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Studying Green Information Systems as Practice (Green IS-as-practice)

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Abstract

In the last few decades, IS and IT have changed human behavior profoundly and therefore can be seen as having the potential to support the shift to a sustainable society. As a result, the role and contribution of IS in eco-sustainability has become the concern of many IS researchers. We posit that the Greenness of IS can be seen in the practice of inscribing, appropriating, and enacting Green intentions and goals, together referred to as Green values in IS. Thus we argue that Green IS can be studied from the practice perspective drawing from the Theory of Practice (Bourdieu, 1977). A practice perspective provides powerful and relevant constructs such as habitus, capital, field, strategy, symbolic power and doxa to understand both the causes and outcomes of Green IS. Armed with these constructs (which can be employed in trio (habitus, capital and field) or in piecemeal), IS researchers can pursue rich and diverse Green IS research agenda. The paper discusses several research directions that IS researchers could take in using the constructs offered by the Theory of Practice.

INTRODUCTION

The concept of sustainable development is becoming more important these days. Sustainable development is defined as the "development that meets the needs of the present world without compromising the ability of future generation to meet their own needs" (Brundtland, 1987).

There are 3 dimensions of sustainable development and they are mutually interdependent, namely the economic dimension, social dimension and ecological dimension. In the context of sustainable development, it is important to ensure that the economic growth is maintained so that society as a whole continue to progress with ecological balanced and maintained.

In this paper, we would like to focus on the ecological dimension of sustainable development as viewed from the organizational standpoint, especially looking at the role of IS in promoting eco-sustainability or "Green IS".

The roles of IS for eco-sustainability

In the extant literature on Green IS, the roles of IS for eco-sustainability were studied from the three perspectives: as an enabler, as a promoter and also in its transformative power to create an environmentally sustainable society.

For example, Boudreau et al (2008) view IS as an enabler in inducing changes within business processes; York et al (2009) provide an extensive discussion on how IS can be used by individuals and organizations in making a sustainable behavior choices. In a more recent work by Watson et al (2010a), IS is known to have a transformative power in creating an environmentally sustainable society. This is summarized in Table 1 below.

Roles of IS	Reference
IS enabled and induced changes in business processes such as production activities and modify (i.e by decreasing) their environmental impacts.	Boudreau et al, 2008
the use of IS to encourage individuals and organizations to make more sustainable behavioral choices.	York et al, 2009
the transformative power of IS to create an environmentally sustainable society.	Watson et al, 2010a

Table 1. Summary of roles of IS in the context of eco-sustainability

Based on our literature review by far, Green IS as a topic is indeed still emerging. We can see the trend that the field is fertile with framework development informed by various theoretical lenses as well as informed by the practitioner studies. This approach (framework development and theorization) is called a "bottom-up" approach in Hasan (2010) and is considered appropriate to study complex problems such as climate change and eco-sustainability issues that are not well defined, have multiple and conflicting definitions and elements. The following section discusses the recent Green IS literature that can be claimed fit the "bottom-up" approach category as the literature deal mostly with framework development and theorization.

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RECENT GREEN IS LITERATURE

Snapshot of recent Green IS research

For the purpose of this paper, we draw our focus based on the Green IS literature contributions highlighted in academic papers published in Year 2010 only. By doing so, it allows us to showcase the latest and most up-to-date Green IS research activities in the field that has gained IS researchers attention.

Two of the most notable findings are proposed by Watson et al (2010a; 2010b), published in MISQ and MISQ Executive respectively. In both articles, the use of IS to increase energy efficiency is given central focus. A framework called the Energy Informatics Framework is developed to frame the transformative power of IS in managing energy efficiency. The framework is then demonstrated its utility using the telematics-based project implemented at UPS, the global package delivery company.

Another interesting study is by Melville (2010) which focuses on the enabling and the transformative power of IS to shape beliefs of individual and organizations in regards to improving environmental and economic performance. The Belief-Action-Outcome (BAO) framework is suggested in providing the basis for theory development of IS for eco-sustainability particularly for informing beliefs, enabling actions and transforming outcomes.

Dedrick (2010) also develops a framework that is called IT and Carbon Productivity. The main premise is that, the total factor of productivity, which made up of input, production process and output can be applied to IT as well as the measuring of carbon productivity. Using IT as the main capital as input, and production processes enabled by IT (especially in looking after energy efficiency), the output from this is asserted to include social, economic as well as economic performance.

In our own work (Ijab et al, 2010), we argue that the Greenness in IS can emerge from the spirit, practice and impact perspective. Using several conceptualizations of IS (from technical, human and process views), we then argue that Greenness in IS can be inscribed during its design and development stage, the Greenness of IS can also emerge as user faithfully (or at times, unfaithfully) appropriate the IS during use stage, and lastly, we argue that Greenness in IS can emerge as a function of impacts. In this post-use stage, the actual Greenness of an IS only evident when organization evaluate the IS that they are developing or using are indeed improve their environmental performance.

To conceptualize our study in Ijab et al (2010), we develop a Green IS Lifecycle Framework which captures the what, where, how and when Greenness in IS can emerge. The utility of the framework is further assisted using the Green IS Typology, which identify at least six shades of Greenness in an IS. For example, in the first type, the Greenness value is inscribed during its development, the user then faithfully appropriated this IS for eco-sustainability purposes and when it gets measured, the impact of this IS is giving the organization with environmental impacts in the forms of either eco-efficiency, eco-equity or eco-effectiveness. The other shades green for IS can be referred from the Green IS typology itself as per Ijab et al (2010).

The contributions of the recent Green IS papers are summarized in the following table.

Contributions	Reference
Conceptualization of how IS is used to increase energy efficiency and this is captured in the "Energy Informatics Framework". Demonstrates the transformative power of IS that can be leveraged to create an ecologically sustainable society.	Watson et al (2010a)
Demonstration of UPS's telematics-based project that successfully improve energy efficiency, increase profitability and reduce carbon emissions. The telematics project also fits the developed "Energy Informatics Framework" developed in Watson et al (2010a).	Watson et al (2010b)
Develops "Belief-Action-Outcome Framework" to frame the critical role that IS can play in shaping beliefs about the environment, in enabling and transforming sustainable processes and practices in organizations and in improving environmental and economic performance. IS is viewed not just an enabler but also from its transformative power.	Melville (2010)
Develops an "IT and Carbon Productivity Framework" that shows how the total factor productivity is a function of processes made up of input, production process and output. IT capital is the major input, while in production process, IT is used to manage energy efficiently and the output is better economic performance as well as social and environmental performances.	Dedrick (2010)
Develop a "Green IS Lifecycle Framework" and "Green IS Typology" that conceptualise the Greenness of an IS from the spirit, practice and impacts perspective.	Ijab, Molla, Kassahun & Teoh (2010)

Table 2. Summary of contributions of recent Green IS academic papers

Key observations from the recent Green IS research

Based on the literature, especially the recent ones, we can safely say that most works are still in the early stages of various frameworks' development with limited and/or demonstrated empirical evidence. Except for Watson et al's (2010b) study which demonstrated the utility of the Energy Informatics Framework by using the case of UPS' telematics project.

Another key observation that we identified is that, these research draw from various theoretical lenses. For example, Watson et al's (2010a, 2010b) are informed by the concepts taken from supply and demand of energy, sensor network and flow networks. For Melville's (2010) BAO Framework is inspired by Coleman's micro-macro model. For Dedrick's (2010) study, his framework is guided by the productivity theory a well as the carbon productivity literature. For our conceptualization of Greenness in IS, we draw our understanding from the technical (Orlikowski, 1992), human (DeSanctis & Poole, 1994; Orlikowski, 1992, 2000; Melville, 2010) and process (Diez & McIntosh, 2009) views of IS.

We believe that the various views of the roles of IS for eco-sustainability combined with the insights from the multiple Green IS frameworks are set to expound our current understanding on how IS can indeed transform us into a more sustainable society.

PRACTICE-ORIENTED THEORY FOR GREEN IS RESEARCH

The overarching theme that we can draw from the existing literature especially the ones by Watson et al (2010a, 2010b) is that, IS roles in enabling, promoting and transforming for eco-sustainability practices can be viewed from the practice perspective. Our conceptualization of Greenness in Green IS for instance state that: "*Greenness of IS can be seen in the practice of inscribing, appropriating, and evaluating Green intentions and goals, together referred to as Green values in IS.*" *(Ijab et al, 2010).*

This implies that Green IS can be taken as a practice and it can exist in at least 3 stages: during IS development, use and post-use or re-use (evaluation). If we are drawing from the telematics-based project at UPS (Watson et al, 2010b), the telematics project is designed and developed with eco-sustainability in mind by its designers, engineers and developers. When the system is put into use, the drivers who are generally the end-user of the system are using the system faithfully, fully aware of the benefits of the system from economic, social as well as environmental aspects. The developer team conduct awareness sessions and also a series of training to guide the drivers how to use the system in their daily practices of delivering packages, even to the behavior such as idling the engine of the truck as well as the practice of reversing of the vehicles. The telematic system is evaluated by the developer team and the senior management in terms of its benefits for social, economical and environmental. The positive results to the environmental outcomes show that the Greenness impact is realized as a result of inscription and faithful appropriation of the telematic systems. This example can fit nicely into the Type 1 of Green IS Typology that we developed. Thus, we argue that the case of UPS' telematics project provides a good example of how Green IS can be seen as a practice.

We also argue that with this conceptualization opens door to the investigation of Green IS from a practice-oriented view. Other IS researchers such as Jenkin and McShane (2009); Watson et al (2010) and Melville (2010) also claim that how organizations use "Green IS" is still not well understood. Based on this, we see a potential to further investigate on how organizations actually use Green IS, assisted by a practice lens.

Other reasons of using practice view for Green IS research

Based on the literature, especially the recent ones, we can safely say that most works are still in the early stages of various frameworks' development with limited and/or demonstrated empirical evidence. Except for Watson et al's (2010b) study which demonstrated the utility of the Energy Informatics Framework by using the case of UPS' telematics project.

Over the years, we can argue that thinking in IS (in terms of the use of theories for analyzing and describing; explaining; predicting; explaining and predicting, and prescribing (Gregor, 2006)) has evolved from a functional (technology/systems) focus to a user (use/customer) focus (DeLone & McLean, 1992, 2003) and now to practice (process) focus (Singh, 2009). This shift of paradigm also shows the change of view from technology determinism and functional view to a more humanistic and process understanding view. It can be claimed that the complexity of interplay of actors and factors in IS use particularly in organizations demand a new way of investigating the organizational use of information systems.

Additionally, we can also see that variables such as sustainability (as part of an individual's motivation to use or not use a technology) is never part of the existing functional theories such as the Task-Technology-Fit model (Goodhue & Thompson, 1995) in studying organizational technology use (Pitt et al, 2010). The other theory such as IS Success models

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(DeLone & McLean, 1992, 2003) rely on the quality of the system and the information provided through it in order to facilitate use, user satisfaction, and eventually increase in personal and organizational performance. It is safe to say that the impact of environmental factors that could also contribute to organizational and environmental performance is not considered in such models (Pitt et al, 2010). The same observation can be made to other IS theories widely used by IS researchers such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) model.

Further, Pitt et al (2010) suggest that if the mainstream theories currently used in IS research are inadequate to understand the issue of IS role in the context of eco-sustainability, "then perhaps we need new theories in IS … based on our present knowledge of customers and technologies, and extend these to cater for an age in which sustainability is the issue of the day" (Pitt et al, 2010; p. 9).

It is also suggested in moving from "functional" and "user" focus towards a "process" perspective, it requires researchers to articulate a post-industrial managerial logic, where individuals reflect on their behavior and adjust their actions accordingly, making their responses to situation less mechanistic and more emergent (Dijksterhuis et al, 1999; Singh, 2009). To support this shift to a more process and practice view, we argue that the move is best incorporated into Green IS research by using practice theory. Here, organizations can be understood as collection of practices, which are materially-mediated arrangements of human activity organized around shared practical understanding (Schatzki, 2005; Singh, 2009). When Green IS is seen as a practice, as in the example of UPS' telematics-project, UPS is composed of a collection of practices (in the article, for example it is broadly categorized into package delivery system layers: packages, trucks and roads – as well as the extensive domain knowledge into how package delivery system at UPS works). The system is materially-mediated arrangement of human activity (drivers, trucks, package to be dispatched and to be delivered, the back-office operations, the senders and receivers of the packages). These activities are organized around a shared practical understandings across the organizations in making all the business processes sync together to deliver the business objectives.

Practice-based research

As we are drawing from the Theory of Practice by Pierre Bourdieu (1977), it is necessary to cite what Bourdieu has to say about practice. He defines practice as "the outcome of a dialectic relationship between a situation and a habitus, being understood as a system of durable but transposable dispositions". What it means here is that, practice is the result of mutual relationship between habitus (or disposition of agents) with the structure (or the field) where the practice takes place. Habitus, which is internally inscribed in a person as a result of his/her upbringing and socialization is durable and yet transposable.

Levina and Vaast (2006, p. 15) assert that a focus on practice means "being attentive to people's recurrent, everyday activities". In the same manner, Orlikowski (2002, p. 256) argues that practice is a "recurrent, materially bounded and situated action engaged in by members of a community". According to Schatzki (2005), practice can also be understood as clusters of recurrent and structured human activities informed by shared institutional meanings in order to get work done. Bourdieu (1977) adds that practice orientation takes into account not only the objectified social structures within which actions recurrently occur, but also the construction of these structures and the 'social' outcomes of the practices. Hence, in studying practice, while the actual practice is being studied, the outcomes of the practice need not be overlooked.

Thus, in a practice-oriented research, the researchers need to investigate how individual and collective activities are produced in a historical and social context, which gives structure and meaning to what people do and to the outcome that they can achieve (Levina & Orlikowski, 2009). This is because practice does not exist on its own. It generally originated and stemmed from the existing and sometimes, the long tradition of the organization. This historical background could set the backdrop on how practice is shaped and be shaped in the organization by individuals and by the collective activities of the agents populating the organization.

Using the Theory of Practice to study Green IS

We suggest that the Theory of Practice is relevant in explaining Green IS from a practice lens. There are three core concepts of the Theory of Practice used by Bourdieu in discussing about practice and they are habitus, capital and field. In summary, habitus is a set of acquired disposition which guides practice and behavior in daily life. It is argued by Bourdiue that habitus is generative from personal experience and history. The second concept is capital. Capital could include resources in the form of economic, social, cultural and symbolic capitals owned or acquired in order to generate practice. The third concept is field. Field is regarded as an arena or the context where practice takes place. The agents are liken to players in a game and they are in the field for achieving a certain objective, for example winning a match.

If we are talking in a more detail terms and borrowing from the actual complexity of the theory of practice, a *field* is defined as "a distinctive social space consisting of interrelated and differentiated positions, a configuration of objective relations between positions, a space of objective relations between individuals or institutions who are competing for the same stake" (Bourdieu & Wacquant, 1992, p. 97). Fields are not fixed entities: the boundaries of fields are imprecise and shifting, and fields can be located within other hierarchically structured sets of fields, for example the workplaces in modern business organization. Examples of the fields include politics, agriculture, religion, education, information systems (IS) and eco-sustainability.

For capital, Bourdieu identifies *capital* as all goods, whether material or symbolic, 'that present themselves as rare and worthy of being sought after in a particular social formation' (Bourdieu 1977, p. 178). The ability to mobilize capital provides power to the agents. However, Bourdieu's conception of power within society is based not only on economic capital (the wealth or other goods that an individual possesses), but also on cultural, social and symbolic capital Bourdieu argues that, it is possible to convert one type of capital into another. For instance, if individuals increase their wealth (economic capital) they may begin to move in a new circle of useful acquaintances (social capital); if they increase their cultural capital through academic achievements, they may also increase their economic capital through higher paid employment.

The *habitus* is a general disposition that generates practices, perceptions and attitudes that are largely unconscious that predispose people to act in certain ways (Bourdieu, 1990). Habitus is a product of social conditioning through which individual classify the world, coming mainly from early socialization in the family but changing according to life experiences. Someone's backgrounds play a major role in defining habitus. On a primary level the habitus is influenced by family, parents, friends, etc. On a secondary level the habitus is influenced by education, jobs, etc.

Field, capital and habitus together explain practices, strategies and outcomes. In simple terms, a field can be conceived as an arena in which people (agents) pursue certain stakes and promote certain interests, drawing on the accumulated capitals (economic, social, cultural and symbolic) as the basis of their strategies, habitus and the power relations available to them for a

certain social position and some social objectives (Bourdieu & Wacquant, 1992). Positions in a field held by the agents can be regarded as an agent's capital. Bourdieu (1990, p. 112) also liken the field as a "game" whereby the agent who has a good sense of the game "is continuously doing what needs to be done, what the game demands and requires" utilizing a set of dispositions for action and a certain degree of ability to act derived from the agent's capitals. People acquire habitus by learning to carry on the practices that transpire in a given field under the objective socioeconomic conditions that is instituted there. Once acquired, habitus generates actions, and assigns meanings to the actions, events, and settings that people encounter, that perpetuate the field's practices and objective conditions. The range of actions and meanings that habitus generates is limited to those compatible with the objective conditions involved. Consequently, in addition to stakes, interests, capitals, and objective conditions, any field also has a space of possible actions, meanings via a set of strategies.

The theory of practice has a number of other constructs that are typically used in discussing about how practice is generated. These constructs include strategy, power and doxa. In the act of doing something, the agents in organizations need to have the capitals or resources in order to be able to execute their activities. In short, they need a strategy of getting the practice done. Hence, strategy involve ways to go about getting capital for enactment of the practice and ways to make the pursuit of acquiring the capital appear like an adherence to rules. The agents, based on their dispositions and capital such as knowledge could creatively devise various strategies that can best achieve their desired objectives.

In executing the strategy, the agents need some power in bargaining for their place or position in the field. So, power is defined by the relational position of the agents in the field in which the capital they possess enable them to enter the dominancy over the agents who own lesser capital (dominated). For example, a person with a better education and better job position are sometimes better off and have a relatively more power over those who have lack education and occupy a lower rank in workplace. With the power available to the agents who has more capitals, they hold the dominancy position in the field and can control the field using the capitals and power available to them. The agents who has lesser power or in the "dominated" position typically "surrender or submit" and accept their position in the field. This situation is sometimes called as "symbolic violence" by Bourdieu. However, this phenomenon is not constant and stable. Instead, struggle for power or more power as well as various strategies deployed to access for capitals occur most of the time in organizations. As a result, there always exist dynamic relationships, interactions and conflicts that shape and reshape how practice is structured in organizations.

Another construct is doxa. Doxa consists of a set of core beliefs, fundamental principles and acquired skills, techniques, tastes, and references that are unique to a particular field. Generally, agents who are in the dominated position submit their beliefs and principles as those set by those agents in power in the field. They institutionalised and practiced these beliefs, principles, the acquired skills, techniques and tastes and references as their own. Thus, doxa in one field are said to be unique to that particular field. Further, even different organizations that belong in the same field may have a different set of doxa of their own as the work culture are unique from one organization to another.

Other IS research using theory of practice

It is interesting to note that there exist a few IS research that have been conducted using the theory of practice as their theoretical lens. The followings provide a brief summary of IS research that employ Bourdieu's notions of practice.

The theory of practice has been utilised in theorising and explaining the cause and consequence of IS to different organizational work practices (Richardson & Howcroft, 2006; Kvasny & Keil, 2006; Levina & Vaast, 2005, 2006; Schultze & Orlikowski, 2004; Schultze & Boland, 2000). For example, Richardson & Howcraft (2006) employ Bourdieu's concepts to support a critical interpretation of call centers, showing how work practices are tightly constrained by oppressive technologies and managerial practices. Kvasny and Keil (2006) finds that the concepts of habitus and field are useful in interpreting the futility of community technology initiatives to bridge the 'digital divide' separating urban social classes.

The theory of practice has also been used to explain human practices across social groups or "fields" where norms within a particular field determine a particular practice in a particular situation (Levina & Vaast, 2005). Levina and Vaast (2005) argue that that practices can be changed even when there are formally designed roles of an agent. In their subsequent research, Levina and Vaast (2006) suggest that the production of practices with respect to embodiment relies quite heavily on a number of elements including community norms, community ties, as well as reciprocity. Each agent or individual draws on "memories of their interpersonal interactions and mimics acceptable behaviors, appearances and manners to reproduce existing relations" (Levina & Vaast, 2006, p.16). Additionally, Schultze and Boland (2000) draw from the theory of practice to examine the reproduction of tensions inherent in the lives of outsourced system administrators. Thus, in Bourdieu's theory of practice, human agency reinforces inertia rather than fosters change and the use of IS as part of work practices helps to facilitate social change.

POTENTIAL RESEARCH AGENDA USING THEORY OF PRACTICE CONSTRUCTS

For researching Green IS-as-practices informed by the theory of practice, we propose the use of the constructs of the theory in either its wholesome approach (which is using all the three constructs) or using the piecemeal approach (by utilizing any one of the constructs on their own).

Based on our observations, the use of all three main constructs is rather rare in any research and in any field of studies. Most of them are using certain constructs independently of each other such as habitus only, or field only or capital only. At times, when all the three constructs are mentioned and used, focus is only given to one of the constructs while the other constructs are not given fair attention in explaining the phenomenon being researched.

Wholesome approach in using the Theory of Practice constructs

Using the wholesome approach, we argue that IS researchers could outline their research foundations using the ideas discussed next.

Green IS can be studied as an institutionally grounded practice that emerge as a result of interactions among different group's habitus, and capitals as well as the position (either dominant or dominated) of the group's fields. In this type of research, the researcher could employ a qualitative study using ethnographic technique and case study method in investigating such "institutionally grounded practices" using Green IS. This is because, in order to understand the

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complexity of interactions among different groups who have different set of habituses, capitals, and power relations, the researcher need to be situated and thoroughly observe how the phenomenon unfold over time.

A practice perspective helps to identify the various mechanisms of green practices in IS, as either: the Green values are inscribed during the design and development stage of IS? or, are the Green values only emerge as a function of users' faithful (or unfaithful) appropriation of an IS during use? or, are the Green values emerge post-use during the evaluation of IS use stage?.

In understanding the mechanism of inscribing, use and post-use, the researchers could use multiple case study of multiple organizations that are implementing Green IS at different stages of its lifecycle. However, there could also be a possibility of all the Green values be observed and studied in a single organization that design, develop, use and evaluate the whole Green IS on their own. The example of UPS' telematics project is the best example where this kind of situation takes place.

Piecemeal approach in using the Theory of Practice constructs

In the piecemeal approach, we identify the following research agenda that IS researchers could kickstart their investigations on Green IS-as-practice:

Using the field construct only, the researchers could can investigate: (1) how IS help to construct the "Green field" within organizations, or (2) how do IS help to organise and stratify the organizations' "Green field"?

The concept of capital can help IS researchers to study: (1) how the configuration of capitals influence the use of IS for greening objectives, or (2) what are the circumstances that can lead Green IS to become a form of capital in organization.

The habitus notion can be used to investigate: (1) how the introduction of Green values to IS change the habitus of IS professionals?, (2) how the introduction of Green IS affects the ways of thinking, speaking and acting within a particular space change? or, (3) do the Green practices do become inscribed on a body (become institutionalized in a person such that it green practices becomes routines and leads to the individual's behavioral change)?

Lastly, using the strategy construct, IS researchers can investigate: (1) how IS is used in the attempt to change power relations within the sustainability field?, (2) how do less influential participants work within and around Green IS where strategies are used in the struggle for capitals?, or (3) how a "feel for the game" is formed and developed in the context of Green IS-as-practice?

SUMMARY

In conclusion, the extant literature have shown how IS could play its role in the context of eco-sustainability, from its enabling function, to promoter of eco-sustainability behaviors and even to its transformative capability in creating a sustainable society.

We assert that Green IS can be researched using the practice view and reasons of why this is justifiable was given. Among others, the shift towards practice-oriented IS research is gaining more foothold in IS field.

We also suggest that the theory of practice by Bourdieu can provide the theoretical lens in understanding how Green IS can be studied as a practice (Green IS-as-practice). For example, we have outlined various Green IS research agenda that can be pursued using the constructs of the theory of practice, either deployed wholesome or in piecemeal.

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It is our hope that this short commentary on Green IS-as-practice and the listed research agenda can inspire more research on Green IS and in enriching our understanding of the use of Green IS-as-practice.

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