Communications of the Association for Information Systems

Volume 37 Article 32

10-2015

Understanding Green IS Initiatives: A Multi-theoretical Framework

Xuequn Wang
Murdoch University, xuequnwang1600@gmail.com

Stoney Brooks
Middle Tennessee State University

Saonee Sarker
University of Virginia

Recommended Citation
Wang, Xuequn; Brooks, Stoney; and Sarker, Saonee (2015) "Understanding Green IS Initiatives: A Multi-theoretical Framework," *Communications of the Association for Information Systems*: Vol. 37 , Article 32.
DOI: 10.17705/1CAIS.03732
Available at: https://aisel.aisnet.org/cais/vol37/iss1/32

Communications of the Association for Information Systems

Research Paper ISSN: 1529-3181

Understanding Green IS Initiatives: A Multi-theoretical Framework

Xuequn Wang

School of Engineering and Information Technology, Murdoch University, Australia

xuequnwang1600@gmail.com

Stoney Brooks

Jones College of Business, Middle Tennessee State University, USA

Saonee Sarker

McIntire School of Commerce, University of Virginia, USA

Abstract:

Sustainability is one of the key issues that organizations confront today, and ecologically responsible ("green") information systems (IS) initiatives are manifestations of sustainable business practices. Engaging in green IS initiatives can be challenging due to poor understanding of their holistic process. In this research, we develop a multi-theoretical framework to provide a holistic understanding of the process of implementing and adopting green IS initiatives. The framework examines how these initiatives' structures, organizational attributes, and environment may influence this process. The framework also provides an agenda for how future studies of green IS can use the constructs proposed and develop them, undertake case studies to expand our propositions, and conduct surveys to verify propositions. In addition, practitioners can use our framework to better understand the differences between various types of green IS initiatives, identify which organizational and environmental factors to adopt, and gain a holistic view of the entire process.

Keywords: Green IS, Sustainability, Adaptive Structuration Theory, Isomorphism, Natural Resource-based View, Theoretical Framework.

This manuscript underwent editorial review. It was received 2/28/2013 and was with the authors for 17 months for 4 revisions. Tina Blegind Jensen served as Associate Editor.

1 Introduction

Organizations often find themselves facing increased pressure to reduce their carbon footprint and emissions from a variety of regulatory, political, and social actors in their external environment. To address these pressures, many organizations adopt sustainability strategies and technologies for improving environmental and economic performance (Melville, 2010). Given the size of organizations' information technology (IT)/information systems (IS) investments, green IS—"initiatives to utilize IT infrastructure to change organizational processes and/or practices to improve energy efficiency and reduce the environmental impacts, and to introduce environmentally healthier products and/or services"(Brooks, Wang, & Sarker, 2012, p. 19)—can increasingly support this drive for sustainability.

Green IS represents a complex phenomenon whose scope may require considerable research to understand. While practitioners acknowledge the importance of green IS initiatives, Jenkin, Webster, and McShane (2011) note that little research has explored its potential or the impact of IT/IS on organizations' environmental footprint. Recent literature has identified four categories of research related to green IS (e.g., Brooks et al., 2012): initiation, enterprise strategies and practices, adoption frameworks, and outcomes. In terms of initiation, the literature has identified factors that may influence the adoption of green IS initiatives, such as environmental uncertainty (Lei & Ngai, 2012), operational inefficiencies (Simmonds & Bhattacherjee, 2012), and internal resistance (Mann, Grant, & Singh Mann, 2009). Previous studies have examined strategies and practices of green IS; for example, on the technology level, Thoroe, Appelhanz, and Schumann (2011) show how distributed RFID-based waste management information systems support the recycling of electronics. Other studies have looked at the implementation of green IS initiatives in more detail. Hjalmarsson and Lind (2011) explore the entrepreneurial stage, collective stage, formalization and control stage, and elaboration stage that organizations use to incorporate green IS initiatives. For outcomes, researchers have focused on three categories: environmental (Gimenez, Sierra, Rodriguez, & Rodon, 2012), economic (Vykoukal, Wolf, & Beck. 2009), and social outcomes (Tarafdar, Modi, Roy, & Datta, 2010).

To assess the status of green IS literature, we conducted a review showing that, while studies of green IS are quite diverse and have significantly added to our understanding, they suffer from certain limitations (see Appendix A). First, green IS initiatives' attributes have received little attention from researchers, including the difference between various types of initiative, which has led to a limited understanding of the role that green IS initiatives play on their adoption. Second, previous studies have examined specific (e.g., technological, individual, organizational, and industrial) levels of green IS, but few have examined green IS across different levels. Third, few studies have examined the adoption, implementation, and impacts of green IS initiatives as a whole, which may be due to the fact that green IS initiatives are still fairly new and little information or few cases that involve such initiatives may exist. However, whether organizations reap the benefit of green IS initiatives largely depends on how successfully these initiatives have been implemented. According to the literature, investing in IT/IS does not necessarily lead to benefits, and organizations often fail to implement IT successfully (Gosain, 2004). A deeper understanding of green IS initiatives is important for both practitioners and researchers. Fourth, few studies have examined the recursive impact on organizations. As organizations implement and integrate green IS initiatives, organizational and societal outcomes can also have an impact on their future adoption. With regards to these limitations in the literature, we investigate:

RQ: How can green IS initiatives be examined throughout the entirety of the process and across multiple levels of analysis?

We help to fill these gaps in the literature. Specifically, we investigate the process of adopting and implementing green IS adoption across multiple levels of analysis. To do so, we offer a multi-theoretical framework that captures the complexities surrounding green IS initiatives. Using adaptive structuration theory (AST), isomorphism from organizational theory, and the natural resource-based view (NRBV), our framework provides a holistic approach to understanding the adoption, implementation, and impacts of green IS initiatives.

Although implementation and adoption are sometimes confused with one another, we view them as distinct. In this paper, we use implementation to mean the phases of the systems lifecycle in which an organization rolls out a new initiative or technology for use. An example would be an IT department replacing their computers with more eco-efficient models. In this case, the replacement process represents the implementation of a green IS initiative. Adoption refers to the use or "buy-in" of a green IS

initiative. When an employee uses the new eco-efficient PC or collaborative technologies to reduce travel, such an adoption has occurred. Distinguishing these terms is important since implementing an initiative does not necessarily equal its adoption: the literature is filled with stories and anecdotes of systems that were implemented but not adopted by the people intended to use them (e.g., Gargeya & Brady, 2005).

The paper proceeds as follows: in Section 2, we outline the need for a multi-theoretical framework of green IS and introduce the theoretical foundations on which we draw. In Section 3, we describe our framework based on AST, isomorphism, and NRBV. Finally, in Section 4, we conclude by discussing the implications of our framework for both research and practice.

2 Theoretical Foundation

2.1 The Problem

Green IS represents a complex phenomenon. Murugesan (2008) defines green IS initiatives as designing, manufacturing, using, and disposing IT in an efficient and effective manner with little or no impact on the environment. Brooks et al. (2012) suggests that green IS involves different initiatives that range from power management to data center operations and from recycling IT equipment to IS use and performance. Therefore, just as there are different types of green IS initiatives, we need to differentiate among their attributes as well. Such differentiation may afford a deeper understanding of green IS so that the benefits represent more than just reducing energy consumption (Boudreau, Chen, & Huber, 2008). The multi-theoretical framework we have developed considers and incorporates the attributes of green IS initiatives.

To address the four limitations articulated above (see Table 1), we integrate AST with the concept of isomorphism and the NRBV to form a multi-theoretical framework that one can use to address green IS initiatives as a whole. By examining the structural features and spirit of green IS, this framework can explain how the attributes of green IS initiatives can lead to adoption and meaningful impact. Second, we study the outcomes of green IS initiatives on different levels. Third, by understanding how green IS initiatives are initiated, implemented, and adopted in organizations, such a framework can support insights on green IS initiatives as a whole. Fourth, because the relationships between organizations and environments are recursive rather than unidirectional, one can use our proposed framework to incorporate such a relationship in the model.

In Sections 2.2 to 2.4, we introduce AST, isomorphism, and NRBV and discuss why these theoretical lenses are useful for addressing the limitations presented in the literature.

Table 1.The Need for a Theoretical Model of Green IS Initiatives

Limitations of current literature	How our framework can address these limitations	Theoretical perspectives based on
Few studies have examined the attributes of green IS initiatives	Our framework considers the structural features and spirit of green IS initiatives (in other words, the attributes) to understand subsequent adoption and impacts	The concept of the structural features and spirit from AST can help understand the attributes of green IS initiatives
Few studies have examined green IS initiatives on different levels	Our framework examine the outcomes of green IS initiatives on different levels	AST can help understand individual and societal outcomes; NRBV can help understand organizational outcomes
Few studies have examined the whole process of green IS initiatives implementation and adoption	Our framework examines how green IS initiatives are appropriated and implemented	AST can help understand the adoption, implementation, and impacts of green IS initiatives as a whole
Few studies focus on the recursive impacts between organizations and the environments	Our framework examines how the outcomes of green IS initiatives impact organizations' future adoption	AST can help understand the impacts of green IS initiatives' outcomes on organizations

2.2 Adaptive Structuration Theory

We selected AST as our primary theoretical base for examining the adoption, implementation, and impacts of green IS initiatives as a whole and for addressing the four limitations (see Section 1) that we found in the literature. To understand the role of advanced IT in organizations, DeSanctis and Poole (1994) have proposed AST as a framework. AST describes the interaction between advanced IT, social structures, and human interaction and incorporates structuration (Orlikowski, 1992; Orlikowski, Yates, Okamura, & Fujimoto, 1995) and appropriation (Ollman, 1971) to illustrate the change process that occurs when people adopt advanced IT in their work. AST has been useful for theory development; some studies have adopted it to examine group decision making (Jankowski & Nyerges, 2001), technology-mediated learning (Gupta & Bostrom, 2009), social networking site adoption (Sinclaire & Vogus, 2011), RFID adoption (Triche, Cao, & Song, 2011), and virtual teams (Naik & Kim, 2010). AST argues that one can describe the social structures of advanced IT by structural features and the spirit of these features. In the same way, we reason that one can use structural features and the features' spirit to explore the attributes of green IS initiatives and address the first limitation regarding attributes in the literature.

AST focuses on the mutual influence of IT and social processes. According to AST, before the development of advanced IT, relevant structures came from the organization and the institutional environment. During IT development, organizations may adopt some structures and adapt them for their own contexts. One can also use AST to explain the overall process of adopting and implementing green IS initiatives and address the third limitation of the current literature. Once a stage has been completed, advanced IT presents new social structures including rules and resources. By showing that such a process is recursive, AST can uncover the complexity of technology-action relationships and, therefore, address the fourth limitation found in the literature.

AST also provides a multilevel perspective. Recent studies have employed multilevel modeling to explore a variety of IT-related phenomena, including resistance to IT implementation (Lapointe & Rivard, 2005) and IT adoption (Sarker & Valacich, 2010). Like other advanced IT, green IS can lead to various outcomes at different levels. As a multilevel perspective, AST offers researchers a comprehensive understanding of the outcomes of green IS initiatives at different levels (e.g., the individual and societal) and, therefore, addresses the second limitation in the literature.

Given the factors involved in building a framework for explaining green IS initiatives, we could have considered and applied several theories and frameworks to our research question. We selected AST as our primary theoretical lens for several reasons. First, since AST is built around structuration theory (DeSanctis & Poole, 1994), we believe that many of the strengths of structuration theory may be retained for our theoretical lens. AST was developed to study how organizations change when they use advanced IT. Such technology includes "electronic messaging systems, executive information systems, collaborative systems, group decision support systems, and other technologies that enable multiparty participation in organizational activities through sophisticated information management"(DeSanctis & Poole, 1994, pp. 121-122). Since green IS initiatives involve implementing complex IT and requires multiple organizational stakeholders to participate (Watson, Boudreau, & Chen, 2010), we can view green IS as a specific kind of advanced IT.

AST argues that one can describe advanced IT's social structures with structural features and the spirit of those features. Structural features include "specific types of rules and resources, or capabilities, offered by the system" (DeSanctis & Poole, 1994, p. 126). Spirit refers to a "general intent with regard to values and goals underlying a given set of structural features" (DeSanctis & Poole, 1994, p. 126). These structural features and spirit can be used to understand attributes of green IS initiatives and help address the first limitation of the current literature.

AST also examines green IS initiatives from a multilevel perspective, which helps to address the second limitation cited in the literature and our research question. According to Melville's (2010) belief-action-outcome framework, the analysis level for green IS can shift between a macro (organizational) level and a micro (individual) level. For example, while Green IS implementation occurs on the organizational level, the outcomes can be felt on the individual, organizational, and/or societal levels. AST directly addresses the need for a multilevel perspective. Fourth, previous research suggests that the process of implementing and adopting green IS implementation may involve different stages. Lei and Ngai (2012) contend that assimilating green IS includes three stages: initiation, adoption, and routinization. While some theories apply to one or several stages, few may be used to examine all of them. In fact, the literature contains several theoretical models that address portions of the whole process (Bose & Luo, 2011; Butler, 2011;

Dao, Langella, & Carbo, 2011; Elliot, 2011; Melville, 2010). While these separate models provide valuable insight into green IS, they do not provide a holistic understanding of the implementation and adoption process. With the help of AST, we can view the whole process in one model and address the third limitation in the literature.

The relationship between green IS initiatives and organizations is reciprocal. AST does not view the adoption of IT as the end of the process; rather, it suggests that new social structures may emerge and be replicated over time, which suggests that adopting IT may, in turn, influence entire organizations. AST is useful for examining how the outcomes resulting from adopting green IS initiatives influence how one adopts future initiatives, which addresses the fourth limitation cited in the literature. Here, AST is consistent with structuration theory in its view that IT interactions can influence organizations' institutional properties (Orlikowski, 1992) and with organizing vision in its view that the organizing vision helps shape technology and vice versa (Swanson & Ramiller, 1997).

Finally, AST adopts a socio-technical perspective for understanding IT (DeSanctis & Poole, 1994). A socio-technical system is one in which its impact comes from interactions with technology, people, social structure, and tasks (Bostrom & Heinen, 1977). AST explains the dynamic way in which IT and social structures shape each other over time. AST shows how organizations' attributes influence their adoption of green IS initiatives and how adopting green IS initiatives influences the organizations' future actions. One can use AST to formulate specific research hypotheses to provide support for an empirical research agenda (DeSanctis & Poole, 1994).

While we acknowledge that other theories relevant to understanding green IS initiatives exist, we believe they fall short of addressing our research request or the void in the existing literature. Based on these arguments, we believe AST is the theoretical lens for our study.

2.3 Isomorphism

To complement AST, we draw on isomorphism for our framework to study organizational responses to environmental issues and understand how isomorphic forces beyond the market may play a critical role in making organizations responsive to others' interests (Scott, 2003). Isomorphism is a process that forces one unit in a population to resemble other units facing the same set of environmental issues (Hawley, 1968) and explains how organizations adapt to such forces with three different mechanisms: mimetic, normative, and coercive isomorphism (Chen, Watson, Boudreau, & Karahanna, 2009). When an organizational field becomes established, there is an inexorable push towards homogenization (DiMaggio & Powell, 1983). In the context of green IS, environmental issues respond to the competitive environment and the natural one.

Mimetic isomorphism occurs when organizations model other organizations' behaviors in pursuit of legitimacy or proprietary practices (DiMaggio & Powell, 1983). When a clear course of action is not available, organizations sometimes feel they need to "catch up" with a market leader and decide to mimic them. Normative pressure exerts an influence such that organizations feel compelled to honor certain cultural and marketplace expectations from their professional circle or the larger society. Coercive isomorphism is associated with powerful actors on whom a focal organization depends (Chen et al., 2009). Institutional/isomorphic forces have been recognized as predictors of the adoption and diffusion of IS products and practices (e.g., Tingling & Parent, 2002), firms' decisions (e.g., market entry) (Davis, Desai, & Francis, 2000; Haveman, 1993), increases in legitimization (Deephouse, 1996; Glynn & Abzug, 2002), and influence on corporate social action (Marquis, Glynn, & Davis, 2007). Such forces may explain why organizations adopt green IS initiatives based on their environment.

2.4 Natural Resource-based View

We also used the NRBV to help understand the impact of adopting green IS initiatives and to address the second limitation found in the current literature. As an extension of the resource-based view (RBV), NRBV can show how green IS initiatives may represent a competitive advantage when organized into groups based on their strategic orientation. NRBV predicts that higher forms of strategy (product stewardship, sustainable development) embed environmental considerations throughout an organization's business practices (Hart, 1995).

RBV argues that, as a subset of organizations, resources can lead to a competitive advantage, and may even enable firms to achieve a sustained competitive advantage (Mata et al., 1995). Researchers have applied RBV to both management (e.g., Barney, 1991; Rumelt, Schendel, & Teece, 1991) and IS literature

(e.g., Mata, Fuerst, & Barney, 1995; Wade & Hulland, 2004) and have proposed it to be a good lens for examining green IS (Melville, 2010).

According to Hart (1995), RBV ignores the interaction between an organization and its natural environment. As Hart states, "It is likely that strategy and competitive advantage in the coming years will be rooted in capabilities that facilitate environmentally sustainable economic activity—a natural-resource-based view of the firm" (p. 991). The NRBV argues that its key strategic capabilities may differ in terms of resource requirements and contributions to ecological sustainability (Chen et al., 2009): pollution prevention, product stewardship, and sustainable development (Hart & Dowell, 2011). Each offers separate environmental driving forces and a different source of competitive advantage. Pollution prevention is associated with lowering costs: by preventing pollution, organizations may reduce their compliance and liability costs. Product stewardship goes beyond pollution to include the entire value chain of an organization's product systems (Hart & Dowell, 2011). Organizations gain competitive advantage through strategic preemption or by establishing standards that are advantageous (Hart & Dowell, 2011). Finally, sustainable development takes these aspects even further with a sustainable development strategy not merely designed to wreak less environmental damage but actually producing positive change that can be maintained into the future; sustainable development, by its definition, is not restricted to environmental concerns but focuses on economic and social concerns as well (Hart & Dowell, 2011).

Most of the work involving NRBV has focused on pollution prevention (Hart & Dowell, 2011), which has left a gap in the research concerning product stewardship and sustainable development. Given that green IS initiatives go beyond simple cost savings associated with preventing pollution (Brooks et al., 2012), NRBV may produce a better understanding of the overall impacts of green IS initiatives.

Thus, with the help of AST, isomorphism, and NRBV, we not only learn how outcomes at different levels may result from green IS initiatives but also how feedback influences occur. Isomorphism can help us understand how these forces influence the initiation of green IS; NRBV aids in understanding the organizational outcomes of green IS initiatives; and AST can be used to examine implementation and adoption and the recursive impact of green IS initiatives (see Figure 1 in Section 3). We do not mean to say that these theories represent the only useful lenses for understanding green IS (Melville, 2010), but they are crucial in addressing the limitations in the literature and achieving our objectives.

3 Multi-Theoretical Framework, Case Example, and Propositions

We developed our multi-theoretical framework to examine the adoption, implementation, and impacts of green IS initiatives as a whole (Figure 1). The framework describes relationships between green IS initiatives, individuals in an organization, the organization itself, society, and the environment. Prior to the implementation of green IS initiatives, organizations and their external environment have social structures. As individuals in organizations decide to adopt green IS initiatives, they start to include some of these structures into green IS initiatives. As DeSanctis and Poole (1994) argue, during this process, the structures may be reproduced or modified into new structures existing in green IS initiatives. Once the green IS initiatives are implemented, organizational changes and green IS initiatives function as new instances of social structures, which then influence individuals' future actions. These implemented green IS initiatives may also influence organizations' future adoption of other green IS initiatives. Thus, the relationships between organizations and the environments are recursive, and they are continually intertwined. In Section 3.1, we first introduce two cases from Hewlett-Packard. Subsequently, in Section 3.2 to 3.7, we present a more detailed description of our framework by using the cases to illustrate the argument of the framework.

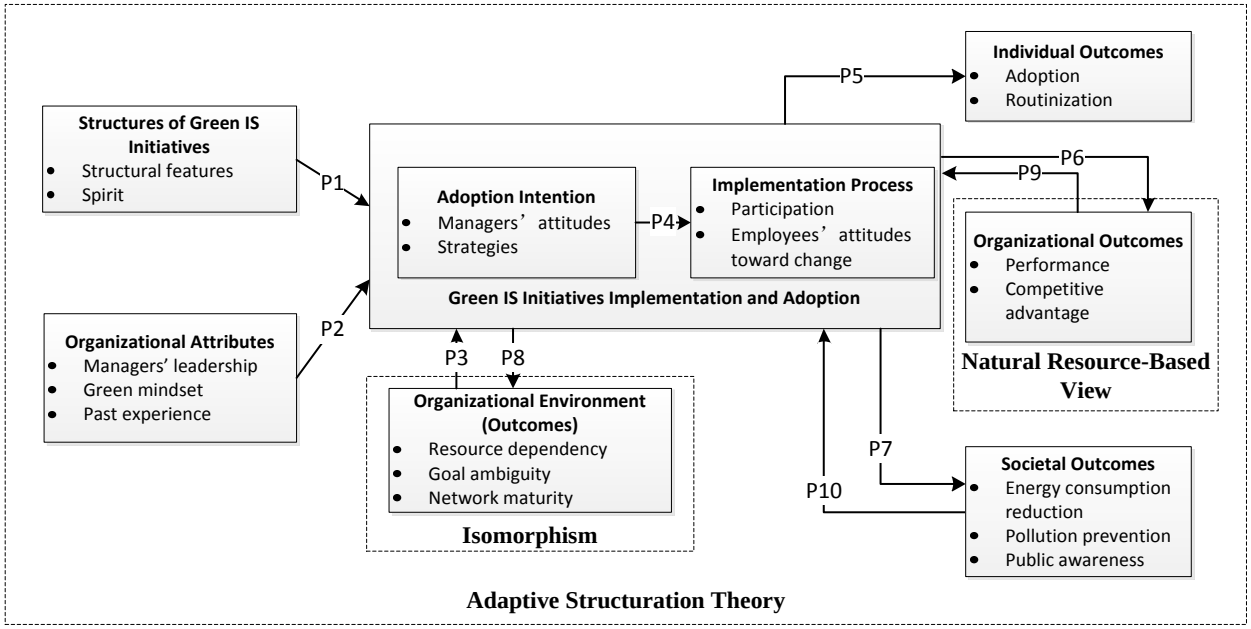

Figure 1.The Multi-framework of Green IS Initiatives

3.1 Hewlett-Packard Case: An Illustrative Example

To illustrate green IS initiatives, we draw on two published cases involving Hewlett-Packard (HP): Preston (2001) and van Osch and Avital (2010). The case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). Researchers have used this approach to support theory development (Iacono, Brown, & Holtham, 2001; Tellis, 1997). The two studies provide insight into HP from valuable sources: van Osch and Avital obtained data through content analysis of an exhaustive set of *The Financial Times'* and *The New York Times'* articles from 1990-2009 with sustainable events and innovations as the unit of analysis. In contrast, Preston details HP's actions written from an insider's perspective (at the time of publication, Preston was part of HP's corporate social and environmental responsibility team).

We selected HP as an example for several reasons. First, this example discusses various types of green IS initiative, which are rare in studies that identify the recursive impact of green IS initiatives. We use HP to illustrate the differences between various types of green IS initiatives. Second, the details of implementing green IS initiatives also illustrate how organizational attributes and its environment can influence the adoption of green IS initiatives and the implementation process. Third, HP's green IS initiatives have resulted in a wide range of outcomes that are helpful in understanding their organizational and social outcomes. Lastly, the recursive impacts of outcomes of green IS initiatives can help illustrate how outcomes of green IS initiatives influence future adoption of other green IS initiatives.

3.1.1 HP Example and Our Framework

As van Osch and Avital (2010) note, "With respect to green IT/IS, HP has been a forerunner in the IT industry". HP evolved three distinct phases of environmental sustainability from the 1980s to the 2000s. In the 80s, it focused on controlling and preventing its pollution. During the 90s, it shifted its focus to product stewardship and viewed entire lifecycle of a product in terms of minimizing environmental impact. In the 2000s, HP harnessed sustainability to develop technologies that actually have a positive impact on environmental challenges (Preston, 2001).

We can describe HP's first phase (preventing pollution) as "green IT" (van Osch & Avital, 2010). Starting in the 1990s, regulatory events across the world pushed IT companies to focus attention on "greening" their businesses. Thus, in 1991, HP launched a recycling scheme across Europe in response to German and U.K. recycling laws. In 2002, electronic waste legislation occurred in California (eliminated from

landfills) and Europe (requirements for manufacturers to provide free e-waste recycling and substitute heavy metals with safer alternatives). With such regulations in mind, HP promised to reduce pollution by eliminating hazardous materials from their product lines and provide recycling services (van Osch & Avital, 2010). Back in 1992, HP devised energy-efficient products to earn the Energy Star label launched by the United States' Environmental Protection Agency (EPA).

Though its early initiatives focused on increasing efficiency and insuring regulatory compliance, HP began to take a more proactive attitude toward green IS initiatives and product stewardship around 2000. In the late 1990s, the company began informally exploring the concept of sustainability (Preston, 2001). Starting with a two-day conference, discussions about sustainability inspired groups to form that eventually led to new sustainability initiatives in HP. In terms of green IS, HP installed environmental management systems (EMS) in plants around the world, which earned the plants the voluntary ISO14001 standard that requires an EMS to effectively manage their impact on the environment (van Osch & Avital, 2010). They installed the EMS primarily to save time and money on environmental compliance reporting.

HP also reinvented product stewardship by focusing on sustainability itself (Preston, 2001). This concept was a hard sell to senior management because it invoked a future state that had not been previously contemplated (Preston, 2001). HP brought in a MBA candidate to conduct research and make recommendations about a sustainability strategy. After extensive work, the candidate found that sustainability did offer companies a competitive advantage and would become increasingly important in the coming years (Preston, 2001). HP pursued sustainable innovation through a strong commitment to the community and ongoing collaboration with key stakeholders. Some of the initiatives it conducted included:

- Organizing recycling events to create public awareness
- Donating over CAD $2 million to establish a chair in corporate social responsibility at York University
- Working on digital inclusion, which received top ratings in 2003 from the research firm Innovest
- Calling for a complete re-think on how PCs are manufactured by CEO Carly Fiorina in 2004, and
- Organizing a competition in 2009 to raise the profile of innovations that could be commercially successful and reduce greenhouse gases.

HP has since launched many green IT/IS initiatives. Given their continued drive for sustainability, the results of such initiatives certainly play a role in determining their future.

With regard to our theoretical model and propositions, HP's example highlights several key points:

- Various green IS initiatives have different attributes. Green IS initiatives involve practices including material recycling, energy efficiency, business process redesign, and collaboration with multiple stakeholders. Therefore, one needs to differentiate various types of green IS initiatives and important to understand how the attributes of green IS initiatives influence their adoption.
- Organizations adopt green IS initiatives for different reasons. The determinants of green IS adoption operate at multiple levels, such as governmental, organizational, and individual.
- There is a recursive relationship between organizations and environments. Thus, not only does the adoption of green IS initiatives in an organization change society, but also those outcomes, in turn, can influence the organization's adoption of future green initiatives.

In Section 3.3, we discuss each proposition of our framework in more detail.

3.2 The Structures of Green IS Initiatives

According to AST, advanced IT brings social structure by enabling or constraining certain actions. Green IS initiatives may require individuals to behave in a more "green" manner or urge stakeholders to collaborate on IT innovation. The social structures of green IS initiatives are often described based on structural features and the spirit of those features. Structural features are "specific types of rules and resources, or capabilities, offered by the system" (DeSanctis & Poole, 1994, p. 126). For green IS initiatives, these may include technical complexity, lower energy consumption, better recycling, information monitoring, and environmental protection. In this way, structural features bring meaning and

control to sustainability, leading organizations to adopt green IS initiatives with better structural features (e.g., a higher level of energy saving) to obtain better economic and environmental outcomes.

Spirit refers to "the general intent with regard to values and goals underlying a given set of structural features" and is the "official line" by which technology shows individuals how to act when using the technology, how to interpret its features, and how to fill gaps that are not spelled out (DeSanctis & Poole, 1994, p. 126). In other words, spirit can help individuals understand and interpret technology and its purpose. Here, eco-goals are relevant for understanding the spirit of green IS initiatives. Previous research has identified such eco-goals for green IS initiatives as eco-efficiency[1] and eco-effectiveness[2]. Green IS initiatives with different eco-goals[3] offer a different type of spirit. In the HP example, the spirit of their early initiatives such as recycling programs and the elimination of hazardous materials primarily involved eco-efficiency. Later HP engaged in more eco-effective initiatives, such as production innovation with multiple stakeholders. Green IS initiatives with eco-efficient spirit are likely to be adopted because they are easier to adopt and organizations generally don't need to change fundamental business processes.

Together, structural features and spirit form green IS initiatives' structure on which organizations can draw to reproduce or create their social structures. Organizations considering adopting green IS initiatives are more likely to do so given certain features (saving more energy) and a spirit of eco-efficiency. Therefore, we propose:

P1: Simpler structural features (e.g., lower energy consumption) and spirit of eco-efficiency will positively influence the intention to adopt Green IS initiatives.

3.3 Organizational Attributes

Whether an organization adopts green IS initiatives also depends on its attributes. Given that individuals actively choose whether and how to adopt a certain technology, the same technology may be understood and adopted differently in different organizations. We discuss the organizational attributes[4] that specifically influence the adoption of green IS initiatives from Section 3.3.1 to Section 3.3.3.

3.3.1 Managers' Leadership

Leadership is "the interaction between two or more members of a group that often involve a structuring or restructuring of the situation and the perceptions and expectations of members" (Bass, 1990, p. 11). Therefore, managers with different leadership styles likely have different interpretations of environmental issues and perceptions of green IS initiatives. For example, democratic leaders may be more interested in eco-collaboration initiatives based on their willingness to collaborate with others, while autocratic leaders may focus on eco-efficiency initiatives.

3.3.2 Green Mindset

We use the term green mindset to refer to managers' general attitudes toward green practices. Managers with a proactive mindset toward sustainability and green practices may be more likely to adopt green IS initiatives at a deeper organizational level. On the other hand, managers with a reactive mindset toward green practices may view them as a liability and be reluctant to launch green IS initiatives or only do so because of government regulations. At HP, Carly Fiorina held a more proactive mindset toward green

[1]Eco-efficiency is "the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing environmental impacts and resource intensity throughout the life cycle, to a level at least in line with the earth's estimated carrying capacity" (DeSimone, Popoff, & World Business Council for Sustainable Development, 1997, p. 47).

[2]Eco-effectiveness involves the design of products that "celebrate interdependence with other living systems" and "work within cradle-to-cradle life cycles rather than cradle-to-grave ones" (McDonough & Braungart, 1998, p. 88). In other words, eco-effectiveness means working on the right things rather than making the wrong things less bad (McDonough & Braungart, 2002). While eco-efficiency may focus on reducing energy consumption of computing equipment, eco-effectiveness guides companies to design equipment with more environmentally friendly or natural materials.

[3]Brooks et al. (2012) propose another eco-goal—eco-collaboration, which is the collaboration of companies and their stakeholders to maximize the benefit of green IS. In such a context, organizations need to collaborate with their partners and even their customers to redesign their products and/or business processes.

[4]We derived the three factors from DeSanctis and Poole (1994) but made them more appropriate to green IS. Specifically, managers' leadership comes from members' style of interacting, past experience comes from members' experience with the structures embedded in the technology, and green mindset comes from the degree to which members agree on which structures should be appropriated.

practices. She urged HP to rethink almost every aspect of the organization and identify opportunities for green IS initiatives from product innovation to manufacturing redesign. One result was the development of printers that made it easier to print on both sides of a piece of paper and, thus, save energy and paper (van Osch & Avital, 2010).

3.3.3 Past Experiences

Managers' experiences with green IS initiatives may influence whether they adopt future green IS initiatives. The more that organizations and managers are involved in green IS initiatives, the more likely they are to identify opportunities. In the case of HP, it has continued to be involved in green IS initiatives. As successful initiatives are implemented, it has undertaken deeper and more complex initiatives, including tackling state and industry regulations on recycling (van Osch & Avital, 2010).

As such, we propose:

P2a: Managers' leadership will positively influence an organization's intention to adopt green IS initiatives. Specifically, democratic leaders are more likely adopt eco-collaboration oriented initiatives.

P2b: Managers' green mindset will positively influence an organization's intention to adopt green IS initiatives.

P2c: Managers' experiences with green IS initiatives will positively influence an organization's intention to adopt green IS initiatives.

3.4 Organizational Environment

Many organizations function in highly regulated industries that produce and reproduce prescriptions of social reality, where any deviation requires legitimization (Deephouse, 1996). Thus, an isomorphic force is exerted by other organizations and agencies on which these organizations depend (Gosain, 2004). Such forces can be coercive, mimetic, or normative.

Coercive isomorphism can explain how the social forces that drive the adoption of green IS initiatives may influence decision makers; it can result from pressure exerted by organizations on which many firms depend and by the cultural expectations of society in which they function (DiMaggio & Powell, 1983). Coercive forces may be governmental mandates, such as pollution control laws, or conglomerate or logically central organizations that determine standard performance criteria. When a government creates a law or a mandate that forces industries to comply or face punishment, most organizations choose to comply. Thus, organizations are not given the chance to make a conscious decision about whether to implement a new green IS initiative; rather, the government makes the choice for them (HP's initial green initiatives were in response to tough laws in Germany and the UK) (van Osch & Avital, 2010).

Further, coercive forces are likely stronger when organizations need resources from other organizations. While coercive forces can lead to the adoption of similar green IS initiatives, there may be varying degrees of agreement among organizations relative to their resource dependency (Oliver, 1991). When dependence is high, it may reduce a firm's ability to resist external pressure (Ang & Cummings, 1997). In this instance, organizations with valuable resources will have greater power and can mandate other organizations to comply with their requirements. Such organizations are then forced to implement green IS initiatives to get the resources they need to survive. As such, we propose:

P3a: Organizations operating in highly regulated domains will tend to adopt similar mandated green IS initiatives.

P3b: Organizations will acquiesce to coercive forces and adopt mandated green IS initiatives to a greater extent when they must depend on other organizations to exchange compliance for resources.

Mimetic isomorphism helps to explain how uncertainty in external environments may influence the adoption of certain green IS initiatives that some other organizations have adopted. Such forces can influence how decision makers choose to follow paths based on the uncertain outcomes of choosing not to follow them. Thus, mimetic processes rely on uncertainty, which can cause organizations to mimic or model themselves after similar organizations in their field whom they perceive to be more legitimate or successful (DiMaggio & Powell, 1983).

To handle mimetic forces, organizations keep watch on what is happening with organizations in the same industrial sector. No organization wants to be left behind or allow their competitors to have an advantage; thus, when they observe competitors launching green IS initiatives, organizations may choose to imitate them, especially when competitors are seen as more successful or legitimate. This mimetic force can push organizations to adopt green IS initiatives by convincing them to "catch up". As a forerunner of the IT industry, HP likely led the mimetic force of the IT industry rather than following it, and organizations may have adopted green IS initiatives in mimetic response to HP's moves.

Thus, the more uncertain an environment, the more ambiguous an organization's goals may become. Analyzing the investment in green IS initiatives is difficult when organizations are less than certain about their goals. As a consequence, organizations may feel unclear about which initiatives are suitable and, thus, more likely to mimic their competitors. As such, we propose:

P3c: Organizations will tend to mimic the adoption of green IS initiatives from other successful organizations.

P3d: Organizations will acquiesce to mimetic forces and adopt similar green IS initiatives to a greater extent when their goals are ambiguous.

Finally, normative forces may explain an organization's desire to share the same set of green IS initiatives as competitors in the industry. By leveling the playing field, a new norm of green IS can spread across the industry and leave behind any organization that does not choose to follow. Normative forces are usually based on the professionalism of upper management for a certain set of organizations in an industry (DiMaggio & Powell, 1983). Thus, when all organizations require a certain level of education, this creates a relative norm followed by similar requirements among competitors. If a set of green IS initiatives such as a recycling program or data center optimization become how most if not all organizations in an industry conduct business, they establish an industrial norm for a green IS initiative. The creation of an unofficial norm can, thus, motivate others to follow since organizations who do not may be shunned, lose their market share, or see a reduction in their legitimacy. For example, HP helped formulate the supply chain code of conduct by co-developing the electronic industry code of conduct (van Osch & Avital, 2010). Once such standards are created and accepted by the industry, then other companies in the supply chain may have to follow those standards. Besides, the more mature an organizational network is, the stronger the relations between organizations. We can expect these relationships to develop shared beliefs, which are likely to make managers behave in identity-appropriate ways (Gosain, 2004) and result in strong normative forces. Therefore, we propose:

P3e: Organizations will tend to adopt green IS initiatives that reflect the collective norms in their industry.

P3f: Organizations will acquiesce to the normative forces and adopt "normative" green IS initiatives to a greater extent when they are embedded in mature organizational networks.

3.5 Implementation of Green IS Initiatives

Once the decision has been made to commence implementation of a green IS initiative, such a process is not as simple as installing new software or hardware or telling employees about a new policy. Implementing a new system, business process, or policy such as a green IS initiative may involve people who will resist change (Gosain, 2004). Project managers understand that handling change management can be one of the biggest challenges in implementation of green IS initiatives. Thus, decision makers' attitudes and the strategies for implementing green IS initiatives can have a substantial impact on change management.

The attitudes of upper management toward implementing a green IS initiative should most affect those employees who are less inclined toward the project (Leonard-Barton & Deschamps, 1988). When managers feel strongly about green IS initiatives, they are more likely to support employees when it comes to implementation. With support from managers, employees are more likely to become involved in implementing green IS initiatives (Ramus & Steger, 2000), and change their attitudes about them. In the late 1990s, HP decided to embark on a strategy of sustainability. To help with implementation, they conducted workshops to convince product stewards in the company that this was the company's proper direction. The end goal was to have these stewards go back to their respective areas and spread the word about the new direction (Preston, 1991).

Implementation strategies can span many techniques stretching across different facets. For software development, the choice of development methodology has a major impact on implementation (Holland & Light, 1999). For policies and hardware, the choice of rollout strategy is crucial. Looking beyond specifics, a formal strategy for implementing green IS initiatives must be decided on and put in place to have a positive effect on implementation and change management issues for green IS initiatives (Aladwani, 2001). Corbett (2010) proposes that organizations' environmental strategies will influence how they implement green IS initiatives. Elliot (2011) argues that formal structures and mechanisms can form shared understandings of particular environmental challenges—"prerequisites for fundamental changes in stakeholder behavior aimed at improving the level of quality of environment" (p. 225). Therefore, formal strategies will likely change attitudes and improve employee participation. As such, we propose:

P4a: Upper management's attitudes will positively influence employee participation and attitudes toward changes brought about by implementing green IS initiatives.

P4b: A formal implementation strategy will positively influence employee participation and attitudes toward changes brought about by implementing green IS initiatives.

3.6 Outcomes of Green IS Initiatives

Green IS initiatives may result in a variety of outcomes on multiple levels, such as individual, organizational, and societal.

3.6.1 Individual Outcomes

When organizations adopt green IS initiatives, they expect employees to see the benefits of the new initiatives and assimilate the technology or process. However, in practice, this is rarely the case. We view the degree to which employees resist or adopt green IS initiatives as individual outcomes. As we mention earlier in Section 3.5, effectively handling the issues surrounding change management is crucial to the success of a green IS initiative (Grover, Jeong, Kettinger, & Teng, 1995). By their nature, people are resistant to change. Employees who have been doing their jobs the same way for many years have difficulty adjusting to an entirely new way of performing their duties. Even a green IS initiative as seemingly simple as powering down a computer after work can become a struggle for people set their ways.

An implemented green IS initiative that is managed well should lead to easier adoption. The less stress of change on an organization, the less upheaval will be felt by employees, especially those that are part of the adoption. Since those participating in an initiative have a sense of "buy-in", they are likely better suited to handle changes than someone who is not a part of the process. Such employees are more likely to adopt green IS initiatives. In addition, those initiatives that provide feedback about the impacts of behavior may positively shape their opinions (Jenkin et al., 2011). For example, using software to capture and provide feedback on consumption patterns and how behavior changes may reduce their environmental footprint (e.g., Yang, Moore, Wong, Pu, & Chong, 2007) may help employees realize just how much impact their actions can have.

After green IS initiatives are adopted, routinization can occur. If employees resist the change well after the implementation takes place, a routine may not happen, but, when the process results in positive outcomes, green IS may become second nature. The complexity of the implemented initiative may also influence adoption and routinization. For example, organizations may replace computer monitors with a type that uses less energy. Here, the level of complexity is low since individuals do not need to change their behavior and routinization is likely to occur. However, if the organization requires employees to shut off all computers at the end of the day, the level of complexity is higher since people must change their behavior. If the implementation process is not managed well, individuals may resist and routinization will not occur. As such, we propose that:

P5a: Successful implementation of green IS initiatives will positively influence individuals' adoption and routinization of initiatives.

P5b: The level of complexity of an implemented green IS initiative will negatively influence individuals' adoption and routinization.

3.6.2 Organizational Outcomes

When organizations adopt green IS initiatives using various strategies, they expect that these initiatives will result in positive outcomes. That is, at the very least, they want to comply with regulations, improve performance whenever possible, and achieve a competitive advantage. HP has used the sustainability strategy to drive real revenue growth in a constantly changing marketplace (Lowitt & Grimsley, 2009). As Lowitt and Grimsley (2009) have noted, "Hewlett-Packard's sustainability strategy has already established the company as a clear thought leader in the industry—an advantage that leads to first-mover opportunities and first pick of top suppliers, employees and partners".

To understand other organizational outcomes, we draw on NRBV, an approach that identifies three interrelated strategies to support sustainability: pollution prevention, product stewardship, and sustainable development (Hart, 1995). Following NRBV, positive links may be established between sustainable strategies and firm performance. Indeed, the literature has confirmed a positive relationship between organizations' orientation toward a natural environment and firm performance (Menguc & Ozanne, 2005). Although these strategies have the potential to make a positive impact, outcomes will differ depending on what strategies are followed and how initiatives are adopted and implemented.

Pollution prevention is likely to improve firm performance: an organization may adopt energy-efficient hardware or redesign a data center that results in lower energy consumption. However, energy-efficient hardware alone cannot help an organization achieve a competitive advantage since it would be easy for competitors to adopt similar hardware. Other kinds of initiatives, such as turning off computers, may require internal changes in the organization and be harder to imitate (Corbett, 2010) but are difficult for organizations to implement since more stakeholders are involved. Organizations must be careful during the implementation process and require a greater commitment from employees since they may have to change their habits. For this level of implementation, organizations might have to reconcile the interests of different stakeholders to be successful.

Product stewardship is designed to reduce the negative consequences of IT production (Setterstrom, 2008) and includes the removal of toxins and take-back programs. In the 1990s, HP established a product stewardship function that focused on global processes for tracking and managing regulatory compliance issues, customer inquiry response systems, information management, public policy shaping, product take-back programs, green packaging, and for integrating "design for the environment" and life-cycle analysis into product development processes (Preston, 2001). The benefits of product stewardship include a first-mover advantage. For organizations like HP that engage in extensive initiatives, approaches are based on unique organization culture, which makes it hard for others to imitate. Therefore, while products may be imitable by other competitors, the process developed during product stewardship may not be and, thus, provide organizations with a competitive advantage.

Sustainable development holds that organizations should lower or eliminate the ecological impact by their activities. This strategy deals with every aspect of the organization. Examples of sustainable development of green IS initiatives include collaboration technologies, business intelligence applications, and manufacturing systems control (Corbett, 2010). Successfully implemented, these initiatives offer organizations a competitive advantage because they often require business process redesign hard for competitors to imitate. On the other hand, they can be quite difficult for organizations to implement, and failed implementation could even damage performance. As such, we argue that:

P6: Successfully implemented green IS initiatives will positively influence organization performance and provide a competitive advantage.

3.6.3 Societal Outcomes

Green IS initiatives are designed to make the environment more sustainable. They can bring positive societal outcomes when successfully implemented, although different kinds of initiatives may have various benefits.

One of the most common outcomes is reduced energy consumption (Brooks et al., 2012). Kurp (2008) shows how green IS initiatives can reduce the energy that data centers consume; Overby (2007) reports that VistaPrint results in significant savings and lower carbon emissions. At HP, reducing the amount of energy wasted by their data centers was crucial. They began by using power management software on their EMS to control units at peak times because they realized that approximately 50 percent of power consumed by a data center was used for cooling while power supplies on the servers were drawing 80

percent of capacity even when idle (Lowitt & Grimsley, 2009). HP built a data center in India using a proprietary system that coordinated cooling in real time that used over 7,000 sensors. This system initially saved 20 percent of cooling costs compared with other data centers and was expected to save enough annual energy to equal 7,500 tons of carbon dioxide emissions (Lowitt & Grimsley, 2009). By adopting these eco-efficiency initiatives, organizations such as HP are able to cut carbon emissions and lower their energy consumption.

Another frequent outcome is reducing and preventing pollution. Given that IT products can cause pollution and have negative impact on the environment, governments continue to draft regulations involving proper disposal. In 2004, HP announced that, in collaboration with Office Depot, it was going to offer free recycling to consumers (van Osch & Avital, 2010). The company has demonstrated an ongoing commitment to product disposal by organizing a series of events to create public awareness for turning in e-waste and the benefits of recycling, informing others about existing recycling channels, and mitigating concerns over data security (van Osch & Avital, 2010). These efforts are designed to reduce and even prevent the pollution resulting from producing and using IT.

The societal outcome of green IS initiatives can also create awareness of sustainability. Events such as HP's recycling program help people to understand the benefits of overall recycling and find ways to recycle. The desire to give back to society and create sustainability-focused professionals demonstrates HP's level of commitment. In 2003, it donated over CAD$2 million to the Schulich School of Business at York University to establish a chair in corporate social responsibility, intended to produce the next generation of global business leaders (van Osch & Avital, 2010).

Ultimately, with initiatives such as these, people may become more aware of the negative impacts of IT, which will result in greater awareness of sustainability for green IS initiatives and other sustainable practices. Those educated by these programs may not only recycle older electronic equipment but recycle other reusable materials and strive to use less energy to provide a benefit to society. To summarize, we propose that:

P7: Successfully implemented green IS initiatives will result in positive societal outcomes such as reducing energy used, preventing pollution, and raising public awareness.

3.6.4 Organizational Environment Outcomes

Isomorphic forces, specifically mimetic ones, have the potential to work in both directions. They may not only explain why organizations make specific choices, but also help explain why their competitors make choices. With regard to mimetic isomorphism, organizations may choose to implement green IS initiatives depending on who is considered a leader of the corporate environment. An organization considered ahead in technology and/or green IS initiatives may find its competitors doing everything they can to catch up or assume the industrial norm so that whatever advantage the lead organization enjoys may soon disappear. For organizations that do not improve, this will result in a more level playing field or a norm of green IS initiatives throughout the industry, which will acts as a driver to push other organizations to adopt the green IS initiative or face a possible downturn in ability or social stature. Thus, faced with the downside of not "following the leader", successfully implementing a Green IS initiative will likely gain the attention of the organizational environment. As such, we propose:

P8: The successfully implemented green IS will positively influence implementation of similar green IS initiatives by other organizations in the same field.

3.7 Recursive Influences on Green IS Initiatives Adoption

There are two recursive influences on green IS initiatives implementation/adoption—one based on organizational outcomes and the other on societal outcomes.

3.7.1 Recursive Influences from Organizational Outcomes to Adopting Green IS Initiatives

Discussing the adoption of green IS initiatives, West (2007, p. 64) explains that "convincing your enterprise to fund data center improvements not directly related to business delivery can be a challenge". Thus, it can difficult for individuals to argue for their organization to adopt green IS initiatives when there is no evidence such initiatives will improve its performance. Once initial initiatives have been implemented such that organizations enjoy benefits such as reduced energy consumption and increased savings, it will be easier to justify adopting further initiatives. Although HP's early adoption of green IS initiatives was in

response to government regulation, over time, they reaped certain benefits such as cost savings and increased efficiency (Lowitt & Grimsley, 2009; van Osch & Avital, 2010), which led HP to rethink the role played by green IS initiatives and made them more open to future opportunities. In fact, it was only after an MBA candidate was brought in to research the applicability of sustainability, which led them to look at previous successful initiatives, that the company moved forward on a sustainability track. This shows that, when organizations experience positive outcomes from their green IS initiatives in the past, they are likely to adopt green IS initiatives in the future. Had HP experienced negative outcomes from its green IS initiatives (e.g., reduced performance), it might not have pursued sustainability at the level they now enjoy. Therefore, we propose that:

P9: A positive outcome of previous green IS initiatives will positively influence an organization to engage in green IS initiatives in the future.

3.7.2 Recursive Influences from Societal Outcomes to Adopting Green IS Initiatives

The societal outcomes of green IS initiatives can create public awareness of sustainability. If the public sees benefits of green IS, there is a strong chance they will push organizations to implement additional initiatives. Organizations generally embrace the idea of corporate social responsibility (CSR), so any outcry from society to continue to "go green" would tend to be greeted affirmatively.

When green IS initiatives have a positive impact that people notice and recognize, such individuals will support the organizations participating in the desired initiative. Following the principles of NRBV, green IS initiatives may offer a competitive advantage when consumers value an initiative that the competition does not provide. As an example, consumers concerned with eco-efficiency would be more likely to purchase a computer system from HP if it offered greater energy efficiency than its competitors. Thus, producing eco-efficient computer systems would provide HP positive feedback in the form of a purchase.

In the context of green IS initiatives, most people are starting to recognize the importance of sustainability. Environmentally friendly behaviors are becoming institutionalized through education, including prominent publications and business school curricula, the popular media, and governmental regulations. As managers and employees read these publications, partake of media offerings, and act on governmental regulations, they may act in more socially responsible ways and engage in further initiatives (Campbell, 2007). Specifically, managers will be more likely to consider the potential of green IS initiatives and urge organizations to participate. Similarly, employees exposed to these materials may be more willing to accept the practices embedded in green IS initiatives. Therefore, we propose that:

P10: Positive outcomes from green IS initiatives will positively influence society to push for more green IS initiatives in the future.

4 Discussion and Conclusion

In this study, we develop a multi-theoretical framework to examine the entire process of green IS across different levels. Our model explicitly recognizes that the attributes of green IS initiatives can differ widely. Attributes of an initiative (P1), the organization (P2), and the organizational environment (P3) may support the organization's intention to implement green IS initiatives. Once a decision to proceed has been made, implementation can begin (P4). As either a byproduct or direct effect of implementation, individuals (P5), the organization (P6), society (P7), and the organizational environment (P8) may be affected. The impact on the organization (P9) and society (P10) can provide feedback for the future implementation of green IS initiatives. Thus, our model examine all stages of green IS initiatives from initiation, implementation, outcomes to feedback influences; our examination of outcomes include different levels such as the individual, organizational, and societal levels.

Our paper serves as a theoretical basis for green IS by addressing the four limitations identified in the literature (Table 1 summarizes), which is consistent with recent calls for research into the role of technology in organizational affairs (Orlikowski & Scott, 2008), and offers new directions for research into green IS (Brooks et al., 2012). Such a model should be of interest to academic researchers, IT practitioners, and governmental regulating agencies. We hope that our work will point to future directions for green IS research and that more studies will come to light so that practitioners and researchers can better understand this phenomenon.

4.1 Contributions to Research

This paper advances our theoretical understanding of green IS in different ways. First, it highlights the various types of green IS and the attributes of green IS initiatives that have received scant attention in the literature. Our review of the recent literature found only four studies that explicitly examine the attributes of green IS initiatives. Without a clear understanding of the attributes of green IS initiatives, researchers may not know how specific types of green IS initiative differ from one another and how such differences may influence their subsequent adoption. We address this limitation by identifying the eco-goals of green initiatives and, using HP as a case study, show how the broad range of the spirit and attributes of these initiatives that may affect the decision to adopt green IS initiatives.

Although green IS has been examined on technological, individual, and organizational levels, different decisions and effects may arise from each. Our model uses approaches such as AST, isomorphism, and NRBV to offer a multilevel perspective on green IS, something few studies have done. Specifically, we articulate the impact of green IS initiatives on the individual, organizational, environmental, and societal levels. Multilevel models are known to offer unique theoretical and practical advantages (Starik & Rands, 1995) by identifying the "individual-level characteristics, behaviors, attitudes, and perceptions that underlie and shape organization-level characteristics and outcomes (and) integrating the micro domain's focus on individuals and groups with the macro domain's focus on organizations, environment, and strategy" (Klein, Tosi, & Cannella, 1999, p. 243). Therefore, our framework can provide a more complete picture of the effects of green IS initiatives.

Our study also contributes to a holistic understanding of green IS, which our review shows has been lacking in prior studies, which primarily focus on one or more stages of green IS. While valuable insights can be assembled from myriad perspectives, assembling these data can be challenging. Following a multi-theoretical perspective, we bring together the existing literature on green IS implementation, adoption, and impact to develop a model that provides a much needed overview of green IS adoption and implementation. By integrating these theoretical lenses, researchers for the first time can view the entire process of implementation and adoption. Thus, the successfully integrating a previous initiative will have a huge impact on future decisions made about green initiatives.

Our study also highlights the recursive impact of outcomes of green IS initiatives on the future direction of organizations. As our review shows, few studies have examined how the outcomes of green IS initiatives influence the future adoption of green IS initiatives; we make an important contribution by arguing that the relationship between organizations and their environment is recursive rather than linear. Thus, our framework includes a feedback loop that shows organizational and societal outcomes as new factors influencing the adoption of future initiatives.

Finally, by using Hewlett-Packard as our primary example, we show how many propositions have come to life in the business world. HP has a long history with green IS initiatives and continues to implement them. Its successes in earlier years have driven it to greater success today, so that HP has reinvented itself as a sustainability-minded organization. The ideas our model proposes continue to play roles in HP's evolution.

4.2 Contributions to Practice

Our paper holds important implications for practice. Organizations may not have a clear understanding of the holistic picture of green initiatives or guidance on how to gain this view. Our model, which examines the entire process, can be an invaluable tool for practitioners. Given that IT/IS implementations are fraught with failure, not all IT projects, including green IS initiatives, may be successfully implemented (Gosain, 2004); thus, tools that provide decision makers with better information and knowledge will help them to reach better decisions. Though many reasons can account for failure, such as poor management, lack of capital, poor quality materials, and so on, lacking a clear understanding of the implementation process is one of the most common. The model we posit provides this vital function and affords managers a roadmap to consider the entire process rather than bits and pieces, which allows them to create their own holistic plan and gives them a greater chance of success. Although the challenges associated with implementing green IS initiatives remain, our proposals should provide managers with a more realistic view of the entire process so that they can plan accordingly.

Future success starts with understanding the different characteristics of green IS initiatives. For example, the plan to implement an initiative to power down PCs every night will differ from one that commits manufacturing lines to using recyclable materials. By having a greater idea of the attributes of the

initiatives involved, managers can determine which to adopt and the implications for their implementation and outcomes.

Managers can also clearly see the roles played by organizational and environmental factors influencing adoption. With an understanding of the organization and other important factors, promising green IS initiatives can be identified beforehand instead of picking one and trying to make it work, increasing successful implementation and saving time and money. For example, by understanding their leadership styles, managers can select initiatives that are appropriate for their organizations and decide to lead the charge or step out of the way, accordingly.

Managers must also realize a recursive relationship exists between organizations and the environments in which they operate. According to AST, decisions organizations make influence other organizations, society, the natural environment, and so on, which, in turn, influence the organization. For a company considering sustainability, such relationships are vital to long-term success. HP has had numerous successes using green IS initiatives—many derived from lessons learned from previous implementations.

The recursive relationship highlighted in our framework assists organizations in two ways. First, if people lack extensive experience with green IS initiatives or feel skeptical about their effect, organizations can start with simple, easily implemented initiatives. As these begin to generate positive outcomes, organizations can then adopt more complex initiatives. Second, managers may view each implementation of green IS initiatives as an opportunity to learn about green IS and gain experience, experiences, and knowledge that become valuable resources to guide future adoption.

Our framework offers valuable input for governmental regulation-creating agencies by showing the many factors that influence organizations' adoption of green initiatives, which, in turn, can lead to lower energy consumption and environmentally healthy products. When government regulation or institutional isomorphism pushes organizations to adopt green IS initiatives, companies often take a passive attitude toward the initiatives, blinding them to the real benefits that exist beyond eco-efficiency. When HP adopted green IT initiatives in response to regulations, it took a while before the company grasped their true benefits. Therefore, regulatory agencies must give organizations the chance to take a proactive attitude and learn that when regulations are enacted, different factors come into play when organizations are forced to deal with implementation.

4.3 Limitations and Opportunities for Future Studies

Like all research, our study has its limitations. We make no claim that this model identifies every relationship of interest involving green IS initiatives; we encourage other researchers to develop their own propositions based on this framework. In addition, although our framework focuses on different levels of analysis (individual, organization, society), future studies may examine group-level environmental orientation (Jenkin et al., 2011) and network effects based on tie strength among individuals. Finally, while we use an IT manufacturing organization as the example for this study, future studies could analyze consumers, governments, and organizations in different sectors.

We present readers with a set of propositions that can be subjected to empirical testing and may serve as a research agenda for others to verify and expand. Given the complexity of our multi-theoretical framework, it may not be easy to test in one study. We recommend that it be parsed into different parts. For example, P1-P3 may be tested separately in different studies or in a single study to understand how different factors influence organizations' adoption of green IS initiatives. Some constructs, such as the structures of green IS, remain to be developed, while others, such as the organizational attributes, have been examined in other contexts but not applied to the context of green IS. Therefore, future studies will need to develop and validate their own constructs before examining their impact on the adoption of green IS initiatives.

Researchers may choose to focus on P4 during the implementation of green IS initiatives, for which case studies can be helpful in clarifying relevant constructs and validating further propositions. It is possible that additional constructs may be identified via case studies so that propositions can be tested and expanded into field studies using surveys. After implementation, P5-P8 may be validated separately or together to examine the multi-level impact of green IS initiatives by using case studies to validate or expand the propositions, followed by field studies and surveys to test and verify them.

Finally, researchers can use P9 and P10 to analyze the influence of feedback and societal impact on the future adoption of Green IS initiatives. While studies during one period are suitable for most propositions,

P9 and P10 are more appropriate for tests using a longitudinal approach. Since green IS remains a new phenomenon, few organizations are likely implementing additional initiatives, and researchers may be unable to obtain a large enough sample. Therefore, longitudinal case studies may be helpful in examining P9 and P10.

Overall, green IS represents a complex and emerging phenomenon that offers scant understanding of the issues related to its adoption, implementation, and impact. We hope our framework will point researchers in fruitful directions and prompt them to engage in future studies of green IS.

References

Aladwani, A. (2001). Change management strategies for successful ERP implementation. *Business Process Management Journal*, *7*(3), 266-275.

Ang, S., & Cummings, L. L. (1997). Strategic response to institutional influences on information systems outsourcing. *Organization Science*, *8*(3), 235-256.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Bass, B. M. (1990). *Bass and Stogdill's handbook of leadership: Theory, research, and managerial applications* (3rd ed.). New York, NY: The Free Press.

Bose, R., & Luo, X. (2011). Integrative framework for assessing firms' potential to undertake Green IT initiatives via virtualization—a theoretical perspective. *Journal of Strategic Information Systems, 20*(1), 38-54.

Bostrom, R. P., & Heinen, J. S. (1977). MIS problems and failures: A socio-technical perspective. Part I: The causes. *MIS Quarterly, 1*(3), 17-32.

Boudreau, M.-C., Chen, A .J., & Huber, M. (2008). Green IS: Building sustainable business practices. In R.T. Watson (Ed.), *Information systems* (pp. 247-261), Athens, Georgia: Global Text Project.

Brooks, S., Wang, X., & Sarker, S. (2012). Unpacking green IS: A review of the existing literature and directions for the future. In J. vom Brocke, S. Seidel, & J. Recker (Eds.), *Green business process management—towards the sustainable enterprise* (pp. 15-37). Heidelberg, Germany: Springer.

Butler, T. (2011). Compliance with institutional imperatives on environmental sustainability: Building theory on the role of Green IS. *Journal of Strategic Information Systems, 20*(1), 6-26.

Campbell, J. L. (2007). Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility. *Academy of Management Review, 32*(3), 946-967.

Chen, A. J., Watson, R. T., Boudreau, M., & Karahanna, E. (2009). Organizational adoption of green IS & IT: An institutional perspective. In *Proceedings of International Conference on Information Systems*.

Corbett, J. (2010). Unearthing the value of green IT. In *Proceedings of International Conference on Information Systems*.

Dao, V., Langella, I., & Carbo, J. (2011). From green to sustainability: Information Technology and an integrated sustainability framework. *Journal of Strategic Information Systems*, *20*(1), 63-79.

Davis, P., Desai, A., & Francis, J. (2000). Mode of international entry: An isomorphism perspective. *Journal of International Business Studies*, 31(2), 239-258.

Deephouse, D. (1996). Does isomorphism legitimate? *Academy of Management Journal, 39*(4), 1024-1039.

DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science, 5*(2), 121-147.

DeSimone, L. D., Popoff, F., & World Business Council for Sustainable Development. (1997). *Eco-efficiency: The business link to sustainable development*. Cambridge, MA: MIT Press.

DiMaggio, P., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational field. *American Sociological Review, 48*(2), 147-160.

Elliot, S. (2011). Transdisciplinary perspectives on environmental sustainability: A resource base and framework for IT-enabled business transformation. *MIS Quarterly, 35*(1), 197-236.

Gargeya, V. B., & Brady, C. (2005). Success and failure factors of adopting SAP in ERP system implementation. *Business Process Management Journal, 11*(5), 501-516.

Gimenez, C., Sierra, V., Rodríguez, J. A., & Rodon, J. (2012). The same assets, but new impacts: IT-enabled coordination and environmental performance. In *Proceedings of European Conference on Information Systems*.

Glynn, M. A., & Abzug, R. (2002). Institutionalizing identity: Symbolic isomorphism and organizational names. *Academy of Management Journal, 45*(1), 267-280.

Gosain, S. (2004). Enterprise information systems as objects and carriers of institutional forces: The new iron cage? *Journal of the Association for Information Systems, 5*(4), 151-182.

Grover, V., Jeong, S. R., Kettinger, W. J., & Teng, J. (1995). The implementation of business process reengineering. *Journal of Management Information Systems, 12*(1), 109-144.

Gupta, S., & Bostrom, R. (2009). Technology-mediated learning: A comprehensive theoretical model. *Journal of the Association for Information Systems, 10*(9), 686-714.

Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of Management Review, 20*(4), 986-1014.

Hart, S. L, & Dowell, G. (2010). A natural-resource-based view of the firm fifteen years after. *Journal of Management, 27*(5), 1464-1479.

Haveman, H. (1993). Follow the leader: Mimetic isomorphism and entry into new markets. *Administrative Science Quarterly, 38*(4), 593-627.

Hawley, A. (1968). Human ecology. In David L. Sills (ed.), *International encyclopedia of the social sciences* (pp. 328-337). New York, NY: Macmillan.

Hjalmarsson, A., & Lind, M. (2011). Challenges in establishing sustainable innovation. In *Proceedings of European Conference on Information Systems*.

Holland, C. P., & Light, B. (1999). A critical success factors model for ERP implementation. *IEEE Software, 16*(3), 30-36.

Iacono, J. C., Brown, A., & Holtham, C. (2011). The use of the case study method in theory testing: The example of steel emarketplaces. *Electronic Journal of Business Research Methods*, *9*(1), 57-65.

Jankowski, P., & Nyerges, T. L. (2001). *Geographic information systems for group decision making: Towards a participatory, geographic information science*. New York, NY: Taylor and Francis.

Jenkin, T. A., Webster, J., & McShane, L. (2011). An agenda for "green" information technology and systems research. *Information and Organization, 21*(17), 17-40.

Klein, K. J., Tosi, H., & Cannella, A. A., Jr. (1999). Multilevel theory building: Benefits, barriers, and new developments. *Academy of Management Review, 24*(2), 243-248.

Kurp, P. (2008). Green computing. *Communications of the ACM, 51*(10), 11-13.

Lapointe, L., & Rivard, S. (2005). A multilevel model of resistance to information technology implementation. *MIS Quarterly, 29*(3), 461-491.

Lei, C. F., & Ngai, E. W. T. (2012). Green IS assimilation: A theoretical framework and research agenda. In *Proceedings of Americas Conference on Information Systems*.

Leonard-Barton, D., & Deschamps, I. (1988). Managerial influence in the implementation of new technology. *Management Science, 34*(10), 1252-1265.

Lowitt, E. M, & Grimsley, J. (2019). *Hewlett-Packard: Sustainability as a competitive advantage*. Retrieved from http://www.hp.com/hpinfo/globalcitizenship/environment/commitment/accenturestudy.pdf

Mann, H., Grant, G., & Singh Mann, I. J. (2009). Green IT: An implementation framework. In *Proceedings of Americas Conference on Information Systems*.

Marquis, C., Glynn, M. A., & Davis, G. (2007). Community isomorphism and corporate social action. *Academy of Management Review, 32*(3), 925-945.

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS Quarterly, 19*(4), 487-505.

Menguc, B. & Ozanne, L. K. (2005). Challenges of the "green imperative": A natural resource-based approach to the environmental orientation-business performance relationship. *Journal of Business Research, 58*(4), 430-438.

McDonough, W., & Braungart, M. (1998). The NEXT industrial revolution? *The Atlantic Monthly, 10*, 82-92.

McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things.* New York, NY: North Point Press.

Melville, N. P. (2010). Information systems innovation for environmental sustainability. *MIS Quarterly, 34*(1), 1-21.

Murugesan, S. (2008). Harnessing green IT: Principles and practices. *IT Professional, 10*(1), 24-33.

Naik, N., & Kim, D. J. (2010). An Extended adaptive structuration theory for the determinants and consequences of virtual team success. In *Proceedings of International Conference on Information Systems*.

Oliver, C. (1991). Strategic responses to institutional pressures. *Academy of Management Review, 16*(1), 145-179.

Ollman, B. (1971). *Alienation: Marx's conception of man in capitalist society*, Cambridge, UK: Cambridge University Press.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science, 3*(3), 398-427.

Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *Academy of Management Annals, 2*(1), 433-474.

Orlikowski, W. J., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping electronic communication: The metastructuring of technology in the context of use. *Organization Science, 6*(4), 423-444.

Overby, S. (2007). Clean, green machines. *CIO, 20*(12), 36-44.

Preston, L. (2001). Sustainability at Hewlett-Packard. *California Management Review, 43*(3), 26-37.

Ramus, C. A., & Steger, U. (2000). The roles of supervisory support behaviors and environmental policy in employee “ecoinitiatives” at leading-edge European companies. *Academy of Management Journal, 43*(4), 605-626.

Rumelt, R. P., Schendel, D., & Teece, D. J. (1991). Strategic management and economics. *Strategic Management Journal*, *12*(S2), 5-29.

Sarker, S., & Valacich, J. S. (2010). An alternative to methodological individualism: A “non-reductionist” approach to studying technology adoption by groups. *MIS Quarterly, 34*(4), 779-A3.

Scott, W. R. (2003). Institutional carriers: reviewing modes of transporting ideas over time and space and considering their consequences. *Industrial and Corporate Change, 12*(4), 879-894.

Setterstrom, A. (2008). The natural resource-based view of a firm: Strategic opportunities in IT. In *Proceedings of Academy of Management 2008 Annual Meetin*g.

Simmonds, D., & Bhattacherjee, A. (2012). Environmental sustainability in organizations: The information technology role. In *Proceedings of Americas Conference on Information Systems*.

Sinclaire, J. K., & Vogus, C. E. (2011). Adoption of social networking sites: An exploratory adaptive structuration perspective for global organizations. *Information Technology and Management, 12*(4), 293-314.

Starik, M., & Rands, G. P. (1995). Weaving an integrated web: Multilevel and multisystem perspectives of ecologically sustainable organizations. *Academy of Management Review, 20*(4), 908-935.

Swanson, E. B., & Ramiller, N. C. (1997). The organizing vision in information systems innovation. *Organization Science, 8*(5), 458-474.

Tarafdar, M., Modi, S., Roy, S., & Datta, A. (2010). Adoption of sustainability in IT services: Role of IT service providers. In *Proceedings of Americas Conference on Information Systems*.

Tellis, W. (1997). Application of a case study methodology. *The Qualitative Report, 3*(3), 1-17.

Thoroe, L., Appelhanz, S., & Schumann, M. (2011). RFID-based individualization of extended producer responsibility and recycling for WEEE. In *Proceedings of European Conference on Information Systems*.

Tingling, P., & Parent, M. (2002). Mimetic isomorphism and technology evaluation: Does imitation transcend judgment? *Journal of the Association for Information Systems, 3*(1), 113-143.

Triche, J., Cao, Q., & Song, J. (2011). Exploring the impact of RFID on organizational structure changes in a healthcare setting: An adaptive structuration theory perspective. In *Proceedings of International Conference on Information Systems*.

van Osch, W., & Avital, M. (2010). From green IT to sustainable innovation. In *Proceedings of Americas Conference on Information Systems*.

Vykoukal, J., Wolf, M., & Beck, R. (2009). Does green IT matter? Analysis of the relationship between green IT and grid technology from a resource-based view perspective. In *Proceedings of Pacific Asia Conference on Information Systems*.

Wade, M., & Hulland, J. (2004). Review: The resource-based view and information systems research: Review, extension, and suggestions for future research. *MIS Quarterly, 28*(1), 107-140.

Watson, R. T., Boudreau, M., & Chen, A. J. (2010). Information systems and environmentally sustainable development: Energy informatics and new directions for the IS community. *MIS Quarterly, 34*(1), 23-38.

West, J. (2007). COOL rules for HOT computing. *CIO, 21*(4), 56-64.

Yang, X., Moore, P. R., Wong, C.-B., Pu, J.-S., & Chong, S. K. (2007). Product lifecycle information acquisition and management for consumer products. *Industrial Management & Data Systems, 107*(7), 936-953.

Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage.

Appendix A: Academic Literature Review

To assess the current status of academic literature, we conducted an updated review following Brooks et al. (2012). In this appendix, we present the methods and results of our review.

For the academic literature, we first search eight premier academic IS journals*: MIS Quarterly (MISQ), Information Systems Research (ISR), Journal of Management Information Systems (JMIS), Journal of the Association for Information Systems (JAIS), European Journal of Information Systems (EJIS), Information Systems Journal (ISJ), Journal of Strategic Information Systems (JSIS),* and *Journal of Information Technology (JIT).* We then expanded our search by including other conference proceedings from theAmericas Conference on Information Systems (AMCIS), the European Conference on Information Systems (ECIS), the Pacific Asia Conference on Information Systems (PACIS), and the International Conference on Information Systems (ICIS).

The first time the term "green IT" appeared was 2007 in *CIO Magazine*; therefore, we considered 2007 as the beginning date, and our search covered the years 2007-2013. We used the terms "green", "sustainable", "sustainability", "environment", "climate", "disposal", "recycling", "e-waste", "energy informatics", "energy efficiency", "emission reductions", "smart grid", "grid computing", "CO2 reduction", "carbon productivity", "greenhouse gas", and "corporate responsibility" to identify relevant papers. We also searched Google Scholar to identify useful academic publications. Table A1 presents the results.

Table A1. A Review of Green IS Literature

Authors	Green IS attributes	Initiation factors	Implementation stages	Outcomes	Recursive influence	Level of analysis
AMCIS 2008						
Chaabane, Ramudhin, Paquet, and Benkaddour (2008)						Industry
Sayeed and Gill (2008)		Profitability; social responsibility				Org.
AMCIS 2009						
Erek, Schmidt, Zarnekow, and Kolbe (2009)						Org.
Hasan, Ghose, and Spedding (2009)						N/A
Mann, Grant, and Singh Mann (2009)		Regulation; government regulations; industry-wide standards; demand; leadership; cost	Determine external and internal factors; assess sophistication of strategy, technology and processes; analyze sustainability measures			Org.
Sayeed and Gill (2009)						Org.
AMCIS 2010						
Cazier, Shao, and St. Louis (2010)				Economic (+)(1)		Individual
Corbett, Webster, Sayili, Zelenika, and Pearce (2010)						N/A

Table A1. A Review of Green IS Literature

Data, Staake, and Fleisch (2010)				Environmental (+)		Industry
Hasan and Dwyer (2010)						N/A
Iacobelli, Olson, and Merhout (2010)						N/A
Kim and Ko (2010)						Org.
Kuo and Dick (2010)		External competitive pressures; bottom line considerations; normative legitimation pressures; coercive legitimation pressures; social responsibility pressures				Org.
McLaren, Manatsa, and Babin (2010)						Org.
Schmidt, Erek, Kolbe, and Zarnekow (2010)		Corporate management; environmental engagement; experience; measurement; standards; hype; initiative from IT staff				Org.
Seidel, Recker, Pimmer, and Brocke (2010)		Strategy definition; organizational support; motivation; traceability				Org.
Tarafdar, Modi, Roy, and Datta (2010)				Environmental (+); economic (+); social (+)		Org.
van Osch and Avital (2010)			Green IT; Green IS; Sustainable Innovation	Environmental (+)	Help create public awareness; Re-think how PC's are manufactured	Org.
AMCIS 2011						
Benitez-Amado and Walczuch (2011)				Economic (+)		Org.
Corbett (2011)						Org.

Table A1. A Review of Green IS Literature

Friedemann, Dehler, Friedrich, Haack, and Schumann (2011)						Org.
Jung, Kim and An (2011)				Environmental (+); economic (+)		Org.
Lee, Oh, Koo, and Sarkis (2011)						Org.
Loeser, Erek, Schmidt, Zarnekow, and Kolbe (2011)						Org.
Nedbal, Wetzlinger, Auinger, and Wagner (2011)	Technical compatibility; Perceived complexity	Top management support; transaction costs; size; regulatory support; competition intensity				Org.
Ruch, Schmidt, Decker, and Kolbe (2011)						Org.
Ryoo, Koo, and Wati (2011)				Environmental (+); economic (+)		Org.
Schiller and Merhout (2011)						Technology
Thies and Stanoevska-Slabeva (2011)						Technology
Vazquez, Rocha, Dominguez, Morales, and Ahluwalia (2011)						N/A
Volkoff, Bertels, and Papania (2011)						Org.
Yim (2011)				Environmental (+/0)		Individual
AMCIS 2012						
Califf, Lin, and Sarker (2012)						N/A
Corbett (2012)						Org.
Corley, Cazier, and Vannoy (2012)				Economic (+)		Individual
Flath, Ilg, and Weinhardt (2012)						Technology

Table A1. A Review of Green IS Literature

Goetzinger, Brandt, and Neumann (2012)						Org.
Ijab, Molla, and Cooper (2012)		Regulative-legislative signals; normative signals; cultural-cognitive signals				Org.
Kranz and Picot (2012)		Environmental concern; energy price consciousness; perceived usefulness; perceived ease of use; perceived behavioral control; sources' influence				Individual
Lei and Ngai (2012)		Environmental uncertainty; organizational slack (operational, human resource, financial); mimetic, coercive, and normative pressures	Initiation; adoption; routinization			Org.
Opitz, Erek, Langkau, Kolbe, and Zarnekow (2012)						Org.
Qiu, Götzinger, and Neumann (2012)						Technology
Simmonds and Bhattacherjee (2012)		Stakeholders' pressures; operational inefficiencies; environmental footprint	Initiation; adoption; adaptation; acceptance; routinization; incorporation	Environmental (+); economic (+); social (+)		Org.
Stolze, Semmler, and Thomas (2012)						N/A
Strüker and van Dinther (2012)						N/A
Thies and Stanoevska-Slabeva (2012)						Org.
AMCIS 2013						
Benitez-Amado, Llorens-Montes, and Fernandez-Perez (2013)		Talent management		Economic (+)		Org.
Brandt (2013)						Technology

Table A1. A Review of Green IS Literature

Erskine and Füstös (2013)				Environmental (+); economic (+)		
Grimm, Erek, and Zarnekow (2013)						Technology
Krogstie, Ståhlbröst, Holst, Jelle, Kulseng, Gudmundsdottir, Braskus, and Olesen (2013)						Individual
Loeser (2013)						N/A
Moeller, Erek, Loeser, and Zarnekow (2013)						Individual
Schmidt and Busse (2013)				Environmental (+); economic (+)		Technology
Schödwell, Erek, and Zarnekow (2013)						Technology
Strüker, Reichert, and Brenig (2013)						Industry
ECIS 2008						
Butler and Daly (2008)		Regulative, normative, and cultural-cognitive influences				Org.
ECIS 2009						
Mary and Butler (2009)		Regulative, normative, and cultural-cognitive influences				Org.
ECIS 2010						
Capra, Formenti, Francalanci, and Gallazzi (2010)						Technology
Schmidt, Schmidtchen, Koray, Kolbe, and Zarnekow (2010)				Economic (+)		Individual
Vykoukal (2010)		Pressure for environmental sustainability; top management support		Environmental (+)		Org.
ECIS 2011						

Table A1. A Review of Green IS Literature

Alaraifi, Molla, and Deng (2011)	Sensor IS factors (complexity; affordability; reliability; compatibility); data center factors (infrastructure requirements; data center age; data center type);	Organization factors (green IS policy; SIS know-how of manager; data center governance); environment factors (regulatory requirements)				Org.
Bodenstein, Schryen, and Neumann (2011)				Environmental (+); economic (+)		Technology
Boehm, Freundlieb, Stolze, Thomas, and Teuteberg (2011)			Determination of customer requirements; definition of to-be properties; synthesis of properties of the product-service system; analysis of as-is properties; implementation and application scenario			Org.
Butler (2011b)						Org.
Curry, Hasan, ul Hassan, Herstand, and O'Riain (2011)						Org.
Graml, Loock, Baeriswyl, and Staake (2011)		Reward benefits; emotional connection; goal setting; social norms; public commitment; prompting; Immediate feedback				Individual
Hjalmarsson and Lind (2011)						Org.
Kranz and Picot (2011)		Social influence; perceived behavioral control; environmental concern				Individual
Schmidt and Kolbe (2011)						Org.
Strüker, Weppner, and Bieser (2011)						Technology
Thoroe, Appelhanz, and Schumann (2011)						Technology

Table A1. A Review of Green IS Literature

Zampou and Pramatari (2011)				Environmental (+)		Technology
ECIS 2012						
Gimenez Thompsen, Sierra Olivera, Rodríguez,and Joan (2012)				Environmental (+)		Org.
Kossahl, Busse, and Kolbe (2012)						N/A
Takeda, Rowe, Habib, de Corbière, and Antheaume (2012)				Environmental (+); economic (+/0)		Org.
Thongmak (2012)		Attention on socials and environments				Individual
Zhang (2012)		Challenges faced in actual green consumption				Org.
ECIS 2013						
Bradshaw and Donnellan (2013)				Not clear		Scheme
Khanna and Venters (2013)						Project
Parmiggiani and Hepsø (2013)						Org.
Stiel and Teuteberg (2013)						Technology
ICIS 2009						
Chen, Watson, Boudreau, and Karahanna (2009)		Mimetic pressures; coercive pressures				Org.
Hedwig, Malkowski, and Neumann (2009)				Environmental (+)		Technology
Molla, Cooper, and Pittayachawan (2009)		Attitude; Policy; technology; governance				Org.
ICIS 2010						
Mithas, Khuntia, and Roy (2010)		Strategic importance to green IT		Environmental (+); economic (+)		Org.
Corbett (2010)						N/A
ICIS 2011						

Table A1. A Review of Green IS Literature

Loock, Staake, and Landwehr (2011)				Environmental (+)		Individual
Tan, Pan, and Zuo (2011)						Org.
ICIS 2012						
Dorsch and Häckel (2012)						Technology
Fradley, Troshani, Rampersad, and Ionno (2012)						Org.
Hedman, Henningsson, and Selander (2012)			Entrepreneurial stage; collectivity stage; formalization and control stage; elaboration of structure stage	Environmental (+); economic (+)		Org.
Hovorka and Corbett (2012)						N/A
Loeser, Erek, and Zarnekow (2012)						Org.
Loock, Landwehr, Staake, Fleisch, and Pentland (2012)						Individual
Nanath and Pillai (2012)						Org.
Nishant, Teo, Goh, and Krishnan (2012)				Economic (+)		Org.
von Mohrenfels and Klapper (2012)		Mobile product information				Individual
Watson, Lind, and Haraldson (2012)						N/A
ICIS 2013						
Brandt, Feuerriegel, and Neumann (2013)				Environmental (+); Economic (+)		Technology
Busse, El Khatib, Brandt, Kranz, and Kolbe (2013)	Perceived complexity; Perceived compatibility	Attitude; sources' influence; perceived behavioral control; moral norm				
PACIS 2007						
Elliot (2007)						N/A
PACIS 2008						

Table A1. A Review of Green IS Literature

Elliot and Binney (2008)		Cost reduction; responsiveness to staff concerns; clients having their requirements met		Environmental (+)		Org.
Huang (2008)			Systems planning; systems analysis; systems design; systems implementation; systems maintenance; systems disposal			Technology
PACIS 2009						
Molla (2009)						Org.
Sarkar and Young (2009)		Managerial attitudes; external influence (government regulations; customer requirements)				Org.
Vykoukal, Wolf, and Beck (2009)						Org.
PACIS 2010						
Ijab, Molla, Kassahun, and Teoh (2010)			Spirit; practice; impact			Org.
Lee and Casalegno (2010)						Org.
Schlieter, Juhrisch, and Niggemann (2010)				Environmental (+)		Org.
PACIS 2011						
Alaraifi, Molla, and Deng (2011)						Org.
Chang, Yen, Li, Chang, and Chen (2011)		Organizational culture; performance assessment; know-how; individual demands and values				Individual
Erek, Loeser, Schmidt, Zarnekow, and Kolbe (2011)						Org.

Table A1. A Review of Green IS Literature

Molla and Abareshi (2011)		Eco-efficiency motive; eco-effectiveness motive; eco-responsiveness motive; eco-legitimacy motive				Org.
Nishant, Teo, and Goh (2011)				Economic (+)		Org.
PACIS 2012						
Cooper and Molla (2012)						Org.
Kurnia, Mahbubur, and Gloet (2012)						Org.
Nishant, Teo, and Goh (2012)				Economic (+)		Org.
PACIS 2013						
Abdul Rahim and Abdul Rahman (2013)				Economic (+)		Org.
Chowdhury, Dewan,and Quaddus (2013)		Social compliance; environmental compliance; operational compliance; economic sustainability; SC governance				Org.
Dewan, Biswas, Chowdhury, and Quaddus (2013)						Org.
Dewan, Biswas, Chowdhury, and Quaddus (2013)						Org.
Joo and Kim (2013)	Technological characteristics	Delivery, education and promotion, beneficial expectation, expectation, communication, experiences, environmental characteristics, follow-up supporting projects				Individual

Table A1. A Review of Green IS Literature

Koo, Chung, and Lee (2013)		Social influence; Media influence; Perceived usefulness; Perceived enjoyment; Perceived environmental problem; Saving money; Legislative pressure				Individual
Lei and Ngai (2013)		Managerial interpretation; relative advantage; strategic orientations; discretionary slack				Org.
Lei and Ngai (2013)						N/A
Lin, Yang, and Hsu (2013)						Org.
Nishant, Teo, and Goh (2013)				Economic (+)		Org.
Nishant, Teo, and Goh (2013)				Environmental (+/0)		Org.
Yang, Li, and Tan (2013)		Alignment of Green IT with business objective; Institutional pressure; corporate social responsibility				Org.
Business & Society						
Jenkin, McShane, and Webster (2011)		Organizational, regulatory-market, sociocultural, ecological forces				Org.
CAIS						
Dedrick (2010)						N/A
Molla, Cooper, and Pittayachawan (2011)		Attitude; policy; governance; practice; technologies				Org.
Information and Organization						
Jenkin, Webster, and McShane (2011)						N/A
International Journal of e-Business Management						
Molla, Pittayachawan, Corbitt, and Deng (2009)						Org.
JSIS						

Table A1. A Review of Green IS Literature

Bengtsson and Ågerfalk (2011)						Org.
Bose and Luo (2011)	Sensory readiness; relationship readiness; synchronism readiness; identification and control readiness	Organizational factors (champion support, resource commitment, firm size); Environmental factors (regulatory support, competition intensity)				Org.
Butler (2011)						Org.
Dao, Langella, and Carbo (2011)						Org.
DesAutels and Berthon (2011)				Economic (0)		Technology
Petrini and Pozzebon (2009)						Org.
Pitt, Parent, Junglas, Chan, and Spyropoulou (2011)						N/A
Watson, Boudreau, Chen, and Sepúlveda (2011)		Ubiquity, uniqueness, unison and universality				Org.
Zhang, Liu, and Li (2011)						Technology
International Journal of Technology Management						
Haigh and Griffiths (2008)				Environmental (-)		Org.
MISQ						
Melville (2010)						N/A
Watson, Boudreau, and Chen (2010)						N/A
Elliot (2011)						N/A
(1): "+" means positive effect; "0" means neutral effect; "-" means negative effect						

About the Authors

Xuequn (Alex) Wang is a Lecturer at Murdoch University. He received his PhD in Information Systems from Washington State University. His research interests include knowledge management, online communities, and idea generation. His research has appeared or may be forthcoming in the *Journal of Organizational Computing and Electronic Commerce, Behaviour and Information Technology, Journal of Computer Information Systems,* and *Journal of Knowledge Management.*

Stoney Brooks is an Assistant Professor in the Jones College of Business at Middle Tennessee State University. He received his PhD in Information Systems from Washington State University. His research interests include negative effects of technology usage, social media in the workplace, and sustainability. His research has appeared or may be forthcoming in *Computers in Human Behavior, Communications of the Association for Information Systems,* and *AIS Transactions on Human-Computer Interactions.*

Saonee Sarker is currently Area Coordinator and Professor of IT in the University of Virginia. Earlier, she was the chair of (and Hubman Distinguished Professor of MIS in) the Department of Management, Information Systems, and Entrepreneurship at Washington State University. She is also Visiting Fellow at Lund University, Sweden, and University of Augsburg, Germany, and Visiting Professor in Aalto University, Finland. She received her Ph.D. in management information systems from Washington State University, her MBA from the University of Cincinnati, and her BA (Honors) from Calcutta University. Her research focuses on globally distributed software development teams and other types of computer-mediated groups, technology adoption by groups, technology-mediated learning, Green IS, and information technology capability of global organizations. Her publications have appeared in outlets such as *MIS Quarterly, Information Systems Research, Journal of Management Information Systems, Journal of the Association of Information Systems, Decision Sciences, European Journal of Information Systems, Decision Support Systems, Information Systems Journal,* and *International Conference on Information Systems proceedings.* She serves as an Associate Editor at *MIS Quarterly, Decision Sciences,* and *Communications of the AIS.*