

8-1-2010

From Green IT to Sustainable Innovation

Wietske van Osch

University of Amsterdam, w.vanosch@uva.nl

Michel Avital

University of Amsterdam, michel@avital.net

Follow this and additional works at: <http://aisel.aisnet.org/amcis2010>

Recommended Citation

Osch, Wietske van and Avital, Michel, "From Green IT to Sustainable Innovation" (2010). *AMCIS 2010 Proceedings*. Paper 490.
<http://aisel.aisnet.org/amcis2010/490>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2010 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

From Green IT to Sustainable Innovation

Wietske van Osch
University of Amsterdam
w.vanosch@uva.nl

Michel Avital
University of Amsterdam
avital@uva.nl

ABSTRACT

Sustainable innovation is about creating social, environmental, and economic value for all stakeholders involved. In this paper we propose the sustainable innovation lens as an extension of the prevailing discourses on Green IT/IS. The sustainable innovation lens goes beyond the environmental facet of sustainability—which is the main focus of Green IT/IS—and offers a three-fold approach that encompasses social, environmental and economic dimensions of sustainability. Moreover, sustainable innovation provides a potent proactive approach to IT/IS development and management by focusing on *creating* positive solutions to environmental and social challenges rather than on *reducing* and *managing* IT footprint. Building on a longitudinal study of Hewlett-Packard, we demonstrate how a company can widen its perspective from Green IT to sustainable innovation, and then illustrate how the latter has a greater potential for change and innovation.

Keywords

Green IT, Green IS, Sustainability, Innovation, Hewlett-Packard (HP)

INTRODUCTION

With the centrality of information technology and charges that the industry is responsible for 2% of the world's total CO₂ emissions (Gartner, 2007), it is not surprising that in recent years the issues of Green IT/IS has gained momentum among academics and practitioners alike. Overall, so far we can identify two primary approaches to sustainability—one focuses on how to reduce the negative ecological impact of information technologies, (referred to as *Green IT* or *greening by IT*), and the other focuses on how to leverage information technologies for solving our environmental problems (referred to as *Green IS* or *greening by IS*). The former approach, herein *Green IT*, treats information technologies as part of the problem and addresses the question of how to reduce their ecological footprint by cutting CO₂ emissions, energy consumption, and waste throughout their lifecycle, that is, in the processes of designing, producing, using, and disposing IT-related services and artifacts. The latter approach, herein *Green IS*, considers information technologies or information systems as part of the solution and analyzes their potential role in helping organizations to manage their environmental footprint.

Notwithstanding the valuable insights that the Green IT/IS¹ movements have contributed, we posit that these discourses have largely overlooked two important issues. First, both discourses have been focused on the ecological (i.e. environmental) facet of sustainability, while falling short of noticing the significance of its social aspect. Second, Green IT has been driven largely by regulation and Green IS by the desire to reduce costs, while virtually disregarding the potential added value capacity of sustainable innovation with respect to the prevailing technologies. Compliance with regulation and cost reduction have steered the discussion and subsequent efforts toward mitigating and managing technology's negative environmental effects through primarily reactive approaches. However, these existing approaches have downplayed the potential of IT and IS in fostering sustainable innovation as a source of social, environmental, and economic value for all stakeholders involved.

To that end, we propose approaching the underlying topic through the *sustainable innovation* lens (Cooperrider, 2008), which builds on, yet extends, the prevailing conceptions of Green IT/IS. Overall, sustainable innovation refers to designing and implementing sustainable organizational processes and practices that generate social, environmental, and economic worth for

¹ The abbreviated term "Green IT/IS" throughout this paper denotes Green IT and Green IS. It does not imply that Green IT and Green IS are similar or interchangeable. Rather, as acknowledged in the paper, we view Green IT and Green IS as two unique discourses and relate them separately as well as jointly to sustainable innovation.

all stakeholders involved. It is not merely about organizing and innovating in an environmentally friendly way, but rather it is about contributing to the overall and long-term well-being of individuals, organizations, society, and future generations (Thatchenkery, Cooperrider, and Avital, 2010). Applying the sustainable innovation lens to the prevailing discourses on Green IT/IS has two appealing promises. First, it offers reframing the underlying issues with an extended approach to sustainability that addresses a range of environmental, social, and economic values in the context of information technology. Second, it redirects our attention to the importance of innovation and multistakeholder collaboration in proactively addressing challenges and opportunities of sustainability.

This paper reports and builds on the results of a longitudinal case study of Hewlett-Packard (HP). The case illustrates how the company has extended in a step-wise fashion its approaches to sustainability and moved from Green IT to Green IS, and then to a more encompassing approach, namely sustainable innovation. Hereby we show that the current Green IT/IS discourses encourage firms to limit their sustainability-related activities to regulatory compliance and to cost savings. Alternatively, by stimulating firms to address social and environmental challenges as business opportunities, the sustainable innovation approach serves as a source of creativity and innovation that enables firms to aim for generating bigger wins for businesses, the environment, and society overall.

Overall, we offer the sustainable innovation lens as a means to broaden the Green IT/IS discourses in consideration with social, environmental, and economic value simultaneously. Moreover, we highlight the need for radical innovation that can generate sustainable value for all stakeholders when addressing sustainability-related challenges.

Next, following a description of the prevailing IT-related context of sustainability, we present our case study of HP and discuss lessons on sustainable innovation as a valuable extended framework for both businesses and research. Finally, we discuss the implications of our findings for approaching the challenges and opportunities associated with Green IT/IS.

THREE PERSPECTIVES ON SUSTAINABLE INFORMATION TECHNOLOGY

Sustainability in the context of IT is often addressed through the narrative of *Green IT* (i.e. greening IT) or *Green IS* (i.e. greening by IT), and we offer another one, namely *sustainable innovation*. In this section we briefly describe the three different approaches to sustainability and juxtapose them in Table 1.

Green IT

If we analyze the nascent literature on Green IT, most studies to date have been concerned with greening IT, that is, with mitigating the negative impact of IT on energy consumption and CO₂ emissions (Murugesan, 2008; Gartner 2007; Pernici *et al.*, 2008). The main focus here is on the IT artifact and on greening all the stages of the IT lifecycle, namely manufacturing, use, and disposal. Therefore it only addresses the environmental facet of sustainability, while overlooking the importance of creating social value. The most prominent driver of Green IT is regulation (Mingay, 2008), but also increased concerns about the impact of IT on a company's energy spending. Thus, both the research and the business practice in this area are primarily reactive and aimed at eliminating waste, increasing efficiency, and lowering energy costs.

Green IS

A smaller set of articles has addressed the potential role of information technology in helping organizations to manage their environmental footprint, i.e. greening by IT. This approach has been referred to as Green IS (Boudreau *et al.*, 2008) stressing the greater potential of information systems rather than information technology in dealing with environmental management. However, like the first branch of studies, it merely addresses the environmental facet of sustainability without taking into account the social aspect. The most prominent driver of Green IS is the desire to reduce costs of energy and carbon emissions (Mingay, 2008) as well as regulatory compliance reporting. Therefore, Green IS efforts are partially reactive—i.e. a response to regulation—yet, the integration of comprehensive environmental management systems (EMS) indicates a company's proactive willingness to cut costs and improve environmental performance.

Sustainable Innovation

Taking an affirmative holistic stance, sustainability can be seen as “a business approach to creating long-term shareholder and stakeholder value by embracing opportunities and risks derived from economic, environmental and social developments” (Dow Jones Sustainability Group). Building on this definition of sustainability, sustainable innovation posits that every current and future social and global issue is a business opportunity in disguise (Cooperrider, 2008). Therefore, generating environmental, social, and economic sustainability is not a burden for businesses, but an innovation challenge, a strong differentiator, and a potential source of competitive advantage (Cooperrider, 2008, Laszlo, 2008).

Hence, sustainable innovation is about a company’s intrinsic motivation to take responsibility for all stakeholders, future generations, and the environment itself. It stresses the crucial role businesses can play in creating a sustainable world when acting as a source of innovation and creativity to address sustainability-related challenges in a holistic manner. Additionally, sustainable innovation highlights the importance of multi-stakeholder innovation—i.e. of collective engagements among businesses, governments, educational institutions, and the community—for generating sustainability.

	Green IT	Green IS	Sustainable Innovation
Focal Point:	IT artifact	Environment	Society
Description:	Reducing IT footprint	Managing environmental footprint	Generating overall sustainable value for all stakeholders
Driver of Change:	Regulation	Costs and regulatory compliance reporting	Technical and social innovation
Nature of Change:	Reactive	Reactive/Proactive	Proactive
Dimensions of Sustainability:	Environmental sustainability	Environmental sustainability	Social and environmental sustainability

Table 1. Summarizing Approaches to Green and Sustainable IT/IS

In short, the sustainable innovation approach can serve as a boundary spanner that provides a wider and inclusive outlook on the underlying subject matter. As portrayed in Table 1 and Figure 1, both *Green IT* and *Green IS* focus on environmental sustainability and thereby largely overlook the equally important social dimension of sustainability. Moreover, because it centers on regulatory compliance and cost reduction as well as on mitigating negative environmental impacts or managing environmental footprints respectively, Green IT/IS approaches virtually overlook the need for proactive innovation in order to generate social, environmental, and economic value for all stakeholders involved. Therefore, we argue that adopting the sustainable innovation perspective can provide a valuable augmentation for the existing Green IT/IS-based frameworks, by redirecting our attention to all facets of sustainability and by highlighting the need for company-driven and multi-stakeholder innovation to address sustainability-related challenges.

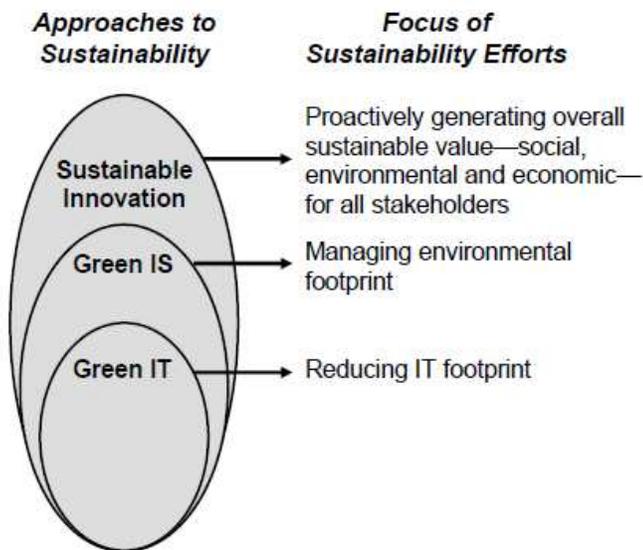


Figure 1. The Nested Approaches to Sustainability

STUDY DESIGN

Following the case study method (Yin, 1994), we analyzed a single case company—Hewlett-Packard (HP)—in order *to delineate the augmenting relationship between Green IT/IS and sustainable innovation as well as to reveal the challenges and opportunities related to sustainable innovation*. Results were obtained from an extensive content analysis of an exhaustive set of *Financial Times* and *New York Times* articles from 1990 until 2009 with sustainable events and innovations as the unit of analysis. The use of the case study method enabled us to gain in-depth understanding of the case company and the context in which it operated. In combination with our multi-source and longitudinal dataset, it allowed us to look for patterns and changes in HP's approach to sustainability-related challenges over time and from different perspectives, and thereby enhanced our confidence about the reliability and validity of our findings. Even though we understand the limitations to generalizability associated with relying on a single case, the results in this paper aim mainly to provide a concrete empirical illustration rather than a thorough verification of sustainable innovation as an augmented approach to sustainable IT/IS.

Case Selection

With respect to Green IT/IS, HP has been a forerunner in the IT industry. It was the first company to set recycling programs—from 1994 onwards—and it was one of the key drivers of several industry initiatives for Green IT/IS and sustainable innovation. Moreover, it was the first company to comply with the EPA Energy Star standards for PCs, monitors, and laptops. Even though currently some rankings (e.g. Greenpeace's guide to greener electronics) consider Apple to be the most green electronics company, HP has been the most prominent and leading sustainable innovator over the past 20 years, as has been validated by many acknowledgements and rankings (e.g. the Silicon Valley Toxics Coalition, in 2003; the AccountAbility ranking, 2004).

Data Collection and Analysis

The dataset provided us with rich evidence about twenty years of greening and sustainability efforts based on news articles about the subject matter from 1990, when climate change became an important issue worldwide, and up to the end of 2009. The *Financial Times* and *New York Times* were selected as the main data sources for the following reasons. First and foremost, we selected both newspapers because of their business focus and their high-quality reporting. Additionally, both the *Financial Times* and *New York Times* have comprehensive coverage: i.e. reports on important new products and strategies as well as social and institutional barriers and drivers of technological innovation that are important insights into our research topic. Furthermore, newspaper articles are a relatively stable and consistent source of longitudinal information about a company's strategies and innovation with respect to sustainable technologies vis-à-vis the evolving discourses on a corporate, industrial, and societal level. Finally, newspaper data are unobtrusive (Yin, 1994), hence it can provide relatively reliable insights.

The data collection and data set development process were performed in a stepwise manner; encompassing a set of filtering stages. In the first stage we focused all *Financial Times* and *New York Times* articles by company name—Hewlett-Packard and HP. Subsequently, we filtered the articles by a set of search terms related to sustainability. Finally, in order to assess whether articles were truly relevant to our data analysis, we adopted a global reading approach for all articles and subsequently narrowed down the number of articles. Even with the use of highly specific search terms, some articles turned out to be unrelated to our research topic and had to be trimmed from the dataset. This final selection stage was performed by two independent coders. The initial agreement between the two coders on the relevance for each article was 95% (970 out of 1021 articles). This filtering process resulted in a final, exhaustive data set of 48 of *Financial Times* and 27 *New York Times* articles that span over 97 and 54 pages of text respectively.

Subsequently, using *NVivo*, the remaining articles were coded in a stepwise data analysis process that involved a combination of structured and open coding strategies. For the structured coding, we utilized a coding scheme that was developed a priori based on the research objectives. An initial interrater reliability estimate of .8² based on a subset of articles³ provided an initial assessment of the coding scheme validity and the coding process reliability. Next, the disagreements were discussed and negotiated, and the coding procedure was fine-tuned accordingly.

² Cohen's kappa coefficient

³ This subset was a randomly chosen year in which all articles of the FT or NYT were analyzed

THE SUSTAINABILITY JOURNEY OF HEWLETT-PACKARD

In what follows, we explore the different greening and sustainable innovation efforts of Hewlett-Packard in the past twenty years. The key efforts are summarized in Table 2. Our findings suggest three successive phases through which HP moved from a narrow approach to sustainability, based on Green IT and later Green IS to a more holistic strategy of sustainable innovation. Building on our generalized observations regarding the need for sustainable innovation for information technology, the subsequent section provides insights for both IT research and IT practice.

Green IT: 1990 –

Green IT, as aforementioned, is primarily focused on mitigating the negative impact of IT on the environment by reducing the environmental footprint of IT. Given the reactive nature of greening IT efforts, it is not surprising that most companies have engaged in greening IT primarily in response to regulatory pressures. In other words, regulation is the primary driver of Green IT. In what follows, we explore the Green IT efforts of Hewlett-Packard and the different regulatory events that spurred these attempts.

From the 1990s onwards, several regulatory events have stimulated many companies in the IT industry, including Hewlett-Packard, to focus their attention on greening their business and manufactured technologies. In the initial stage, in response to regulatory pressure from Europe and different U.S. states, greening IT took the primary form of greening disposal, which consisted mostly of setting up recycling programs to process the enormous amounts of so-called e-waste (electronic waste) that were produced annually.

For instance, in 1991 HP started a Europe-wide recycling scheme primarily as a response to the tough GERMPACK law that was passed in Germany in April 1991 and the UK Environmental Protection Act. These two legislations forced manufacturers to take back all transport packaging, re-packaging, and sales packaging as well as to collect waste, while prohibiting incineration. Subsequently, in 1992, the Industry Council for Electronic Equipment Recycling (ICER) was formed by industry partners including HP to inform its members about the implementation of UK regulations and other related legislations that affect disposal.

Moreover, in 2002, California⁴ became the first U.S. state to ban electronic equipment from landfills and to pass legislation that aimed at establishing a comprehensive recycling program for e-waste. However, the most far-reaching regulation with respect to recycling was passed by the European Union in 2002—the Waste Electrical and Electronic Equipment (WEEE) directive that requires manufacturers to collect from consumers and recycle e-waste free of charge, and the Restriction of Hazardous Substances (RoHS) directive that requires the substitution of six heavy metals⁵ with safer alternatives.

Following this strict regulation, HP promised to eliminate hazardous substances from its product line and to engage in the greening of its manufacturing process. In 2004, HP announced that it would take more of the financial burden of recycling from its customers and the local governments, and subsequently announced free recycling programs in the U.S. through collaboration with Office Depot. Subsequently, in 2006, HP announced further extension of the free recycling programs and pledged to halt shipping old equipment to tertiary markets in developing countries.

Another set of programs addressed the issue of energy efficiency, and have triggered the production of energy-efficient computers, printers, and similar devices. In 1992, the U.S. Environmental Protection Agency (EPA) launched the Energy Star, a voluntary labeling program aimed at promoting and recognizing energy-efficiency in electrical appliances. HP identified the opportunity and in the same year signed with the EPA a partnership agreement that provides the right to use the Energy Star Label for the introduction of a new energy-efficient personal computer line. In 2007 and again in 2008, the Energy Star specifications were revised and the compliance bar was raised to match the affordances of technological progress. HP continues to adhere to energy-efficient engineering and currently 90% of its notebooks, 41% of its desktop PCs, 88% of its monitors, and 100% of its workstation platforms comply with the EPA Energy Star standards.

Whereas the above are the main regulatory events that triggered Green IT efforts by HP, the list of regulatory events and compliances goes much further. However, as this is beyond the scope of this paper, we focus here on the most significant events and the most significant actions that HP undertook, namely greening disposal, manufacturing, and energy use.

⁴ Later followed by the states of Washington, Maine, and Maryland that passed similar recycling laws

⁵ Lead, mercury, cadmium, hexavalent chromium, and flame retardants such as polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)

Green IS: 2000 –

Green IS refers to the use of information technology, or more specifically information systems, in helping organizations to manage their environmental footprint. In 2000, after the installation of EMS intranets in plants around the world, HP gained companywide ISO14001 certification of its worldwide manufacturing operations. The ISO14001 is a voluntary international standard that specifies the requirements for an environmental management system (EMS) needed to manage effectively a company's impact on the environment. Making the efforts to gain the certificate and comply with the stringent standard highlighted the importance and significance that HP attributed to managing its environmental footprint in the most ecologically friendly fashion possible.

The main reasons for installing the EMS by HP was their potential benefit of saving time and money in environmental compliance reporting. Moreover, EMS made it easier for HP to streamline compliance activities, to track accountability, to delegate tasks and to generate environmental reports. Despite the more proactive nature of installing environmental management systems, i.e. of Green IS, this example illustrates that the main motives underlying these greening by IT efforts are the need for cost savings, increased efficiency, and regulatory compliance reporting.

Sustainable Innovation: 2003 –

Sustainable innovation is distinguished from the previous two approaches by its simultaneous focus on social, environmental, and economic sustainability. Moreover it holds that innovation—by businesses and through multi-stakeholder engagements—is the chief driver for addressing sustainability-related challenges. The case of HP reveals several distinct examples of innovative efforts to create social, environmental, and economic sustainability as well as attempts to involve essential stakeholders in this proactive process.

Sustainable innovation requires a strong commitment to the community and ongoing collaboration with its key stakeholders. HP has demonstrated such commitment by organizing a series of recycling events that helped to create public awareness for turning in old, broken and other unused electronic equipment. The campaign focused on increasing public awareness of the benefits of recycling, informing about the existing recycling channels, and mitigating concerns over data security. These recycling expositions aimed to provide information and to get the e-waste out of people's houses.

In 2003, HP donated two million \$Can to Toronto's Schulich School of Business at York University to establish a chair in corporate social responsibility. The donation was to recognize the school for its commitment to preparing students to manage complex social and environmental challenges. HP explained the donation as a modest contribution to nourishing the next generation of global business leaders who possess ethical depth and passion for positive social change. This donation illustrates the involvement of HP with other stakeholders in society, in this case academia, in an attempt to invest in future creative solutions to sustainability-related challenges and foster far-reaching social change. The sustainable innovation approach implies a proactive attitude and modus operandi that reaches out far beyond the immediate business environment and financial returns, as this example illustrates.

Furthermore, in 2003, the research firm Innovest gave HP a top rating for its work on digital inclusion, a primarily social issue. The digital community centers of HP in Europe, Africa, and the Middle East demonstrate the company's commitment to the welfare of local communities in the less developed parts of the world as well as to social innovation. Although some dismiss such acts as mere attempts to enhance the company's image and potentially increase market share and future demand, the concrete added value and contribution of these centers to their respective communities is undeniable.

Another indication of the adoption of the sustainable innovation approach by HP was the call of its CEO, Carly Fiorina, in 2004 for a complete re-think of how PC's are manufactured as one of the top priorities for research and development. Researchers were asked to not only increase energy efficiency, but also find ways to use alternative materials or recycled materials, find different manufacturing processes, redesign technologies, and help customers to green their workplace. One of the results was the design of printers that made it easy to print on both sides of the paper as a way for consumers to save energy and paper.

Sustainable innovation holds that companies can also take a proactive role in solving sustainability-related challenges through shaping legislation. HP has driven and supported several state regulations regarding recycling and has initiated several industry-related initiatives. For instance, by announcing voluntary efforts to increase recycling in 2006 amid concerns over a muddle of state and federal regulations governing the disposal of e-waste, HP broadened its strategic focus to the business context to influence policy as well as other industry partners by setting clear and ambitious recycling standards.

Sustainable innovation requires the foresight and skills to assess and manage impacts on various stakeholders throughout extended supply chains. HP has shown its commitment to such concerns by formulating the Supply Chain Code of Conduct,

by co-developing the Electronic Industry Code of Conduct, and through other supplier responsibility projects aimed at building management skills and promoting industry standards for socially responsible business practices across the global supply chain.

Last, HP has embraced the involvement of the multi-stakeholder as innovation partners by engaging with NGOs and the wider community. For example, in 2009 HP together with the NPO Forum for the Future organized a competition—the Financial Times Climate Change Challenge—to raise the profile of innovations that could be both commercially successful and reduce greenhouse gas emissions. It hereby opened the possibility for stakeholders to engage in innovation of sustainable products or solutions that provide social, environmental and economic value.

The greening and sustainability efforts of HP in each of the abovementioned phases are summarized in Table 2.

Strategies	Green IT 1990 -	Green IS 2000 -	Sustainable Innovation 2003 -
Examples from HP:	<ul style="list-style-type: none"> • Europe-wide recycling scheme in response to German recycling laws • Free recycling programs in response to California state legislation and the EU WEEE directive • Elimination of hazardous substances in response to EU RoHS directive • Production of energy efficient products in order to earn the EPA Energy Star label 	<ul style="list-style-type: none"> • ISO40001 Certification of Environmental Management System 	<ul style="list-style-type: none"> • Collaboration with key stakeholders and strong commitment to community through organizing recycling events for informing consumers; stimulating university research and education on social responsibility; setting up digital inclusion projects • Radical rethink and redesign of electronic products and manufacturing processes • Shaping legislation and initiating industry initiatives • Assessing and managing stakeholder impacts along the supply chain • Multi-stakeholder product innovation

Table 2: The Sustainability Journal of HP

LESSONS FOR SUSTAINABLE INNOVATION: RESEARCH AND PRACTICE

In this section, we reflect on the need for sustainable innovation in the IT industry and its implications for IT research and IT practice. Our findings indicate that Green IT, Green IS and Sustainable Innovation might be phases in a step-model that describes the progression of sustainability efforts of a company as it moves from a largely reactive greening approach to proactive sustainable innovation (see Figure 2). When HP first engaged in sustainability-related challenges, it adopted a virtually reactive approach based on greening information technology, that is, on reducing its IT footprint, in response to multiple regulations governing the need for recycling, the elimination of hazardous substances, and the production of more energy efficient products. Subsequently, the greening efforts became more complex and HP adopted an environmental management system—Green IS—in order to manage its environmental footprint in a cost-effective fashion. Finally, spurred by innovation rather than regulation, HP engaged in several sustainable innovation efforts, such as collaborating with key stakeholders, organizing community projects, radical product and process innovation, shaping legislation, and expanding its sustainability efforts to the entire supply chain.

Implications and Recommendations for IT Research

Sustainable innovation, as introduced in this paper, can serve as a rhetorical approach that offers an extension of the Green IT/IS discourse beyond ecological considerations. Adopting the sustainable innovation lens would provide researchers with the leverage necessary to transcend beyond the study of environmental sustainability into a wider context relating to innovation and society, for instance, by studying how companies, through their IT innovation efforts, can contribute to sustainability, diversity, human rights, employee relations, safe and clean products, as well as good governance structures.

Furthermore, by relying on sustainable innovation, research can look at how we can turn contemporary social and global issues into business opportunities and how we can use innovation for generating a sustainable world. This implies not only

adopting a broader perspective on sustainability—by incorporating its three pillars—but also a wider approach to innovation—by acknowledging the need for collaborative engagements between businesses and society.

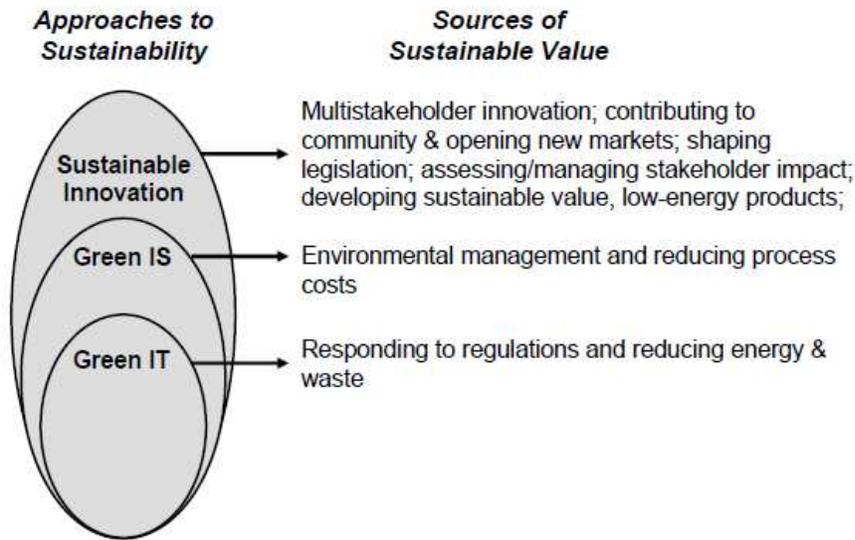


Figure 2. Sources of Sustainable Value

Implications and Recommendations for IT Practice

Our observations can also provide insights into the practice of sustainable use and application of IT, which seems to leave much room for improvement according to watchdog groups who monitor the situation. For instance, Greenpeace’s 2009 Guide to Greener Electronics indicates that only a few companies in the IT industry have made an effort to become greener and that most companies perform unsatisfactorily.⁶

Overall, for new information technologies and systems to generate environmental and social value for stakeholders, we need to reinforce current efforts that focus on incremental and reactive innovations—related to the reduction of energy consumption and waste disposal and the extension of technology life spans—with more radical technological innovations that reshape current practices and reconfigure existing work systems.

Moreover, our findings show that creating sustainable information technology is likely to require multi-stakeholder involvement. The IT industry, let alone a single organization, is unlikely to drive successfully a significant change or manage the sustainable challenge single-handedly, using the leverage of technological innovation. Instead, leading companies and the IT industry as a whole should seek involvement of the public, interest groups, universities, non-profit organizations, and government agencies.

Finally, our results indicate that merely responding to social and economic factors that trigger needs for more sustainable technologies is unlikely to be sufficient for reshaping the extraordinary potential of information technology in creating significant sustainable value. Rather, applying the sustainable innovation approach, companies need to adopt a leading role in shaping radical new technologies that provide environmental, social and economic value for all stakeholders involved and in reshaping the respective societal and institutional frameworks.

CONCLUSION

Building on a longitudinal study of Hewlett-Packard, we have demonstrated that creating social, environmental, and economic value requires innovation and multi-stakeholder involvement in addressing sustainability-related challenges and opportunities. In spite of the limitations to generalizing from a single case, we propose the sustainable innovation approach as an extension of the current Green IT/IS frameworks. Sustainable innovation redirects our efforts to the creation of sustainable

⁶ <http://www.greenpeace.org/international/campaigns/toxics/electronics/how-the-companies-line-up>

environmental, social, and economic value, and does not limit our actions to environmental concerns. Moreover, sustainable innovation offers an augmented perspective by focusing on *creating* positive solutions to environmental and social challenges rather than on *reducing* and *managing* the IT footprint. The sustainable innovation approach can serve as an indispensable framework for understanding the opportunities associated with sustainability-related challenges and for shaping them vis-à-vis our envisioned social and environmental aspirations.

REFERENCES

1. Boudreau, M., Watson, R.T. and Chen, A. (2008) From Green IT to Green IS. *Cutter Benchmark Review*, 8, 5, 5-11.
2. Cooperrider, D. (2008) Sustainable Innovation. *BizEd*, 32-37.
3. Gartner Research (2007) Gartner Symposium/ITxpo 2007: Emerging Trends. Gartner Inc.
4. Laszlo, C. (2008) *Sustainable Value. How the World's Leading Companies Are Doing Well by Doing Good*, Greenleaf Publishing, Sheffield.
5. Mingay, S. 2008. Green IT: The New Industry Shock Wave. In *Gartner, Green IT Grand Conference: 7*.
6. Murugesan, S. (2008) Harnessing Green IT: Principles and Practices. *IT Professional*, 10,1, 24-33.
7. Pernici, B., Ardagna, D. and Cappiello, C. (2008) Business Process Design: Towards Service-based Green Information Systems. In *SSME Cross Session in IFIP World Computer Congress*, 280, 195-203.
8. Thatchenkery, T. Cooperrider, D. and Avital, M. (Eds.) (2010), *Positive Design and Appreciative Construction: From Sustainable Development to Sustainable Value*, Advances in Appreciative Inquiry, Volume 4, Emerald Publishing, Bingley, UK (In press).
9. Yin, R. K. (1994) *Case study research: Design and methods*, Sage, Thousand Oaks, CA.