to heat/cool the building and reducing the electricity used to power computers and other technical equipment (The Climate Group, 2008).

Office maintenance. General office maintenance is not only good for maintaining equipment, but also for saving energy (Kaestner, 2008). One favorable practice to reduce the over-use of PC's and printers is to turn them off when the workday is over, rather than leaving them on stand-by (Globalwarning, 2010). Greening It (2009) states "IT-related emissions can be easily cut by around 15 percent, by doing simple things like switching off computers at the end of the day" (p. 150). Hewlett-Packard (HP) estimate that if 100,000 people turned off their PCs at the end of every day, "energy savings could total more than 2680 kilowatt-hours and carbon emission reductions could total more than 1500 kg daily" (Greening IT, 2009, p. 27).

Another practice to reduce carbon emissions when leaving the office is to turn off all lights (Berthon et al, 2010). CUTCO (American based cutlery manufacturer) saved roughly

$7,500 annually by turning off center row lighting in the administration building (Berthon et al, 2010). Replace incandescent light globes with compact fluorescent energy-efficient globes (Globalwarming, 2010). Incandescent light globes produce additional heat along with light (Globalwarming, 2010). By replacing incandescent light globes with energy-efficient globes, there is a reduction in overall office temperature (Globalwarming, 2010). Furthermore, Boyes (2008) states "compact fluorescents will cost you 75% less to run…and will last 10 times longer" (p. 2). Even switching the printer setting to print on two sides can help reduce the overall paper consumption. CUCTO reduced their annual paper consumption by 27 percent when printer settings were changed to two-sided (Berthon et al, 2010).

Recycling. There are many different types of office activities that can keep employees engaged in recycling. Recycling is probably the most common office activity when discussing business practices designed to assist in protecting the environment. In 2006, the U.S. recycled more the 53 percent of consumed paper (American Forest & Paper Association, 2008). In 2007, the average person recycled 1.54 pounds per day (University of Oregon and Medical University of South Carolina, 2010). Recycling paper reduces the amount of waste that is either incinerated or dumped into landfills (University of Oregon and Medical University of South Carolina, 2010).

However recycling paper still has negative environmental impacts (University of Oregon and Medical University of South Carolina, 2010). Recycling paper creates additional energy use and pollution from reprocessing materials (University of Oregon and Medical University of South Carolina, 2010). The costs associated with recycling paper are much lower than the environmental costs of not recycling paper (University of Oregon and Medical University of South Carolina, 2010). Another positive side affect of recycling is reduced waste hauling costs

(Globalwarming, 2010). CUTCO's major recycling efforts resulted in a 26 percent decrease in trash from all facilities (Berthon et al, 2010).

Businesses in the Unites States continue to use around 21 million tons of paper every year (Underwood, 2008). San Francisco's municipal government found that reducing paper waste, not just through recycling but by not using it in the first place, can have a positive effect on their bottom line (Thibodeau, 2008). San Francisco's municipal government uses roughly 215 million sheets of paper annually (Thibodeau, 2008). The cost of paper alone is $946,000 (Thibodeau, 2008). To meet its goal of 20% paper reduction, San Francisco's municipal government deployed a document management system that allows for the electronic creation and sharing of PDFs (Thibodeau, 2008).

Yet, these recycling activities do not just stop with recycling paper. Ernst & Young's (2010) 2008 and 2009 fiscal year Americans environment footprint initiative reduced disposable cup consumption by 54%. CUTCO encouraged employees to use reusable products such as plates, silverware, and drinking glasses brought from home, for holiday parties (Berthon et al, 2010). Only two bags of trash were collected at the end of the 75-employee holiday luncheon (Berthon et al, 2010).

Globalwarming (2010) discusses other recycling activities that organizations can successfully implement. Each year, hundreds of thousands of ink cartridges wind up in the landfills (Globalwarming, 2010). Many, if not all ink manufacturers provide an additional cartridge pouch in the box to pack the used cartridge and send off for recycling (Globalwarming, 2010).

Employee involvement. Green business encompasses the organization as a whole (Kain, 2010). The success of green business does not only focus on the actual business practice (Kain,

2010). For green business carbon reduction initiatives to be successful, employee involvement is key (Kenney, 2007).

Employee engagement is vitally important to the success of an intra-company green initiative (Kenney, 2007). Successful initiatives need to be considered as long-term initiates (Kenney, 2007). These initiatives can include such activities as recycling cans and bottles, recycling paper products, and using beverage containers from home rather than plastic cups purchased by the company. However, simply creating a green initiative (i.e., adding aluminum can recycling bins in break-rooms) is only one part of a successful green initiative. Developing a program for employees is equally as important (Benton, 2008).

Benton (2008) discusses six steps to engage employees, in order to successfully implement a recycling program in an IT department. These steps are (1) "begin training before the start of the program", (2) "provide clear and understandable guidance", (3) "create a 'green team'", (4) "develop incentives and rewards to motivate", (5) "education is an ongoing activity", and (6) "maintain flexibility with respect to the program's design" (Benton, 2008, p. 43). Employee involvement is key. 3M executives credit employee involvement at all levels for 30 years of success of its "3P" (Pollution Prevention Pays) program (Kenney, 2007). So far, the 6,300 employee-driven suggestions resulted in a savings of more than $1 billion dollars.

Green IT

Green IT "refers to the environmentally sustainable application of IT" (Sobotta, 2009, p. 25). Green IT can help achieve 3BL success by minimizing the impact on the environment through the generation of e-waste and saving energy (Sobotta, 2009). By implementing green IT, the reduction of greenhouse gas emissions can be achieved (Sobotta, 2009). Green IT addresses many environmental challenges such as:

- efficiency,

- recycling,

- reduction of toxic compounds,

- effective management systems (Berthon et al, 2010).

If we maintain business as usual, we can expect that CO2 emissions from information technologies will continue to rise from .53 billion tons of CO2 (in 2002) to 1.43 billion tons of CO2 by 2020 (The Climate Group, 2008). IT continues to play a vital role in the growth of the global economy (The Climate Group, 2008). As an organizations' reliance on IT continues to grow, so will the carbon emissions that ultimately create the carbon footprint (The Climate Group, 2008). The challenge facing many organizations is identifying ways to mitigate IT carbon emissions while continuing to provide profits to shareholders and maintaining the quality of goods and services that are provided to customers (The Climate Group, 2008).

The increase of IT energy consumption has negative implications to the organization:

- increased demand of electricity,

- increased energy costs for business,

- increased greenhouse gases from electricity generation, and

- increased capital costs for expansion or construction of a new data center (Sobotta, 2009).

The data center. Sobotta (2009) describes the implementation of Green IT in an organization as lowering energy costs by implementing technical measures. The mitigation of energy issues can be handled by providing better power management equipment, more efficient power usage of servers, virtualization of servers, and more efficient power and cooling management in data centers (Sobotta, 2009). This section identifies technical measures to create

opportunities to reduce carbon emissions and IT costs by improving data center utilization and enhancing computing performance.

The main purpose of a data center is running the applications that handle the core business and operational data of the organization (Da Silva, 2009). There are huge opportunities for data center energy savings (Greening IT, 2009). Muirhead (2006) states "a moderate size server in a data center of a large financial services organization has about the same annual carbon footprint as a gas-guzzling family SUV getting 15 miles-to-the-gallon" (p. 32). More energy is consumed per square meter in the data center than any other part of an office building (Greening IT, 2009). Data centers continue to consume more and more power (Da Silva, 2009). As the power consumption increases, so does the carbon footprint created by data centers (Da Silva, 2009). EMC's Director of Data Center Operations and Global Infrastructure Support indicated that EMC is experiencing an annual data center increase of 70% (Pepper, 2008).

The carbon emissions from data centers are alarmingly close to the emissions of the airline industry and steel plants (Greening IT, 2009). Greening IT (2009) also comments that "by 2020 their consumption of energy - and output of GHGs - is expected to be higher than air travel" (p. 150). High data center energy consumption is not only due to the fact they are turned on 24 hours a day, seven days a week, but also because they generate a lot of heat and require massive cooling systems in order for the data center to remain operational (Greening IT, 2009). Data centers need to be more energy efficient and environmentally friendly. The Climate Group (2008) believes "the world will be using 122 million servers in 2020, up from 18 million today" (p. 21).

Sobotta (2009) states "as of 2006, the electricity usage attributable to servers and data

centers in the United States was estimated at about 61 billion kilo-watt hours" (p. 32). This amount of electricity output is similar to the amount used by the entire U.S. transportation manufacturing industry (Sobotta, 2009). With the cost of oil estimated to increase and stay above $50 a barrel, the costs associated with supplying electricity to data centers will increase as well (Muirhead, 2006).

In an effort to reduce electricity consumption and ultimately reducing carbon emissions, i/o Data Centers (a US-based IT infrastructure provider) utilizes a massive array of solar panels on the roof of the data center to attempt to increase energy efficiency (Greening IT, 2009). The thousands of i/o Data Center servers are powered in part by the 11-acre solar panel roof that generates 4.5 MW of electricity (Greening IT, 2009).

According to Muirhead (2006), in 2005 43 companies saved $11.6 billion by reducing greenhouse gases and adopting energy efficiency measures. Of the 43 companies, four (Bayer, BT, DuPont and Norske Canada) were able to achieved "absolute GHG emissions reductions of more than 60 percent while saving $4 billion in energy costs" (The Climate Group, 2006, p. 29). Of the same 43 companies, 21 of those companies achieved GHG reductions of 25%. One of the 21 companies is Johnson & Johnson who reduced its CO2 emissions by 22% largely due to energy efficiency measures, while increasing annual revenues by 27% (The Climate Group, 2006).

Virtualization. In recent years, the growth of power demand has continued to rise (Da Silva, 2009). From 2006 to 2010, the United States went from 60 billion kilowatt hours to an estimated 110 billion kilowatt hours (Da Silva, 2009). Wenzel (2008) states "data center energy use could double by 2011, amounting to $7.4 billion in U.S. electricity costs and requiring the equivalent of 10 new power plants, according to the Environmental Protection Agency" (p. 1).

Due to this increase, many companies are looking to build new data centers (Da Silva, 2009). Virtualization, consolidation and using blade servers have slowed this trend somewhat, but data centers continue to run out of power capacity (Da Silva, 2009).

Virtualization is described by Bruce Tyson (2010) as a consolidation of server resources that "…creates a single platform from which multiple servers can run" (p. 1). Virtual servers run independently of the host's operating system, allowing multiple systems to access hardware resources. Utilizing virtualization can help an organization reduce emissions by 27% (The Climate Group, 2008). Because servers can be administered in bulk from a remote console, IT staffing can be significantly curtailed while improving support services across the enterprise. "Virtualization results in more (three times more) users per server and per server administrator" (Gillen, Grieser & Perry, 2008, p. 4).

Gillen, Grieser & Perry (2008) state "the number of potential users per system administrator jumps from 2,400 to over 11,000" (p.4) by utilizing virtualization. Because virtualization can support more users per server, fewer servers are needed to maintain operations (Tyson, 2010). With fewer servers needed to support users, the unused servers can be shut down and the power they consume can be saved (Da Silva, 2009). Furthermore, since virtualization servers posses many power efficiency benefits they consume less power and in turn, emit less carbon (Sobotta, 2009).

Using virtualization, huge energy savings and increases in productivity can be realized for little or no additional energy consumption (The Climate Group, 2008). Discovery Communications LLC (the entertainment company known for cable TV networks Discovery Channel, TLC and Animal Planet) reduced its server count from 850 to 535 physical machines by implementing virtualization (Mitchell, 2008). Utilizing virtualization and other high

efficiency equipment, such as sealed server racks, hot aisle/cold aisle design, and high efficiency chillers, Discovery has already experienced 20% in energy savings since re-engineering the data center (Mitchell, 2008). By utilizing virtualization, Austin Energy is running 600 servers on 150 physical machines (King, 2008). Austin Energy CIO Andres Carvallo states "This translates to 40% energy savings" (King, 2008, p. 5).

Cloud computing. Cloud computing can significantly reduce carbon emissions both directly and indirectly (Sobotta, 2009). Cloud computing offers a scalable infrastructure and software off site that translates into a saving labor, hardware, and power costs (Tyson, 2010). The amount of carbon emissions is reduced due to fewer hardware components present at an organization's physical office (Sobotta, 2009). Cloud computing also has an indirect impact on the reduction of carbon emissions. The indirect impact of cloud computing as it relates to the reduction of carbon emissions is that cloud computing allows businesses to focus more on "core business rather needing to dedicate so many resources to running their IT infrastructure and services" (Sobotta, 2009, p. 85).

Power management. Sustainable 'green IT' initiatives began in 1992 when the U.S. Government implemented the ENERGY STAR initiative (Greening IT, 2009). This voluntary labeling system recognized electronic products such as energy-efficient monitors, cooling equipment and other technologies (Greening IT, 2009). This government initiative led to the adoption of 'sleep mode' after a designated period of inactivity (Greening IT, 2009).

ENERGY STAR is the product of a joint program between the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE). Ultimately, this partnership helps individual consumers and businesses save money and protect the environment

through energy efficient products and practices ("About energy star," 2010). The ENERGY

STAR website states the following:

"Through its partnerships with more than 17,000 private and public sector organizations,

ENERGY STAR delivers the technical information and tools that organizations and consumers

need to choose energy-efficient solutions and best management practices. ENERGY STAR has

successfully delivered energy and cost savings across the country, saving businesses,

organizations, and consumers about $17 billion in 2009 alone. Over the past decade, ENERGY

STAR has been a driving force behind the more widespread use of such technological

innovations as efficient fluorescent lighting, power management systems for office equipment,

and low standby energy use."("About energy star," 2010)

The EPA reports that "power management is important to saving energy, especially since

computers are often in use more hours per day than they used to be" ("Computers for

consumers," 2010). ENERGY STAR reports that if every U.S. purchased home office product

earned the ENERGY STAR, we would:

- "Save more than $75 million in annual energy costs",

- "Prevent 1 billion pounds of greenhouse gases, equivalent to emissions from
  90,000 cars",

- "Save 700 million kWh of electricity" ("Computers for consumers," 2010, p. 1)

Marriott is an example of an organization that is being a good steward of the environment

by utilizing ENERGY STAR devices. By replacing older printers with more-efficient ENERGY

STAR devices, Marriott helped to reduce its annual carbon footprint by 36 tons (Hoffman,

2008). A Hummer driven 60,000 miles a year produces roughly the same amount of carbon

dioxide into the atmosphere as 36 tons of carbon emissions (Hoffman, 2008).

Roughly 850 million PCs are turned on every single day (Lower the environmental impact of computing, 2008). CUTCO saves an estimated $41,000 annually, simply from implementing computer power management. Power management does not only reduce the energy used for desktop PCs. A single PC has the ability to generate more heat than a 100 watt light bulb (Lower the environmental impact of computing, 2008). In a classroom environment, this heat can cause air conditioners to run continuously, raise electricity costs, and potential require the investment in larger air conditioning units (Lower the environmental impact of computing, 2008).

E-waste. Electronic waste (e-waste) is a growing problem throughout the world and is steadily becoming larger (Lower the environmental impact of computing, 2008). Generally speaking, when people think of toxic waste, they do not think of PCs. E-waste may represent only 2% of trash landfill, e-waste does represent 80% of the toxic waste in those same landfills (Lower the environmental impact of computing, 2008). Recycling paper is not the only type of recycling. Electronic components can also be recycled.

Technocratic efficiency refers to "doing more with less, reducing and reusing waste and minimizing the impact that technology has on the environment" (Berthon et al., 2010, p. 18). As new 'cleaner' technology is introduced in the markets place, the disposal of old IT equipment is quickly becoming a large environmental issue (Berthon et al., 2010). These IT components, such as PCs, monitors, and modems contain toxic materials and end up in landfills when they could have been recycled (Berthon et al., 2010).

Products such as computers, monitors, printers and mobile phones are also not being recycled. Over "…80% of electronic equipment ends up in landfills as toxic waste, taking up space and leaking mercury and lead into the soil and water supply" (Kaestner, 2009, p. 19).

Some 20-50 million tons of "e-waste" is produced each year, most of which ends up in the

developing world (Business, 2006). These figures are only poised to grow unless businesses

implement more efficient technologies and robust recycling policies (Kaestner, 2009). Based on

the figures above, the assumption underlying this study is that more energy efficient technology

and organizational recycling initiatives can help to reduce the carbon dioxide release and wasted

products in corporate America.

Marriott International Inc. (a global lodging company) initiated their green practices in

2005 (Hoffman, 2008). Marriott has "become environmentally sound in the disposal of IT

assets" (Hoffman, 2008, p. 1). In 2005, Marriott contracted with Intechra LLC. (an asset

disposition company) and has since recycled more than 18,000 printers, monitors, peripherals

and other systems (Hoffman, 2008). According to Hoffman (2008) "that represents nearly 200

tons of plastics, transistors and other materials that didn't end up in landfills" (Hoffman, 2008, p.

1).

Conclusion

Organizations are starting to "get the message…Carbon Down, Profits Up" (Muirhead, 2006, p. 31). The recognition that business activity has a "wide range of impacts on the communities within which they operate" is becoming more prevalent (Harizan & Siwar, 2006, p. 1). Organizations are beginning to expand their sustainability focus from financial results to include both social and environmental outcomes (Taylor, 2006). This concept of "consideration of, and response to, issues beyond the narrow economic, technical and legal requirements of the firm… (to) accomplish social benefits along with the traditional economic gains which the firms seeks" is referred to as *corporate social responsibility* (CSR) (Husted, 2003, p. 482).

McCombs School research found that positive CSR practices benefit a company by adding value to the relationships with customers, employees, shareholders, and other firms (Taylor, 2006). By accepting CSR, suppliers, business associates, and customers have more confidence in the organization and therefore, increase sales and lead to profit maximization. CSR not only strengthens the company's image with the surrounding community, but also with its own employees (Taylor, 2006). Alternatively, lack of CSR practices can lead to loss of revenue and damaged reputations (Phillips, 2006).

CSR needs to become more of a strategic initiative within an organization (Taylor, 2006). CSR begins with developing and engaging an organization's employees and integrating CSR into the sustainability business model (Laff, 2009). CSR helps to strengthen an organization's sustainability business model, also known as *the triple bottom line (3BL)*, by refocusing actions, such as carbon footprint reduction, to ensure they address the needs of all stakeholders, community, environment, employees, customers, and suppliers (Taylor, 2006). As noted by Gable and Shireman (2005), 3BL "…aims to align the interests of the economy, society, and

environment so that any action that benefits one, benefits the others" (p. 1). Green business

(2010) describes the triple bottom line (3BL) as: "People, Planet, and Profit" (p. 1). The key is in

the term "and". The triple bottom line recognizes the interdependence among all three

components (GreenLivingTips, 2010). Triple bottom line success is measured "in profits -and-

environmental stewardship -and- social responsibility" (GreenLivingTips, 2010, p. 4), not profits

at the expense of the environment, or the community at the expense of profits.

The green IT and green business practices identified in this study should be incorporated

into an organization's triple bottom line business model as CSR carbon footprint reduction

practices. Mitigating the carbon footprint by properly implementing CSR practices can help

organizations achieve the triple bottom line (The Climate Group, 2008). By engaging in one or

more of the carbon footprint reduction activities described in this study, each of these 3BL

components has a direct impact on an organization's ability to reduce the size of their carbon

footprint. Tables 1 and 2 below present business and IT activities that can be implemented to

reduce the carbon footprint. Activities are presented in relation to the 3BL categories that are

impacted. The tables can be used by an IT department as a strategic guide to identify both green

business activities and green technology to:

- achieve reduction in carbon footprint, and
- achieve successful 3BL.

The tables specifically address the modifications that can be made within a mid-sized service

organization related to business and technology. The modifications are grouped by Modification

Area (green computing and green business). Each modification area is comprised of sub-

categories (i.e. Modification Area: *Green Computing*, Sub-Category: *Telecommuting*) Each Sub-

Category is accompanied with potential modifications and results that help the audience visualize

this topic. The sub-category impacts in relation to 3BL (shareholder, Environment, and Society) are identified as well.

Table 1

Summary of green computing modifications and related 3BL categories

Modification Area	Sub-Category	Proposed Modification	Potential Results	3BL Framework		
				Society (People)	Environment (Planet)	Shareholder (Profit)
Green Computing	Data Centers	Use alternate source of energy	Increase energy efficiency, reduce carbon footprint		X	X
	Virtualization	Transition physical servers to virtual servers	Increase energy efficiency, reduce carbon footprint, reduce physical servers	X	X	X
	Cloud Computing	Transition physical servers to virtual servers	Reduce energy usage, reduce carbon footprint, reduce hardware components	X	X	X
	Power Management	Use ENERGY STAR devices	Reduce excess energy usage, Reduce carbon footprint	X	X	X
	E-Waste	Reuse or properly recycle hardware components	Reduce toxic waste in landfills	X	X	

Table 2

Summary of green business modifications and related 3BL categories

Modification Area	Sub-Category	Proposed Modification	Potential Results	3BL Framework		
				Society (People)	Environment (Planet)	Shareholder (Profit)
Green Business Practices	Dematerialization	Utilize video conferencing	Reduce carbon footprint through reduced travel	X	X	
	Telecommuting	Work from home	Reduce carbon emissions through reduced travel	X	X	
	Office Maintenance	Turn off PC's and Printers after hours	Decrease energy use, reduce carbon footprint		X	X
		Turn off office lights after hours	Decrease energy use, reduce carbon footprint		X	X
		Use energy efficient lighting	Increase energy efficiency, reduce excessive heat		X	X
		Adjust printer setting to two-sided	Reduce paper usage, reduce recycling needs		X	X
	Recycling	Provide paper reciprocals	Reduce landfill waste, Reduce carbon footprint	X	X	
	Employee Involvement	Educate employees through training and green business activities	Recycling will become habit outside of workplace, generate a sense of pride with organization	X	X	

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