

Sustainability - is it for the CIO?

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Abstract

This article addresses the significant role that the Chief Information Officer (CIO) can play in improving the sustainability of the planet. Information Technology is a primary contributor to a company's environmental footprint, but if managed the right way can provide solutions that help reduce the environmental footprint of a company, as well as reduce costs. This can be done through the use of green technologies and methods that allow corporations to assess, manage, and reduce their energy use, water use, and production of e-waste.

Introduction

The term 'sustainability' has many definitions. The most popularly accepted definition of sustainable development is 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland, 1987). This definition was coined by the Brundtland Commission, which was set up by the United Nations in 1983 and headed by the Norwegian Prime Minister Gro Harlem Brundtland. The commission studied environmental and economic issues and compiled their findings in a report which was published in 1987 as 'Our Common Futures' (Brundtland, 1987).

In 2007 the 45th Vice President of the United States, Albert Arnold (Al) Gore Jr., and the Intergovernmental Panel on Climate Change (IPCC) were awarded the Nobel Peace Prize. They warned that if not confronted, climate change had the potential to contribute to conflicts and wars over diminishing resources such as food and water (Gore, 2006). Their work succeeded in ingraining the concept of environmental sustainability in the public's mind, and stimulated action to make necessary changes. One example of the increased awareness and understanding of the need for sustainability is shown in the findings of a survey sponsored by IBM (IBM News: Press Releases, Dec 13 2007) of 100 utility executives and 1,900 household and small businesses in six countries. The survey found that about two-thirds of the surveyed utility customers would like to use renewable power if they had the choice. Another survey of companies in the United States and Europe reported that 70 percent of respondents currently had some sort of environmental initiatives (Prior and Montgomery, Mar 2 2007). Individuals, corporations, and nations are beginning to understand the seriousness of the impact of global

warming, and the consequences to the planet if laws and lifestyles are not changed. Gartner's John Mahoney (Gartner Press Release, Dec 7 2006) calls climate change a 'strategic discontinuity' which needs to be addressed.

In the 2006 documentary film 'An Inconvenient Truth' directed by Davis Guggenheim, and corresponding book *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, Al Gore says, "Our new technologies, combined with our numbers, have made us, collectively, a force of nature" (Gore, 2006). The extensive use of information technologies (IT) is playing a significant role in impacting the planet. Yet IT is also a set of tools that can help make the planet more sustainable if manufactured, managed, used, and disposed of in an appropriate manner so that damage to the environment is minimized (Walsh, 2009). Weitzman (1997) also shows a link between sustainability and national income when there is technological progress.

This article aims to address the role IT can play for corporations in improving the sustainability of the planet, and the crucial role the Chief Information Officer (CIO) will play as the executive charged with making technology decisions in a company. In addition to literature research, references are also made to talks given by executives at the 5th annual University of California Los Angeles (UCLA) CIO Impacts Forum special session on Green Technologies leading to Green Business held on February 27, 2008.

The article begins by discussing one measurement of sustainability using the environmental footprint, and the increases in the size of the environmental footprints in corporations due to IT use. The article will then discuss how IT dependent resources and activities selected by the CIO can help reduce a corporation's environmental footprint. Corporations can reduce their environmental footprint even further with green buildings, which use IT to monitor and control energy consumption. The article concludes with a discussion on why the CIO is becoming a primary stakeholder in improving the environmental footprint of the firm, and hence the sustainability of the planet.

Environmental Footprint

Sustainability is often measured using the environmental footprint. Wackernagel and Rees (1996) define the environmental footprint, also referred to as the ecological footprint, as the land or water required to support the production habits of an entity (person, product, activity or service). Next American City, a national quarterly magazine about making cities better, similarly defines the environmental footprint as the environmental impact an entity makes as it performs an activity. In this article, the environmental footprint is discussed in terms of (i) energy consumption (ii) water consumption and (iii) waste disposal.

There are many scales of environmental footprints starting at the individual, and increasing in size with corporate footprints, and even national and international

footprints. Individuals generate an environmental footprint through their daily activities and the choices they make, which extend to all aspects of their lives including food, health and beauty products, water and energy use, and waste disposal. Nations also generate environmental footprints, which are influenced by the policies established and laws enforced by governments. Countries whose laws provide incentives and penalties to individuals and corporations that promote the conservation of energy and water and the reduction and safe handling of waste will have smaller environmental footprints than those that do not have such laws. In his blog, Koorosh Zahrai (April 21, 2009) calls for world economies to use measures called the 'Gross Social Gain' (GSG) and 'Gross Social Product' (GSP) rather than the Gross National Product (GNP) as they would measure social benefits to society and help curb negative effects on the environment.

While individuals make lifestyle changes and nations follow the policies and laws created by their governments to reduce their respective environmental footprints, corporations can possibly play the most significant role in improving the sustainability of the planet (corporate social responsibility is discussed in McGee, 1998). Corporate sustainability has been defined as 'the activities, generating the inclusion of the social and environmental aspects in the normal business aspects of a company and its interaction with its stakeholders' (Caldelli and Parmigiani, 2004). This definition includes economic, social and environmental factors. This is supported by the large investments being made in technology for sustainability, according to John Babcock.¹ Although Babcock sees these large investments as a bubble, he expects the impacts of IT for sustainability to be large, and as an industry to continue to grow. Investments are also being made for the greening of entire industries such as the Green Chemistry initiative, the Book Industry Environmental Council, and programs and university centers such as the Leaders in Sustainability at UCLA Anderson School of Management and Golisano Institute for Sustainability at the Rochester Institute of Technology.

Corporations have become heavy users of information technology. The availability of information technologies such as the internet, email, and mobile phones has made it easy to access information and to communicate, resulting in paper and emission savings. Yet data centers with their related infrastructure have become heavy users of energy and water, and generate significant amounts of difficult to dispose of waste.

A study on data centers (Lorenz, Nov 2007) published by the Environmental Protection Agency (EPA) found that data centers consumed 1.5 percent of the total power generated in the United States in 2006. They consume about 61 billion kilowatt hours (kWh) per year, which is approximately the power consumed by almost 6 million households. Even more disturbing however, is the increasing trend for power consumption. According to InformationWeek's McGee (Feb 15 2007), energy consumption for data center servers and the related infrastructure in the US and worldwide doubled between 2000 and 2005. Given the current trends, the consumption

¹ John Babcock is a partner at Rustic Canyon Group and chaired the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

is predicted to double again by 2011 (Snyder, Jan 2008), making the increase in consumption fourfold in 11 years.

Data centers and their related infrastructures use 20-100 watts of energy per square foot, with newer, more powerful servers consuming up to as much as 400 watts per square foot. Server and other IT equipment consume about three-quarters of this energy, and the remaining one-quarter is used for the operation of mechanical and electrical systems that operate the lights and cool the IT equipment (Gray, Sep 2005).

Today, technologies are becoming available that give corporations the ability to assess, manage, and reduce their energy and water consumption as well as manage the waste they generate. As the head of IT in a company, the CIO can play a vital role in reducing the company's environmental footprint and hence increasing the sustainability of the planet. This is supported in a list of Gartner's top challenges for CEOs in 2009 (Gartner Press Release, Mar 19 2009), according to which sustainability will remain a top priority for the CEO. This will result in the CIO playing an important role as they review policies and practices that fit in with the company's needs to satisfy environmental concerns before making technology decisions, which play a significant role in the company's environmental footprint. The CIO's decisions have companywide impact because all business processes in corporations today are driven by an IT system. In his Computerworld blog, Mark Hall (Jul 23 2008) calls the CIO the best fit for the role of 'Carbon Information Manager', an emerging role charged with the responsibility of measuring and reducing the company's environmental footprint.

The CIO can impact the corporation's environmental footprint by picking the right (i) resources, and (ii) activities/operations. These are discussed in detail below.

Resources

Resources selected by the CIO can play a significant role in the environmental footprint of the company. Resources include (i) IT purchased, and (ii) energy purchased. Based on the CIO's decision, a company's IT could have products that are energy efficient, and the company could be using energy from sources that are renewable.

IT Purchased

One decision the CIO can make is to purchase IT equipment (desktops, laptops, servers, etc.) that is energy efficient, meaning the equipment consumes less energy to get the same level of energy service. The EPA backs a program called Energy Star to identify products that consume less energy, save money, and help save the environment. Companies such as Hewlett Packard and Dell already offer such equipment. Laptops that have a drive made of flash memory similar to a USB thumb drive, which consume less energy, instead of the traditional hard drive are an example.

Another example are LED lights in displays, which also have the potential of consuming less energy.

Energy Purchased

Another decision the CIO can make is to find ways to reduce IT's, and hence the company's, energy consumption. With the use of IT, energy consumed or energy intensity per square foot in a company has increased significantly. Findings from a survey conducted in the US and Europe by AMR Research (Prior and Montgomery, Mar 2 2007) found that most companies were focusing on reducing their energy consumption because of the dual payoffs of reduced operating costs and reduced environmental footprint. This can be done by evaluating the resources used to generate energy at the company's energy provider. Traditionally, cheap fossil fuels such as coal, oil, and natural gas have been used for energy generation. However, not only are these resources limited, using them for energy generation also affects the sustainability of the planet.

Today, energy can be generated using renewable energy resources such as wind, solar, hydropower, biomass, hydrogen, geothermal and ocean, all of which offer clean alternatives to fossil fuels according to Randy Howard.² Energy generated using renewable resources produces little to no pollution or greenhouse gases, and is much less likely to run out. Although energy generated using renewable resources currently has infrastructural difficulties such as requiring large open spaces for generation, higher costs, voltage variation, and intermittent power, technologies such as grid-connected solar photovoltaic (PV) (US Department of Energy: Solar Energy Technologies Program) are becoming available to address these problems. The cost of energy produced using renewables will go down as technologies and processes improve, and consumption increases.

Activities/Operations

Like resources, the IT related activities and operations selected by the CIO also impact the environmental footprint of the company. Activities are steps that can be taken to reduce energy and water consumption, to manage energy, and to dispose of waste responsibly. These are supported by findings from a survey of IT executives (Oliver Wyman for Network Appliance, Dec 2007), which found that utility costs in a company can be as high as 30 percent of the company's total IT budget. The top contenders for utility costs are data center space (more equipment is added to the same data center space, thereby increasing the energy and water consumption for the same space), energy consumption, and water consumption for heating and cooling. Although not as often sighted, printers and copiers also use large users of utilities (PR Newswire, Mar

² Randy Howard is the Assistant General Manager with Los Angeles Department of Water and Power and was a speaker in the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

17 2009). The mitigation of activities by the CIO can impact the environmental footprint of the company. To reduce the company's environmental footprint, the CIO will need to reduce the energy and water (and therefore energy) consumed by IT. The CIO will also need to manage energy in the organization and ensure safe disposal of waste (equipment or e-waste). These are discussed in detail below.

Energy Consumption and Management

The CIO needs to manage the energy the corporation consumes on a regular basis. An executive from a utility company who spoke at the Green Technologies leading to Green Business forum at UCLA's CIO Impacts Forum believes that technologies such as digital or 'smart' meters can help companies manage their energy consumption. Although these technologies have an associated upfront cost, they can provide usage information in greater detail, and communicate that information to the energy generation company for better monitoring and billing purposes. In a recent article, the Los Angeles Times (April 20, 2008) reported that Southern California Edison, San Diego Gas and Electric, and Pacific Gas and Electric utility companies are planning to install digital meters at consumer sites.

Another technology, the smart grid, can also help the CIO reduce the company's energy costs. The smart grid is able to provide real-time usage and cost information to companies allowing them to plan their energy consumption. For instance, if a CIO finds that energy is cheaper at certain times of the day either due to lower usage or energy from renewable sources being available during those times, the CIO may decide to conduct certain tasks during those hours. In the near future, a new generation of appliances could become available that will be programmed to automatically pick times when energy prices are lower, or when renewable energy such as wind or solar power is more plentiful. In fact, with a true smart grid, companies can generate their own needed energy using renewables or back-up power systems, and sell any surplus back to the grid during peak demand times. Companies would be able to save money with smart grids and help in improving the sustainability of the planet.

Reducing the consumption of energy is also a necessary step for the CIO. Data centers are among the largest consumers of energy in the company. It is therefore important for the CIO to assess the company's energy needs before making purchasing decisions. New servers manufactured by companies such as Dell and Sun, as well as desktops, notebooks, and other IT equipment that is energy efficient is becoming available to the CIO. Technologies such as virtualization and server consolidation can also reduce the energy consumed. The higher cost of these technologies can be offset by the cost savings in energy consumption (Shankland, Dec 4 2006).

Water Consumption

IT use has caused corporations to become heavy users of water, which is mainly utilized in the cooling of data centers. Assessing the company's energy consumption will also

help the CIO understand how to reduce water consumption. Saving water can result in significant savings in energy and costs.

Technologies such as airside and waterside economizers are available for assessing and monitoring water usage. Economizers and slush piles are also available for data center cooling. In addition, some newer servers use innovative methods for cooling such as built-in muffin fans and pumps, resulting in reduced water consumption. Usage of DC power in data centers is another method of reducing energy and water consumption (Stansberry, Mar 26 2007). A company's water consumption can also be reduced by reusing highly treated waste water for data center cooling and other needs in an IT intense corporate environment.

Safe Disposal of e-waste

Safe disposal of IT equipment including e-waste such as computers, laptops, and cartridges is another important charter of the CIO in reducing the company's environmental footprint. This is especially important today when IT equipment has a short life span.

E-waste should not be thrown into the trash, thereby ending up in a landfill where toxic substances from the equipment may seep into water sources. If not disposed of properly, e-waste may also be sent to developing nations, where the equipment may be disassembled by untrained workers without proper equipment, exposing them to toxic metals like mercury, cadmium, and lead. Many hardware manufacturers such as Dell, Sony, Toshiba, HP, and Apple offer take-back programs to ensure safe disposal of e-waste. Staples, Walmart, and other retailers also offer similar programs. E-waste disposal can also be handled by third parties. The US EPA offers guidelines for safe disposal on their website.

In spite of these options, in 2006 e-waste accounted for 18 billion pounds of electronic trash worldwide, but only about 2 percent of it could be recovered. As the head of IT, it is the CIO's responsibility to ensure that e-waste is handled properly at the end of its lifecycle.

Green Buildings

The previous section discussed ways in which the CIO can make decisions and perform activities that reduce the environmental footprint of the company. This section discusses the elevated charter of the CIO, who is being given the responsibility to design, create and manage entire buildings that are 'green'. According to Paul Marcoux³, companies such as Cisco are taking bigger steps towards reducing the company's environmental footprint by building smart buildings. Smart buildings use advances in technology to

³ Paul Marcoux is the Vice President of Green Engineering at Cisco Systems, and was a speaker in the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

reduce a company's energy consumption, thereby saving the company money in the long run (Waltner, Jul 21 2008).

A smart building is able to monitor and regulate variables such as heating and air conditioning. It can also oversee building functions such as security, fire suppression, and elevator operations using advanced information technologies. Monitoring these functions saves energy because heating, cooling, and lights are turned on only when required, and only in locations that are being used. Although upfront costs of such buildings are high, the costs of operating them are minimal, thereby resulting in cost and energy savings. With 70 percent of the energy consumption in the US by residential and commercial buildings according to reports from the US Department of Energy (Waltner, Jul 21 2008), green or smart buildings can contribute significantly to improving the sustainability of the planet. Programs such as the Leadership in Energy and Environmental Design (LEED) program will increase the pace of adoption of green buildings.

Conclusions

Based on research and talks presented by various speakers in the Green Technologies leading to Green Business session of UCLA's 5th CIO Impacts Forums, today's CIO is playing an important role in the environmental footprint of the company, and the sustainability of the planet. Companies are using their business intelligence to understand their company's environmental footprint (Vizard, Mar 20 2008), and the many CIOs are being forced to look into reducing their company's environmental footprint by lowering the cost of running the data center. Options ranging from improving the water and air-cooling in the data center, to moving the entire data center to another country or location that has better access to low-cost power, to enterprise-wide software risk determination and upgrades are being explored. Although each company will be making its own sustainability decision, it is becoming clear that the role of the CIO is expanding to include involvement in the company's sustainability. Teri Takai, CIO of the State of California, says, "I believe that the CIO should take a leadership role in ensuring that [everything IT is] green". The state of Virginia also agreed with the Secretary of Technology Aneesh Chopra when he said, "the CIO is an important stakeholder for states that plan to lead by example in lowering our energy footprint". Richard Varn, CIO of San Antonio and a senior fellow with the Center for Digital Government, also believes that "We don't make green technologies; we may make them more useful".

Although corporations are now aware of sustainability and many have hired their own Sustainability Officers, sustainability needs to become part of the corporate culture. According to Tom Cooper⁴, this is the case at Kaiser Permanente, and the incentives need to be economic as well as focused towards improving the company's sustainability.

⁴ Tom Cooper is National Manager of Sustainable Design and Research at Kaiser Permanente, and was a speaker in the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

Peter Arbitter⁵ also believes that solutions with a cradle-to-cradle approach that increase the efficiency of the IT infrastructure and decouple economic growth from environmental degradation are needed.

Cost however continues to be a major barrier according to Daniel Fleischer, senior research analyst at IDC (Sturgeon, Dec 22 2006). A cost benefit analysis should be conducted to understand how the company can save money and improve its environmental footprint (Sturgeon, Dec 22 2006), with the CIO playing a key role. The CIO could be involved in the following tasks in improving the environmental footprint of the company:

- Work with the Sustainability Officer in the company to ensure the IT used in the company is environmentally friendly
- Evaluate the sustainability of IT used in the company and make IT purchase and usage decisions based on the evaluation
- Work with the company's business executives to convince them that investing in information technology for improving sustainability will
 - result in saving money in the long run,
 - result in intangible/holistic benefits such as employee productivity and health,
 - and result in a better image for the company, which will in turn bring in new customers and result in higher customer retention

Charles Corbett⁶ referred to corporations' role in improving the sustainability of the planet by studying environmental performance and financial performance. In his presentation he referred to research that found a strong link between environmentally friendly firms and better financially performing firms.

According to Forrester Research (Mines, 2007), business executives will eventually believe in sustainability as a better way to do business, and as a necessity due to company stakeholder demand. Because of the significant role of IT in increasing a company's environmental footprint and its role in providing solutions to reduce the company's environmental footprint, the CIO will play a major role in sustainability in the company as well as the planet in the future.

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⁵ Peter Arbitter is the Senior Vice President of Portfolio and Technology Management at Siemens IT Solutions and Services, and was a speaker in the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

⁶ Charles Corbett is a Professor and Joseph J. Jacobs Term Chair in Entrepreneurial Studies at UCLA Anderson School of Management, and was a speaker in the session on Green Technologies leading to Green Business at UCLA's CIO Impacts Forum.

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