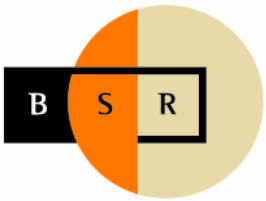

Business for Social Responsibility

Software Accelerates Sustainable Development

Prepared
August 2008

About BSR: A leader in corporate responsibility since 1992, Business for Social Responsibility (BSR) works with its global network of more than 250 member companies to develop sustainable business strategies and solutions through consulting, research, and cross-sector collaboration. With six offices in Asia, Europe and North America, BSR leverages its expertise in environment, human rights, economic development, and transparency and accountability to guide global companies toward creating a just and sustainable world. Visit www.bsr.org for more information.

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Prepared August 2008

About This Report

In 2007, Business for Social Responsibility launched with its members a work stream to identify and prioritize corporate responsibility issues for the software sector and to identify positive contributions that the sector's products and services can make to sustainability. The companies in the Software Working Group — currently Adobe, Autodesk, HP, McAfee, Microsoft, SAP and Symantec — are committed to working together to understand and meet society's expectations for a responsible software sector, and to developing products and services that enable sustainability. The group continues to engage stakeholders and invites you to join the discussion.

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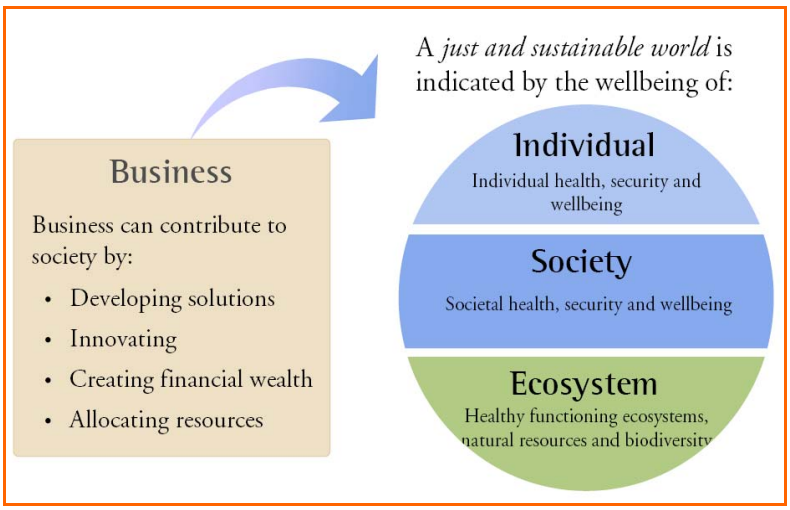
i. Preface

Our global society is dependent on information and communications technology (ICT) networks. Commonplace tasks, such as placing a phone call, making airline reservations or banking via the Internet are all built upon extensive flows of information and supported by vast ICT infrastructures. In many ways, software and ICT hardware are the key elements of the infrastructure that enables modern life.

As a result of the growing awareness of interrelated impacts of business and ICT on society, software companies are taking a closer look at their operations to ensure that they are meeting expectations for corporate responsibility. However, models and methodologies for corporate responsibility that have been developed by other industries are not 100 percent transferable to the software industry. For example, efforts in the apparel industry have focused on supply chain, labor and environmental standards, and the oil and gas industry has made health and safety, energy security and climate change issues their top priorities. Although these issues are important to manage for a variety of reasons, they are not necessarily the most important issues for the software industry.

While corporate social responsibility (CSR) has been increasingly well defined in other sectors of the economy, its meaning for the software industry is still taking shape. Through conversations with leaders in the industry, BSR has come to understand that while core issues of ethics, employee engagement and environmental impacts must be and are being addressed, there is an imperative to take a broader view of what corporate responsibility means for the software industry. To do otherwise would miss an opportunity for the industry to contribute to broad societal transformation toward sustainable development.

Figure 1: Corporate Social Responsibility Framework



Source: Business for Social Responsibility

In 2007, BSR launched an innovative project to define corporate responsibility priorities for the software sector and to identify positive contributions that the sector's products and

services can make to sustainability. The companies in the Software Working Group — currently Adobe, Autodesk, HP, McAfee, Microsoft, SAP and Symantec — are committed to working together to understand and meet society's expectations for a responsible software sector, and to developing products and services that enable sustainability. The group continues to reach out to a broad range of key stakeholders and invite them to join the discussion.

Based on the Software Working Group's materiality analysis, the following issues rose to the fore:

- Innovation and Software Solutions to Achieve Sustainable Development
- Governance, Ethics, Compliance and Transparency
- Global Workforce Management and Employee Engagement
- Access, Privacy and Security
- Environment – particularly, Energy Management and Climate Change

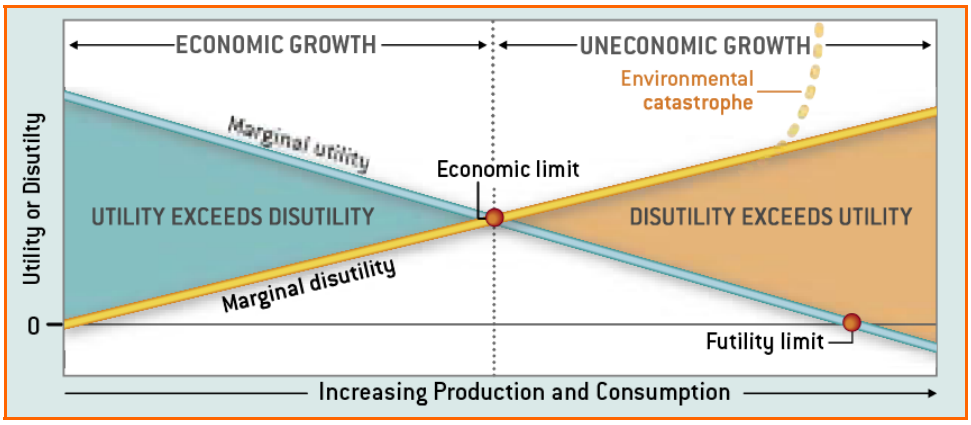
These are extremely complex issues that cannot be addressed solely by the software sector or by the business community acting in isolation. A comprehensive, multi-pronged approach that involves stakeholders from the government, business and civil society sectors is needed to be successful. This paper is a first step in defining the challenge and potential contribution that software can make in order to enable collaborative action.

However, enthusiasm for the possibilities created by software should be tempered by the realization that all technologies have potentially beneficial and detrimental applications. There are undoubtedly risks associated with the unethical use of software, such as limits to privacy and free expression. Although we deliberately focus this paper on value creation and the identification of opportunities for software to make a positive contribution to sustainable development, we acknowledge that there are potential new challenges as well.

Section I of this paper discusses the most pressing challenges to sustainable development. For our purposes, sustainable development is economic activity that increases human well-being while preserving the capacity of the environment to support future generations.[1] This definition encompasses several priorities, including equitable income distribution, ensuring access to healthcare and education, stewardship of natural resource inputs and the capacity of the environment to absorb wastes, and creating responsive governance that enables the above stated priorities. This vision of sustainable development is substantially different from current patterns of economic growth.

[1] Definition adapted from Daly, Herman E., "Sustainable Development: Definitions, Principles, Policies," Invited Address, World Bank, April 30, 2002, Washington, DC. http://www.publicpolicy.umd.edu/faculty/daly/World%20Bank%20speech%20com%202.pdf. Accessed August 24, 2008.

Figure 2: Sustainable Development Framework



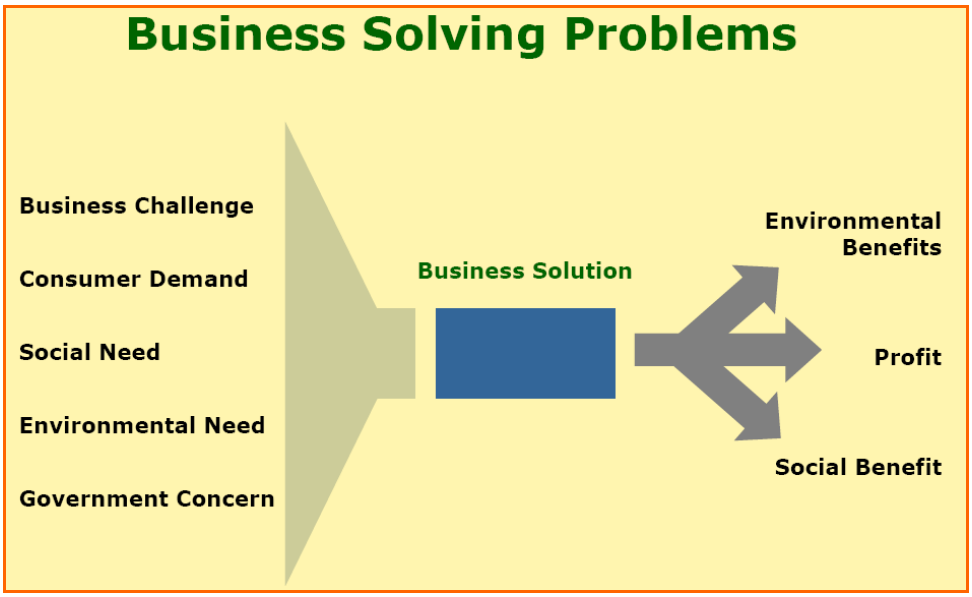
Source: Scientific American[2]

Section II of this paper articulates how software features can have a widespread impact to accelerate sustainable development by enabling people and institutions to address the most urgent sustainability challenges we face today. We believe the software industry's most important contribution to sustainable development will be through **the creation and delivery of innovative products and services that accelerate changes in how people, businesses, communities and information networks interact to achieve sustainable development.**

To this end, software companies need to better understand how their applications can serve as sustainable development solutions. This requires a new perspective on product and service development in the software sector, including a careful examination of the ethics and impacts that arise from the industry.

[2] Daly, Herman E., "Economics in a Full World." *Scientific American*, September 2005. http://www.puaf.umd.edu/faculty/daly/sciam-Daly5%20copy%201.pdf. Accessed August 24, 2008.

Figure 3: Model for the Business Contribution to Sustainable Development



Source: Business for Social Responsibility

Section III of this paper begins to articulate the most promising areas where software can positively impact sustainable development. Our recommendation is that these areas will benefit from further attention.

We invite you to explore the ways that software can enable transformation for sustainability and to begin discussions at your company about new applications and services that might improve the hope of a sustainable worldwide economy and society.

1. Most Significant Sustainability Challenges

There are many resources and studies that describe what is needed to achieve sustainability and a comprehensive treatment of the topic is beyond the scope of this paper. Rather, we are including overview descriptions of what we believe are the most important challenges that are relevant to the software industry.

A. An Overview of Sustainability Challenges

The most significant challenges to sustainable development include the challenges identified by the Millennium Development Goals (MDGs) and the Millennium Ecosystem Assessment (MA).

The MDGs form a vision of a world with less poverty, hunger and disease, greater survival prospects for mothers and their infants, better educated children, equal opportunities for women, and a healthier environment. The MDGs provide a framework for development and time-bound targets by which progress can be measured.

Millennium Development Goals

Goal 1	Eradicate extreme poverty and hunger
Goal 2	Achieve universal primary education
Goal 3	Promote gender equality and empower women
Goal 4	Reduce child mortality
Goal 5	Improve maternal health
Goal 6	Combat HIV/AIDS, malaria and other diseases
Goal 7	Ensure environmental sustainability
Goal 8	Develop a global partnership for development

The MA assessed the consequences of ecosystem change for human well-being. The MA involved the work of more than 1,360 experts worldwide and their findings provide a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems and the services they provide (such as clean water, food, forest products, flood control and natural resources), and the options to restore, conserve or enhance the sustainable use of ecosystems.

The MDGs and the MA are significant United Nations-sponsored, global, multi-year initiatives to understand and to address the most significant sustainability challenges, including extreme poverty, access to healthcare and education, and environmental degradation. Both initiatives have increased attention and galvanized action by a broad range of stakeholders.

In addition to the challenges that these two initiatives summarize, there are several additional challenges of particular significance:

- Effective public governance, particularly related to social and environmental issues
- Protection of cultures and civil rights
- Equitable participation in global economies

The following sub-section describes these challenges in further detail. Readers familiar with sustainability challenges may wish to skip to Section II, which begins on page 16.

B. Sustainable Development Challenges in Perspective

The following issues are the most important to address in order to achieve sustainable development.

Education and Literacy

Education and its corollary, literacy, are the primary building blocks necessary for human development, and are seen by some as a fundamental human right. Universal primary education is one of the eight MDGs that must be achieved for the eradication of poverty.

Overall, progress is being made in increasing primary school enrollment, which rose from 647 million to 688 million worldwide between 1999 and 2005. However, this progress masks persistent disparities, both between males and females and among developing and least-developed countries. For example, about 774 million adults worldwide, 64 percent of them women, remain illiterate and adult literacy rates remain below the world average in South and West Asia, and in sub-Saharan Africa (59 percent in each), as well as in the Arab States and the Caribbean (about 71 percent each).[3]

Education prepares children for participation in society by stimulating their ability to reason, comprehend and communicate. Even a basic level of education better equips individuals to respond to challenges (such as avoiding exposure to or successfully living with HIV/AIDS) and to exploit opportunities (such as access to new technologies) than those without an education.

Education also plays a critical role in economic development. The most important indicator of the long-term success of developing economies is education. In terms of earning power, some studies have shown that adult salaries increase an average of 10 percent for every year of school completed. In addition, an educated workforce attracts businesses. Education levels are a key factor influencing which geographic areas benefit from globalization.[4]

Education in the New Millennium

Technology is often seen as cure-all for ailing educational systems. However, technology cannot address systemic neglect. It must be included as part of a holistic approach to improved education.

Some key questions for educators and policymakers include:

- What technology investments will have the most impact on improved learning?
- How will technology be used in the context of lesson plans and content?
- What preparation do students need to use the technology prior to engaging with and learning new content?
- How are educational spaces and programs designed so that all students feel included?

[3] "Education for All by 2015: Will We Make It?" UNESCO EFA Global Monitoring Report 2008, http://portal.unesco.org/education/en/ev.php-URL_ID=49591&URL_DO=DO_TOPIC&URL_SECTION=201.html. Accessed August 24, 2008.

[4] Bhargava, A., "Globalization, Literacy Levels and Economic Development," United Nations University – World Institute for Development Economics Research, January 2008. http://www.wider.unu.edu/publications/working-papers/research-papers/2008/en_GB/rp2008-04/. Accessed August 24, 2008.

Access to Healthcare

One of the most important aspects of sustainable development is healthcare. Reductions in child mortality, improvements in maternal health and combating infectious diseases comprise three of the eight MDGs.

Access to healthcare, or the lack thereof, is a serious concern for countries at every level of development. In developed countries, the uninsured often forfeit healthcare or receive substandard medical care because they are unable to afford better treatment. In developing countries, millions die each year for lack of access to basic services.

Today, more than half a million women die of childbirth-related causes each year, with a disproportionate number of those deaths in Africa.[5] In 2007, it was estimated that 33.2 million adults and children were infected with HIV/AIDS worldwide.[6] By 2010, it is estimated that more than 44 million children in 34 developing countries will have lost one or both parents, with the majority of these deaths resulting from AIDS.[7]

Global Health Solutions

Advances in epidemiological modeling, remote health consultation, health records management and other new software applications have the potential to greatly improve healthcare delivery worldwide. According to the Office of the National Coordinator for Health Information Technology, ICT in healthcare can:

- Improve health care quality
- Prevent medical errors
- Reduce health care costs
- Increase administrative efficiencies
- Decrease paperwork
- Expand access to affordable care

Global health issues have global consequences. Healthy, productive citizens are essential for economic development because healthy populations are more stable, draining fewer resources from local economies and lowering the risk of humanitarian crises. Additionally, as globalization enables the movement of goods and people at increasing speeds, it also increases the speed at which infection and disease are spread. Recent health scares such as SARS and avian influenza highlight both the risks we face and the benefits of a prepared global healthcare system.

[5] "The State of the World's Children 2008: Child Survival," UNICEF, 2008. http://www.unicef.org/publications/index_42623.html. Accessed August 24, 2008.

[6] "2007 AIDS Epidemic Update," UNAIDS, http://www.unaids.org/en/KnowledgeCentre/HIVData/EpiUpdate/EpiUpdArchive/2007/. Accessed August 24, 2008.

[7] "USAID Reports on Children and HIV/AIDS," USAID, http://www.usaid.gov/pubs/hiv_aids/. Accessed August 24, 2008.

Governance

Governance is the management of societies' resources and activities via political authority, institutions and other ruling structures. Governance is exercised and executed by governments, corporations, non-governmental organizations and in partnerships between and among these groups. According to the World Bank, good governance includes such aspects as transparency and accountability, political stability, minimization of violence, government and regulatory quality, effective development and enforcement of law, and control of corruption.

Underdeveloped, bad and weak governance have disastrous implications. At the beginning of this century, an average of 35 people were killed every hour as a direct result of armed conflict.[8] In 2006, there were almost 8.4 million refugees and 773,500 asylum seekers.[9] On a scale of 10 (highly clean) and 0 (highly corrupt), the global average for corruption is 3.99, with almost 75 percent of nations ranking below 5 on this scale.[10]

Improvements in governance are necessary for the successful achievement of all other development goals. Strong public governance enables economic growth, increases protections for human rights, enables the delivery of basic services such as education and healthcare, and improves regulation of environmental impacts. Opportunities for business success are heightened in areas with good governance as economic competitiveness is enhanced, innovation is fostered, and opportunities for corruption are reduced.

Software Enabling Good Governance

In "The Connected Republic," a white paper from Cisco Internet Business Solutions Group, authors Paul Johnston and Martin Stewart-Weeks make the case for "the potential of technology not just to improve public service delivery, but to change the very business of governing." However, they also provide some words of caution:

- Capacity: Governments will need to develop not just the technological tools for engagement, but also the civic capacity to use those tools.
- Equity: Governments will need to ensure that those who are unwilling or unable to participate are not left behind or unfairly disadvantaged.
- Accountability and responsibility: Governments will have to develop new tools to ensure there are proper systems in place to prevent responsibility from falling between the cracks.

[8] "World Report on Violence and Health," World Health Organization, 2002, Eds. Krug, Etienne G., Dahlberg, Linda L., et al. http://www.who.int/violence_injury_prevention/violence/world_report/en/. Accessed August 24, 2008.

[9] "Refugees by Numbers 2006 Edition," UN High Commission on Refugees, http://www.unhcr.org/cgi-bin/texis/vtx/basics/opendoc.htm?tbl=BASICS&id=3b028097c. Accessed August 24, 2008.

[10] "TI Corruption Perceptions Index," Transparency International, 2007, http://www.transparency.org/policy_research/surveys_indices/cpi. Accessed August 24, 2008.

Economic Development and Poverty Alleviation

Economic development is the progressive change in the structure of economic activity in a nation or region that results in increased human well-being. This includes business activities that create jobs, increase incomes, create a tax base, and improve access to food, healthcare, education and general improvements to living conditions.

As regions become more economically developed, economic activity becomes increasingly concentrated in certain areas and disparities in welfare emerge between rural and urban areas, leading and lagging regions within countries, and countries in different parts of the world. Currently, 39 of the world's 78 poorest countries are in Africa.[11] An estimated 2.1 billion people live on less than $2 a day and more than 1 billion on less than $1 a day.[12]

The Role of Business in Economic Development

Businesses significantly impact economic development through development of new products and services, facilities siting, sourcing of their goods and services, workforce relocation in pursuit of the cheapest skilled workforce, and through community investment.

Business impacts can be improved by participating in innovative development strategies such as microfinance, small business development, targeted economic policy initiatives, and skill building among local populations.

Business is the most important driver of economic development for the world's economies. As growth in developed economies continues to slow, developing economies are expected to continue growing — a result of labor surpluses, higher returns to physical capital, and increasing access to technology. Although growth remains uneven across regions and economies, at least 20 economies designated as "small" by the World Bank graduated from its low- and middle-income economies classification in the last decade.[13] Exclusion from global markets, internal conflicts, resource constraints, poor policies and market failures have limited growth and poverty reduction in low-income economies, especially in Africa. However, with adequate investment in physical and human capital and access to markets and trade schemes, developing economies should be able to close the wealth gap with richer economies in the long run.

[11] "What Is IDA?" The International Development Association of the World Bank, http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/IDA/0,,contentMDK:21206704~pagePK:51236175~piPK:437394~theSitePK:73154,00.html. Accessed August 24, 2008.

[12] "Fast Facts: The Faces of Poverty," UN Millennium Project, 2006, http://www.unmillenniumproject.org/documents/UNMP-FastFacts-E.pdf. Accessed August 24, 2008.

[13] "2008 World Development Indicators: A Portrait of the Global Economy," The World Bank, http://siteresources.worldbank.org/DATASTATISTICS/Resources/WDI08_section4_intro.pdf. Accessed August 24, 2008.

Culture and Civil Rights

Culture refers to patterns of human behavior and the structures — such as norms, mores, languages, religions, arts, knowledge and values — that support those patterns and give them meaning. Cultural diversity is argued to be valuable for two primary reasons: its *intrinsic* value and its *utilitarian* value. The intrinsic value of cultural diversity is in its right to exist and the resulting positive impacts on its members' abilities to lead more fulfilling intellectual, emotional, moral and spiritual lives. The utilitarian value of diversity is in the service it provides — adaptability, dynamism, opportunity creation and support of human potential.

Current communication, travel, migration and technological capabilities allow for transfer of and impact upon cultural practices not possible in previous eras. There is concern that this will result in cultural homogenization and the absorption of smaller cultural groups into a dominant majority. For example, of the 5,000 to 7,000 languages spoken globally today, 95 percent of the world's population speaks less than 300 of them.[14]

Civil rights are the rights bestowed upon an individual as a citizen of a nation state who has allegiance to that nation state and is entitled to its protection. Those things protected as civil rights are often public goods like free speech, privacy, public commons, diversity and scientific inquiry.

Businesses expanding from one national or geographic location into others, as well as those whose products and services enable cross-cultural exchange, have an opportunity to impact cultural diversity and civil rights. The introduction of new technologies and business practices, operations siting, workforce migration and the changing nature of national/international institutions and laws confer growing power onto international and multinational businesses.

Environment

Climate

The International Panel on Climate Change (IPCC) recently concluded that evidence of the warming of the global climate system is unequivocal, and that atmospheric concentrations of greenhouse gases from human activities have contributed to changes in climate. The global average surface temperature has risen nearly 0.36 degrees Fahrenheit (0.2 degrees Celsius) in the last 30 years, bringing the overall temperature to its warmest in the current interglacial period

A Low-Carbon Economy?

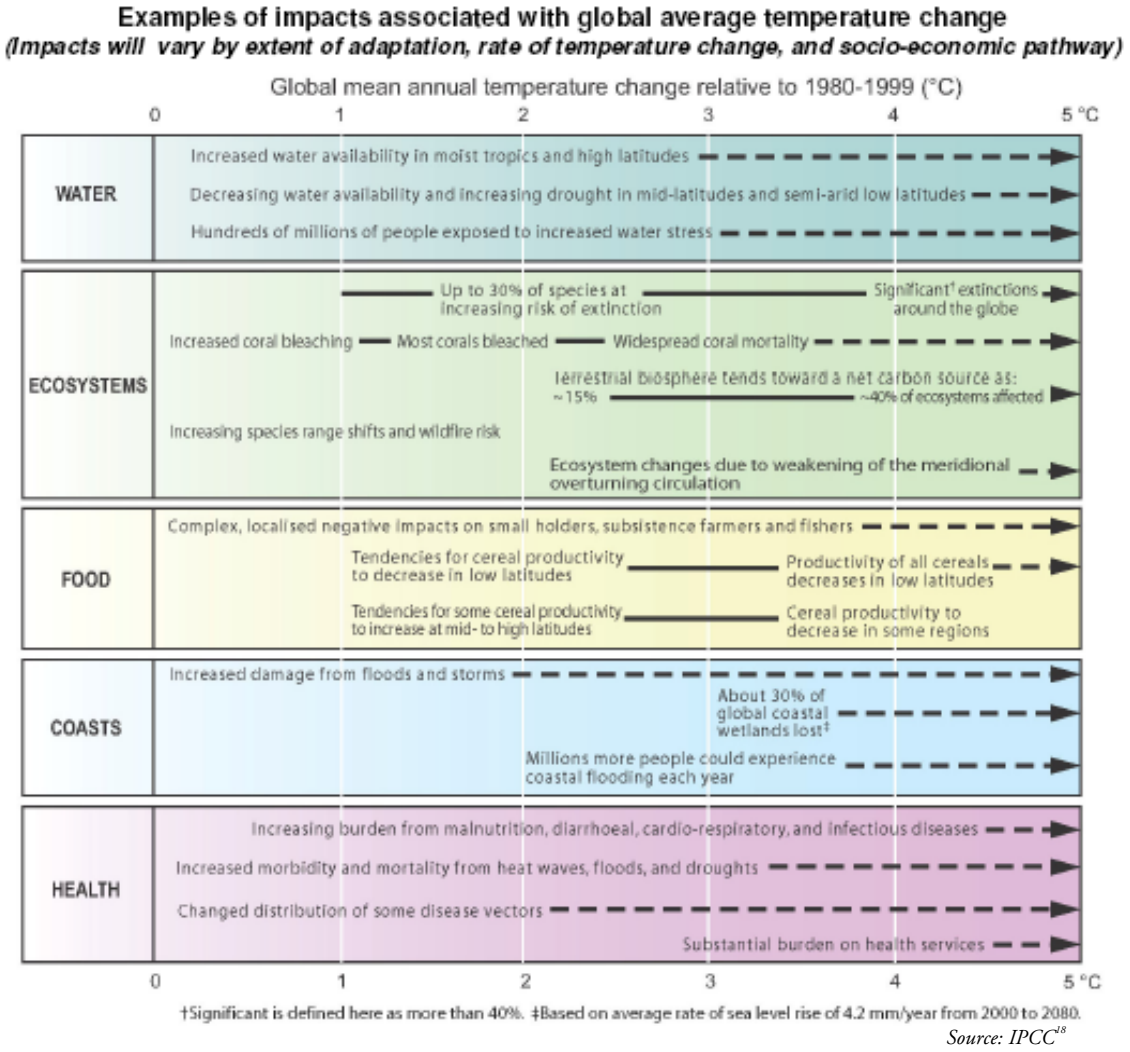
A groundbreaking research report titled "SMART 2020" was released in 2008 by a partnership between the Global eSustainability Initiative, the Climate Group and McKinsey. The report analyzed the potential for ICT to transform the global economy and reduce greenhouse gas emissions simultaneously. The main improvements in energy efficiency discussed in the report include:

- Manufacturing
- Buildings
- Transportation
- Energy Grids

[14] "Variety and Values: A Sustainable Response to Globalisation?" BT, 2000, www.btplc.com/Societyandenvironment/CSRresources/Originalthinking/varietyandvalues.pdf. Accessed August 24, 2008.

that began about 12,000 years ago.[15] The global temperature is now within about 1.8 degrees Fahrenheit (1 degree Celsius) of the maximum temperature of the past million years.[16] Scientists agree that this warming trend is a result of carbon dioxide emissions, as well as other greenhouse gasses produced by human activities. There is also scientific consensus that climate change is making extreme weather more frequent, more ferocious[17] and increasingly destructive.

The implications of climate change on a global scale for sustainable development are staggering. Regional effects will likely include decreasing sea ice extent, warming over land,



Source: IPCC[18]

[15] Hansen, J., et al. "Global Temperature Change." Proceedings of the National Academy of Sciences, 2006, http://www.pnas.org/content/103/39/14288.full?sid=9d848a33-04a3-4027-853e-381a29bb3779. Accessed Aug. 24, 2008.

[16] Ibid.

[17] See three articles: Black, R., "Humans 'Causing Stronger Storms,'" BBC News, Sept. 11, 2006, http://news.bbc.co.uk/2/hi/science/nature/5335362.stm. "Report Links Global Warming, Storms," *San Francisco Chronicle*, Sept. 12, 2006, http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/09/12/MNG5HL3S611.DTL. Goudarzi, S., "Global Warming Near Critical Level," http://www.livescience.com/environment/060925_temperatures_high.html. All links accessed Aug. 24, 2008.

[18] "IPCC Fourth Assessment Report: Climate Change 2007, Synthesis Report – Summary for Policy Makers," http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf. Accessed Aug. 24, 2008.

contraction of snow cover, increasing frequency and severity of extreme heat events, increase in cyclone and hurricane intensity, and changes in precipitation patterns.

Also according to the IPCC, those in the weakest economic position are often the most vulnerable to climate change. There is increasing evidence of greater vulnerability of specific groups such as the poor and elderly in not only developing but also developed countries. Moreover, there is increased evidence that low-latitude and less-developed areas generally face greater risk, for example in dry areas and mega-deltas.

Water

Freshwater resources are becoming more scarce or polluted, leading to a global crisis in access to clean water. While impacts are most acutely felt in Africa and West Asia, a lack of freshwater is already an economic constraint in major growth markets like China, India and Indonesia, as well as commercial centers in Australia and the western United States. According to the United Nations, if present consumption patterns continue, two-thirds of the world's population will live in water-stressed conditions by the year 2025.[19] Further compounding and politicizing these challenges is the reality that fully one-third of the world's population lacks access to enough water to meet their most basic needs.[20]

Smarter Water Management

Microsoft recently launched "Eye on Earth" in partnership with the European Environment Agency to gather together critical information, including European water, soil, air and ozone indicators, into one place. In the near term, the online application allows beachgoers to avoid polluted beaches and protect their health.

Poor and declining water quality is also an acute problem in many regions around the world and it is prompting action from regulators concerned about the impact of poor water quality on economic development and public health. For example, growing concerns about water quality in China have spurred government action toward more stringent environmental protections.

[19] "Making Every Drop Count." UN-FAO press release, February 14, 2007.

[20] Ibid.

Land Use / Biodiversity

Biological diversity (biodiversity) supports human well-being by providing ecosystem services, including provisioning, regulating, supporting and cultural services. Yet, as a result of human actions, biodiversity is declining, having reduced more rapidly in the past 50 years in component number and potential to provide goods and services than at any time in human history.[21] The effects of biodiversity loss are broad, with impacts including decreased livelihoods, security, resiliency, social relations, health, and freedom of choices and actions.[22]

Ecosystem services are resources and processes provided by natural ecosystems that humans rely on in some way. These include the provision of food and water, as well as the regulation of climate and disease.

The rate of extinction appears to be accelerating. A recent survey by UNEP concluded the following:

- Since 2000, primary forests are being lost at 6 million hectares annually
- Over the last three decades, average species abundance has declined by about 40 percent and inland water species have declined by 50 percent
- Species such as amphibians, African mammals, British butterflies and agricultural birds are generally declining, with between 12 percent and 52 percent of all species within well-studied higher taxa threatened by extinction.[23]

Such loss of biodiversity is linked tightly with changes in land use, because physical human and economic influences create pressure to harvest and extract resources from virgin and intact landscapes. The conversion of forests to cropland is a prime example, and silviculture, fishing, urban sprawl and transportation are also contributors. Even more powerful are the indirect effects of land use change over time. For example, greenhouse gas emission from deforestation (which account for one-fifth of

WWF on Google Earth

WWF is one of the largest environmental organizations in the world. Its main activities include local biodiversity conservation projects in every region of the world. The organization has begun to make information about its projects available through Google's satellite imagery-based mapping tool, Google Earth. Currently, 200 of WWF's on-the-ground projects are now available on Google Earth.

[21] "Ecosystems and Human Well-Being: General Synthesis." Millennium Ecosystem Assessment, 2005, http://www.millenniumassessment.org/en/Synthesis.aspx. Accessed August 24, 2008.
[22] Ibid.
[23] "Global Biodiversity Outlook 2," Convention on Biodiversity 2006, Secretariat of the Convention on Biological Diversity, http://www.cbd.int/doc/gbo2/cbd-gbo2-en.pdf. Accessed August 24, 2008.

such emissions in total)[24] is a leading driver of climate change, which in turn affects local weather, water and related conditions that provide bases for habitation.

Toxicity and Health

Consumers use products containing thousands of different chemicals in their daily lives and have considered these inventions to be valuable enhancements to their quality of life. However, there is an increasing and alarming body of scientific evidence revealing negative impacts on consumer health and the environment from everyday products.

In contrast to this increasing evidence about the negative impacts of highly studied chemicals, the vast majority of chemicals introduced to markets are not tested for toxicity. As a result, there is growing concern about unknown risks to health and ecosystems from these chemicals. Recent legislation in the European Union has attempted to address this problem by requiring chemical manufacturers to provide information about the health hazards associated with their products.

There has been a growing interest and attention to "body burden" testing, measuring the toxicity levels and inventory of chemicals found within human populations. Yet, because the consequences of many combinations of chemicals are unknown, the implications of such test results are fraught with uncertainties. Additionally, evidence is mounting that small doses of chemicals may have large impacts, and how they interact with other chemicals may be problematic.

Toxicity Information Management

The International Uniform Chemical Information Database (IUCLID) is a software program for the administration of data on chemical substances. It has been designed for entering and storing in a relational database the information on the properties of substances in an agreed upon format. It can generate reports from information entered into the database in formats suitable to meet the reporting requirements of a variety of regulatory regimes, including the European Directive on the Registration, Evaluation, Authorization and Restriction of Chemical Substances (REACH).

[24] Stern, Nicholas. "Stern Review: The Economics of Climate Change – Part VI: International Collective Action." HM Treasury, 2006, http://www.hm-treasury.gov.uk/media/9/5/Chapter_25_Reversing_Emissions_from_Land_Use_Change.pdf. Accessed August 24, 2008.

Materials Use / Source Reduction

From cell phones, video games and consoles to televisions and computer equipment, the segment of our waste stream represented by obsolete electronics is now the fastest growing in the industrialized world. As new devices come to market and existing products are rendered obsolete, billions of pounds of lead, cadmium, mercury and plastics will be added to the waste stream.[25] In 2003, the U.S. generated 2.8 million tons of electronic waste and only recovered (re-used or recycled) 290,000 tons; the remaining waste entered the municipal waste stream,[26] potentially leaching from landfills into groundwater, surface water and soils.

Compared to manufacturing-related environmental management, government policy and markets have done little to spur companies to develop and organize themselves around *product* sustainability. Similarly, customers have historically lacked the will and the tools to make sustainability a robust part of their product purchasing choices.

The private sector can play a significant role in improving resource productivity to maximize the performance and utility of raw materials by considering the social, environmental and economic impacts of materials throughout their life cycles. Source reduction or waste prevention includes the design, manufacture, purchase or use of materials, such as products and packaging, to reduce their amount of toxicity before they enter the waste stream.

II. Overview of Software and CSR

In this section we describe what software is, the software-related trends that are transforming society, the emergence of CSR practices within the industry and a framework for understanding how software can create benefits for society.

A. Software Defined

At its most basic, software is a set of digital instructions, i.e. programming, that allows computer hardware to change its physical state to process information. Although, the distinctions between hardware and software are not always clear, in general, hardware refers to physical devices and software refers to digital instructions that allow hardware devices to perform their desired functions.

Software's digital instructions can be written in many languages and can run on many devices. Most users are familiar with what is called the "user interface," which is a visual display of information for the user. Behind the user interface, software is performing

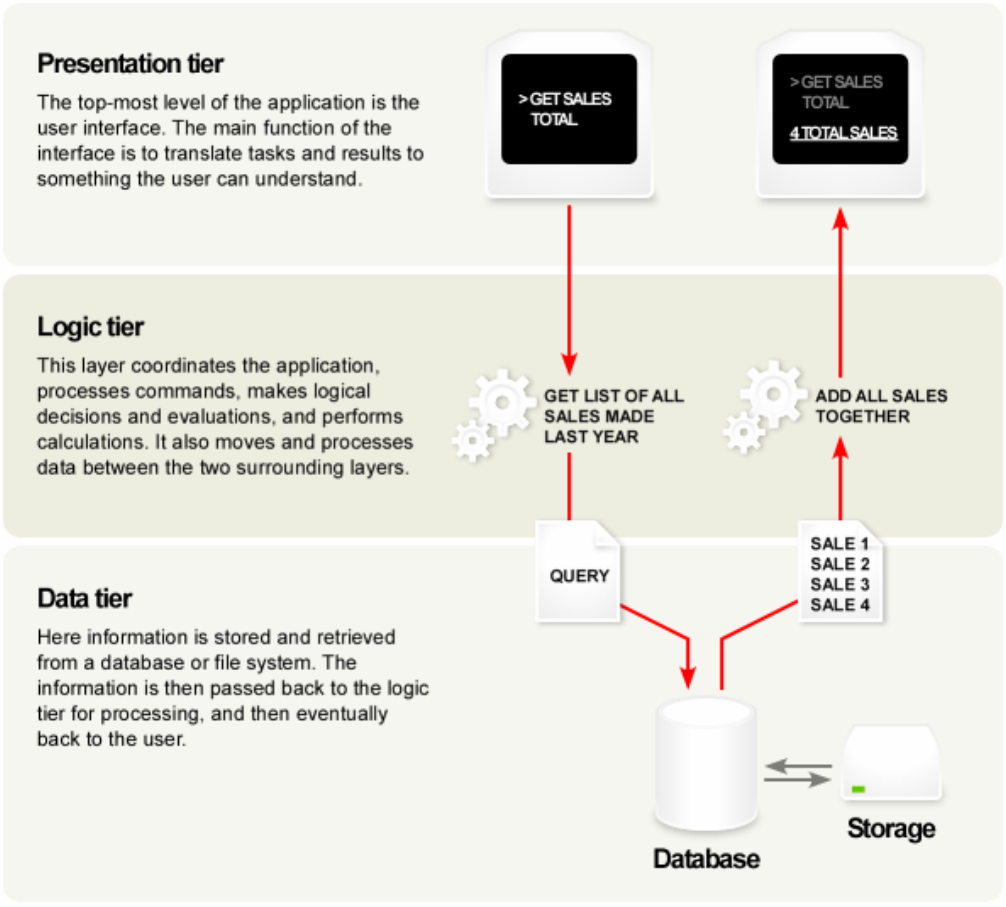
[25] Nakagawa, L. "Toxic Trade: The Real Cost of Electronics Waste Exports from the United States," Earth Trends, 2006, http://earthtrends.wri.org/pdf_library/feature/eco_fea_toxictrade.pdf. Accessed August 24, 2008.

[26] "Municipal Solid Waste in the United States: Tables 12 and 13," EPA, Office of Solid Waste and Emergency Response, 2003, http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/03data.pdf. Accessed August 24, 2008.

complex calculations and following logical processes to manipulate data and present results to the user in a meaningful way. This relationship is often described by the concept of multi-tiered software architecture (as illustrated below).

Complicating this simplistic model is the fact that each tier may run on different software in different locations, i.e. a laptop runs the user interface, while a program on a server runs the logical processes using data that is stored on another server elsewhere. The evolving complexity of software platforms, languages and applications has made interoperability — which is the ability of different pieces of software to communicate and interact successfully — a key feature of software development.

Figure 4: Overview of a Three-Tier Application



Source: Wikipedia (public domain image)

This complexity has been enabled by the Internet, a network of networks that enables information to be passed through network infrastructure, e.g. routers, from and to computing nodes, e.g. servers and clients (comprised of hardware and software). Software is required for the successful functioning of these networks.

There are other key distinctions among different types of software:

- **Languages:** A programming language is an artificial language that can be used to write programs that control the behavior of a machine, particularly a computer. Examples include: ASP, BASIC, C++, COBOL, dBASE, Java, Perl and PHP.
- **Platform/Programming/Application software:**
    - **Platform software,** also known as operating system software, is the programming that allows a user to interact with the computer and its peripherals, e.g. monitor, keyboard, mouse, etc. Examples include: Mac OS, MS Vista and Linux.
    - **Programming software** includes tools to assist programmers in writing computer programs and software using different programming languages in a more convenient way. The tools include text editors, compilers, interpreters, linkers and debuggers.
    - **Application software** is the programming that employs the capabilities of a computer directly to a task that the user wishes to perform. Examples: word processing, spreadsheet and web browsing software, including many kinds of online applications that are accessed through the Internet and web sites.

B. Information and Communications Technology Trends

There are a number of business trends and drivers that continue to influence the development of the software industry and its resulting social and environmental issues.

- **Mass proliferation of devices and more types of devices that run software** – Over time, computing devices and operating system and applications software have spread around the world. Software now runs on servers, computers, mobile phones, personal digital assistants, networking equipment, home appliances, consumer electronics, billboards, etc.
- **Increased computing, network and storage capacity** – Microprocessors continue to improve their performance and networks are expanding around the world in terms of reach and bandwidth. Server farms are emerging to warehouse the world's digitized knowledge, which continues to grow at a phenomenal rate.
- **A connected world** – It is increasingly rare to find a computing device that is not constantly or intermittently networked in some way with other devices. This is true for computers, peripherals, cell phones and a wide array of other digital devices. Software is the medium that allows these devices to communicate with one another and is driving the trend toward interoperability, i.e. the ability of software based on different languages and platforms to interact seamlessly.
- **Virtual reality** – Improved graphics software and hardware have allowed graphics to seem more lifelike. A number of applications, including video games and online environments such as Second Life, are taking advantage of these capabilities to produce online virtual environments, allowing users to interact in real-time in lifelike settings. The virtual world looks more like the real world every day.

- **Rapid innovation and obsolescence** – Software products evolve based on changes in the underlying hardware's capabilities, improvements in programming languages and techniques, and changing user demands. Compared to other industries, the pace of change is more intense and disruptive, meaning that companies and technologies come and go at a rapid clip.
- **Geography of data storage** – The location of data storage facilities is now a strategic consideration for the software industry, in which location decisions take into account new considerations such as energy costs and the regulatory environment, i.e. which countries laws may be applied to the data.
- **Geography of software employees** – Skilled software developers are trained throughout the world and software companies are increasing their global reach in terms of employees and markets. The changing geography of the industry affects how companies manage their workforce, how they engage with employees, how they define their corporate responsibility obligations and which communities are impacted by companies' decisions.
- **Contribution to economic growth** – The software industry plays an increasingly important role in the economy, not only by driving job growth, tax revenue and workforce development, but also through indirect economic effects, such as enabling new business models, increasing worker productivity, increasing demand for goods and services, and the multiplier effects of employment and expenditures. According to an IDC report released in 2007, over the next four years, there will be an additional 7 million jobs added in information technology globally, with about 60 percent of those in software.
- **Software as a service** – Software companies are experimenting with business models that offer software as a service to users in addition to software as a stand-alone product for sale. This is enabled by the growth of connectivity, standardization of many applications and the commoditization of computing power.
- **Business network transformation** – Industries have moved away from vertical integration toward an orchestrated network of partners providing differentiated services at every step of the value chain, which necessitates sophisticated systems for coordinating and communicating across many organizations.
- **Open-source versus proprietary software** – Companies have experimented with different business models, including keeping source code proprietary, licensing code or making it freely available.

C. Emergence of CSR Practices in the Software Industry

In the past few years, we have seen an increasing formalization of responsibilities for CSR at leading software companies. For example, companies have hired full-time employees to coordinate CSR strategy and implementation across their companies, to integrate

sustainability criteria into product strategies and to engage with experts in the area of sustainability.

In addition, an increasing number of leading software companies are looking more closely at their environmental footprints to find ways to be more energy and resource efficient. Companies are also finding employee engagement to be a key influencer both in terms of business success and defining corporate responsibility priorities.

Finally, large integrated companies are discovering that the significant software holdings that make up their business portfolios come with distinct sets of issues and stakeholders with particular interests in software.

D. How Software Can Create Benefits for Society

In this section we describe the features of software that impact how people, businesses, communities and information interact, and the potential opportunities those features create for sustainable development.

Ubiquitous Access

What is it?

Software runs on a diverse set of hardware devices, including personal computers, laptops, mobile phones, global positioning system units, music players, grocery scanners and check-out machines, electronic billboards, etc. As a result, access to data and systems is more widespread than ever and continues to expand. Although this is not necessarily a feature of software, it does enable much of the software functionality that may positively impact sustainability.

What does it allow people to do?

Ubiquitous access allows people to stay connected to the software applications that they depend on day to day, even as they travel vast distances. This allows greater mobility while preserving productivity. "Disconnect time," previously limited by network connectivity, is now more of a user choice.

Opportunities for sustainable development

- **Mobility** – Users can continue the computing tasks that they are accustomed

to, which increases the productivity of workers.

- **Productive Businesses** – Companies can improve the reach and efficiency of their sales and other functions through software-enabled point-of-sale devices.
- **Entertainment** – People can access forms of entertainment where and when they previously couldn't, e.g. watching a movie on a cross-country train ride.
- **Accessibility** – Greater access to information for "immobile populations," such as the bedridden and elderly, can improve their social connections and quality of life.
- **Services Delivered Through Flexible Infrastructure** – Bringing services to remote or previously untargeted populations via mobile technology may be inexpensive and contribute to rural development or urban redevelopment.
- **Openness** – As access becomes ubiquitous, more democratic/high-response-rate decision making may be enabled.

The Dark Side

- **Every Step You Take (Can Be Recorded)** – Using global positioning system or other technologies, a user's location can be tracked and recorded. While this is a rich information set that can be used for beneficial commercial, government or academic purposes, it also raises significant concerns about privacy.
- **Always On** – Convenience of access can lead to blurred lines between work and personal life.
- **Mobile Indecency** – Mobile devices increase the risk of inappropriate content and public indecency.

Examples

- The BlackBerry allows users to stay connected with wireless access to email, corporate data, phone, web and organizer features, which enhances the productivity of mobile workforces.
- The METRO Group Future Store Initiative (FSI) brings high tech to the shopping experience. FSI is the joint platform for the setting of new technological standards for the consumer goods industry. The use of modern technologies in trading and retailing will enhance efficiency both in warehouse

management and logistics. At the same time, companies will be able to offer their customers tailor-made services and an enhanced shopping experience.

- WIZZIT offers transactional, low-cost bank accounts to the unbanked and under-banked of South Africa. Users can make person-to-person payments, transfers and pre-paid purchases using a cell phone. The service not only empowers previously excluded individuals to interact financially, it broadens the economic activity of a region and provides an avenue for social uplift.
- MobiTV Inc is a provider and platform for content delivery over mobile and broadband networks. It delivers live television, premium and primetime programming, video-on-demand, satellite and digital music services from broadcast and cable television networks and major music labels to millions of users worldwide.
- Voxiva's solutions allow users in the field to submit real-time data reports to a hosted system via web, phone, text messaging or PDA. Data can be mapped and analyzed in real-time by managers using Voxiva's web interface. Supervisors can use communication tools to send automated alerts and broadcast messages back out to the field, supporting two-way information flow.

Data Management

What is it?

Software makes possible the collection, storage and analysis of enormous amounts of data.

What does it allow people to do?

Data management enables an increased understanding of our world and more informed decision making.

Opportunities for sustainable development

- **Record Keeping** – Information storage and access allows for better administration of programs in a wide variety of areas.
- **Transparency** – By opening up data stores and presenting data in accessible

formats, increased transparency can enhance the governance and responsiveness of a wide variety of institutions, e.g. governments, business, etc.

- **Effective Responses** – Better information enables people to understand and respond to sustainability challenges, such as emerging epidemics and environmental crises.
- **Measurable Outcomes** – With the right information and analysis, programs can be managed in ways that produce measurable beneficial outcomes to stakeholders.
- **Cognitive Extension** – With artificial intelligence and enhanced analytics, users have the capability to take on problems beyond the scope of human intelligence.
- **Information Diversity** – Collection of information from different types of users allows a more diverse picture of truth online and users can find information on any topic written from different points of view.
- **Balance** – Information from a diversity of perspectives can provide a balanced portrayal of issues and their full complexities.
- **Social Ratings** – Aggregate user ratings of information on various qualities, such as credibility or importance, can help individuals sort through massive amounts of information.
- **User Creation** – Individuals and organizations can generate news and information outside of the dominant regime.

The Dark Side

- **Perpetual Lies** – The persistence of information online, particularly inaccurate information (e.g. personal libel or fictitious history), can cause problems because the information is always readily accessible and difficult or impossible to correct or delete.
- **The End of Secrets** – Increasingly rich data sets of personally identifiable information (credit and purchasing histories, online preferences, email contact lists, web site histories) could potentially be combined to create a comprehensive super-profile that reveals more about an individual beyond any reasonable expectation of privacy.

Examples

- The **Human Genome Project** collected comprehensive information about human DNA to aid scientific understanding of human biology. Another important feature of the project was the federal government's long-standing dedication to the transfer of technology to the private sector. By licensing technologies to private companies and awarding grants for innovative research, the project catalyzed the multibillion-dollar U.S. biotechnology industry and fostered the development of new medical applications.
- **GuideStar's** mission is to revolutionize philanthropy and nonprofit practice by providing information that advances transparency, enables users to make better decisions, and encourages charitable giving.
- **Charity Navigator** analyzes non-profit organizations' financial documents to provide unbiased, objective ratings on the financial health of a large number of charitable organizations.
- **Respect-inside.org** is an international web site that provides information about the traceability of manufactured consumer goods and industrial products. It describes the transparency, traceability and visibility of the supply chain and the measures taken to improve the living and working conditions of persons involved in the manufacturing process, from outset to the finished product.
- **Digg** is an online information sharing platform and community where users submit and rate content – with highest rated content receiving more prominent placement on the site and throughout Digg information feeds to other sites.
- **Blogging** allows disenfranchised people access to an audience for the purpose of sharing information and opinions. In China, political dissidents have attempted to bypass media censorship via blogs; in another example, Iraqis and U.S. soldiers affected by the U.S. invasion of Iraq have established blogs in order to communicate information not approved for communication by the U.S. government.

Information Visualization and Multimedia

What is it?

Information visualization is the pictorial representation of complex data, such as maps and diagrams. The explosion in the amount and complexity of data has challenged business and academia to find ways to interpret and communicate information and ideas. One response has been enhanced visual representation of data through digital multimedia, which refers to combinations of datasets that include text, imagery, sound and video. Digital multimedia is a new medium for an old art form. For example, film was effectively multimedia storytelling; now physical film has in large part been replaced by digital storage of the same information.

What does it allow people to do?

Visualization allows complex data sets to be represented visually, which enables users to better understand patterns and solve problems. Digital multimedia allows more influential communications with a broader reach, e.g. across language barriers.

Opportunities for sustainable development

- **Communicate Ideas More Effectively** – Visualization can be a powerful tool for representing information and framing ideas. It can reinforce cognition, hypothesis building and reasoning, particularly for those who are visual learners.
- **Cross Cultural Communication** – Visualizations can overcome language barriers to communicate information using a visual vocabulary of shapes, colors and patterns.
- **Communicate Effectively and Persuasively** – Digital multimedia can be used to tell persuasive stories to a broad audience.

The Dark Side

- **Diffusion of Obscenity** – Because cultures around the world define obscenity differently, the images, videos and other multimedia "artifacts" of one culture found online can represent obscenities to another culture.

Examples

- Many Eyes is an online tool that automates information visualization. As part of the Collaborative User Experience research group at IBM, Many Eyes explores information visualizations that help people collectively make sense of data.
- Witness is an international human rights organization that uses video and online technologies to open the eyes of the world to human rights violations.
- The Berkeley Art Museum's RIP.MIX.BURN.BAM.PFA exhibit celebrates the cultural and artistic practice of remix, inviting guest artists to "rip, mix and burn" elements from two digital-media works in the museum's collection. As an example of open-source art, this exhibit mirrors the phenomenon of innovation in art based on previous work.
- A video from WWF exemplifies the application of digital multimedia to environmental awareness through a viral marketing campaign.
- YouTube is an exponentially growing online community and warehouse in which users generate and upload video content for entertainment, social commentary and information sharing. Videos are accessible to the general population, but community members are also able to add written comments and responses to each submission.

Simulation

What is it?

Simulation is the imitation of people, places, systems, events, etc. to resemble the real thing. Combined with scientific modeling and massive computing power, simulation becomes a realistic approximation of the way things actually are.

What does it allow people to do?

Simulating complex natural or human systems allows us to understand the interrelated qualities of those systems. They also allow us to preview how specific interventions would impact the systems overall and anticipate unintended consequences.

Opportunities for sustainable development

- **Understand Cause and Effect** – Simulation, by approximating real world systems, enables people to understand causes and effects within those systems.
- **Public Policy Optimization** – Public policies can be simulated to better understand their likely consequences before they are implemented.
- **Climate Change Modeling** – The impacts of climate change can be simulated to gain a better understanding of changes to our climate and potential responses.
- **Dematerialization** – By using simulation to tweak prototypes, engineers and designers can reduce the use of physical materials or optimize the use of physical materials.
- **Innovation** – Simulation increases possibilities in engineering, design, construction, chemistry, biology or potentially any science-based application.

The Dark Side

- **Computer-Related Addiction** – Although not an acknowledged medical disorder, excessive and compulsive behavior related to addictive computer usage — for example, Internet gaming in simulated worlds — has generated attention for negative impacts on users.

Examples

- The RAND Roybal Center for Health Policy Simulation develops better models to understand the consequences of biomedical developments and social forces for health, health spending and health care delivery, including the Future Elderly Model (FEM), a multi-year effort to identify and forecast the consequences of medical breakthroughs over the next 30 years.
- isee systems creates systems thinking-based software products that enable users to create models that simulate business processes and scenarios, pointing out the impacts of a new procedure or policy, and offering the opportunity to fix undesirable outcomes.

Virtual Social Networking and Collaboration

What is it?

Virtual social networking encompasses interactions among community members that take place through electronic means, such as email, bulletin boards, social software web sites, etc. Collaboration is any process involving multiple individuals or organizations working together toward common goals. The Internet has made collaboration faster and less expensive than other methods of collaborating.

What does it allow people to do?

Virtual social networking allows individuals to extend their relationships into virtual environments, to form new relationships based on shared interests, and to amass support for campaigns of shared interest. Humans are inherently social animals and their propensity for organizing has been greatly augmented by software that allows

connections virtually. Collaboration allows multiple people to contribute their skills and expertise toward a common goal.

Opportunities for sustainable development

- **Establishing and Maintaining Relationships** – Email and other online communications allow people to maintain their relationships through regular contact despite any challenges associated with geographic distance or schedule conflicts.
- **Adding Value Through Network Effects** – Virtual communities and businesses that rely on participation of users to create value may realize positive network effects by adding additional users. For example, for sites that include user ratings, every new participating member increases the value for other members, assuming that more ratings are desirable.
- **Smart Teams** – Assembling the right team for the right job can accelerate progress toward objectives, by identifying individuals with the necessary skills and capabilities to tackle problems.
- **Build Consensus** – Collaboration across organizational boundaries can create solutions that take advantage of diverse stakeholders' skills and resources, and may build consensus and buy-in by virtue of stakeholders' sustained involvement.

The Dark Side

- **Cyberstalking** – Stalkers can gather information and make contact through social networking sites.
- **Illegal Employment Screening** – Employers can gather and use information about their current or prospective employees from social networking sites, including information that should not enter into hiring decisions.

Examples

- Think is an online community created by MTV to give young people a platform for organizing around causes such as the environment, global poverty and education.
- PulseWire is an interactive website that enables women worldwide to communicate and collaborate to solve global problems, such as HIV/AIDS, water sustainability and human trafficking.
- Idealist.org/Action Without Borders is an interactive site where people and organizations can exchange resources and ideas, locate opportunities and supporters, and work together to take action toward specific sustainability goals.
- Symantec launched a Norton online community to connect the company's customers with other users, Symantec employees and experts in online security. By sharing Symantec Norton software experiences, Symantec can quickly resolve problems, identify new security needs and gather direct feedback that helps make the software more effective, powerful and user-friendly.
- Wikipedia is a multilingual, web-based, free content encyclopedia project. Wikipedia is written collaboratively by volunteers from all around the world. Since its creation in 2001, it has grown rapidly into one of the largest reference web sites. There are more than 75,000 active contributors working on some 10 million articles in more than 250 languages.[27]
- WiserEarth is an open-source network for global social change with user-contributed content. The site creates a global database and platform for civil society organizations working on the environment, social justice and indigenous issues. WiserEarth allows users to find organizations anywhere in the world that address the issues they are interested in and it allows them to find people in the same way, whether they are near or far.

[27] Wikipedia, Wikipedia:About, http://en.wikipedia.org/wiki/Wikipedia:About. Accessed August 24, 2008.

Anonymity

What is it?

The nature of online interactions makes it possible to interact with systems and other users without revealing personally identifiable information.

What does it allow people to do?

Anonymity allows users to create and access information — including culturally sensitive information — anonymously. It also allows users to create new online personas that may or may not resemble their real-world personalities.

Opportunities for sustainable development

- **Advocacy Free from Reprisal –** Human rights groups, activists, whistleblowers or other users use anonymity to report on human rights abuses while reducing the likelihood of retaliation.
- **Investigate Sensitive Subjects** – Young people can access information about sensitive topics, such as safe sex and contraception, without revealing to adults that they are interested in the topic.

The Dark Side

- **Cybercrime and Cyberterrorism** – Criminals can launch financially, politically or personally motivated attacks while obscuring their identities.

Examples

- Blogger Kathy Sierra received death threats and was scared into canceling an appearance at O'Reilly's ETech conference in San Diego in 2007.[28] The

[28] The Tech Chronicles: "The Attack on Kathy Sierra," http://www.sfgate.com/cgi-bin/blogs/sfgate/detail?blogid=19&entry_id=14783. Accessed August 24, 2008.

incident prompted a global debate about online discourse, free speech and whether the blogosphere's freewheeling climate has gotten out of hand.

- Hackers gained access to many U.S. computer networks, including those at Lockheed Martin, Sandia National Laboratories, Redstone Arsenal and NASA, through a series of coordinated attacks on American computer systems since 2003.[29]
- The government and private sector in Georgia have been victims of cybercrime throughout the Russian invasion of the country in the summer of 2008.

eCommerce

What is it?

Secure electronic transactions form the backbone of online commerce, not only in the financial services business but across many industries. From placing orders and logistics to market research and advertising, online commerce continues to grow in significance to the global economy. Automation makes processes routine and reduces their cost, while scalability allows for a high volume of transactions within available resources.

What does it allow people to do?

Online commerce allows buyers and sellers to conduct business without ever having to meet in the real world. The automation of transactions and business processes allow for very low cost transactions to be scaled into significant sized businesses.

Opportunities for sustainable development

- **New Markets** – Online commerce has enabled trading of goods and services on a vast scale. Companies are finding it possible to connect with far flung customers in ways that were previously impossible.
- **New Business Models** – Consumer and business trust in online commerce has enabled new business models to be successful. For example, online advertisements have generated sizeable business for companies that place the ads, and they also provide income to web sites that allow the ads. In addition,

[29] Wikipedia, Wikipedia: Titan Rain, http://en.wikipedia.org/wiki/Titan_Rain. Accessed August 24, 2008.

online marketplaces are thriving due to the ability to more efficiently connect buyers and sellers online.

- **Bottom-of-the-Pyramid Business Models** – As transaction and connectivity costs decrease, new opportunities will emerge for the poorest citizens who live on less than $2 per day to consume and produce goods and services online.

The Dark Side

Online commerce allows buyers and sellers to conduct business without ever having to meet in the real world. The automation of transactions and business processes allow for very low cost transactions to be scaled into significant sized businesses.

Examples

- **eBay** combines commerce, communication and community in an online platform to enhance traditional buying and selling.
- **Kiva** is a microfinance platform for lending money to entrepreneurs in the developing world. Loan recipients provide regular updates on their activities, creating closer connection to lenders and increased accountability.
- **Chris Anderson**, editor-in-chief of *Wired* magazine, wrote *The Long Tail* to describe a "culture and economy [that] is increasingly shifting away from a focus on a relatively small number of 'hits' (mainstream products and markets) at the head of the demand curve and toward a huge number of niches in the tail."[30]

III. Conclusion: Solutions for the Future

The path forward for sustainability will require changes in markets, in government policies and enforcement, in individual and corporate behaviors, and very importantly, in technology solutions. We see four main ways that software will contribute to sustainable development:

- **Addressing Environmental Crises** – Climate, water and food crises put enormous strains on people and societies and only through large-scale transformation enabled by interoperable systems can we achieve a low-carbon economy that provides access to food and water and protects these vital human rights.

[30] Anderson, C., "The Long Tail, in a nutshell," http://www.longtail.com/about.html, Accessed August 24, 2008.

- **Bringing Information to Life and Putting It to Good Use** – Whether for improved governance, optimized environmental performance or increased social benefit, software can help to illuminate patterns in the real world, to consider a broad range of options, and to make decisions that are definitively beneficial to stakeholders.
- **Enabling Collaborative Problem Solving** – Individuals and organizations are empowered by software to work collaboratively across traditional boundaries, to leverage knowledge and expertise outside their own specializations, and to become part of a collective brain that can result in multi-stakeholder governance, development leapfrogging and innovation for sustainability.
- **Democratizing Global Commerce and Ensuring the Integrity of Markets** – Scalable, low-cost transactions can mean the difference between fanciful ideas and workable business models. Software is the key to extending many kinds of services and creating new markets to drive social and environmental objectives.
- **Broadening Access to Healthcare, Education and Financial Services** – These are fundamental drivers of sustainable development; a healthy, educated and prosperous global population has the capability to make a future that is more sustainable and software can play a key role in enabling easy and affordable access to these services.

The software products and services that will change the development game and put global society on the path to sustainability do not yet exist. However, there are signs that these new applications are emerging and that they will profoundly transform economies, cultures and individuals over the long term. The software industry can examine its product strategies and roadmaps to identify potential products and services that will result in a more sustainable world, and stakeholders can provide critical insights into the problems and solutions we face. Together, the path to a sustainable future can be defined and realized. By imagining, we bring it closer to reality.