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SPECIAL ISSUE: IS & ENVIRONMENTAL SUSTAINABILITY

SPURRING IMPACTFUL RESEARCH ON INFORMATION SYSTEMS FOR ENVIRONMENTAL SUSTAINABILITY

Arvind Malhotra
Kenan-Flagler Business School, University of North Carolina at Chapel Hill, 300 Kenan Center Drive,
Chapel Hill, NC 27599 U.S.A. {malhotra@unc.edu}

Nigel P. Melville
Stephen M. Ross School of Business, University of Michigan, 701 Tappan Street,
Ann Arbor, MI 48109-1234 U.S.A. {npmelv@umich.edu}

Richard T. Watson
Terry College of Business, University of Georgia, 310 Herty Drive,
Athens, GA 30602-6273 U.S.A. {rwatson@uga.edu}

The Challenge

As the future of our ecosystem and society hangs in delicate balance, sustainability issues have come to the societal and governmental forefront. Organizations, governments, and cross-national bodies are turning their attention to the question of *how we can make the world a better place*. Sustainability is a complex term that can encompass environmental, economic, and societal issues. In essence, sustainability is conservation, deployment, and reuse of resources in responsible ways. From an organizational perspective, sustainability has been widely operationalized as endeavoring to achieve societal goals within commercial goals in such a way as to optimize social, environmental, and economic dimensions simultaneously—rather than these goals being treated as trade-offs (Porter and Kramer 2006).

In terms of environmental sustainability, IS applications for good citizenship or to mitigate harmful value chain activities abound. Such responsive information systems for environmental sustainability include a large technology consulting company launching a smart city online simulation to raise awareness of climate and energy issues and to drive engagement. Another example is a logistics firm that has improved safety, lowered emissions, and cut maintenance expenses by gathering route data every day for every truck and analyzing these data streams (Watson, Boudreau, Li, and Levis 2010). This system complements its package-flow software, which determines the most sustainable delivery routes by limiting left-hand turns for its drivers, resulting in a reduction of three million gallons of gas usage and 32,000 metric tons of CO_2 emissions (Washburn et al. 2009). Going beyond responsiveness, "strategic" IS for environmental sustainability allow companies to proactively transform value chain activities to benefit society both economically and environmentally. Such applications may also confer upon companies the ability to create and leverage strategic differentiation capabilities based on socioeconomic and environmental issues. For example, a large software firm uses its energy and carbon management software to enable a sustainability transformation internally, while also marketing the software externally, thereby giving it a competitive advantage in the marketplace.

Thus far, our narrative could be describing any new organizational opportunity or problem and an IS response—from environmental resource planning systems for integrating disparate islands of information in the 1990s to social media for enabling collaboration in the networked era. So what is new here? It is this: The challenge of climate change poses enormous and widespread risk to people, societies, and the natural environment. The threat is real. The threat is colossal. And the threat is ever increasing. This is the challenge of great urgency.

The Research Response

The study of information systems for environmental sustainability has coalesced into two research streams (Loeser 2013). Green IS, the larger of the two, refers to the study of the design, implementation, and impact of information systems that contribute to sustainable business processes (Watson et al. 2008). Green IT, in contrast, refers to study of technology energy efficiency and equipment utilization (Watson et al. 2008). Both streams address the threat of climate change. However, given the unique nature of the threat, there is a pressing need for impactful research. By this, we mean studies that go beyond conceptualizing, analyzing, and even designing, to those with *demonstrable impact* on mitigating the threat of climate change.

To understand the extent to which existing research is characterized by demonstrable impact, we examined the existing literature. Building on recent reviews (Melville 2010), we focused on the six-year span of 2008–2013 and searched within the AIS basket of eight leading IS journals (*European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems,* and *MIS Quarterly*). We used the Web of Science to search the topics of "green" or "environmental sustainability." We also searched eight environmental management journals (*Business & Society, Business Strategy and the Environment, Ecological Economics, Energy Economics, Energy Policy, Environmental & Resource Economics, Journal of Environmental Economics and Management,* and *Journal of Industrial Ecology*) using search topics of "ICT," "information systems," "information technology," or "Internet." The results revealed 14 articles in IS journals (1 in *European Journal of Information Systems*, 10 in a special issue of *Journal of Strategic Information Systems*, and 3 in *MIS Quarterly*): about a third of an article per journal per year. The numbers are similar for environmental management journals (16 articles total).

We plotted the 30 papers graphically by green IS and green IT. In addition, we classified them according to their place along the value space of research: ***conceptualize*** (review papers, conceptual frameworks, etc.); ***analyze*** (case studies, ethnographic analyses, quantitative empirical analyses, hermeneutics, etc.); ***design oriented*** (design science); or ***impact oriented*** (implementation and sustainability impacts using action research, *in vivo* real-time approaches, etc.) (Figure 1). We observe that most studies are green IS (23), and all but one are in either the conceptual (10) or the analyze (19) categories. Thus, at least based on this sample of journals (which are at least somewhat reflective of "important" research in the field), very little research is being done in the areas of design science and impact dimensions. Based on the few studies published in leading IS and environmental management journals (arguably the most "impactful" journals) as well as their uneven distribution across categories (Figure 1), the objective of this special issue is to highlight the pressing need for and examples of "rigorous and relevant" research spanning the green IS and green IT research value space.

Special Issue Themes

Three papers are presented in this special issue on "Information Systems for Environmental Sustainability." Each one uses a different methodology (case interpretation, survey, and field experiment) and addresses a different part of the research value space shown in Figure 1 (conceptualization of a design framework, analysis of drivers of sustained use, and impact of use). The first paper ("Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformation"), through an interpretive case study of a global software solutions provider, presents a framework for the design and study of green IS. The second paper ("Assessing the Effects of Benefits and Institutional Influences on the Continued Use of Environmentally Munificent Bypass Systems in Long-Haul Trucking") specifically looks at a green IS (the bypass system) from an individual benefit and institutional pressures perspective to present conditions for continued "use" of a green IS designed to reduce environmentally negative impacts. The third paper ("Motivating Energy-Efficient Behavior with Green IS: An Investigation of Goal Setting and the Role of Defaults") tests the efficacy of a system designed by a utility company to help customers reduce their energy consumption through different levels of consumption-related goal setting. Broadly, three transformation themes are represented by the papers: (1) green IS for organizational transformations, (2) green IS for supply-side transformations, and (3) green IS for consumption-side transformations. We now provide a content as well as a reflective summary of each article.

Green IS for Organizational Sustainability Transformations

Content Summary

Stefan Seidel, Jan Recker and Jan vom Brocke in their article, "Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations," present a theoretical framework based on the affordances view

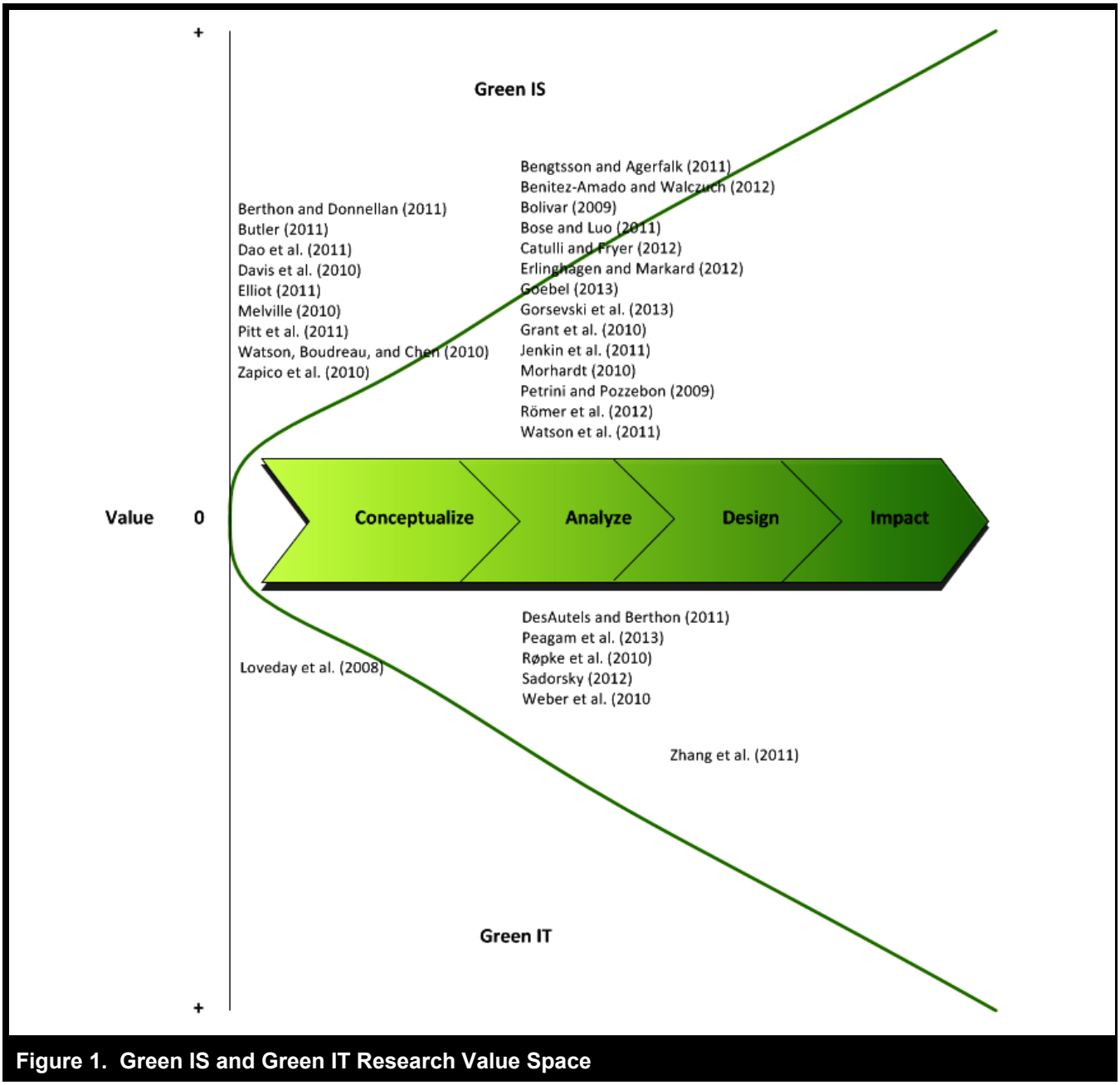

Figure 1. Green IS and Green IT Research Value Space

to suggest characteristics of green IS that enables organizational transformation. They highlight the key affordances of green IS that present an organization with a set of options for transformation.

Four affordances are classified into two categories: sensemaking affordances and sustainable practicing affordances. They suggest that ***reflective disclosure*** (allowing monitoring, analysis of presentation of current practices) and ***information democratization*** (accessibility and usability of sustainability-related information from multiple sources for use by any and all individuals in the organization) as two components of sensemaking affordances. ***Output management*** (directing individual work actions to conform to certain boundary conditions to reduce negative environmental impact) and ***delocalization*** (transforming work practices to become less location-dependent and consequently reducing the negative impact from resource movement) are suggested as the two key components of sensible practicing affordances. The authors present six propositions related to sustainability transformation

in organizations based on underlying affordances of green IS. The paper raises 19 questions pertaining to organizational goal setting for sustainability transformations, institutionalization of policies and structure, and faithful appropriation for design, implementation, adoption, and use of green IS.

Reflective Summary

The case has been made that IS can be a transformation engine for creating more sustainable organization, and thus a more sustainable society. However, we have few exemplars of this transformation. Thus we lack insights on how to design such systems and how to execute the transition to sustainability using information systems. Seidel et al. provide us with such a case. They have identified four affordances based on a single case, and this is a useful starting point.

However, we need to move simultaneously, we believe, in two directions. We can use other cases to extend the range of affordances and components of the taxonomy. We should also be mindful, however, of Henry Ford's apocryphal admonition, "If I had asked people what they wanted, they would have said faster horses." Steve Jobs was similarly dismissive of the customer's opinion and put his faith in the genius of a very few futurists. Thus, we suggest there is also a need to encourage a highly creative and lightly bounded argument on how to create IS capabilities that radically transform an organization from the environmental sustainability perspective. In doing so, we need to advance eco-effectiveness as well as eco-efficiency. This contrast is captured by the phrase, "working on the right things—on the right products and services and systems—instead of making the wrong things less bad" (McDonough and Braungart 2002, p. 76). Indeed, a few eco-effective solutions, such as Ray Anderson's (1998) decision to convert his business from selling carpet to leasing it, may be more powerful than many eco-efficient changes.

Thus, Seidel et al.'s research stimulates us to pose two critical questions. First, how do we identify the case or cases that reveal eco-effective affordances and their corresponding transformational power? For example, the American Hospital Supplies case study (Vitale 1985) popularized the computer as a competitive weapon (Ives and Learmonth 1984), and we now need a parallel revelatory case to expose the power of IS to create a sustainable society. The introduction of private networks, and thus the ability to share information with external stakeholders, was a critical factor in adding computers to the firm's strategic arsenal. It might well be that three-dimensional printing, because of its ability to restructure the physical nature of the supply chain and thus energy usage, will be one technology that ignites eco-effectiveness opportunities. Second, beyond observing best practice, how do we to apply theory and design science to rise above the incrementalism of eco-efficiency to create radical changes the promote eco-effectiveness? IS research would gain much in stature if it could be an active change agent rather than a passive reporter of what practice has discerned. Of greater importance, it would contribute to solving one of our most pressing problems.

Green IS for Supply-Side Transformations

Content Summary

Kent Marett, Robert F. Otondo, and G. Stephen Taylor in their article, "Assessing the Effects of Benefits and Institutional Influences on the Continued Use of Environmentally Munificent Bypass Systems in Long-Haul Trucking," analyze the underlying factors for successful and sustained use of green IS in the trucking industry. Two factors—attractiveness of individual benefits and role of institutional pressures—affecting continued post-implementation use of bypass systems (a type of IS that analyzes sensor generated information in flow networks to reduce the environmental impact of bottlenecks and consequent delays) are examined. Through the use of a survey, the authors find that personal benefits (financial rewards and system accessibility) are significant positive influencers of intention to continue using bypass systems. However, environmental benefits were not found to be a significant influencer of intent to continue using, although Marett et al. caution against premature conclusions that drivers are not concerned about environmental benefits given that financial benefits may be so large as to overshadow environmental considerations. In terms of institutional pressures, the research finds that mimetic pressure (actions of other drivers and competitors' actions) and normative pressure (standard industry practices) are significant positive influencers of intention of continued use. However, organizational coercive pressure was not found to not be an influencer of intent of continued use. The authors' findings have implications in terms of rewards design by organizations and policy making by governmental agencies to ensure that once designed, green IS continues to be used in a manner faithful to the design intent.

Reflective Summary

Marett et al.'s investigation of the U.S. trucking industry provides evidence indicating that financial benefits and institutional pressures influence intentions to use an information

system designed to reduce CO_2 emissions. While this causal relationship is not surprising given that financial incentives and institutional pressures are well-accepted activators, it is reassuring on two levels. First, because of the reluctance in some countries of many politicians to acknowledge that global warming is a problem, it is important to learn that the alignment of financial and environmental goals can lead to the reduction of CO_2 emissions. Second, when financial gains are fuzzy, mimetic and normative pressures can influence behavior. It is often difficult to tease out clear monetary gains for some clearly environmentally advantageous actions, but if a small number of leading-edge pro-environment firms can set a path that is followed by many, then we all gain. For example, the strong pro-environmental message Walmart's then CEO issued in 2005 (Spicer and Lambdin 2012) is likely to influence many industry leaders. This article illustrates that both the rational and social dimension of information can influence behavior, which we can also think of as the interplay between prices and perceptions (Watson et al. 2012).

Pricing information is attuned to our rational side. Carbon taxes, for example, are a way of making the pricing system work in favor of sustainability. On the social front, we are influenced by perceptions, another form of information. The observed behavior of others, the messages they espouse, and the causes they favor, especially if they are opinion leaders, can affect the beliefs and behavior of many (Melville 2010). Both forms of information—prices and perceptions—need to align with global sustainability goals. This article fits into the general category of learning about this alignment and its impact. Such knowledge is critical to the development of an information strategy for environmental sustainability (Watson et al. 2012).

Thus, there are two critical aspects of future IS research. First, to learn how to create accurate systems for pricing environmental damage so that externalized costs can be fairly internalized. Second, we need to investigate how the presentation of information can influence perceptions in favor of valid environmental sustainability actions. For example, what should be the content and form of corporate environmental reporting and what product information is critical to promoting environmentally conscious consumption?

Marett et al.'s use of institutional theory also surfaces another set of research questions we believe are important. One major shortcoming of the IS academic community, we contend, is its general failure to influence mass change through participating in the formulation of industry standards and government policy. We need to discover how we can insert ourselves into these processes so that IS-related outcomes will create pressures for desirable ecological change. While others have touched on research questions in this domain (e.g., Watson, Boudreau, and Chen 2010), we add the following questions: What government policies and industry standards will impel organizations toward greater environmental responsibility? What policies and standards will ensure the generation of data of sufficient breadth and depth to promote large-scale energy consumption reduction and environmental health gains? What are the effects of industry instituted policies and standards (set by consortiums and business entities) versus federal and local government mandated policies and standards?

Green IS for Demand-Side Transformations

Content Summary

Claire-Michelle Loock, Thorsten Staake, and Frédéric Thiesse in their article, "Motivating Energy-Efficient Behavior with Green IS: An Investigation of Goal Setting and Role of Defaults," use field experiments to study the role of information systems in encouraging and effecting more energy-efficient behavior in households. Based on analysis data about the behavior of 1,791 electricity consumers pertaining to goal setting, the authors suggest intervention strategies that can be used to increase the use and consequent impact of green IS. Interestingly, the research finds that setting medium-level default goals are the best at encouraging action from consumers, resulting in actual savings (vis-à-vis setting default goals that are too high or too low compared to self-set goals by consumers). Several design principles emerge from the research presented. First, green IS should allow consumers to actively set goals rather than just presenting them consumption information (environmental impact). Appropriate goals to encourage proactive behaviors are also prescribed by the research. Finally, the role of feedback is also highlighted in the use and reuse of the green IS to reduce energy consumption. Based on their research, three future research streams are suggested by the authors in the direction of behavioral interventions that are possible through green IS, leading to larger impact of green IS design.

Reflective Summary

Humans are goal seeking. We are driven by goals of acquisition, social bonding, comprehending our milieu, and defense of our acquired goods and beliefs (Lawrence and Nohria 2002). The pursuit of energy reduction challenges the intrinsic goals of acquisition and defense. Citizens are asked to give up something, maybe even slightly, that they have acquired (e.g., heating set 2º C lower in winter) or something they might acquire (e.g., a more powerful car) for the benefit

of society. Normally, such trade-offs are made at a more personal level (e.g., avoiding acquiring by stealing from a friend because it destroys a social bond). The pursuit of energy efficiency requires citizens to readjust downward their consumption goals for the greater good by direct reduction or choosing more energy efficient appliances. As a result, there is loss of the immediate personal connection through which evolution fashioned our four drives (Lawrence and Nohria 2002). We are wired to act for our personal interest or that of our tribe, but not several billion unknown fellow humans. Information plays a critical role in setting goals, because we rely on information to determine valid goals. We can anchor and adjust from our current performance level, benchmark against our aspirants, or have externally imposed goals. Critically, how do we use information to change personal goals in the interests of all citizens?

Loock et al. examine the effectiveness of goal setting tactics on energy consumption. The shift from manual to wireless metering is changing the information landscape of electricity billing from data poverty to data richness. Simultaneously, but at a slower pace, the Internet of things is emerging. Consequently, it will be feasible in the future to have real-time energy use for many objects. Thus, their work is a critical first step in learning how we can use wireless metering data streams of object energy usage to change consumption by lowering demand, by shifting demand to times when greener energy is more abundant, or alerting consumers to object use exceptions. We will soon have the potential to narrow a goal's timeframe (e.g., from months to hours), change feedback frequency, and access the depth and breadth of benchmark data. Large scale wireless metering presents the opportunity for mass scale experimental research on goal setting with consumers.

The Internet has become a data bonanza for online retailers who can learn much more about their customers than traditional retailers. Wireless metering will provide a similar data lode, and we expect that Loock et al.'s article will become a widely recognized precursor to many studies exploring the relationship between goals, information, and energy consumption. Some possible research questions that become feasible because of the order of magnitude increase in granularity include: Is goal setting more effective when related to time (e.g., I will use 10% less electricity on weekends) or an object (e.g., I will use 10% less electricity on cooling)? What is the right time frame for goal setting? What is the right bundle of information (e.g., types of benchmarks)? What is the best presentation format for achieving the greatest reduction in energy demand or shifts in demand patterns to match sustainable energy supplies?

Going Beyond to Spur Impactful Research

As researchers, we believe we have an implicit bargain with society, the ultimate source of our funding. Our collective research efforts should advance human welfare. Thus, the research value space model presented earlier (Figure 1) recognizes that the purpose of research is to create a desirable impact. In the case of green IS, the goal is to reduce primarily the environmental impacts of human activity. Traditionally, IS research has been focused on the early stages of the value space of research (conceptualize and analyze), and we have left it to practitioners to translate our work into social advances (design and impact).

This tradition, we assert, has not served our field well. First, those who are clearly identified with an impact usually accumulate the fame and rewards. Second, our conceptualization and analysis is derivative in that we rely on other fields for our conceptual foundations and have been a context-oriented exploiter of theory from other fields. The three papers in this special issue are very typical in that they draw upon concepts identified and developed by other disciplines. They are good research by our current standards, but do we have the correct benchmarks? Specifically, what should be the standard for assessing green IS research?

Environmental sustainability is a real, colossal, and present problem that must be solved with some haste, in case there is a tipping point beyond which global warming, rising oceans, and ocean acidification cannot be reversed for hundreds of thousands of years, if ever. Given the power of IS to transform, IS scholars should be impactful participants. Collectively, we must shift to the right end of the value chain and actively engage in problem solution. Thus, our key concern is to lay out a path that will enable IS to have an impact. Looking at the framework (Figure 1), we have to begin to think of IS research in terms of the value space shown in the framework. While a lot of focus has been on the lower levels (conceptualization and analysis of IS), more needs to be done in actual design. Going further, researchers must not only work on the actual design of future IS but also establish the "in-field" impact of such systems.

When conventional approaches fail, organizations often implement solutions that loosen the old shackles to enable the pursuit of new goals. Free trade zones and skunk works are examples of such green field approaches. We propose that *MIS Quarterly* establish a new territory charged with promoting and publishing impactful green IS research. As a result of some experimentation with the review process in handling the papers for this special focus on green IS, we specifically recommend the following:

- A small editorial team (two or three people) be established as the gate openers for green IS research. The members should fully embrace the goal of impactful research and be willing to push strongly against the conventional boundaries of what is a contribution. This does not mean that conceptualization, for example, will be disdained, but rather authors of such work must make the connection to impact explicit. Research about research is thus unlikely to be accepted.

- The concept of a special Green team should remain intact for at least a decade. Its membership should be revitalized on a regular basis, but is should be steadfast in the pursuit of impactful green IS scholarship.

- Through a process of trial and learning, as part of managing this special issue, we have come to a realization that certain topics require a different review process than the conventional process. The editorial board will have to establish such topics (e.g., information systems for environmental sustainability, big data, etc.) and the criteria for selection of these topics (e.g., social impact, exceptionally swift pace of change, etc.). Once the topics have been selected

  - Dedicated editorial teams like the one above have to be established.

  - An accelerated process that fosters innovative thinking may be needed. As an example, for this special issue we truncated the current three-level review process to a two-level process. In addition, we made sure that before a decision was committed to the review system, the authors were given an opportunity to comment on a reviewer's perceived mistakes, oversights, misunderstandings, or overcautiousness. The editorial team should recognize that authors are the main value creators. We want to push the balance in favor of the author, which we believe is necessary for encouraging innovation.

  - Another possibility is for authors and the editorial team to carefully consider impact contribution along with other factors such as theoretical contribution. For example, if the latter is modest but meets *MIS Quarterly* standards, a very high impact contribution may be weighted heavily in the final decision.

- Regarding authors, another potential research accelerant is to encourage green IS researchers to foster a community within and outside the IS scholarly community on this topic. This could, for example, include explicit mention of researchers publishing green IS papers in such journals as *Journal of Industrial Ecology*, especially pertaining to impactful research.

Conclusion

IS has played a key role in globalizing the world economy over the last several decades. It has been a transformative force for many organizations and industries on the whole; enabling them to reduce costs, create new products and services, and interact with customers more effectively. However, as businesses have become information intensive, sustainability is a relatively untouched information intensive opportunity.

The Internet of people (e-mail, social media, web sites, and so forth) has dramatically changed the nature of communication between people and organizations. The emergence of sensor networks, sensitized objects, and their connection to ubiquitous networks is creating an Internet of objects. Information systems that connect the Internet of people and the Internet of objects will lay the foundation for advancing environmental sustainability. People will get disaggregated information about the environmental impact of their objects and those deployed by others. They will be instantly alerted, for example, when their air-conditioning unit's energy consumption is outside reasonable boundaries for the current time and weather conditions and be able to take action remotely to fix the problem. They will also, for instance, be able to follow visually the pollution plume of every coal-fired power station for their region, just as they can now track a thunderstorm on their smartphone. They will be able to deploy information systems that assess the impact of current pollutants in their locality on their health. Sensor information will reveal the hidden effects of environmental damage. If CO_2 were purple, we venture to assert that we would soon be very alarmed seeing the sky become more purple each year. The increased use of social media will have transformative potential for green IS on the demand side, encouraging better practices in neighborhoods and cities, reducing the burden on the environment. For instance, the emerging carpooling and ridesharing applications can lead to decreased environmental impact by transportation. Coupled with the Internet of things, shared transportation can then be guided through most efficient routes. The emergence of self-driven cars in itself is a transformative change. Adding transportation to the Internet of things can turn them into sensors. These sensors can capture what we can't perceive and turn it into information that we can perceive and prompt transformative actions. This two-way, sensor-driven communication is blurring the boundaries between the production side and the demand side as is the

case with the "smart grid" in the utility industry. Similar macro-transformations are possible through emerging technologies like 3D printing, wearable technologies, etc.

We hope this set of three papers contributes to galvanizing IS scholars to adopt green IS as an important topic of IS research. Personally, we believe it should be the predominate research mission of the field for the next few decades because sustainability is the world's most important problem. We ask that after reading each of these papers, you resolve to tackle one or more of the questions raised by the authors or by us in this preamble.

Green IS is truly transformative for business and society, so should be a transformative opportunity for IS research as well—both in its processes and outcomes. Such transformation cannot be accomplished through the narrow lens of any one field. It is our hope that the IS field can build collaborative bridges to attract researchers from diverse arenas (environmental sciences, public policy, engineering, etc). We also hope that IS journals become the outlet of choice when it comes to impactful research on environmental sustainability. IS is a critical core of sustainability oriented transformations and the affordances framework presented in this special issue is the right start for thinking about green IS design, but just a start.

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Appendix

List of Identified Articles by Type and Journal

Green IS		
1	Bengtsson and Agerfalk (2011)	Information Technology as a Change Actant in Sustainability Innovation: Insights from Uppsala
2	Benitez-Amado and Walczuch (2012)	Information Technology, the Organizational Capability of Proactive Corporate Environmental Strategy and Firm Performance: A Resource-Based Analysis
3	Berthon and Donnellan (2011)	The Greening of IT: Paradox or Promise?
4	Bolívar (2009)	Evaluating Corporate Environmental Reporting on the Internet: The Utility and Resource Industries in Spain
5	Bose and Luo (2011)	Integrative Framework for Assessing Firms' Potential to Undertake Green IT Initiatives Via Virtualization —A Theoretical Perspective
6	Butler (2011)	Compliance with Institutional Imperatives on Environmental Sustainability: Building Theory on the Role of Green IS
7	Catulli and Fryer (2012)	Information and Communication Technology-Enabled Low Carbon Technologies
8	Dao et al. (2011)	From Green to Sustainability: Information Technology and an Integrated Sustainability Framework
9	Davis et al. (2010)	Ecology 2.0
10	Elliot (2011)	Transdisciplinary Perspectives on Environmental Sustainability: A Resource Base and Framework for IT-Enabled Business Transformation
11	Erlinghagen and Markard (2012)	Smart Grids and the Transformation of the Electricity Sector: ICT Firms as Potential Catalysts for Sectoral Change
12	Goebel (2013)	On the Business Value of ICT-Controlled Plug-in Electric Vehicle Charging in California
13	Gorsevski et al. (2013)	A Group-Based Spatial Decision Support System for Wind Farm Site Selection in Northwest Ohio
14	Grant et al. (2010)	Information and Communication Technology for Industrial Symbiosis
15	Jenkin et al. (2011)	Green Information Technologies and Systems: Employees' Perceptions of Organizational Practices
16	Melville (2010)	Information Systems Innovation for Environmental Sustainability
17	Morhardt (2010)	Corporate Social Responsibility and Sustainability Reporting on the Internet
18	Petrini and Pozzebon (2009)	Managing Sustainability with the Support of Business Intelligence: Integrating Socio-Environmental Indicators and Organisational Context
19	Pitt et al. (2011)	Integrating the Smartphone into a Sound Environmental Systems Strategy: Principles, Practices, and a Research Agenda
20	Römer et al. (2012)	The Role of Smart Metering and Decentralized Electricity Storage for Smart Grids: The Importance of Positive Externalities
21	Watson, Boudreau, and Chen (2010)	Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community
22	Zapico et al. (2010)	Environmental Metrics: The Main Opportunity from ICT for Industrial Ecology
23	Watson et al. (2011)	Green Projects An Information Drives Analysis of Four Cases
Green IT		
1	DesAutels and Berthon (2011)	The PC (Polluting Computer): Forever a Tragedy of the Commons?
2	Peagam et al. (2013)	Business-to-Business Information Technology User Practices at End of Life in the United Kingdom, Germany, and France
3	Loveday et al. (2008)	The Energy and Monetary Implications of the "24/7" "'Always On" Society
4	Røpke et al. (2010)	Information and Communication Technologies—A New Round of Household Electrification
5	Sadorsky (2012)	Information Communication Technology and Electricity Consumption in Emerging Economies
6	Weber et al. (2010)	The Energy and Climate Change Implications of Different Music Delivery Methods
7	Zhang et al. (2011)	Designing IT Systems According to Environmental Settings: A Strategic Analysis Framework

Note that shading indicates an IS journal. Authors' judgment was involved in choosing the environmental management journals and the key words to search for within each set of journals, and in identifying articles with a green IS or green IT topic within search results. While the results may not be exhaustive and contain some subjectivity, we believe that they reasonably represent the publication of green IS/IT articles within leading IS and environmental management journals.