Exploring Green Information Systems and Technologies as Persuasive Systems: A Systematic Review of Applications in Published Research

Research-in-Progress

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Abstract

Adopting eco-friendly behaviors has gained attention in multiple scientific fields ranging from psychology to business, to information systems and computer science. Combining knowledge of creating software solutions with behavioral science studies can enhance research on sustainability and contribute to fostering green attitudes. Considering current state of Green Information Systems and Technologies (IS/IT), we suggest employing persuasive techniques to create "green" solutions. Bridging studies of Persuasive Technologies and Behavior Change Support Systems with the Green IS/IT, we suggest that Persuasive Systems Design principles are capable of enhancing performance of "green" applications as well as improving eco-oriented behaviors in both individual and organizational user contexts. Having reviewed and analyzed published articles on environmentally-oriented systems, we examined which persuasive design principles are currently used and which ones could be utilized better in contemporary and future applications.

Keywords: Green IS, Green IT, persuasive technologies, behavior change technologies, eco-behavior, sustainability, literature review

Introduction

Nowadays a question of how to employ more environmentally friendly practices is emerging. Since technology is incorporated into most aspects of people's lives, it can be used to streamline attitudes towards sustainability and to instill "greener" behaviors in individual users, organizations, and communities. DiSalvo et al. (2010) investigated and organized diversity of the field of sustainability and human-computer interaction, highlighting several most prominent genres, such as persuasive technology, ambient awareness, sustainable interaction design, formative user studies, persuasive and participatory sensing. These emerging issues not only redefine multi-disciplinary significance of sustainable systems and applications but also extend connection with other scientific fields.

Considering that persuasiveness is a "secret ingredient" for initiating behavior change and fostering more environmentally responsible attitudes, we believe that raising awareness and encouraging usage of the Green IS/IT systems and applications is required. We conducted systematic literature review to discover

articles with instances of the "green" systems to find persuasive design principles these systems currently use. Consequentially, discovering most often overlooked principles, we suggest that the missing persuasive techniques could be incorporated in the "green" systems to enhance their influence on behavior change. Therefore, our research goals are (1) to reveal importance of behavior change in adopting Green IS/IT and (2) encourage considering a wider range of persuasive principles that can facilitate acceptance and strengthen impact of the "green" systems and applications.

Theoretical Background

Green IS/IT Research

As early as 1992, the U.S. Environmental Protection Agency launched *Energy Star,* a voluntary labeling program designed to promote and recognize energy-efficiency in technologies (Brown et al. 2002). Simultaneously, the Swedish organization TCO Development launched the TCO Certification program to promote low magnetic and electrical emissions from CRT-based computer displays (Sundblad 2002). However, only as late as 2007, at CHI conference, sustainability and interaction were explicitly brought up to attention of academic community, which lead to emerging the area of sustainable HCI and initiation of extensive Green IS/IT research (Kranz et al. 2015). Murugesan (2008) defined Green IT and articulated the need to participate in contributing to greening the environment. Watson et al. (2010) and Melville (2010) called for IS research on energy informatics and environmental sustainability in the *Management Information Systems Quarterly*. This period was marked by increasing impact on aspects of the individuals' and organizations' daily routines, emerging number of studies, conference tracks, journal special issues, workshops, and researches concerning Green IS/IT (Kranz et al. 2015).

Although, there are several outlooks on defining Green IS/IT, they share a common agreement that both refer to environmentally sound IS/IT (Sarkis et al. 2013). Some researchers separate Green IS and Green IT (e.g. Brooks et al. 2012; Dedrick 2010; Erek et al. 2011; Hedman et al. 2012), some view Green IT as a part of Green IS (e.g. Brooks et al. 2012; Melville 2010). We support the view stating that Green IS and Green IT are synonymous (e.g. Malhotra et al. 2013; Mithas et al. 2010; Osch and Avital 2010; Tushi et al. 2014). With the increasing interest in switching to "green" behaviors, demand in knowledge on how to design systems which support such attitudes is growing. Thus, the Green IS/IT research could investigate how to convince individuals and organizations to adopt various "green" practices. One of the most pervasive concerns that has been highlighted in the Green IS/IT research is the impact of the carbon footprint (Corbett 2013a; Corbett 2013b). Regulatory pushes have been made to reduce carbon footprints of both organizations and individuals. Often, local regulations force corporate agendas include more sustainable practices in operations of all divisions, including IS. Apart from the legislations, customers and other stakeholders also demand organizations to be more socially responsible and contribute to the community instead of continuously drawing on its resources. Additionally, competitive pressure pushes organizations to adopt "green" trends since organizations have observed that "going green" or being eco-friendly oriented is not merely a fad, but also a technique used by sustainable businesses to retain customers by advertising own "green" practices. Moreover, increasing sustainability and reducing IT costs are not necessarily mutually exclusive; in fact, they can go hand in hand, if a company manages to orchestrate them properly (Murugesan 2008).

A body of IS research that examines individual adoption of information technologies has already been developed (e.g. Technology Adoption Model by Fred (1989)). Initially, being only a concern of large corporations, Green IS/IT is now appearing more often in the IS research, while Green IS/IT initiatives appear in innovative uses in transportation, energy, manufacturing, urban architecture, and leading improvements of society's well-being (Atkinson and Castro 2008). Previous research has shown the need to increase motivation to create and use Green IS/IT, environmentally-oriented applications and systems. Some attempts to encourage usage of the Green IS have been made. For example, Molla (2009) initiated studies of relationship of motivation and adoption of the Green IS/IT trends. However, a better understanding of factors influencing adoption and effectiveness of "green" systems and applications is needed (Dedrick 2010). To show how Green IS/IT is related to eco-sustainability and to determine research themes of the Green IS/IT, Kranz et al. (2015) explored previous works and designed classification of the three orders (Dedrick 2010; Hilty et al. 2006; Köhler and Erdmann 2004): (1) direct impacts on the environment due to the physical existence and use of IT, (2) enabling effects of ITs in other

sectors such as energy, logistics, mobility, and manufacturing that lead to more sustainable business operations, and (3) systemic effects of IT's causing medium – or long-term changes of behavior and economic structures towards more eco-sustainable practices. Our research contributes to the third effect of Green IS/IT on eco-sustainability, namely, exploring persuasive principles used in Green IS/IT applications designed to implement long-term changes in users' behaviors.

Persuasive Technology and Behavior Change Support Systems (BCSS)

Interactive information technology designed for changing users' attitudes or behavior is known as persuasive technology (Fogg 2002). After introduction of the study of the persuasive technology by Fogg, the research on the use of technologies to persuade, motivate, and activate individuals' behavior change has been expanding quickly. Faludi (2009) concluded that persuasion is a science, newborn and inexact, but a science nonetheless. Nowadays people are being constantly persuaded. Advertisers and marketers have been using persuasion techniques for decades and current environment is calling the systems' designers to utilize them as well. When used for persuasive design, these techniques are not marketing or advertising; they are an art of crafting a user experience which enables behavior change through the users' actual interaction with the systems. (Faludi 2009).

Traditionally, persuasion has meant "human communication designed to influence the autonomous judgments and actions of others" (Simons et al. 2001). Combining positive attributes of interpersonal and mass communication, the Web, Internet, mobile, and other ambient technologies create opportunities for persuasive interaction because users can be reached easily. (Cassel et al. 1998). Briñol and Petty (2009) depict persuasion as following: "In the typical situation where persuasion is possible, a person or a group of people (the recipient) receives an intervention (a persuasive message) from another individual or group (the source) in a particular setting (the context)". Persuasive systems may be defined as computerized software or information systems designed to reinforce, change, or shape attitudes or behaviors or both without using coercion or deception (Oinas-Kukkonen 2013). Successful persuasion takes place when the target of change, for instance an attitude or a belief, is modified in the desired direction, such as environmentally sustainable context in the Green IS/IT case. A variety of persuasive applications that have already been created are referred to as Behavior Change Support Systems (BCSS), in which persuasion is the essence, while the key element is the voluntary use (Oinas-Kukkonen 2013). Currently, one of the most developed domains for persuasive technology implementation is the health-related one (incorporating healthcare improvements and fostering healthier lifestyles). Considering that information technology always influences people's attitudes and behaviors in one way or another, not only the software designers but also the general audience should be well-aware of the various ways and approaches of how people may be, are being, and will be influenced through the IS/IT design. DiSalvo et al. (2010) found that in many existing applications persuasion borders coercion, even to the point where some designs employ overly aggressive modification techniques (Nakajima et al. 2008). This is a serious ethical concern, in particular for proponents of user-centered design. The framework we used in this research to analyze Green IS/IT systems recognizes the threat of coercion and warns the systems' creators to avoid using any compulsion in their persuasive systems and applications.

Persuasive Systems Design (PSD) Model

Despite the fact that attitudinal theories from social psychology have been extensively applied to the study of user intentions and behavior, most of these theories have been developed for predicting user acceptance of the information technology rather than for providing systematic analysis and design methods for developing persuasive software solutions (Oinas-Kukkonen and Harjumaa 2009). Tushi et al. (2014) highlighted eighteen theories and twelve frameworks used in Green IS/IT research, among which thirteen provide some insight into practical guidelines for shaping more sustainable behaviors. These theories and frameworks are: Technology Organization Environment (Bose and Luo 2011; Lei and Ngai 2013; Nedbal et al. 2011), Institutional Theory (Butler 2011; Sarkar and Young 2009), Organizational Theory (Butler 2011), Theory of Reasoned Action (Chow and Chen 2009; Sarkar and Young 2009), Diffusion of Innovation (Bose and Luo 2011; Nedbal et al. 2011), Process-Virtualization (Bose and Luo 2011), Theory of Planned Behavior (Chow and Chen 2009), Motivation Theory (Koo et al. 2013; Molla and Abareshi 2011; Molla and Abareshi 2012), Reference Group Theory (Koo et al. 2013), Extended Model of Goal-Directed Behavior (Loock et al. 2013), Belief-Action-Outcome Framework (Gholami et al. 2013;

Melville 2010; Mithas et al. 2010; Stiel 2014), Implementation Framework (Mann et al. 2009), Energy Efficiency and Low Carbon Enabler Green IT Framework (Uddin and Rahman 2012). Despite being vast and powerful in their particular purposes, none of these theories and frameworks seem to be suitable for persuading both individual users and organizations to adopt "greener" and more sustainable attitudes.

Therefore, we propose that the Persuasive Systems Design (PSD) model offers new insights and a way of designing IS/IT systems which would encourage both individual and organizational behavior change towards "greener" and more sustainable practices. Thus, we highlight that the PSD model stands out as a sophisticated and holistic persuasive design and evaluation method applicable for behavioral changing Green IS/IT applications in different contexts. Oinas-Kukkonen and Harjumaa (2009) have conceptualized this framework as a structure for designing and evaluating persuasive systems. The Persuasive Systems Design (PSD) model encompasses multiple theoretical constructs, such as Goal-Setting Theory, Elaboration Likelihood Model, and Theory of Reasoned Action/Planned Behavior. Many of the principles in the PSD model have been adopted and modified from the seminal works of BJ Fogg (2003). There are also similar approaches, such as Ritterband's behavior model for Internet interventions and Abraham and Michie's taxonomy of behavior change techniques (Lehto and Oinas-Kukkonen 2011). Despite the similarities and potential overlap, these approaches are quite different from the PSD model.

The PSD model presents a way to analyze, design, and evaluate persuasion context and related techniques. Its design principles provide concrete instructions on how to develop a persuasive system. Persuasion context analysis includes recognizing the intent, the event, and the strategy for persuasion. In the PSD model, the categories for persuasive system principles are: ***primary task support*** *(*supporting the user's primary task), ***dialogue support*** (supporting the interaction between the user and the system), ***system credibility*** (the more credible the system is, the more persuasive it is), and ***social support*** (the system motivates users by leveraging social influence) (Oinas-Kukkonen and Harjumaa 2009). Each of the four main categories is comprised of several design principles. Primary task design principles are *reduction, tunneling, tailoring, personalization, self-monitoring, simulation,* and *rehearsal. Praise, rewards, reminders, suggestion, similarity, liking,* and *social role* are the dialogue support principles. Credibility category comprises *trustworthiness, expertise, surface credibility, real-world feel, authority, third-party endorsements,* and *verifiability*. Finally, *social facilitation, social comparison, normative influence, social learning, cooperation, competition,* and *recognition* are the social support principles.

Methodology

Literature Search

To exemplify how the Persuasive Systems Design (PSD) principles are used in Green IS/IT applications, we conducted a literature review of articles which describe systems aimed at decreasing humans' harmful impact on environment. To identify these articles, we used Scopus, ProQuest, EBSCOHost Web, and Web of Science databases to search for words "green", "sustainab*", and "ecolog*" in abstracts, titles and keywords of the articles published between years 2005 and 2016 in 8 core IS journals (*Management Information Systems Quarterly, Journal of the Association for Information Systems, The Journal of Strategic Information Systems, Journal of Management Information Systems, Journal of Information Technology, Information Systems Journal, European Journal of Information Systems, Information Systems Research*) as well as *Information Systems Frontiers, IEEE Software, IEEE Pervasive Computing,* and *Business & Information Systems Engineering*. We used the following queries:

- Scopus: (ISSN(0276-7783) OR ISSN(1536-9323) OR ISSN(0963-8687) OR ISSN(0742-1222) OR ISSN(0268-3962) OR ISSN(1047-7047) OR ISSN(1350-1917) OR ISSN(0960-085x) OR ISSN(1387-3326) OR ISSN(0740-7459) OR ISSN(1536-1268) OR ISSN(0937-6429)) AND (PUBYEAR > 2004) AND (TITLE-ABS-KEY (green) OR TITLE-ABS-KEY (sustainab*) OR TITLE-ABS-KEY (ecolog*));
- ProQuest: (ISSN(0276-7783) OR ISSN(1536-9323) OR ISSN(0963-8687) OR ISSN(0742-1222) OR ISSN(0268-3962) OR ISSN(1047-7047) OR ISSN(1350-1917) OR ISSN(0960-085x) OR ISSN(1387-3326) OR ISSN(0740-7459) OR ISSN(1536-1268) OR ISSN(0937-6429)) AND

(AB(green) OR AB(sustainab*) OR ab(ecolog*) OR IF(green) OR IF(sustainab*) OR IF(ecolog*)) + applied year filter 2005 to 2016;

- EBSCOHost Web: IS (0276-7783 OR 1536-9323 OR 0963-8687 OR 0742-1222 OR 0268-3962 OR 1047-7047 OR 1350-1917 OR 0960-085x OR 1387-3326 OR 0740-7459 OR 1536-1268 OR 0937-6429) AND (AB (green OR ecolog* OR sustainab*) OR TI (green OR ecolog* OR sustainab*)) + applied year filter from 2005 to 2016;
- Web of Science: IS = (0276-7783 OR 1536-9323 OR 0963-8687 OR 0742-1222 OR 0268-3962 OR 1047-7047 OR 1350-1917 OR 0960-085x OR 1387-3326 OR 0740-7459 OR 1536-1268 OR 0937-6429) AND (TI = (green OR sustainab* OR ecolog*) OR TS = (ecolog* OR green or sustainab*)) + applied year filter from 2005 to 2016.

Scopus database search returned 181 results, ProQuest – 216, EBSCOHost Web IS – 94, and Web of Science – 138.

Data Extraction

To be considered for inclusion in the final review, articles were required to meet certain criteria. We aimed to analyze articles that (1) contain empirical evidence, (2) contain a description of an application or a system, as well as (3) discuss behavior change. Articles that did not meet all requirements were excluded. Selected articles were reviewed using the PSD model as a framework for analysis. Data extraction and application of inclusion and exclusion criteria were conducted by the authors. Any data analysis and coding discrepancies were discussed until consensus between the researchers was reached. The persuasive design principles were identified in four categories: primary task support, dialogue support, system credibility support, and social support. Each of these categories was further divided into seven sub-categories. Data extraction process is presented in Fig.1.

Figure 1. Data Extraction Process

Findings

Altogether the database searches yielded 629 results; after removing duplicate articles, 222 unique, potentially relevant articles were identified. We retrieved and reviewed abstracts of these articles further excluding 189 articles which only mentioned Green IS/IT domain without discussing any systems at all. The full texts of the remaining 33 articles were analyzed thoroughly and classified into six categories. These categories reflect presence/absence of the empirical evidence, presence/absence of the behavior change discussion, and presence/absence of a specific system (see Table 1).

For the final review, we selected six articles that contain empirical evidence, behavior change discussion and a concrete system aimed to change its users' behaviors. These systems were:

- Personal carbon management systems in organizations (Corbett 2013a);
- Smart meters for sustainable homes (Fitzpatrick and Smith 2009);
- Carbon tracker (Hilpert et al. 2013);
- Velix – web-based energy feedback system for electricity customers (Loock et al. 2013);
- Environmentally munificent bypass systems in long-haul trucking (Marett 2013);

Several mobile applications: greenMeter, FindGreen, Bike Your Drive, Seafood Watch, Ilincpro (Pitt et al. 2011).

	Behavior change not addressed	**Behavior change addressed**
Neither a specific system, no empirical evidence	Bai and Sarkis 2013; Benitez-Amado and Walczuch 2012; Bose and Luo 2011; Dao et al. 2011; Penzenstadler et al. 2014; Petrini and Pozzebon 2009; Watson et al. 2010	Elliot 2011; Malhotra et al. 2013; Melville 2010
Empirical evidence, but no specific system	Atkinson et al. 2014; Gräuler et al. 2013; Grimsley and Meehan 2007; Hertel and Wiesent 2013; Molla 2013; Ryoo and Koo 2013; Zhang et al. 2011	Coffey et al. 2013; Seidel et al. 2013
A system with empirical evidence	Bengtsson and Ågerfalk 2011; Butler 2011; Casu et al. 2013; Corbett 2013b; Iacob et al. 2013; llic et al. 2009; Watson et al. 2011; Zhang et al. 2014	Corbett 2013a; Fitzpatrick and Smith 2009; Hilpert et al 2013; Loock et al. 2013; Marett 2013; Pitt et al. 2011 (analyzed articles)

Table 1. Classification of Selected Articles

Discussion

Table 2 illustrates a summary of all persuasive principles identified in the Green IS/IT systems and applications. Based on the information provided in the articles if a persuasive principle was present, it was coded with a "Y", correspondingly, if absent – with an "N". In case an article lacked enough information to deduct logically either presence or absence of a principle, "N/A" coding was applied.

The design principles in the primary task category support carrying out the user's primary task. Specifically, in all systems, the primary task support category is the most distinct with majority of the principles present. Namely, *reduction, tunneling, tailoring, personalization,* and *self-monitoring* appear in five cases and *simulation* is present in half of the analyzed applications. Example implementation: reducing efforts in estimating own negative environmental impact; setting personal resource consumption goals; synchronizing the system with others users' applications; receiving tailored and personalized information based on identified user group and/or personal user settings; log of personal performance for self-monitoring; providing features to simulate and test user scenarios to identify sustainable routines. Rehearsal, which denotes the system's ability to provides means for rehearsing behaviors to change in real world, is not clearly addressed in most of the reviewed cases.

Since any interactive system provides at least some feedback to its users, potentially via verbal information or other kinds of summaries, several design principles related to implementing computer-human dialogue help users move towards their goal or target behavior. Dialog support category principles are much less clearly reflected than the primary task support ones, with only *reminders* present in all systems. *Social role* is present in five cases, *praise, suggestion* and *similarity* are in half of the cases, *liking* is in four cases, and *rewards* is in three cases. Example implementation: visual and/or verbal praise positively reinforcing "green" behaviors; rewarding with points or even financial benefits when users' eco-friendly behaviors improve; calling, e-mailing, sending text messages or using other prompts to remind the users of "green" practices; suggesting tips and providing feedback on improving performance; similarity denotes that people with some eco-friendly disposition choose using the "green" systems; liking is provided by the systems' interfaces; adherence to social role is promoted by educational references, and mentions of sustainable governmental regulations.

The design principles in the system credibility category describe how to design a system which is more credible and thus more persuasive. In system credibility only *authority* is clearly established in all systems, *verifiability* is present in four cases, *real-world feel* is in three, *expertise, surface credibility,* and *third-party endorsements* are in two cases. Presence of many of the principles in this category is unclear from information provided in analyzed articles, thus indicating that certain credibility features were not sufficiently emphasized in these systems. Example implementation: expertise of the systems' developers; professional surface design; changing location-based preferences and real-time projects; authority support of experienced developers, researchers and governments; advertising, recommendations and

endorsements from external sources; test results of implemented "green" practices, feedback, and tips that are easily verifiable by the users themselves.

Category	System Principles	Corbett 2013a	Fitzpatrick and Smith 2009	Hilpert et al. 2013	Loock et al. 2013	Marett 2013	Pitt et al. 2011
Primary Task Support	Reduction	Y	Y	Y	Y	Y	Y
	Tunneling	Y	N	Y	Y	Y	Y
	Tailoring	Y	Y	Y	Y	N	Y
	Personalization	Y	Y	Y	Y	N	Y
	Self-Monitoring	Y	Y	Y	Y	N	Y
	Simulation	Y	Y	N	N	N	Y
	Rehearsal	N/A	N/A	N/A	Y	N/A	N/A
Dialogue Support	Praise	Y	N	N	N	Y	Y
	Rewards	Y	N/A	N	N	Y	Y
	Reminders	Y	Y	Y	Y	Y	Y
	Suggestion	Y	N	N	Y	N	Y
	Similarity	Y	Y	N	N	N	Y
	Liking	Y	Y	Y	N	N	Y
	Social Role	Y	Y	Y	N/A	Y	Y
Credibility Support	Trustworthiness	N/A	N/A	N/A	N/A	N/A	N/A
	Expertise	Y	Y	N/A	N/A	N/A	N/A
	Surface Credibility	Y	Y	N/A	N/A	N	N/A
	Real-World Feel	Y	N/A	N/A	N/A	Y	Y
	Authority	Y	Y	Y	Y	Y	Y
	Third-Party Endorsements	Y	N	Y	N	N	N/A
	Verifiability	Y	N	Y	Y	Y	N/A
Social Support	Social Facilitation	Y	Y	N/A	N/A	N	Y
	Social Comparison	Y	Y	N/A	Y	Y	Y
	Normative Influence	Y	Y	Y	N/A	Y	N/A
	Social Learning	Y	Y	Y	Y	Y	Y
	Cooperation	Y	N	N/A	N/A	N	Y
	Competition	N/A	Y	N/A	N/A	Y	N/A
	Recognition	N/A	N/A	N/A	N/A	Y	N

Table 2. Persuasive Principles Identified in Systems Discussed in Analyzed Articles

The design principles in the social support category describe how to build the system to motivate users by leveraging social influence. The situation with the social support category is similar to the credibility one. Only *social learning* is present in all systems, *social comparison* is in five, and *normative influence* is in four. Other principles appear to be underemphasized in the systems, given that *social facilitation* is present in three, *cooperation* and *competition* are in two, and *recognition* is in one. Table 2 shows that in many cases articles did not provide sufficient information on the social support principles, indicating that these principles can be emphasized more in the systems. Example implementation: social facilitation

enables practicing "green" behaviors with others users which consequentially, increases normative influence and enables comparing results, cooperate, compete, and receive recognition from the peers or even outsiders who are not using the system but are able to observe behavioral changes of the users of the systems.

Overall, all of the systems incorporate certain persuasive principles, yet some principles are much less distinct or absent at all, suggesting that the systems have similar areas of improvement. Primary task support category is the most represented category in all analyzed articles and systems. This can be justified by the designers' focus on carrying out the primary task of the system. Yet without strengthening other design principles, persuasiveness of the systems loses its full potential and becomes less effective which ultimately undermine achieving objectives of the primary task. Thus, we suggest that the designers of the systems place more emphasis on (1) dialogue support principles to increase interaction between users and the system to lead the users towards their goal(s); (2) credibility support principles to prove reliability of the system, and thus increase the system's persuasiveness; and (3) ensuring engagement of the users with social support principles, since social influence contributes to augmenting overall persuasiveness of the system.

Limitations

Since both Green IS/IT and persuasive, behavior-changing technologies are fairly new fields of exploration, the review examined articles published between 2005 and 2016. However, as the number of articles related to the explored fields is increasing rapidly, this search does not cover recently published and forthcoming articles as well as systems and applications that are being developed. Additionally, there is a possibility that the systems and applications reviewed incorporate persuasive principles that were not described in the articles. Furthermore, the review is limited to articles written in English, thus, research of persuasive and behavior changing systems published in other languages is excluded. Finally, the search is limited to certain publications which poses a threat to generalizing results of the research. However, this choice was made in order to ensure credibility of the references.

Conclusion

Reviewing previous works, we have encountered that the discussion of the Green IS/IT, currently still a young domain, has not yet thoroughly addressed topics of persuasive technology and Behavior Change Support Systems. However, the issue of changing behaviors cannot be neglected in the Green IS/IT research as it has a major influence on encouraging people to give preference to sustainable practices. Conducting systematic literature review, we noted that of all Green IS/IT-related articles only a handful briefly mention behavior change and only a few depict systems or applications for implementing alterations in attitude and conduct. This finding shows a need to develop and research more practical solutions for popularizing eco-friendly behaviors.

Analyzing existing "green" systems used for individual or organizational behavior change, we showed the need to increase understanding of how and under what conditions specific persuasive principles (either in isolation or collectively) lead to improving environmental consciousness of people. Additionally, we pointed out that implementation of currently overlooked PSD principles in the "green" systems and applications could increase the systems' potential effectiveness. Finally, we encourage further research of relationship of persuasiveness and behavior change with the Green IS/IT's design and quality improvement.

We highlighted that the PSD model is a prospective and well-fitting framework for designing behavior changing applications aimed to reduce adverse human environmental impact in different contexts. The framework is relevant for both researchers and practitioners since both are empowered with skills and knowledge to undertake required actions for securing environmental sustainability. Ultimately, we conclude that utilizing this approach for creating more effective sustainably-oriented applications can streamline Green IS/IT practices and lead to behavior changes of individual users as well as larger communities.

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