Breaking bad habits: A field experiment about how routinized work practices can be made more eco-efficient through IS for sensemaking

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Abstract

We conducted a field experiment to compare the effects of information system (IS) supporting reflective disclosure and information democratization on the sustainability footprint of a routine organizational work practice, paper printing. We find that both sensemaking processes lead to employees reducing their printing; however, the processes are interchangeable and do not mutually reinforce each other's effects. This finding contrasts a latent assumption of prior research about a co-dependence between reflective disclosure and information democratization, and suggests organizations have a choice in how they can design and use IS to help employees make sense of different possibilities for more eco-efficient work.

Keywords: Green IS, sensemaking, reflective disclosure, information democratization, field experiment

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1. Introduction

Many organizations are investing efforts into implementing more sustainable work practices, with the aim to lower resource consumption, better the environmental footprint of organizational outputs and processes, and enhance their reputation (Butler & Hackney, 2021; Cooper & Molla, 2017; Gholami et al., 2013; Hu et al., 2016). To achieve these goals, organizations must engage their employees in understanding new sustainability targets, such as lowering greenhouse gas emissions, and to 'do their bit' to achieve them (Gholami et al., 2018; Jenkin et al., 2011; Yang et al., 2019). To foster such engagement, it has been argued that *sensemaking*, the ability to reframe routinized behaviours in organizations and prepare for collective action in light of new goals (Maitlis, 2005; Seidel et al., 2013; Thomas et al., 1993; Weick et al., 2005), is key to successfully establishing sustainable work practices. Sensemaking allows employees to comprehend, assess, and interpret information about the environmental impact of their personal decisions at work and the impact of their own practices on the natural environment (Seidel et al., 2018; Vlaar et al., 2008; Watson et al., 2012).

Our specific interest is in understanding how information systems (IS) can help organizations to modify routinized work practices to become more sustainable by providing employees with support for sensemaking. In this regard, routinized work practices are the recurrent patterns of action carried out by organizational actors (Pentland et al., 2010) – the way work gets done when employees 'do their bit'. Routinized work practices build on 'schemas, consistency in thinking, and reproducibility' (Ramiller & Swanson, 2009, p. 16), sets of individual activities that have become so standardized, stabilized, schematized, and routinized that they become 'automated', where employees perform their work efficiently, consistently, and reliably, minimizing cognitive effort.

Turning such routinized behaviours into more sustainable practices means challenging the typical advantages of routinization by introducing new requirements and demands, which essentially act as competing forces (Schildt et al., 2020; Weick, 1995). The example here would be pointing out that routinized work habits and performance adversely impact the natural environment and can no longer be tolerated.

To achieve such a transformation, the current organizational system, that is, the set of routines through which information is processed, coded, and evaluated (March & Simon, 1958; Tallon et al., 2019), must be re-inspected in light of the new requirements. In sustainability transformation practice, these new requirements are most often about eco-efficiency (Dyllick & Hockerts, 2002; Huppes & Ishikawa, 2005; Watson et al., 2010), such as reducing the routine level of resource consumption and the extent of environmentally harmful outputs or by-products being produced.¹

When new requirements such as eco-efficiency goals are being applied to existing work practices, the organizational system must be re-oriented to meet the transformation requirements (Butler, 2011; Seidel et al., 2013). An organization must, for example, redesign its processes such that the organizational routines exert a minimal negative impact on the environment, in terms of resource consumption and environmentally harmful outputs.

This process of re-inspection, re-evaluation, and re-orientation has been described as sensemaking, the interactive process of seeking information, ascribing meaning, and engaging in new action (Thomas et al., 1993). While sensemaking can occur on many levels, i.e. by individuals in organizations (micro-level), in work groups (mesolevel), and by organizations as a whole (macro-level) (Wagner III & Hollenbeck, 2020), sensemaking ultimately starts at the individual level. It is at this level that employees change their understanding and, consequently, their behaviour when making sense of a new situation. In the context of sustainability, therefore, it is imperative to understand how employees comprehend and interpret the new demands and prepare the ground for new action, such as more eco-efficient work routines (Bolander & Sandberg, 2013; Corley & Gioia, 2011; Weick et al., 2005).

It is well established that IS can support sensemaking in organizations (Hedman & Henningsson, 2016; Massey & Clapper, 1995; Weick & Meader, 1993; Zammuto et al., 2007). There are various examples where IS support for sensemaking was used in organizations with environmental sustainability goals in mind. The case of the Carbon Tracker is one such example, where the software collected carbon emission data

¹ Eco-efficiency is not the only sustainability transformation goal (e.g. eco-effectiveness, eco-productivity, or eco-equity) but most sustainability transformations pursue this particular goal (Hauschild, 2015).

during road transportation to help the organization reconsider the routing of their vehicles (Hilpert et al., 2013). Another example is the case of the Green e-community platform, which allowed users to engage in discussions about sustainability-related issues at a university, such as disposable plastic cups, paper towels, printouts, and waste (Seidel et al., 2018; Seidel et al., 2014).

Information systems are one key vehicle for organizations to use to support sensemaking, which helps to understand and modify work practices in light of new sustainability goals (Gholami et al., 2016). IS research has examined cases where ISsupported sensemaking was key to a sustainability transformation (Seidel et al., 2013) and has also extracted design principles for creating IS that can support environmental sensemaking (Seidel et al., 2018). However, no study has yet quantitatively examined the effects that different IS-supported sensemaking processes can have on the sustainability footprint of typical routinized work practices.

We take this step. We focus on two specific sensemaking processes, reflective disclosure and information democratization (Seidel et al., 2013), supported by two different types of information systems, a weekly reporting system and an online forum, both of which are meant to engage employees in supporting pro-environmental behaviours in organizations. Reflective disclosure allows 'for a reconsideration of belief formation, action formation, and outcome assessment related to work practices', and, if realized, enables 'seeking information about current work practice beliefs, actions, and outcomes, and enable imagination, articulation, and assessment of alternative actions and outcomes based on environmental sustainability considerations' (Seidel et al., 2013, p. 1282). In that sense, reflective disclosure enables individuals to refocus a prior understanding of a situation by critically introducing new perspectives and action possibilities that oppose familiar circumstances (Kompridis, 2005, 2006). Information democratization, on the other hand, enables the 'dissemination and interaction about sustainability-related information', and when implemented in IS enables the 'diffusion and network cultivation of information as well as opportunities to participate in and influence the decisions made as part of the initiative' (Seidel et al., 2013, p. 1282). From a

normative perspective, information democratization empowers individuals through a more equitable information environment (Tewksbury & Rittenberg, 2012).

Through a field experiment, we test the impact of these two IS-supported sensemaking processes on making an actual routinized work practice, paper printing, more eco-efficient. The research question we ask is:

RQ. *How do reflective disclosure and information democratization impact the eco-efficiency of paper printing as a common routinized work practice?*

Our work provides several contributions. Theoretically, we clarify a latent assumption about a co-dependence between reflective disclosure and information democratization (Seidel et al., 2013). Through our field experiment, we examine the nature of the relationship between the two sensemaking processes to clarify whether organizations need to use either reflective disclosure or information democratization, or a combination of both, to achieve targeted sustainability goals. Practically, comparing the effects of reflective disclosure and information democratization allows us to clarify what type of information systems organizations should build or implement, which is relevant in particular for the design of IS for environmental goals (Fridgen et al., 2016; Ketter et al., 2020; Loock et al., 2013; Recker, 2016; Seidel et al., 2018; Zampou et al., 2022).

We proceed as follows. We start by reviewing the literature on information systems and environmental sustainability. Next, we provide background on paper printing as a typical routinized work practice common to many organizations, which is the research context of our study. Building on the sensemaking literature, we then develop hypotheses about processes of reflective disclosure and information democratization to guide our empirical study. Then, we describe the experimental design of our study and present results from our data analysis. Finally, we discuss implications and limitations, and close with conclusions.

2. Background

2.1. Research on information systems for environmental sustainability

Organizations increasingly look to design, adopt, implement, and use information systems not only to support economic goals but also to promote environmentally sustainable behaviours in their organizations (Elliot, 2011; Watson et al., 2010). The hope is that so-called 'green information systems' (Leidner et al., 2022; Singh & Sahu, 2020; Watson et al., 2008) can be designed and used to enable practices and processes that improve the environmental performance of organizations (Melville, 2010). Green IS describes the use of information systems that serve as 'a potential enabler for green and sustainable practices' (Seidel et al., 2010, p. 1), which promotes behavioural change in individuals, organizations, and society (Iacobelli et al., 2010) such that the environmental footprint of any behaviour or practice becomes more ecoefficient or eco-effective. While eco-effectiveness 'aims to stop contamination and depletion, instead of only slowing down their speed, by directing individual and organizational attention to the underlying and fundamental redesign of the system' (Chen et al., 2008, p. 195), the goal of eco-efficiency is to better current practices and behaviours such that they continue to create economic value yet at the same time decrease negative environmental impacts (Dyllick & Hockerts, 2002; Huppes & Ishikawa, 2005). In other words, eco-effectiveness involves doing the environmentally right thing, such as redesigning work to avoid fossil fuel consumption altogether, while eco-efficiency involves doing things right, such as reducing fossil fuel consumption.

Research on how IS can support individuals and organizations to achieve ecoeffectiveness or eco-efficiency goals has focused on the complex relationships between humans, organizations, their individual or organizational behaviour, the environment, and the technology, all of which need to be examined together to address issues of uncertainty about environmental sustainability (Elliot, 2011). For example, the belief–action–outcome framework suggests that environmental outcomes of behaviours are an outcome of belief and action formation on both a macro-level (the organization) and a micro-level (the individual) (Melville, 2010). Or, the energy informatics framework describes how information systems play a central role in

linking the interdependencies between energy supply and demand that exist between stakeholders (suppliers, consumers, and governments) and the energy system elements (sensor networks, flow networks, and sensitized objects) (Watson et al., 2010). Information systems can help balance these interdependencies by enabling a range of digital mirror actions such as deferrable management, battery (dis)charging, or dynamic pricing (Watson et al., 2022).

Green IS research has then begun to explore the link between IS and environmental sustainability empirically. For example, Butler (2011) conducted semistructured interviews to explore the enabling effects of IS in helping a company manage environmental compliance and related organizational risks. Other studies investigated how IS relates to individual sustainable behaviours (Butler & Hackney, 2021; Gholami et al., 2013; Leidner et al., 2022; Loeser et al., 2017; Loock et al., 2013; Marett et al., 2013; Wunderlich et al., 2019), while others again examined how IS can be better designed to achieve more sustainable outcomes (Corbett, 2013; Fridgen et al., 2016; Piel et al., 2017; Seidel et al., 2018; Watson et al., 2022; Zampou et al., 2022), or how to fit IS implementations with an organization's sustainability strategy (Cooper & Molla, 2017; Corbett & Mellouli, 2017; Hanelt et al., 2017; Pitt et al., 2011; Watson et al., 2011; Yang et al., 2019).

Several literature reviews exist by now that summarize knowledge about the role of green IS in supporting behavioural change to improve sustainability in organizations (Cherki El Idrissi & Corbett, 2016; Sedera et al., 2017; Singh & Sahu, 2020; Wang et al., 2015). Broadly speaking, at this point, three main roles of green IS can be distinguished as follows: *automating*, *nudging*, or *sensemaking*. First, information systems can be used to automate several decisions to favour eco-efficient outcomes. For example, autonomous cyber-physical systems controlling greenhouse lighting can reduce energy costs for greenhouse agriculture by about 30 percent (Watson et al., 2018).

Second, IS can be used to nudge or influence people to make more environmentally beneficial decisions. For example, IS can be used to implement dynamic pricing models that motivate electric vehicle operators to deploy their unused cars for energy grid (dis-)charging (Valogianni et al., 2020), an eco-effective outcome. IS can also be deployed to nudge people to engage in more eco-efficient behaviour, e.g. through real-time feedback on energy-intensive activities like showering (Tiefenbeck et al., 2018) or driving (Degirmenci & Breitner, 2023; Potvin-Bernal et al., 2020).

Third, IS can be used as a tool to support sensemaking about transformation initiatives with new eco-effectiveness or eco-efficiency goals (Hahn et al., 2014; Hedman & Henningsson, 2016; Seidel et al., 2018). In this sense, IS are used as cognitive vehicles that help individuals understand and reflect on their behaviour about the environmental consequences of their actions. It is to this stream of research that our study contributes.

IS-supported automating, nudging, and sensemaking all have in common the need for relevant information to operate efficiently and generate a positive impact on proenvironmental behaviours. The role of information is pivotal as it can alter preferences for environmentally sustainable practices (Caspersen & Navrud, 2021; Galati et al., 2022) or shape green behaviours towards the consumption of natural resources (Chi, 2021; Testa et al., 2020). Information can be used for various reasons, such as waste reduction, recycling, energy saving, or water saving (D'Amato et al., 2019). To influence sustainable behaviours, information can be made available to challenge current beliefs and attitudes (Isensee et al., 2022; Walsh & Dodds, 2022), or to allow social interaction through information provision, where personal decisions can be affected by others (He et al., 2020; Yin & Shi, 2021).

We build on the approach of information provision and focus on sensemaking, challenging current beliefs through reflective disclosure and establishing social interaction through information democratization. We argue that these sensemaking processes can break through the routinization of work practices and help employees re-orient their work practices toward new eco-efficiency goals, thus facilitating an eco-efficient transformation.

2.2. Research context: Paper printing as a typical routinized work practice

How IS can support individuals in sensemaking to engage in more eco-efficient work is ultimately an empirical question. Thus, as a research context, we chose paper printing as our empirical setting. We had several reasons. First, paper printing is a highly routinized, often daily, work practice for many employees in many sectors. It is characteristic of a cognitively highly automated routine, in the sense that 'people go on doing the things they routinely do without deliberately thinking about how they do them' (Sandberg & Tsoukas, 2015, p. S25). As such, it is a revelatory setting for studying how established, efficient, and automated routines could possibly be modified through the 'competing force' of newly imposed sustainability goals. Paper printing is a practice where sensemaking is needed to introduce 'disruptive ambiguity' (Weick et al., 2005) because otherwise the automated routine of carrying out printing jobs will likely continue unchanged.

Second, paper printing is highly common in many organizations and key to most administrative and management processes (Garcia & Fonseca, 2018; Yu et al., 2018). The International Data Corporation (IDC, 2020) reports that 3.2 trillion pages (6 million pages per minute) were printed on office and home printers globally in 2019. And despite technological innovations such as cloud-based storage, printing remains a substantial environmental problem and one of the most common drivers of carbon dioxide (CO₂) emissions in organizations. Even a 13.7% decline in total page printing volume attributed to work-from-home regulations during the COVID-19 pandemic (IDC, 2020) still leaves a substantial number of 2.8 trillion pages being printed annually. Moreover, about half the pages printed by office workers working from home during the pandemic were still work-related documents (IDC, 2021).

Third, paper printing is an environmentally important work practice to investigate. Making paper printing more eco-efficient entails several benefits for the environment. Paper consumption is among the most environmentally harmful practices of all, particularly in knowledge-intensive industries that do not include physical production processes (Kayo et al., 2018; Kiurski et al., 2017; Rothenberg & Zyglidopoulos, 2007). Producing paper for printing is also environmentally problematic. For example, the paper production industry in the United States, the second largest paper industry in the world, is the largest user per ton of product of industrial process water and accounts for around 40% of the industrial wood harvest, 34% of the municipal solid

waste, and 9% of total manufacturing CO₂ emissions (Environmental Paper Network, 2007).

Fourth, paper printing is an example representative of output management, a key manifestation of IS-supported sustainable practices (Seidel et al., 2013). Output management means 'the management of environmentally harmful outputs and the associated resources consumption of work practices' and allows 'work practices to be confined to the boundaries of certain sustainability regulations and norms (e.g., consumption of paper or other non-renewable, harmful, or environmentally undesirable resources)' (Seidel et al., 2013, p. 1282). Paper printing aligns with this definition because it is a practice where the output created has tangible and direct environmental footprints, and where this output can be actively managed by controlling how and how much paper is being printed. Thus, paper printing is a key organizational work practice that can and should be made more eco-efficient, because 'doing more with less' (Chen et al., 2008) while printing entails immense environmental benefits.

It is this wasteful versus essential printing distinction that propels organizations to rethink their strategy to monitor employee printing behaviour and reduce paper consumption (Bolderdijk et al., 2013). Organizations typically use a print management system to control printing waste and find more efficient ways of printing, such as double-sided or black-and-white printing (Dempsey & Palilonis, 2012). While some argue that changing default settings is an effective way to influence behaviour change (Egebark & Ekström, 2016), others emphasize that giving feedback to employees will be more effective to influence their motivation and behaviour (Gregory-Smith et al., 2015) and shape their printing preferences (Liao et al., 2022), such as the choice not to print emails or other digital texts (Kuhn, 2022; Lo et al., 2014). While an eco-effective transformation would imply, for example, the shift from printing to entirely digital solutions, including the use of tablets and digital signatures, an eco-efficient transformation involves reducing existing environmentally harmful outputs, such as switching to double-sided printing, requiring print jobs to be manually released, or simply printing less.

It is for these four key reasons that in this study we focus on an eco-efficient transformation, where employees are provided with IS for sensemaking to help them reconsider their printing behaviour and participate in the transformation process through reflective disclosure and information democratization.

3. Hypothesis development

Our interest is in ascertaining whether IS-enabled sensemaking processes indeed assist employees with modifying their routinized work practices in light of sustainability goals. We focus specifically on two different types of sensemaking processes, reflective disclosure and information democratization, both of which have been theorized to be important to sustainability initiatives (Seidel et al., 2013).

Reflective disclosure builds on Kompridis's (2006) idea of critique, where people understand and assign meaning to their experience in order to be able to imagine and articulate alternatives to their current conditions, and Heidegger's (1927) idea of world disclosure where 'the world is pre-reflectively disclosed *to* us, yet, in another, the world is disclosed *through* us' (Kompridis, 2006, p. 34). Reflective disclosure is relevant to sensemaking where people search for meaning and settle for plausibility (Weick et al., 2005), which involves analysing a situation to deal with uncertainty through critical reflection to refocus a prior understanding that was pre-reflectively disclosed earlier.

Information systems can support reflective disclosure when they feature material properties for the monitoring, analysis, and presentation of environmental indicators such as greenhouse gas emissions (Seidel et al., 2013). For example, when information systems help to define and diffuse key environmental performance indicators for employees in an organization, they can become increasingly aware of the impact of their practices, in turn, potentially evoking behavioural change.

According to Seidel et al. (2018), actors can engage in reflective disclosure when they experience disruptive ambiguity and surprise, noticing and bracketing, as well as presumption and action planning, all of which are part of a sensemaking process. Disruptive ambiguity occurs through new information provided to them that evokes cognitive dissonance: 'new information may become known to a person, creating at least momentary dissonance with existing knowledge, opinion, or cognitive concerning behaviour' (Festinger, 1957, p. 4). For example, such dissonance may arise when organizational actors are confronted with environmental data about which they had no clear idea (Seidel et al., 2018). The disclosure of such information can help them reflect on their behaviour and may elicit surprise about the actual consumption of environmentally harmful resources.

Surprise represents 'a difference between an individual's anticipations and subsequent experiences in the new setting' (Louis, 1980, p. 237) and may be positive (e.g. delight at finding that your consumption of environmentally harmful resources is below the organization's average) and/or negative (e.g. disappointment at finding that your consumption still has an effect on the natural environment). In order to generate common ground, labelling and categorizing environmental information facilitates acts of noticing and bracketing, which is the starting point of sensemaking processes and stabilizes the stream of experience (Seidel et al., 2018). In this regard, 'labelling ignores differences among actors and deploys cognitive representations that are able to generate recurring behaviours' (Weick et al., 2005, p. 411). In the context of environmentally harmful behaviours, labelling salient environmental indicators can help differentiate between different categories for recurring practices and behaviours to become more environmentally sustainable through noticing and bracketing, which allows organizational actors to presume potential alternative environmentally responsible actions (Seidel et al., 2018). It is through presumption and action planning that prospective sensemaking is accomplished (Gephart et al., 2010), by focusing on future-oriented aspects involving 'the conscious and intentional consideration of the probable future impact of certain actions, and especially non-actions' (Gioia et al., 1994, p. 378). Such consideration is an essential element in a sustainability context for individuals to reflect on their actions and non-actions, enabling them to choose alternative actions to avoid environmentally harmful behaviours (e.g. choosing double-sided over single-sided printing where possible or going paperless while work requirements are complied with). To promote prospective sensemaking (Gioia & Mehra, 1996; Stigliani & Ravasi, 2012), a specification of abstract practices is required in order to proceed from the first question of sensemaking, 'what's going on

here?' to the second, equally important question, 'what do I do next?' (Weick et al., 2005). IS can, therefore, be designed to enhance the plausibility and guide action by informing users about the possibilities of outcomes (Seidel et al., 2018).

Overall, we expect that reflective disclosure through IS will enable individuals to better reflect on past actions and consider behavioural changes in light of the impact of individual actions; in other words, the environmental credentials of their actions will be made sense of. We propose:

H1. Reflective disclosure affects paper consumption, such that employees reduce their paper consumption when they engage in reflective disclosure through the use of an appropriately designed information system.

Information democratization is a similar yet distinct cognitive engagement with beliefs, actions, and outcomes. One prominent example of the democratization of information is a public library, which, in the digital age, has emerged into an online information environment with different types of resources, including, for instance, online encyclopaedia websites such as Wikipedia, where usually anyone can be a contributor (Wallace & Van Fleet, 2005).

The possibility to discuss, share, and learn from others' behaviours and outcomes can support a change in views and reasoning, and allows identifying new action opportunities and behavioural change possibilities. It allows individuals to experience sensemaking at a group level because individuals can access information and interact with others by actively participating in sustainability conversations, which may in turn help them establish sustainable work practices (Hilpert et al., 2013; Seidel et al., 2013). Through the diffusion and network cultivation of information, individuals are encouraged to engage with a sustainability initiative through feedback and comments on issues that are relevant for the work practice and through opportunities to influence decisions made as part of the initiative (Loeser et al., 2017; Seidel et al., 2013).

IS can support information democratization by providing a platform for open and inclusive communication with individuals across all functional areas and levels of the organization (Seidel et al., 2018). Communication focuses on effectively conveying

knowledge and information (Su, 2015), and is considered a central component of sensemaking through which shared meanings are created as a result of connections to others and past experiences (van der Heijden et al., 2012; Weber & Glynn, 2006; Weick et al., 2005; Wrzesniewski et al., 2003). Such retrospective interpretations are fostered through interdependent interaction (Weick et al., 2005) in which communication is an ongoing process for individuals to exchange knowledge and experiences to make sense of events that affect them (Taylor & Van Every, 2000). As such, this kind of social interaction empowers individuals to gain 'different insights and viewpoints that otherwise may not have been accessible' (Seidel et al., 2018, p. 227).

Overall, we expect that IS-enabled information democratization will allow employees to engage in conversations regarding sustainable work practices, enabling them to reconsider their potentially environmentally harmful routinized behaviour. We thus state:

H2. Information democratization affects paper consumption, such that employees reduce their paper consumption when they engage in information democratization through the use of an appropriately designed information system.

While IS supporting either reflective disclosure or information democratization can be expected to lead to more eco-efficient work practices, the question remains, what happens when employees are confronted with both processes at the same time. An explanation of the distinct impact of two different forms of sensemaking processes on the outcome of the routinized behaviour is yet to be provided. Both types of sensemaking supported through information systems prepare the ground for action (Seidel et al., 2018), but through different mechanisms. Reflective disclosure enables the sensing and weighing of environmental stimuli through the presentation and reconsideration of work practices at an individual level, while information democratization enables the synthesizing of different stimuli through interaction and dialogue at a group level. Both sensemaking processes are important but what is yet to be established is how much each of them matters, relatively, and what happens when both processes are enabled and actualized at the same time. We propose that the effects of reflective disclosure and information democratization will each be important yet distinct, particularly because they operate at different levels of analysis (i.e. individual and group). We, therefore, propose that the two sensemaking processes will interact. The assumption most prevalent in the literature is that this interaction will take the form of co-dependence (Seidel et al., 2013), such that reflective disclosure and information democratization will mutually reinforce each other, supplementing each other's effect. That argument claims that reflective disclosure depends on the action possibilities provided by information democratization in order to be effective, and at the same time, information democratization depends on the basis of information acquisition provided through disclosure.

Certain types of information systems could contain both sensemaking processes, for example, a digital dashboard may include both performance analysis and feedback functionality, which would allow for reflective disclosure as well as information democratization. However, there might also be instances where organizations choose to allow exclusively one process or the other, such that a co-dependence might not exist. We, therefore, hypothesize in this research that an interaction effect between the two sensemaking processes might be complementary and boost the impact on pro-environmental behaviours or might be interchangeable in nature with no additional effect when provided jointly. We build on Seidel et al.'s (2013) co-dependence argument and state:

H3. There will be an interaction effect between reflective disclosure and information democratization on paper consumption, such that employees reduce their paper consumption even more when they engage in both reflective disclosure and information democratization by using two appropriately designed information systems.

Fig. 1 presents our research model and three hypotheses. The model also introduces the main control variables included in our research design.



Fig. 1. Research model.

4. Methods

4.1. Design of study

Our aim was to provide the first quantified evaluation of the impact of sensemaking in the form of IS-supported reflective disclosure and information democratization on users and their individual work practices. We designed a field experiment, which maximizes both internal and ecological validity (Boudreau et al., 2001), to experimentally manipulate two variables within a naturally occurring system and subsequently measure the impact of the manipulation on one dependent variable that is of relevance in the real-world system.

An experiment makes it possible to isolate, control, and examine specific variables (the cause) and the consequence they cause in other variables (the effect) due to the availability of means, which is the primary strength of experimental research over other research approaches (Straub et al., 2022). In our study, we define reflective

disclosure and information democratization as the cause, and eco-efficient practicing in the form of reduced paper consumption during printing as the effect of the experiment.

Specifically, we used a 2 (with/without reflective disclosure) \times 2 (with/without information democratization) between-subject, full-factorial pretest–posttest experimental design to manipulate the presence and absence of two types of IS designed to support sensemaking, i.e. reflective disclosure and information democratization, at the workplace within an organization at the time it was running a sustainability initiative. We chose a between-subjects design over a within-subjects design to avoid any fatigue and carryover effects because in a within-subjects design, each subject would have been required to be exposed to every level of the experimental treatment, that is, (1) no treatment (control), (2) reflective disclosure (email report), (3) information democratization (discussion forum), and (4) reflective disclosure + information democratization (both email report and discussion forum) (see Table 1).

Table 1

Experimental design

		Reflective	e disclosure
		without	with
Information	without	No treatment (control)	Email report
democratization	with	Discussion forum	Email report + discussion forum

The work practice for our field experiment was paper printing. We used a print management tool to track paper printing behaviour, which allowed us to monitor individual employees' paper printing through their staff accounts and evaluate the sustainability of this practice in quantifiable terms. That is, paper consumption levels were measured in terms of the number of printed pages, single-sided pages, doublesided pages, colour pages, and black & white pages; and the equivalent consumption of natural resources such as trees, carbon, and energy.

We followed Bordens and Abbott's (2018) guidelines to design a between-subject matched-groups experiment and distributed participants randomly across the four groups. We first tracked the paper printing of participants for four weeks and then matched participants across experimental groups based on their printing behaviour to avoid an unequal distribution of participants who print substantially more than other participants. Such a matched-groups approach was critical for the study because paper consumption is the dependent variable. The equal distribution of participants in terms of paper consumption implicated an unequal distribution of demographics due to randomization. The matched-groups design eliminated the effect of paper consumption from group differences and compensated for the reduced sensitivity of the statistic (Bordens & Abbott, 2018).

4.2. Procedures

We conducted our field experiment within a large Australian university, where employees freely use printers in both colour and greyscale, as well as single versus duplex printing. These conditions meant the experiment could be conducted while participants can choose freely between printing options. Our procedures consisted of four stages, as presented in Fig. 2.



Fig. 2. Timeline of the procedures.

In the first stage, we designed our treatments. We started by developing the conceptual design and a first prototype implementation of two types of IS artefacts that enabled reflective disclosure and information democratization for users (15 March–29 November 2016). In the first iteration, we created an email report, including the data visualization of printed papers, and a wiki knowledge base, including a discussion board and a voting feature. This email report and wiki knowledge base were then introduced to a pilot focus group of fellow green IS researchers during the SIGGreen Annual Workshop Meeting at ICIS (12-13 December 2016). We introduced them to a scenario and asked them to imagine themselves working in an organization, where they have a printer available with single-sided, double-sided, colour, and black & white printing options. They were then introduced to the organization's sustainability initiative, where the goal was to reduce employees' paper consumption. With a draft of the email newsletter and the wiki knowledge base, they answered questions such as 'What does the email newsletter/wiki evoke in you?', 'What do you think about the weekly progress chart/the possibility to talk about environmental related topics?', 'Would the newsletter/wiki change anything about your printing behaviour?'. Based on the feedback, we then revised the design of our IS artefacts as treatments in the next iteration (10 January-13 October 2017). One major change was replacing the wiki knowledge base with an online discussion forum to facilitate open and inclusive communication and a sense of community through two main functionalities: a discussion board and a voting system, to foster communication and establish a community more effectively.

In the second stage, we worked with the central IT department of the large Australian university to establish a sustainability initiative with the explicit aim to reduce paper consumption. The initiative was launched on 4 July 2017 and continued for about 6 months. We used the central communication channels of the university to advertise the initiative and recruit participants within the network of the organization using email, the news website, intranet, and faculty newsletters. Participant recruitment took about two months. Next, through an online survey, including closed and open-ended questions, we collected quantitative data on our control variables and qualitative data to develop the topics and polls for our online discussion forum as the information democratization treatment of our experiment. We launched the first survey on 11 October 2017 and closed the survey on 20 October 2017. Participants' paper consumption was then tracked with the organization's print management tool, which we used to develop the printer usage data for our email reports as the reflective disclosure treatment of the experiment. We collected paper consumption data for a total of twelve weeks: four weeks prior to starting our experiment to establish our matched-groups design (18 September 2017–15 October 2017), six weeks while providing the reflective disclosure and information democratization treatments (16 October 2017–26 November 2017), and two weeks after providing the treatments had ended (27 November 2017–10 December 2017).

In the third stage, both treatments were available to participants from 16 October 2017 for six weeks, who received an email report and an invitation to participate in an online discussion forum each week. The email reports were only sent to the reflective disclosure group, the invitations to the online discussion forum were only sent to the information democratization group, and both treatments were provided to the combined group. Our experiment was undertaken during the middle to end of the university teaching period (after the mid-term break but before the exam period), to rule out effects such as extensive syllabus printing (start of semester), exam printing (examination), or low-to-no printing (semester break).

In the fourth stage, participants were asked to complete a second survey at the end of the initiative, one week after the final treatments were sent (6 December 2017) to collect manipulation check data about how participants actually engaged with our treatments for reflective disclosure and information democratization (see Table A1 in Appendix A for the control variables). The survey was closed on 8 January 2018.

4.3. Experimental measures

Our dependent variable was **paper consumption**, tracked with a print management tool, using metrics such as total pages printed, number of single-sided prints, number of colour prints, and so forth. We tracked and analysed data during the experiment using the treatments from a six-week period to mitigate bias from potential short-term disturbances in printing. A time period of six weeks was deemed reasonable in light of potential experimental attrition that can occur within experiments of a longer duration and which could threaten internal validity (Shadish et al., 2002). We monitored the risk of attrition through the online forum, where we could see whether, how, and how much participants continued – or not – to actively engage with the study on a weekly basis. All participants across the four groups were informed, and consented to, their printing being tracked as part of the initiative.

We also measured several control variables. First, in the pre-test survey, we defined exclusion criteria to ensure that (1) only participants with access to a printer at the case organization participated in our study and (2) the printer allowed doublesided printing. It was important that participants had the option to choose double-sided printing over single-sided printing to enable presumption and action planning to reduce paper consumption. Second, we surveyed participants' beliefs regarding the importance of paper reduction using an adapted three-item scale from McCarty and Shrum (2001), who created a scale to measure the importance of recycling. We changed the focal object of the scale (from 'recycling' to 'reducing paper consumption') and added an explicit definition of scope to two items (by referring to the 'entire value chain'). The average score for the construct 'importance of paper reduction' was 6.18 on a scale from 1 (strongly disagree) to 7 (strongly agree), with a standard deviation of 0.80. Third, we surveyed participants on their levels of environmental awareness using a scale from Steg et al. (2005). The average environmental awareness was 6.46 on a scale from 1 (strongly disagree) to 7 (strongly agree), with a standard deviation of 0.65. Fourth, we measured participants' knowledge of computers and IT using a scale adapted from Bulgurcu et al. (2010). The average knowledge of computers and IT was 5.31 on a scale from 1 (very low) to 7 (very high), with a standard deviation of 1.10. Fifth, a post-test survey served to examine the effectiveness of each treatment by measuring *engagement of users* with the email reporting system and the online discussion forum. At the end of the sustainability initiative, we asked participants to report on the frequency of reading their email reports and use of the online forum (read, post, and/or vote). These measures served as manipulation checks to determine which participants actually used

the treatments and at what intensity. Of the 95 participants, 77 responded to the survey conducted before the sustainability initiative started, and 72 at the end. The control measures are provided in Table A1 in Appendix A. While gender, age, job role, years working in the organization, importance of paper reduction, environmental awareness, and knowledge of computers and IT were included as control variables into our research model (see Fig. 1), the two exclusion criteria of (1) access to a printer and (2) double-sided printing availability were excluded because only participants who responded with 'yes' to these two questions were included in the experiment.

4.4. Treatment design

The two independent variables were developed and manipulated through the design and provision of two simple information systems, enabling the two sensemaking processes of reflective disclosure and information democratization. In the experiment, we controlled access to the two types of information systems, such that one experimental group did not have any IS available (control), two groups had access to one IS each, and one group had access to both IS. With paper printing serving as our experimental context of a routinized work practice, we chose to build two types of IS artefacts: one, a simple reporting system in email format that visualized printing data in a way that prompts reflective disclosure; and two, an online discussion forum with features such as commenting and voting to prompt information democratization.

To operationalize **IS support for reflective disclosure**, we designed a reporting system based on common email technology giving participants access to environmental indicators in relation to their work practices of paper printing on a weekly basis. As a first step, we translated relevant concept dimensions of reflective disclosure from Seidel et al. (2013) into specific system features (Table 2).

Table 2

Reflective disclosure concept dimensions and system features.

Relevant concept	System feature (our study)
dimension (Seidel et	
al., 2013)	
Seeking information	Regular distribution of email to participants about their
	current levels of paper printing.
Imagination and	1. Numerical, textual, and visual display of environmental
articulation	indicators: manufacturing trees, greenhouse gases, and
	energy used to produce paper.
	2. Translation of environmental indicators into economic
	indicator: costs in dollars for the printed pages.
Assessment	Comparison of employees' paper printing behaviours (a) to
	self, (b) to an average of other staff, and (c) over time
	(compared to previous weeks).

The email report provided participants with a comparison of their paper consumption over time and to other participants, which we expected to affect the awareness of the work practice. To avoid rebound (boomerang) effects (Schultz et al., 2007), we designed the disclosure features such that each participant received their own data in comparison to previous times and to aggregate data in the form of participant average. We integrated injunctive information that allowed participants to perceive what is commonly approved or disapproved to further reduce rebound effects for participants consuming less paper than their peer average (Hasan et al., 2013; Schultz et al., 2007). Here, green bars indicated individual paper consumption below the average, red bars were above the average, and the average was represented with grey bars. This visual perceptual approach of association and differentiation allowed participants to perceive similar objects belonging to a group and different objects belonging to distinctly different groups (below average: green; above average: red; average: grey), which helped to improve participants' sensemaking experience (Baker et al., 2009). Besides reducing rebound effects, this type of descriptive and injunctive information allowed participants to experience disruptive ambiguity and surprise,

which relates to reflective disclosure as suggested by Seidel et al. (2018). The information was potentially new to participants with the ability to create dissonance with their prior knowledge related to their paper consumption behaviour. Disruptive ambiguity involved the opportunity to elicit surprise because participants' anticipations regarding their paper consumption might have been different from their experience compared with the disclosure in the email report. Fig. 3 shows an excerpt from an email report displaying a comparison of sheets of paper consumed by one participant. Appendix B provides a more extensive example of the email reporting system.



Fig. 3. Excerpt from email report system displaying comparative paper consumption levels.

Additional features were implemented in the email report to allow for noticing and bracketing as well as presumption and action planning (Seidel et al., 2018). For example, we labelled various paper printing-related indicators (sheets of paper, printed pages, single-sided pages, double-sided pages, colour pages, and black & white pages), salient environmental indicators (trees consumed, CO₂ produced, energy in bulb hours), and economic indicators (cost in dollars) to help participants differentiate between different categories to enable noticing and bracketing. This labelling allowed

participants to become aware of the different categories (*noticing*) and single out specific cues that signified desired preferences (*bracketing*) (Jensen et al., 2009). Thus, we specified the abstract practice of paper printing using concrete environmental symbols so participants could presume potential alternative environmentally responsible actions. Furthermore, the email report suggested that choosing double-sided printing over single-sided printing would reduce paper consumption, allowing for action planning and enabling participants to engage in a specific pro-environmental behaviour at the workplace (Bissing-Olson et al., 2013; Ones & Dilchert, 2012). Fig. B1 in Appendix B presents an overview of further information from one exemplary email report.

To operationalize **IS support for information democratization**, we designed an online discussion forum to allow participants the possibility of engaging in dialogue and reconsidering their routinized work practice behaviours. Here, again, we first translated relevant concept dimensions into specific system features (Table 3).

Table 3

Information democratization concept dimensions and system features

Relevant concept	System feature (our study)
dimension (Seidel et	
al., 2013)	
Diffusion of	Functions to comment and provide feedback together with a
information	mechanism that distributes sustainability theme content to
	all users.
Network cultivation	Functions to participate and socialize in discussions.
Influence decisions	A voting function to allow participants to help form the
	environmental sustainability initiative to reduce paper
	consumption.

Participants were surveyed on how they felt about sustainability issues at work to provide topics in the forum that were relevant for the discussions. Further questions were posted weekly relating to their paper printing behaviour, including, for example, a discussion of reasons to print single-sided rather than double-sided, or the challenges of going paperless. Participant responses were grouped into six main topics, as illustrated in Fig. 4 with one exemplary topic, and Table C1 in Appendix C, which presents an overview of all topics, poll options, and votes. Participants were invited to discuss these topics on a weekly basis with each topic, including a poll to stimulate the discussions and to enable users to influence decisions made as part of the sustainability initiative (Seidel et al., 2013).

How can we make our printing gre	ener?			
Post Reply 🦘 🖉 🖌 🕞 Search this topic	Q 🌣		First unread post • 9 post	s • Page 1 of 1
How can we make our printing greener? F	Please choo	se one option that you consider most importan		
You may select 1 option				
Print double-sided rather than single-sided to reduce paper consumption	0		<mark>14</mark> 82%	
Avoid colour printing: colour printing generally uses more ink	0		No votes	
Select 'secure print' as the job type in the printer properties to minimise printing that is not collected		2	12%	
Other (please explain in the text field below)	0 1		6%	
	Total votes:	17		
	Submit vo	ote		
How can we make our printing green	er?	<i>d</i> [*] × ! i 66	Site Admin	ONLINE
Going paperless is not something that is done over work with paper for various reasons. With your hel paper-based working processes. To help us develop thoughts in the text field below.	night. Despite p, we try to u p a better und	e being interested in a digital shift, many prefer to understand the balance between greener printing and derstanding, please take the poll above and share your	Joined: Sun Oct 22, 2017 1:48 pm Location: Brisbane, Australia Contact: 💬	
 How can we make our printing greener? What would it take to make paper-based we sacrificing working efficiency? 	orking process	es more environmentally sustainable without		
Your feedback is highly appreciated. Thank you so	much for you	ır help!		0

Fig. 4. Excerpt from online discussion forum displaying one topic, including voting feature.

The online discussion forum enabled participants to engage in open and inclusive communication (Seidel et al., 2018), which in turn helped them connect with their colleagues to share their experience with paper printing at work. Such interaction with colleagues helped to create a sense of community (Seidel et al., 2014) and enabled retrospective sensemaking to gain different insights and viewpoints in order to make sense of their paper printing behaviour. Fig. C1 in Appendix C presents an exemplary discussion among participants that occurred in the online forum.

We used both quantitative and qualitative data to develop these two IS: quantitative data from the print management tool to create the email reports (sheets of paper printed per week in the form of visualized data); and qualitative data from the first survey to create topics in the online discussion forum. Providing the email reports and discussion forum enabled the participants who received the reflective disclosure treatment to reflect on their printing behaviour, and those who received the information democratization treatment to feel included and also to shape the sustainability initiative, providing the opportunity to participate in the voting process.

4.5. Participants

Participant selection involved screening employees for frequency and volume of printing. We recruited employees who use printers both frequently and rarely as part of their work to allow for natural variation. Recruitment was undertaken by contacting university faculty managers, heads of schools, personal assistants, and by advertising through diverse university news channels, the university's intranet, and on diverse social media websites. All participants consented to having their paper printing behaviour tracked through the university's print management tool and disclosing their identity for the survey. The identity disclosure enabled us to match their paper consumption with the manipulation checks. While collecting identifiable data where sensitive individual data is being tracked might adversely affect response rates, this was essential to measure actual paper consumption instead of self-reported consumption, and to ensure that the reflective disclosure and information democratization treatments were used effectively by implementing the manipulation checks. Participants were assured of confidentiality in order to optimize data quality (Durant et al., 2002), and that only aggregated, anonymized results would be reported. The identifiable nature of the data collection and the sensitivity of tracking paper consumption in the work environment could potentially increase participant concerns about disapproval or other consequences of their printing behaviour (McNeeley, 2012). Therefore, participants were assured that identifiable data related to their paper consumption and survey responses will only be used as part of the research and under no circumstances shared with any other entity of the participating university.

Interaction with participants was only through the distribution of the treatments via email to minimize experimenter bias. In our between-subject matched-groups experiment, we distributed matched sets of participants at random, one per group across groups of the experiment (Bordens & Abbott, 2018), to ensure a double-blind method that neither subjects nor researchers could influence the distribution of participants. This random matched-groups distribution was essential to minimize any potential observer-expectancy effect. No participant was aware of the type of alternative treatments that existed for other participants to prevent resentful demoralization and compensatory rivalry.

In total, 98 employees of the university participated in our study; two withdrew and one left the university during the sustainability initiative, resulting in 95 participants producing usable data (23 in the control group, 24 in the reflective disclosure group, 25 in the information democratization group, and 23 in the group receiving both treatments). Participants were mostly female (66.3%) and in an administrative position (58.9%) with an average age of 41 years, and the average years working in the university was 8 years for all participants. A complete list of participant profiles is provided in the appendix (see Table A2 in Appendix A).

5. Data analysis

5.1. Descriptive statistics

We measured paper consumption for a period of twelve weeks. The number of pages the 95 participants printed was tracked, first before starting the treatments (preexperiment, 4 weeks); second, during the use of the treatments (during the experiment, 6 weeks); and third, after the completion of providing the treatments (post-experiment, 2 weeks). Table 4 provides an overview of the printed pages with a breakdown of double-sided, single-sided, black & white, and colour pages.

Table 4

Printed pages

	Pre-exp	periment	During		Post-ex	periment	Total		
	(4 w	eeks)	experiment		(2 weeks)		(12 weeks)		
			(6 w	eeks)					
Pages	23,093	100.0%	57,040	100.0%	13,470	100.0%	93,603	100.0%	
Double- sided	17,454	75.6%	46,918	82.3%	10,370	77.0%	74,742	79.9%	
Single- sided	5,684	24.6%	10,122	17.8%	3,100	23.0%	18,906	20.2%	
Black & white	14,892	64.5%	33,639	59.0%	7,506	55.7%	56,037	59.9%	
Colour	8,246	35.7%	23,401	41.0%	5,964	44.3%	37,611	40.2%	

The range of paper consumption in total pages for the four groups was 6,643–22,342, for single-sided pages 1,111–3,550, for double-sided pages 5,532–18,792, for colour pages 1,783–12,135, for black & white pages 4,860–10,207, and the costs ranged between \$196.10 and \$1,083.08. In sum, 95 participants consumed 32,192 sheets of paper within the six-week period of our experiment while we used the treatments, which equalled 3.86 trees consumed, 407.63 kg CO₂ produced, and 25,605 bulb hours of energy consumed.

5.2. Hypothesis testing

We estimated a generalized linear model using SPSS. Generalized linear models allow analysing data with a non-normal distribution of the dependent variable, which is typically the case with count data (Hair et al., 2019), as in our experiment. Paper consumption was the dependent variable, and treatments of reflective disclosure (REFL) and information democratization (INFO) were the independent variables. We added the manipulation checks (REFL_CHK; INFO_CHK) and the control variables as covariates. Manipulation checks measured the actual impact of the email reporting system and the online discussion forum on paper consumption to control for the effectiveness of the treatments. Following guidelines by Hair et al. (2019), interaction effects can be assessed both graphically and statistically. Table 5 shows the model results, and Fig. 5 plots the marginal means.

Table 5

Dependent	Scaled	Factor	Wald χ^2	Sig.	Df
variable	Pearson				
	χ^2/df				
Paper	1.234	REFL	28.066	< 0.001	1
consumption		INFO	11.066	< 0.001	1
		REFL * INFO	15.433	< 0.001	1
		REFL *	0.180	0.914	2
		REFL_CHK			
		INFO *	0.053	0.974	2
		INFO_CHK			
		REFL * INFO *	13.969	0.007	4
		REFL_CHK *			
		INFO_CHK			
		GEND	7.508	0.006	1
		AGE	1.956	0.162	1
		ROLE	0.408	0.523	1
		YEARS	2.562	0.109	1
		IMP	0.934	0.334	1
		EA	0.204	0.652	1
		IT	0.023	0.879	1

Generalized linear model results

Note: REFL = reflective disclosure, INFO = information democratization, REFL_CHK = manipulation check for reflective disclosure, INFO_CHK = manipulation check for information democratization, GEND = gender, AGE = age, ROLE = job role, YEARS = years working in organization, IMP = importance of paper reduction, EA = environmental awareness, IT = knowledge of computers and IT

The generalized linear model had a scaled Pearson χ^2 value of 95 with 77 degrees of freedom. This ratio of 1.234 suggests that there is little to no residual overdispersion in the data, suggesting good model fit (Myers et al., 2010). The main effects of the treatments (REFL and INFO) on paper consumption were statistically significant at p < 0.001. The interaction effect between REFL and INFO on paper consumption was also statistically significant, at p < 0.001. From the control variables, only gender showed a significant impact on paper consumption at p = 0.006.



We then ran pairwise comparisons (Table 6) to investigate the effects underlying the interaction between reflective disclosure and information democratization in more detail, using a Bonferroni-adjusted alpha level of 0.05/4 = 0.0125. For participants who did not receive the REFL treatment, there was a statistically significant mean

difference of 978.22 papers (p < 0.001) between participants with and without the INFO treatment, a decline of 72.73% in paper consumption. When participants received the REFL treatment, paper consumption declined by 48.86% but the mean difference was not statistically significant (159.39, p = 0.375). For participants who did not receive the INFO treatment, the REFL treatment produced a statistically significant mean difference of 1018.75 papers (p < 0.001), a decline of 75.75% in paper consumption. When receiving the INFO treatment, paper consumption declined by 54.51% but the mean difference was not statistically significant (199.92, p = 0.356).

Table 6

-					
Dependent	Treatment 1	Treatment 2	Mean	Std.	Sig.
variable			difference	error	
			(I-J)		
Paper	Without	Without INFO (I),	978.22	243.76	< 0.001
consumption	REFL	with INFO (J)			
	With REFL	Without INFO (I),	159.39	179.76	0.375
		with INFO (J)			
	Without	Without REFL (I),	1018.75	275.46	< 0.001
	INFO	with REFL (J)			
	With INFO	Without REFL (I),	199.92	216.67	0.356
		with REFL (J)			

Pairwise comparisons

Note: REFL = reflective disclosure, INFO = information democratization

The results of the pairwise comparisons show that the REFL and INFO treatments had a statistically significant impact on paper consumption in separate instances, such that paper consumption was reduced substantially. However, a combined instance of REFL and INFO did not further reduce paper consumption in a statistically significant way. These results show an interaction effect but not a substantial multiplicatory or otherwise magnifying effect when both treatments were combined.

6. Discussion

6.1. Synthesis of findings

Our findings from the generalized linear model show that implementing the email reporting system as a form of reflective disclosure led to a practically meaningful impact on the work practice of paper printing, resulting in a reduction in paper printing by 75.75%. Likewise, the online discussion forum as the information democratization treatment also substantially influenced paper consumption with a reduction in paper printing by 72.73%. Although there is a statistically significant interaction effect between reflective disclosure and information democratization on paper consumption, the pairwise comparisons (Table 6) show no additional substantial practical reduction by employing both treatments, in turn suggesting that both forms of IS sensemaking support are interchangeable to some extent.

6.2. Implications for research

Our study provides insights on how information systems that support sensemaking engage users to improve their work practices environmentally. First, our research offers an operationalization of the sensemaking processes of reflective disclosure and information democratization in a sustainability context with a focus on main effects and interaction effects.

Second, this first quantitative evaluation of a specific systems implementation using reflective disclosure and information democratization features on the individual and group level of a routinized behaviour provides insights to the stream of green IS research by determining whether there is any effect of sensemaking on employees' work practices from an environmental sustainability perspective. The next step for this sensemaking research would be to investigate how the main effects and interaction effects might be different through different systems or concatenations of systems. In this regard, our instantiation of reflective disclosure in the form of an email reporting system can be regarded as a passive form of participation, and the instantiation of

information democratization in the form of an online discussion forum as an active form of participation. The effort of actively contributing to the forum by commenting and voting is higher than just reading the topics. And as such, the engagement of our participants is not dissimilar to the levels of engagement in other community forums (e.g. between silent lurkers and active contributors) (Lugtig, 2014; Phang et al., 2015; Ridings et al., 2006). Therefore, future studies could focus on a comparison between active and passive participations.

Third, our results suggest that gender had an impact on paper consumption. While female staff printed 437.75 papers on average, male staff printed 144.19, due potentially to the fact that 41 of the female participants were administrative staff and 22 were academics, while 15 of the male participants were administrative staff and 17 were academics. The greater number of female participants in administrative roles might mean they require more printing than male (academic) participants. However, our generalized linear model showed job role (administrative vs. academic) had no significant impact on paper consumption. Nevertheless, this finding is worth exploring further.

Fourth, our results allow discrimination of sensemaking mechanisms: while both reflective disclosure and information democratization are effective instruments to understand and modify routinized behaviours to more eco-efficient work practices, our results inform knowledge to sensemaking research on the interaction between reflective disclosure and information democratization as sensemaking mechanisms, in turn contributing to the literature on sensemaking theory in general (Schultz et al., 2007; Tallon & Kraemer, 2007; Weick et al., 2005).

Specifically, while it has been theorized in earlier studies that reflective disclosure and information democratization are provided jointly in information systems (Seidel et al., 2013), we argue that sensemaking features can be made available separately. For example, a dashboard might come with a performance analysis (reflective disclosure), but might not provide a feedback functionality (information democratization); or, a corporate blog might allow commentary (information democratization), but not feature analytical processing (reflective disclosure).

To this conversation about co-dependence, our contribution is empirical: We clarify the impact of reflective disclosure and information democratization on proenvironmental behaviours separately and in a combined instance. This analysis of cause-and-effect relationships between reflective disclosure and information democratization is important since prior studies have not examined these two sensemaking processes both separately and combined, which means interaction effects were previously not apparent.

This empirical clarification paves the way for further theoretical work: we demonstrated empirically that reflective disclosure and information democratization invoke different outcomes separately and combined, but in our experiment, we could not examine how and why these differences manifest. Reflective disclosure and information democratization invoke different cognitive and social processes that are still to be unearthed and compared as to their effect on eco-effectiveness or ecoefficiency goals: Is social deliberation more or less important than cognitively weighing up different options? Which process serves eco-effectiveness goals better than eco-efficiency goals? Such research could be qualitative in nature, for example, by interviewing employees, to unveil reasons for the interchangeability of the two sensemaking processes.

Finally, our study emphasizes the importance of understanding organizational routines to question and modify existing environmentally harmful behaviours through sensemaking. We studied one common routinized practice, and future research could investigate a wider scope of organizational routines, such as through a revelatory qualitative case study to conceptualize the nature of different organizational routines and to identify new requirements necessary to transform routinized behaviours to sustainable work practices through IS-supported sensemaking.

6.3. Implications for practice

From a practical perspective, our research informs organizations about the effects of sensemaking mechanisms that have a substantive potential to shape organizational routines to become more environmentally sustainable. Our study shows that sensemaking in information systems, including reflective disclosure and information democratization, can significantly reduce environmentally harmful behaviours in organizations. The interaction effect of our analysis suggests that reflective disclosure and information democratization are interchangeable, which contrasts with Seidel et al.'s (2013) assumption of a co-dependence, implicating a tension in the agency for reflective disclosure and information democratization. Thus, we recommend that organizations take this interaction effect into consideration in their design of information systems to support sensemaking in sustainability initiatives. This recommendation is based on the fact that an over-engineering of sensemaking in information systems can lead to an excessive use of resources, and budgets are usually limited.

Organizations that plan to implement sensemaking systems first need to scrutinize whether employees are open to (1) reflective disclosure vested in material properties of information systems such as email reports or dashboard features, and (2) information democratization realized through instantiations such as online forums or community platforms. We presume this twofold approach is particularly important due to the following benefits and drawbacks associated with both sensemaking processes, which we encountered during our study. For example, email reports, including reflective disclosure, such as those in our study, are highly accessible to employees and require low effort due to the passive nature of participation. However, technical requirements need to be met, such as the implementation of a print management tool in our case organization, which was necessary to monitor and present salient environmental indicators to organizational actors. Another drawback of reflective disclosure relates to cases when employees feel such reports to be intrusive through a possible shaming effect. In our study, some participants reported that they felt uncomfortable with the reports due to remorse or other reasons regarding their paper consumption, which prompted two participants to withdraw from the study.

Information democratization would be a favourable choice for integrating in information systems when discussions about sustainability-related topics are welcoming, accessible, and inclusive for employees, depending on the communication culture of the organization. One major downside to information democratization, however, is the higher time commitment for both the organization to develop such

intervention and for the employees to use it. For example, establishing topics that are relevant for discussion can take a considerable amount of time, on a regular basis, such as in our study when we surveyed participants about their paper printing routines. We suggest other sustainability initiatives may require a similar degree of time and effort to effectively engage participants with an open and inclusive discussion. From the employee perspective, engaging with online forums requires a high level of effort due to the active nature of participation. Where an email report might take the employee only a few seconds to browse in order to enable reflective disclosure, an online forum might take several minutes to allow for information democratization, which can lead to a higher disruption of employees' workflow. We suggest that organizations carefully gauge the benefits and drawbacks of both sensemaking processes before designing and implementing sensemaking features in information systems.

6.4. Limitations and future research

The scope of our study is limited in terms of selecting the organization, work practice, and information systems tools. We note that operationalization choices are bound to one study context at a time. Theoretically, reflective disclosure and information democratization could impact the eco-efficiency of work practices for a variety of organizations, independent of the type of work practice, and the way that information systems provide these processes. This assertion will, however, require further empirical, programmatic research that explores variations in IS implementation, type of work practice, and type of organization. To initiate such efforts, we commenced our field experiment empirically within one organization, which limits generalizability. It was, however, a suitable setting for an initial evaluation of sensemaking and to determine whether there was *any* effect of the sensemaking processes as theorized. Further research can now be conducted to systematically explore theoretical variations and boundary conditions.

For example, other types of organizations will implicate other types of job roles. While a university typically distinguishes between administrative and academic staff, more complex distinctions (e.g. directorial, managerial, and/or functional roles) can exist in other types of organizations. Further, we focus on only one work practice, paper printing. Other common, routinized work practices exist. For example, physical work travel is a relevant general work practice prone to the influence of sensemaking, and one that could be improved through information systems (e.g. by using video conferencing solutions like Zoom or Skype with increasing frequency instead of travel). Also, such practices are subject to different environmental impacts (e.g. reduce energy primarily), and thus the mechanisms for improvement might be different compared to reducing paper consumption, which may mean information systems with different features might be needed to enable sensemaking. In the long term, future research can be established to investigate the consumption of other nonrenewable, harmful, or environmentally undesirable resources, and to examine other IS-enabled work practices, such as file sharing, video conferencing, phone conferencing, and instant messaging.

Another limitation refers to various exogenous factors that might have influenced the printing behaviour observed in our study where we tried to minimize such an effect through our matched-design approach. Future research could focus on this aspect to examine how sensemaking might be exacerbated through the use of already existing IS, such as possibly available learning management systems in the university context, or enterprise resource planning systems or similar systems in an enterprise context. Another influencing factor could be users' pre-existing environmental concerns (such as no concern, egoistic, altruistic, naturalistic). We measured how important participants find paper reduction in terms of environmentally sustainable outcomes, and we also measured participants' environmental awareness, but a more nuanced view on different user clusters might provide further insights on how sensemaking works differently based on varying environmental concerns.

Limitations of our study also relate to the IS designs used for manipulation, i.e. developing an email reporting system for reflective disclosure and an online discussion forum for information democratization. An email report is not the only way to instantiate support to evoke reflective disclosure, nor is a forum the only way to instantiate information democratization. We tried to be transparent about how and why we mapped relevant concept dimensions of reflective disclosure and information democratization into specific system features (see Tables 2 and 3). We conducted usability tests to improve the design and usability of the email report and discussion forum to more adequately represent reflective disclosure and information democratization. Both the email reports and the online forum were characterized by high accessibility to users, which made them effective and ecologically valid manipulations. Still, reflective disclosure and information democratization can be implemented differently. For example, a feature allowing reflective disclosure can also be implemented as a dialog window on the printer that would show a count of how many pages have been printed, how many in colour, duplex, etc., for the participant and comparatively to the peers. For information democratization, a live feedback system could also be an appropriate choice to engage participants in a sustainability conversation. However, such systems like a dialog window and live feedback are both technically and regulatory more restrictive to implement in organizations and would have impeded our field experiment design. Therefore, we used an email reporting system and an online discussion forum in our study due to their high practicability, easy implementation, and adequate applicability for feedback and interaction about participants' paper printing behaviours. Nevertheless, we acknowledge that other treatments might lead to different results.

We also note that our study is not a direct test of the propositions formulated by Seidel et al. (2013). For example, we did not examine *seeking information* or *network cultivation* but rather translated these concept dimensions into system features to measure the impact of reflective disclosure and information democratization on our dependent variable, paper consumption. To directly test Seidel et al.'s (2013) theory, further research could develop an itemization of all concept dimensions introduced by Seidel et al. to measure these dimensions as constructs of reflective disclosure and information democratization, plus output management and work virtualization, in a more precise and nuanced way.

Next, while we used manipulation checks to control for the effectiveness of the treatments, we cannot ascertain through which cognitive processes (for reflective disclosure) and which social processes (for information democratization) participants developed sensemaking. Different processes could possibly affect how they

appropriated the interventions, and as such provides an opportunity for future research to analyse these processes in more detail.

The duration of weekly treatments can be regarded as another limitation. Both treatments in our experiment were available to participants for six weeks, which was limited in terms of the time period they covered. Such a time frame provided the advantage of mitigating bias from potential short-term disturbances in printing, particularly because our experiment was run towards the end of the teaching term. Another advantage of a six-week time period was that longer periods can lead to participant fatigue, for those who have actively contributed to the study on a weekly basis. Future research could run longer experiments over a period of a semester or even a year, which might provide an opportunity to analyse various time periods of the experiment.

While participants in our study could select between single-sided or double-sided printing, and colour or black & white printing, there might be further options available in other organizations. A comparison between types of printing technology users have access to could provide further insights in future research (desktop vs. shared-operating on either print and collect or print-release and collect basis). A shared printing technology (print-release-collect) can save thousands of pages because users, even if they print (initial action), might never leave their desk to release and collect documents from the printing room. This delaying of printing can remove a significant number of uncollected documents from printing to determine how sensemaking can affect printing behaviour in more nuanced ways, e.g. when users not only switch from single-sided to double-sided printing, or from colour to black & white printing, but also from a print-collect to a print-release-collect approach.

The limitations regarding our experimental design in terms of participant selection could be that sampling for a study on environmental sustainability may lead to selfselection among the experimental subjects (Kankanhalli et al., 2005). Participants who were more concerned about environmental sustainability might also be those who were more likely to participate in such a study. Therefore, we also collected data about employees with minimal (or no) printing behaviours to mitigate this bias. Also, we

acknowledge the possibility of Hawthorne effects. Ethical clearance mandated disclosure about the study goals to participants during selection, so participants were well aware that their printing behaviour would be tracked over the course of our sustainability initiative. This disclosure might have led to participants modifying their behaviour in response to their awareness of being observed. However, all participants from the four experimental groups gave their consent to have their paper printing tracked, and ethical clearance required all participants be informed. Therefore, we can assume that a potential Hawthorne effect was distributed relatively evenly across the four groups.

Finally, we conducted our experiment in Australia, a country of typical Western culture. A replication of our study in other countries, particularly of eastern culture, might lead to different results.

6.5. Extending the context: Generalizing our research to other routinized work practices

Paper printing describes one specific routinized work practice, which was important to conduct a field experiment in a particular setting; however, the context also somewhat limits the ability to generalize our findings. Therefore, other sustainable work practices should be in the focus of future investigations to ascertain the generalizability of our results. To provide grounds to generalize analytically rather than statistically, it might make sense to use the distinction by Seidel et al. (2013) between output management and delocalization as two types for sustainable practices. Examining the effect of IS-enabled sensemaking on work practices other than paper consumption that also fall under the category of output management will likely lead to results similar to ours. Examples include the carbon footprint of commuting to work or the energy consumption of working with electronic devices. With regard to commuting, for example, individuals could be motivated to switch to public transport. In terms of energy consumption, a goal could be to switch off the lights or shut down the computer more frequently to save energy. Both contexts are similar to our focus of paper consumption, where an environmentally harmful behaviour is monitored, and

feedback is provided to employees through sensemaking to reflect and modify their routinized behaviour.

However, in all of these cases, the focus is on eco-efficient transformation, in other words, the reduction in the ecological footprint of existing environmentally harmful solutions (Huppes & Ishikawa, 2005; vom Brocke et al., 2013; Watson et al., 2011). While we focused on eco-efficiency in our study, there are also other sustainability goals (e.g. eco-effectiveness), which is a different matter altogether. For example, in the context of printing, examining what content is being printed, or how essential printing is, and in what format (eco, green, digital, or classic) would provide new insights where output management could also be linked to eco-effective transformation. Considering the three exemplary output management contexts of paper consumption, commuting, and energy consumption, eco-effective transformation could entail going paperless by alternative digital solutions users can switch to, including the use of tablets and digital signatures, the electrification of transportation systems, and the transition from fossil fuel energy to renewable energy sources. In all of these cases, a deeper consideration of the entire supply chain system is necessary, where the literature on comparative life cycle analysis should be consulted to achieve a holistic comparison between eco-efficient and eco-effective solutions. Since we focus on an eco-efficient output management in this study, that is, printing less through IS-supported sensemaking, eco-effective focused approaches may lead to different results.

The second type of sustainable practicing type, delocalization, may entail a more substantial differentiation from output management in terms of the findings we present. Delocalization has the potential to reduce environmentally harmful emissions through location-independent work practices (Seidel et al., 2013) and is even more relevant in the current time of worldwide pandemic shocks and social distancing, where video conferencing is increasingly replacing business travel. While video conferencing might be a compulsory choice during lockdown restrictions due to critical pandemic-related situations such as increasing COVID-19 cases, it is still a deliberate decision outside such constraints with considerable environmental impacts. Therefore, sensemaking can penetrate such routinized procedures and motivate

employees to reconsider their travel behaviours. This is the reason why we use sensemaking, where routinized behaviour is sought to be changed through questioning and reflection. That is, one might look at sensemaking differently and in doing so employ approaches other than sensemaking theory, such as persuasive systems design (Oinas-Kukkonen & Harjumaa, 2009), digital nudging (Weinmann et al., 2016), or gamified information systems (Liu et al., 2017), where sustainable habits are established to replace existing environmentally harmful ones. Our study took place pre-COVID (2017-18), where we consistently tracked printing behaviour at the workplace. During pandemic and post-pandemic times, the demand for online working, learning, and living has increased, and delocalization (Seidel et al., 2013) as an IS-enabled practice becomes increasingly important. It will be for future studies to explore how reflective disclosure and information democratization affect delocalization, enabling the comparison of such findings with our eco-efficient output management scenario of paper consumption.

Overall, our findings are most likely generalizable to other eco-efficient output management work practices such as sustainable commuting and energy consumption. Nevertheless, future studies should investigate if this really holds true. We expect that conditions will more noticeably differ from eco-effective output management and delocalization scenarios, which means a generalization is possible and would require further investigation.

7. Conclusions

Implementing information systems that support sensemaking through functionality for reflective disclosure and information democratization can assist organizations to make their work practices more eco-efficient. Organizations do not necessarily need to invest in both types of systems because their benefits are not additive: adding information democratization to reflective disclosure or vice versa does not substantially enhance the sustainability benefits accrued by one of the systems. This interchangeability of the two sensemaking processes suggests that if the applicability of reflective disclosure and information democratization is not being taken into account, sensemaking in information systems could have more features than necessary

resulting in an excess of sustainability-related expenditures in organizations. Such consideration can optimize the balance between economic and ecological goals, and maximize the success of sustainability initiatives.

Appendix A. Measurement details

Table A1

Control variables

Before initiative

Exclusion criteria

Do you have access to one or more printers at [organization] that you can use for your day to day work? (Yes/No/I don't know)

Do the printers that you use in your job allow double-sided printing? (Yes/No/I don't know)

Importance of paper reduction: Seven-point Likert scale (strongly disagree to strongly agree); Source: McCarty and Shrum (2001); Cronbach's alpha: 0.763

Reducing paper consumption at [organization]...

...will reduce pollution considering the entire value chain.

... is important to save natural resources across the entire value chain.

...will save land that would be used as dump sites.

Environmental awareness: Seven-point Likert scale (strongly disagree to strongly

agree); Source: Steg et al. (2005); Cronbach's alpha: 0.708

Global warming is a problem for society.

Energy savings help reduce global warming.

The exhaustion of fossil fuels is a problem.

The exhaustion of energy sources is a problem.

Environmental quality will improve if we use less energy.

It is not certain whether global warming is a real problem (reverse scaled)*

Knowledge of computers and IT: Seven-point Likert scale (very low to very high); Source: Bulgurcu et al. (2010)

After initiative

Manipulation check for reflective disclosure: In the last six weeks, how many of the weekly paper printing reports did you read?

All 6 reports

5 reports
4 reports
3 reports
2 reports
1 report
None/I haven't received any reports

Manipulation check for information democratization: With regard to the weekly online discussions in the forum, in which of the following have you been involved? You can select multiple answers.

I have read comments in the forum.

I posted in the forum.

I voted in the polls.

I have received invitations to participate in the online discussions, but I didn't read/post/vote.

I haven't received any invitation to participate in an online discussion.

*Item excluded from analysis due to low Cronbach's alpha value

Table A2

Participant profiles

	Contr	ol	Refl	ectiv	Inform	ation	Bo	th	All	
	group)	e		democ	ratizatio	tre	atments	partic	ipants
	(n=23	3)	disc	losure	n (n=2	5)	(n=	=23)	(n=95)
			(n=2	24)						
Gender										
Female	12	52.2	16	66.7	18	72.0%	1	73.9%	63	66.3
		%		%			7			%
Male	11	47.8	8	33.3	7	28.0%	6	26.1%	32	33.7
		%		%						%

Age

	20-25	0	0.0%	1	4.2	2	8.0%	0	0.0%	3	3.2
		0	24.0	0	%0			_	2 0 4 0 /	•	%0
	26-35	8	34.8	9	37.5	2	8.0%	7	30.4%	26	27.4
			%		%						%
	36-45	1	4.4%	2	8.3	6	24.0%	5	21.7%	14	14.7
					%						%
	46-55	5	21.7	6	25.0	7	28.0%	3	13.0%	21	22.1
			%		%						%
	56-65	2	8.7%	1	4.2	2	8.0%	1	4.4%	6	6.3
					%						%
	66-75	0	0.0%	0	0.0	0	0.0%	1	4.4%	1	1.1
					%						%
	Missing	7	30.4	5	20.8	6	24.0%	6	26.1%	24	25.3
			%		%						%
J	ob role										
	Administr	14	60.9	15	62.5	14	56.0%	1	56.5%	56	58.9
	ative		%		%			3			%
	Academic	9	39.1	9	37.5	11	44.0%	1	43.5%	39	41.1
			%		%			0			%
Ŋ	ears working	g in org	ganizatio	n							
	0-5	7	30.4	12	50.0	11	44.0%	8	34.8%	38	40.0
			%		%						%
	6-10	5	21.7	3	12.5	5	20.0%	6	26.1%	19	20.0
			%		%						%
	11-15	2	8.7%	2	8.3	0	0.0%	3	13.0%	7	7.4
					%						%
	16-20	1	4.4%	1	4.2	1	4.0%	0	0.0%	3	3.2
	-				%						%
	21-25	0	0.0%	1	4.2	2	8.0%	1	4.4%	4	4.2
	21 20	v	0.070		0/0	-	0.070	Ŧ	1.1/0	•	0/0
					/0						70

26-30	1	4.4%	0	0.0	1	4.0%	0	0.0%	2	2.1
				%						%
Missing	7	30.4	5	20.8	5	20.0%	5	21.7%	22	23.2
		%		%						%

Appendix B. Materials for the reflective disclosure treatment

	Last week				
	You	Average			
Sheets of paper	20	73			
Printed pages	28	128			
Single-sided pages	12	18			
Double-sided pages	16	110			
Colour pages	0	51			
Black & white pages	28	77			
Trees	0.24 % of a tree	0.87 % of a tree			
Carbon	251 g of CO ₂	920 g of CO ₂			
Energy	15.9 bulb hours	57.8 bulb hours			
Cost	\$0.31	\$4.95			

Trees: corresponds to number of trees gone into making the paper.

Carbon: corresponds to greenhouse gases released in the production of the paper (CO₂ equivalent).

Energy: represents the energy used to produce the paper, and is shown as the equivalent energy consumed by a standard 60W light bulb.

Please consider that whenever it is possible, printing double-sided rather than single-sided will reduce paper consumption.

Fig. B1. Detailed view of email report, including environmental information.

Appendix C. Materials for the information democratization treatment

Re: How can we make by Guest » Thu Nov 16, 20	our printing greener? 17 5:48 pm			Guest	
All too often I end up with them having already printe unit's course work and ther	handouts that are not collected by studen of the document. Could we 'give' them a pr on we're not duplicating or wasting the print	ts because of non atte inting allowance which ing,	ndance, disinterest or n is somehow tied in to A		
	1 5 5 1	5			۵
Re: How can we make by Guest » Thu Nov 16, 20	our printing greener? 17 5:51 pm		🖋 🗶 ! i lífi	Guest	
- same idea as above - re-u	se/purpose any single-side printed paper -	including for note page	ds etc.		
the following to reduce pri - event staff / meeting org	nting: anisers - not printing out programs/agenda	is etc. but providing di	igitally unless otherwise		
 instead of paper allow sci 	ribbling on other (possibly new) non-digital	surfaces - e.g., enabl	e erasable writing on more		
wall surfaces / desk surfac	es / etc				۵
Re: How can we make by Guest » Fri Nov 17, 201	our printing greener? 7 4:24 pm		/ x ! i 66	Guest	
If we can digitise as a first	option, that would be great. I also agree v	vith many of the ideas	listed above, so I won't		
printing greener by choosir	ing to buy 100% (or close to it) recycled pap but for most day to day printing, perhaps	er? I imagine that a fe	w documents may need to		
be on bright, write paper,	but for most day-to-day printing, perhaps	recycleu is enough: Ju	st a thought.		۵
Quick Reply					
Subject:	Re: How can we make our printing greener	?			
				1	
		Full Editor & Preview	Submit		
Post Reply 🦘 🛛 🖌 📼					9 posts • Page 1 of 1

Fig. C1. Posting comments allowing an open and inclusive discussion in the online

discussion forum.

Table C1

Forum topics and poll options

Topic	Poll option	Votes	%
How can [case	Avoid doing sustainability initiatives just to	2	17
organization] avoid	save money		
greenwashing?	Avoid lip service: less talk, more action	4	33
	Avoid lack of transparency: monitoring,	6	50
Total votes: 12	assessment, and reporting is required		
Total comments: 6	Other (please explain in the text field below)	0	0

Provide [case organization] staff with tablets	3	21
to read, edit, and share documents digitally		
Change formal procedures of documentation,	7	50
for example, through digital signatures		
I don't want to go paperless, working with	1	7
papers fits well with the way I work		
Other (please explain in the text field below)	3	21
Reviewing, marking, and editing documents	8	50
Comparing charts, figures, and tables	2	13
I don't work with paper	0	0
Other (please explain in the text field below)	6	38
Print double-sided rather than single-sided to	14	82
reduce paper consumption		
Avoid colour printing: colour printing	0	0
generally uses more ink		
Select 'secure print' as the job type in the	2	12
printer properties to minimize printing that is		
not collected		
Other (please explain in the text field below)	1	6
Having to turn a page back and forth for	3	30
referencing back		
Bleed-through to the other side of the paper	3	30
Technical barriers (for example, if using a	2	20
scanner that will only scan single-sided)		
Other (please explain in the text field below)	2	20
Reduce energy waste, for example, electricity	7	64
waste of lights, computers, air con, etc.		
	Provide [case organization] staff with tablets to read, edit, and share documents digitally Change formal procedures of documentation, for example, through digital signatures I don't want to go paperless, working with papers fits well with the way I work Other (please explain in the text field below) Reviewing, marking, and editing documents Comparing charts, figures, and tables I don't work with paper Other (please explain in the text field below) Print double-sided rather than single-sided to reduce paper consumption Avoid colour printing: colour printing generally uses more ink Select 'secure print' as the job type in the printer properties to minimize printing that is not collected Other (please explain in the text field below) Having to turn a page back and forth for referencing back Bleed-through to the other side of the paper Technical barriers (for example, if using a scanner that will only scan single-sided) Other (please explain in the text field below)	Provide [case organization] staff with tablets to read, edit, and share documents digitally3Change formal procedures of documentation, for example, through digital signatures7I don't want to go paperless, working with papers fits well with the way I work1Other (please explain in the text field below)3Reviewing, marking, and editing documents Comparing charts, figures, and tables2I don't work with paper0Other (please explain in the text field below)6Print double-sided rather than single-sided to reduce paper consumption14Avoid colour printing: colour printing generally uses more ink0Select 'secure print' as the job type in the printer properties to minimize printing that is not collected1Other (please explain in the text field below)1Having to turn a page back and forth for referencing back3Bleed-through to the other side of the paper scanner that will only scan single-sided)2Other (please explain in the text field below)2Reduce energy waste, for example, electricity vaste of lights, computers, air con, etc.7

What should be next	Overcome plastic pollution like waste of	3	27
for a greener [case	disposable water bottles and the need for		
organization]?	refillable containers		
	Resolve recycling issues such as better	1	9
Total votes: 11	sorting of recyclables and the impact on		
Total comments: 7	landfill		
	Other (please explain in the text field below)	0	0

References

- Baker, J., Jones, D. R., & Burkman, J. (2009). Using visual representations of data to enhance sensemaking in data exploration tasks. *Journal of the Association for Information Systems*, 10(7), 533-559. <u>https://doi.org/10.17705/1jais.00204</u>
- Bissing-Olson, M., Iyer, A., Fielding, K. S., & Zacher, H. (2013). Relationships between daily affect and pro-environmental behavior at work: The moderating role of pro-environmental attitude. *Journal of Organizational Behavior*, 34(2), 156-175. https://doi.org/10.1002/job.1788
- Bolander, P., & Sandberg, J. (2013). How employee selection decisions are made in practice. Organization Studies, 34(3), 285-311. https://doi.org/10.1177/0170840612464757
- Bolderdijk, J. W., Steg, L., & Postmes, T. (2013). Fostering support for work floor energy conservation policies: Accounting for privacy concerns. *Journal of Organizational Behavior*, 34(2), 195-210. <u>https://doi.org/10.1002/job.1831</u>
- Bordens, K. S., & Abbott, B. B. (2018). *Research design and methods: A process approach* (10th ed.). McGraw-Hill.
- Boudreau, M.-C., Gefen, D., & Straub, D. W. (2001). Validation in information systems research: A state-of-the-art assessment. *MIS Quarterly*, 25(1), 1-16. <u>https://doi.org/10.2307/3250956</u>
- Bulgurcu, B., Cavusoglu, H., & Benbasat, I. (2010). Information security policy compliance: An empirical study of rationality-based beliefs and information security awareness. *MIS Quarterly*, 34(3), 523-548. https://doi.org/10.2307/25750690
- 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. https://doi.org/10.1016/j.jsis.2010.09.006
- Butler, T., & Hackney, R. (2021). The role of informational mechanisms in the adoption of green IS to achieve eco-sustainability in municipalities.
 Information & Management, 58(3), 1-17.
 https://doi.org/10.1016/j.im.2020.103320

- Caspersen, E., & Navrud, S. (2021). The sharing economy and consumer preferences for environmentally sustainable last mile deliveries. *Transportation Research Part D: Transport and Environment*, 95, 1-18. <u>https://doi.org/10.1016/j.trd.2021.102863</u>
- Chen, A. J., Boudreau, M.-C., & Watson, R. T. (2008). Information systems and ecological sustainability. *Journal of Systems and Information Technology*, 10(3), 186-201. <u>https://doi.org/10.1108/13287260810916907</u>
- Cherki El Idrissi, S., & Corbett, J. (2016). Green IS research: A modernity perspective. *Communications of the Association for Information Systems*, 38, 596-623. <u>https://doi.org/10.17705/1CAIS.03830</u>
- Chi, N. T. K. (2021). Understanding the effects of eco-label, eco-brand, and social media on green consumption intention in ecotourism destinations. *Journal of Cleaner Production*, 321, 1-17. <u>https://doi.org/10.1016/j.jclepro.2021.128995</u>
- Cooper, V., & Molla, A. (2017). Information systems absorptive capacity for environmentally driven IS-enabled transformation. *Information Systems Journal*, 27(4), 379-425. <u>https://doi.org/10.1111/isj.12109</u>
- Corbett, J. (2013). Designing and using carbon management systems to promote ecologically responsible behaviors. *Journal of the Association for Information Systems*, 14(7), 339-378. <u>https://doi.org/10.17705/1jais.00338</u>
- Corbett, J., & Mellouli, S. (2017). Winning the SDG battle in cities: How an integrated information ecosystem can contribute to the achievement of the 2030 sustainable development goals. *Information Systems Journal*, 27(4), 427-461. <u>https://doi.org/10.1111/isj.12138</u>
- Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: What constitutes a theoretical contribution? *Academy of Management Review*, 36(1), 12-32. <u>https://doi.org/10.5465/amr.2009.0486</u>
- D'Amato, A., Giaccherini, M., & Zoli, M. (2019). The role of information sources and providers in shaping green behaviours. Evidence from Europe. *Ecological Economics*, 164, 1-10. https://doi.org/10.1016/j.ecolecon.2019.04.004
- Degirmenci, K., & Breitner, M. H. (2023). Gamification and sensory stimuli in ecodriving research: A field experiment to reduce energy consumption in electric

vehicles. *Transportation Research Part F: Traffic Psychology and Behaviour*, 92, 266-282. <u>https://doi.org/10.1016/j.trf.2022.10.014</u>

- Dempsey, M. E., & Palilonis, A. (2012). Reuse, recycle ... reduce: A greener library with print management. *Library Hi Tech*, 30(3), 408-417. <u>https://doi.org/10.1108/07378831211266555</u>
- Durant, L. E., Carey, M. P., & Schroder, K. E. E. (2002). Effects of anonymity, gender, and erotophilia on the quality of data obtained from self-reports of socially sensitive behaviors. *Journal of Behavioral Medicine*, 25(5), 439-467. <u>https://doi.org/10.1023/a:1020419023766</u>
- Dyllick, T., & Hockerts, K. (2002). Beyond the business case for corporate sustainability. *Business Strategy and the Environment*, 11(2), 130-141. <u>https://doi.org/10.1002/bse.323</u>
- Egebark, J., & Ekström, M. (2016). Can indifference make the world greener? Journal of Environmental Economics and Management, 76, 1-13. <u>https://doi.org/10.1016/j.jeem.2015.11.004</u>
- Elliot, S. (2011). Transdisciplinary perspectives on environmental sustainability: A resource base and framework for IT-enabled business transformation. *MIS Quarterly*, 35(1), 197-236. <u>https://doi.org/10.2307/23043495</u>

Environmental Paper Network. (2007). *The state of the paper industry: Monitoring the indicators of environmental performance.* <u>http://environmentalpaper.org/wp-content/uploads/2017/08/state-of-the-paper-industry-2007-full.pdf</u>

Festinger, L. (1957). A theory of cognitive dissonance. Stanford University Press.

- Fridgen, G., Häfner, L., König, C., & Sachs, T. (2016). Providing utility to utilities: The value of information systems enabled flexibility in electricity consumption. *Journal of the Association for Information Systems*, 17(8), 537-563. https://doi.org/10.17705/1jais.00434
- Galati, A., Alaimo, L. S., Ciaccio, T., Vrontis, D., & Fiore, M. (2022). Plastic or not plastic? That's the problem: Analysing the Italian students purchasing behavior of mineral water bottles made with eco-friendly packaging. *Resources*,

Conservation and Recycling, 179, 1-13. https://doi.org/10.1016/j.resconrec.2021.106060

- Garcia, L. C., & Fonseca, A. (2018). The use of administrative sanctions to prevent environmental damage in impact assessment follow-ups. *Journal of Environmental Management*, 219, 46-55. https://doi.org/10.1016/j.jenvman.2018.04.112
- Gephart, R. P., Topal, C., & Zhang, Z. (2010). Future-oriented sensemaking: Temporalities and institutional legitimation. In T. Hernes & S. Maitlis (Eds.), *Process, sensemaking, and organizing* (pp. 275-311). Oxford University Press. <u>https://doi.org/10.1093/acprof:oso/9780199594566.003.0013</u>
- Gholami, R., Molla, A., Goswami, S., & Brewster, C. (2018). Green information systems use in social enterprise: The case of a community-led eco-localization website in the West Midlands region of the UK. *Information Systems Frontiers*, 20(6), 1345-1361. https://doi.org/10.1007/s10796-016-9733-z
- Gholami, R., Sulaiman, A. B., Ramayah, T., & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information & Management*, 50(7), 431-438. <u>https://doi.org/10.1016/j.im.2013.01.004</u>
- Gholami, R., Watson, R. T., Hasan, H., Molla, A., & Bjørn-Andersen, N. (2016). Information systems solutions for environmental sustainability: How can we do more? *Journal of the Association for Information Systems*, 17(8), 521-536. <u>https://doi.org/10.17705/1jais.00435</u>
- Gioia, D. A., & Mehra, A. (1996). Sensemaking in organizations. Academy of Management Review, 21(4), 1226-1240. <u>https://doi.org/10.2307/259169</u>
- Gioia, D. A., Thomas, J. B., Clark, S. M., & Chittipeddi, K. (1994). Symbolism and strategic change in academia: The dynamics of sensemaking and influence. *Organization Science*, 5(3), 363-383. <u>https://doi.org/10.1287/orsc.5.3.363</u>
- Gregory-Smith, D., Wells, V. K., Manika, D., & Graham, S. (2015). An environmental social marketing intervention among employees: Assessing attitude and behaviour change. *Journal of Marketing Management*, 31(3-4), 336-377. <u>http://doi.org/10.1080/0267257X.2014.971045</u>

- Hahn, T., Preuss, L., Pinkse, J., & Figge, F. (2014). Cognitive frames in corporate sustainability: Managerial sensemaking with paradoxical and business case frames. *Academy of Management Review*, 39(4), 463-487. <u>https://doi.org/10.5465/amr.2012.0341</u>
- Hair, J. F., Jr., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage.
- Hanelt, A., Busse, S., & Kolbe, L. M. (2017). Driving business transformation toward sustainability: Exploring the impact of supporting IS on the performance contribution of eco-innovations. *Information Systems Journal*, 27(4), 463-502. <u>https://doi.org/10.1111/isj.12130</u>
- Hasan, S., Medland, R., Foth, M., & Curry, E. (2013). Curbing resource consumption using team-based feedback: Paper printing in a longitudinal case study. In S. Berkovsky & J. Freyne (Eds.), *Persuasive technology* (Lecture Notes in Computer Science, Vol. 7822, pp. 75-86). Springer. https://doi.org/10.1007/978-3-642-37157-8_11
- Hauschild, M. Z. (2015). Better but is it good enough? On the need to consider both eco-efficiency and eco-effectiveness to gauge industrial sustainability. *Procedia CIRP*, 29, 1-7. <u>https://doi.org/10.1016/j.procir.2015.02.126</u>
- He, Z., Zhou, Y., Wang, J., Li, C., Wang, M., & Li, W. (2020). The impact of motivation, intention, and contextual factors on green purchasing behavior: New energy vehicles as an example. *Business Strategy and the Environment*, 30(2), 1249-1269. https://doi.org/10.1002/bse.2682
- Hedman, J., & Henningsson, S. (2016). Developing ecological sustainability: A green IS response model. *Information Systems Journal*, 26(3), 259-287. <u>https://doi.org/10.1111/isj.12095</u>
- Heidegger, M. (1927). Sein und Zeit. Max Niemeyer Verlag.
- Hilpert, H., Schumann, M., & Kranz, J. (2013). Leveraging green IS in logistics: Developing an artifact for greenhouse gas emission tracking. *Business & Information Systems Engineering*, 5(5), 315-325. https://doi.org/10.1007/s12599-013-0285-1

- Hu, P. J.-H., Hu, H.-F., Wei, C.-P., & Hsu, P.-F. (2016). Examining firms' green information technology practices: A hierarchical view of key drivers and their effects. *Journal of Management Information Systems*, 33(4), 1149-1179. <u>https://doi.org/10.1080/07421222.2016.1267532</u>
- Huppes, G., & Ishikawa, M. (2005). Eco-efficiency and its terminology. Journal of Industrial Ecology, 9(4), 43-46. <u>https://doi.org/10.1162/108819805775247891</u>
- Iacobelli, L. B., Olson, R. A., & Merhout, J. W. (2010). Green/sustainable IT/IS: Concepts and cases. Americas Conference on Information Systems, Lima, Peru.
- IDC. (2020). *IDC forecasts a sharp decline in total page volumes printed on office and home devices in 2020 as COVID-19 affects the document printing market.* <u>https://www.idc.com/getdoc.jsp?containerId=prUS46609820</u>
- IDC. (2021). IDC forecasts worldwide page volumes to rebound in 2021, but will not reach pre-COVID-19 levels. https://www.idc.com/getdoc.jsp?containerId=prUS48126321

Isensee, C., Teuteberg, F., & Griese, K.-M. (2022). How can corporate culture contribute to emission reduction in the construction sector? An SME case study on beliefs, actions, and outcomes. *Corporate Social Responsibility and Environmental Management*, 1-18. https://doi.org/10.1002/csr.2368

- Jenkin, T. A., Webster, J., & McShane, L. (2011). An agenda for 'green' information technology and systems research. *Information and Organization*, 21(1), 17-40. <u>https://doi.org/10.1016/j.infoandorg.2010.09.003</u>
- Jensen, T. B., Kjærgaard, A., & Svejvig, P. (2009). Using institutional theory with sensemaking theory: A case study of information system implementation in healthcare. *Journal of Information Technology*, 24(4), 343-353. <u>https://doi.org/10.1057/jit.2009.11</u>
- Kankanhalli, A., Tan, B. C. Y., & Wei, K.-K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly*, 29(1), 113-143. <u>https://doi.org/10.2307/25148670</u>
- Kayo, C., Dente, S. M. R., Aoki-Suzuki, C., Tanaka, D., Murakami, S., & Hashimoto,S. (2018). Environmental impact assessment of wood use in Japan through

2050 using material flow analysis and life cycle assessment. *Journal of Industrial Ecology*, 23(3), 635-648. <u>https://doi.org/10.1111/jiec.12766</u>

- Ketter, W., Padmanabhan, B., Pant, G., & Raghu, T. S. (2020). Special issue editorial: Addressing societal challenges through analytics: An ESG ICE framework and research agenda. *Journal of the Association for Information Systems*, 21(5), 1115-1127. https://doi.org/10.17705/1jais.00631
- Kiurski, J. S., Marić, B. B., Oros, I. B., & Kecić, V. S. (2017). The ecodesign practice in Serbian printing industry. *Journal of Cleaner Production*, 149, 1200-1209. <u>https://doi.org/10.1016/j.jclepro.2017.02.193</u>
- Kompridis, N. (2005). Disclosing possibility: The past and future of critical theory. International Journal of Philosophical Studies, 13(3), 325-351. <u>https://doi.org/10.1080/09672550500169125</u>
- Kompridis, N. (2006). *Critique and disclosure: Critical theory between past and future*. MIT Press. <u>https://doi.org/10.7551/mitpress/2222.001.0001</u>
- Kuhn, A. (2022). Who gets lost? How digital academic reading impacts equal opportunity in higher education. *New Media & Society*, 1-22. <u>https://doi.org/10.1177/14614448211072306</u>
- Leidner, D. E., Sutanto, J., & Goutas, L. (2022). Multifarious roles and conflicts on an interorganizational green IS. *MIS Quarterly*, 46(2), 1-18. <u>https://doi.org/10.25300/MISQ/2022/15116</u>
- Liao, B., Li, L., & Yang, Z. (2022). Perceived social green preference: The motivation mechanism of inducing green behaviour. *Current Psychology*, 41(1), 1-17. <u>https://doi.org/10.1007/s12144-021-02483-z</u>
- Liu, D., Santhanam, R., & Webster, J. (2017). Toward meaningful engagement: A framework for design and research of gamified information systems. *MIS Quarterly*, 41(4), 1011-1034. <u>https://doi.org/10.25300/MISQ/2017/41.4.01</u>
- Lo, S. H., Peters, G.-J. Y., van Breukelen, G. J. P., & Kok, G. (2014). Only reasoned action? An interorganizational study of energy-saving behaviors in office buildings. *Energy Efficiency*, 7, 761-775. <u>https://doi.org/10.1007/s12053-014-9254-x</u>

- Loeser, F., Recker, J., vom Brocke, J., Molla, A., & Zarnekow, R. (2017). How IT executives create organizational benefits by translating environmental strategies into green IS initiatives. *Information Systems Journal*, 27(4), 503-553. <u>https://doi.org/10.1111/isj.12136</u>
- Loock, C.-M., Staake, T., & Thiesse, F. (2013). Motivating energy-efficient behavior with green IS: An investigation of goal setting and the role of defaults. *MIS Quarterly*, 37(4), 1313-1332. <u>https://doi.org/10.25300/MISQ/2013/37.4.15</u>
- Louis, M. R. (1980). Surprise and sense making: What newcomers experience in entering unfamiliar organizational settings. *Administrative Science Quarterly*, 25(2), 226-251. <u>https://doi.org/10.2307/2392453</u>
- Lugtig, P. (2014). Panel attrition: Separating stayers, fast attriters, gradual attriters, and lurkers. *Sociological Methods & Research*, *43*(4), 699-723. <u>https://doi.org/10.1177/0049124113520305</u>
- Maitlis, S. (2005). The social processes of organizational sensemaking. Academy of Management Journal, 48(1), 21-49. <u>https://doi.org/10.5465/amj.2005.15993111</u>
- March, J. G., & Simon, H. A. (1958). Organizations. Wiley.
- Marett, K., Otondo, R. F., & Taylor, G. S. (2013). Assessing the effects of benefits and institutional influences on the continued use of environmentally munificent bypass systems in long-haul trucking. *MIS Quarterly*, 37(4), 1301-1312. <u>https://doi.org/10.25300/MISQ/2013/37.4.14</u>
- Massey, A. P., & Clapper, D. L. (1995). Element finding: The impact of a group support system on a crucial phase of sense making. *Journal of Management Information Systems*, 11(4), 149-176. https://doi.org/10.1080/07421222.1995.11518063
- McCarty, J. A., & Shrum, L. J. (2001). The influence of individualism, collectivism, and locus of control on environmental beliefs and behavior. *Journal of Public Policy & Marketing*, 20(1), 93-104. <u>https://doi.org/10.1509/jppm.20.1.93.17291</u>
- McNeeley. (2012). Sensitive issues in surveys: Reducing refusals while increasing reliability and quality of responses to sensitive survey items. In L. Gideon

(Ed.), *Handbook of survey methodology for the social sciences* (pp. 377-396). Springer. <u>https://doi.org/10.1007/978-1-4614-3876-2_22</u>

- Melville, N. P. (2010). Information systems innovation for environmental sustainability. *MIS Quarterly*, *34*(1), 1-21. <u>https://doi.org/10.2307/20721412</u>
- Myers, R. H., Montgomery, D. C., Vining, G. G., & Robinson, T. J. (2010). *Generalized linear models* (2nd ed.). Wiley. <u>https://doi.org/10.1002/9780470556986</u>
- Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive systems design: Key issues, process model, and system features. *Communications of the Association for Information Systems*, 24(28), 485-500. <u>https://doi.org/10.17705/1CAIS.02428</u>
- Ones, D. S., & Dilchert, S. (2012). Environmental sustainability at work: A call to action. *Industrial and Organizational Psychology*, 5(4), 444-466. <u>https://doi.org/10.1111/j.1754-9434.2012.01478.x</u>
- Pentland, B. T., Hærem, T., & Hillison, D. (2010). Comparing organizational routines as recurrent patterns of action. *Organization Studies*, 31(7), 917-940. <u>https://doi.org/10.1177/0170840610373200</u>
- Phang, C. W., Kankanhalli, A., & Tan, B. C. Y. (2015). What motivates contributors vs. lurkers? An investigation of online feedback forums. *Information Systems Research*, 26(4), 773-792. <u>https://doi.org/10.1287/isre.2015.0599</u>
- Piel, J.-H., Hamann, J. F. H., Koukal, A., & Breitner, M. H. (2017). Promoting the system integration of renewable energies: Toward a decision support system for incentivizing spatially diversified deployment. *Journal of Management Information Systems*, 34(4), 994-1022.
 https://doi.org/10.1080/07421222.2017.1394044

Pitt, L. F., Parent, M., Junglas, I., Chan, A., & Spyropoulou, S. (2011). Integrating the smartphone into a sound environmental information systems strategy:
Principles, practices and a research agenda. *Journal of Strategic Information Systems*, 20(1), 27-37. https://doi.org/10.1016/j.jsis.2010.09.005

Potvin-Bernal, J., Hansma, B., Donmez, B., Lockwood, P., & Shu, L. H. (2020). Influencing greater adoption of eco-driving practices using an associative graphical display. *Journal of Mechanical Design*, 142(3), 1-11. https://doi.org/10.1115/1.4045968

- Ramiller, N. C., & Swanson, E. B. (2009). Mindfulness routines for innovating with information technology. *Journal of Decision Systems*, 18(1), 13-26. <u>https://doi.org/10.3166/jds.18.13-26</u>
- Recker, J. (2016). *Toward a design theory for green information systems*. Hawaii International Conference on System Sciences, Koloa, HI.
- Ridings, C., Gefen, D., & Arinze, B. (2006). Psychological barriers: Lurker and poster motivation and behavior in online communities. *Communications of the Association for Information Systems*, 18, 329-354. https://doi.org/10.17705/1CAIS.01816
- Rothenberg, S., & Zyglidopoulos, S. C. (2007). Determinants of environmental innovation adoption in the printing industry: The importance of task environment. *Business Strategy and the Environment*, 16(1), 39-49. <u>https://doi.org/10.1002/bse.441</u>
- Sandberg, J., & Tsoukas, H. (2015). Making sense of the sensemaking perspective: Its constituents, limitations, and opportunities for further development. *Journal of Organizational Behavior*, 36(S1), S6-S32. <u>https://doi.org/10.1002/job.1937</u>
- Schildt, H., Mantere, S., & Cornelissen, J. (2020). Power in sensemaking processes. Organization Studies, 41(2), 241-265. https://doi.org/10.1177/0170840619847718
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, *18*(5), 429-434. https://doi.org/10.1177/1745691617693325
- Sedera, D., Lokuge, S., Tushi, B., & Tan, F. (2017). Multi-disciplinary green IT archival analysis: A pathway for future studies. *Communications of the Association for Information Systems*, 41, 674-733. <u>https://doi.org/10.17705/1CAIS.04128</u>
- Seidel, S., Chandra Kruse, L., Székely, N., Gau, M., & Stieger, D. (2018). Design principles for sensemaking support systems in environmental sustainability

transformations. *European Journal of Information Systems*, 27(2), 221-247. https://doi.org/10.1057/s41303-017-0039-0

- Seidel, S., Chandra, L., Reuter, N., Stieger, D., & Gau, M. (2014). Green ecommunity: Sensemaking in environmental sustainability transformations. In M. C. Tremblay, D. VanderMeer, M. Rothenberger, A. Gupta, & V. Yoon (Eds.), *Advancing the impact of design science: Moving from theory to practice* (Lecture Notes in Computer Science, Vol. 8463, pp. 438-442). Springer. https://doi.org/10.1007/978-3-319-06701-8 41
- Seidel, S., Recker, J., Pimmer, C., & vom Brocke, J. (2010). Enablers and barriers to the organizational adoption of sustainable business practices. Americas Conference on Information Systems, Lima, Peru.
- Seidel, S., Recker, J., & vom Brocke, J. (2013). Sensemaking and sustainable practicing: Functional affordances of information systems in green transformations. *MIS Quarterly*, 37(4), 1275-1299. <u>https://doi.org/10.25300/MISQ/2013/37.4.13</u>
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasiexperimental designs for generalized causal inference*. Houghton Mifflin.
- Singh, M., & Sahu, G. P. (2020). Towards adoption of green IS: A literature review using classification methodology. *International Journal of Information Management*, 54, 1-16. <u>https://doi.org/10.1016/j.ijinfomgt.2020.102147</u>
- Steg, L., Dreijerink, L., & Abrahamse, W. (2005). Factors influencing the acceptability of energy policies: A test of VBN theory. *Journal of Environmental Psychology*, 25(4), 415-425. <u>https://doi.org/10.1016/j.jenvp.2005.08.003</u>
- Stigliani, I., & Ravasi, D. (2012). Organizing thoughts and connecting brains: Material practices and the transition from individual to group-level prospective sensemaking. *Academy of Management Journal*, 55(5), 1232-1259. <u>https://doi.org/10.5465/amj.2010.0890</u>
- Straub, D. W., Gefen, D., & Recker, J. (2022). Quantitative research in information systems. Association for Information Systems (AISWorld) Section on IS

Research, Methods, and Theories. <u>http://www.janrecker.com/quantitative-</u> research-in-information-systems

- Su, N. (2015). Cultural sensemaking in offshore information technology service suppliers: A cultural frame perspective. *MIS Quarterly*, 39(4), 959-983. <u>https://doi.org/10.25300/MISQ/2015/39.4.10</u>
- Tallon, P. P., & Kraemer, K. L. (2007). Fact or fiction? A sensemaking perspective on the reality behind executives' perceptions of IT business value. *Journal of Management Information Systems*, 24(1), 13-54. https://doi.org/10.2753/MIS0742-1222240101
- Tallon, P. P., Queiroz, M., Coltman, T., & Sharma, R. (2019). Information technology and the search for organizational agility: A systematic review with future research possibilities. *Journal of Strategic Information Systems*, 28(2), 218-237. <u>https://doi.org/10.1016/j.jsis.2018.12.002</u>
- Taylor, J. R., & Van Every, E. J. (2000). *The emergent organization: Communication as its site and surface*. Lawrence Erlbaum Associates.
- Testa, F., Iovino, R., & Iraldo, F. (2020). The circular economy and consumer behaviour: The mediating role of information seeking in buying circular packaging. *Business Strategy and the Environment*, 29(8), 3435-3448. https://doi.org/10.1002/bse.2587
- Tewksbury, D., & Rittenberg, J. (2012). News on the Internet: Information and citizenship in the 21st century. Oxford University Press. <u>https://doi.org/10.1093/acprof:osobl/9780195391961.001.0001</u>
- Thomas, J. B., Clark, S. M., & Gioia, D. A. (1993). Strategic sensemaking and organizational performance: Linkages among scanning, interpretation, action, and outcomes. *Academy of Management Journal*, 36(2), 239-270. <u>https://doi.org/10.5465/256522</u>
- Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., & Staake, T. (2018). Overcoming salience bias: How real-time feedback fosters resource conservation. *Management Science*, 64(3), 1458-1476. <u>https://doi.org/10.1287/mnsc.2016.2646</u>

- Valogianni, K., Ketter, W., Collins, J., & Zhdanov, D. (2020). Sustainable electric vehicle charging using adaptive pricing. *Production and Operations Management*, 29(6), 1550-1572. <u>https://doi.org/10.1111/poms.13179</u>
- van der Heijden, A., Cramer, J. M., & Driessen, P. P. J. (2012). Change agent sensemaking for sustainability in a multinational subsidiary. *Journal of Organizational Change Management*, 25(4), 535-559. <u>https://doi.org/10.1108/09534811211239218</u>
- Vlaar, P. W. L., van Fenema, P. C., & Tiwari, V. (2008). Cocreating understanding and value in distributed work: How members of onsite and offshore vendor teams give, make, demand, and break sense. *MIS Quarterly*, 32(2), 227-255. https://doi.org/10.2307/25148839
- vom Brocke, J., Watson, R. T., Dwyer, C., Elliot, S., & Melville, N. P. (2013). Green information systems: Directives for the IS discipline. *Communications of the Association for Information Systems*, 33(30), 509-520. <u>https://doi.org/10.17705/1CAIS.03330</u>
- Wagner III, J. A., & Hollenbeck, J. R. (2020). Organizational behavior: Securing competitive advantage (3rd ed.). Routledge. https://doi.org/10.4324/9781003009580
- Wallace, D. P., & Van Fleet, C. (2005). From the editors: The democratization of information? Wikipedia as a reference resource. *Reference & User Services Quarterly*, 45(2), 100-103.
- Walsh, P. R., & Dodds, R. (2022). The impact of intermediaries and social marketing on promoting sustainable behaviour in leisure travellers. *Journal of Cleaner Production*, 338, 1-9. <u>https://doi.org/10.1016/j.jclepro.2022.130537</u>
- Wang, X., Brooks, S., & Sarker, S. (2015). Understanding green IS initiatives: A multi-theoretical framework. *Communications of the Association for Information Systems*, 37, 670-704. https://doi.org/10.17705/1CAIS.03732
- Watson, R. T., Boudreau, M.-C., & 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. <u>https://doi.org/10.2307/20721413</u>

- Watson, R. T., 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). Global Text Project.
- Watson, R. T., Boudreau, M.-C., Chen, A. J., & Sepúlveda, H. H. (2011). Green projects: An information drives analysis of four cases. *Journal of Strategic Information Systems*, 20(1), 55-62. <u>https://doi.org/10.1016/j.jsis.2010.09.004</u>
- Watson, R. T., Boudreau, M.-C., & van Iersel, M. W. (2018). Simulation of greenhouse energy use: An application of energy informatics. *Energy Informatics*, 1(1), 1-14. <u>https://doi.org/10.1007/s42162-018-0005-7</u>
- Watson, R. T., Corbett, J., Boudreau, M.-C., & Webster, J. (2012). An information strategy for environmental sustainability. *Communications of the ACM*, 55(7), 28-30. <u>https://doi.org/10.1145/2209249.2209261</u>
- Watson, R. T., Ketter, W., Recker, J., & Seidel, S. (2022). Sustainable energy transition: Intermittency policy based on digital mirror actions. *Journal of the Association for Information Systems*, 23(3), 631-638. <u>https://doi.org/10.17705/1jais.00752</u>
- Weber, K., & Glynn, M. A. (2006). Making sense with institutions: Context, thought and action in Karl Weick's theory. *Organization Studies*, 27(11), 1639-1660. <u>https://doi.org/10.1177/0170840606068343</u>
- Weick, K. E. (1995). Sensemaking in organizations. Sage Publications.
- Weick, K. E., & Meader, D. K. (1993). Sensemaking and group support systems. In L.
 M. Jessup & J. S. Valacich (Eds.), *Group support systems: New perspectives* (pp. 230-252). Macmillan.
- Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, 16(4), 409-421. https://doi.org/10.1287/orsc.1050.0133
- Weinmann, M., Schneider, C., & vom Brocke, J. (2016). Digital nudging. Business & Information Systems Engineering, 58(6), 433-436. <u>https://doi.org/10.1007/s12599-016-0453-1</u>

- Wrzesniewski, A., Dutton, J. E., & Debebe, G. (2003). Interpersonal sensemaking and the meaning of work. *Research in Organizational Behavior*, 25, 93-135. https://doi.org/10.1016/S0191-3085(03)25003-6
- Wunderlich, P., Veit, D. J., & Sarker, S. (2019). Adoption of sustainable technologies: A mixed-methods study of German households. *MIS Quarterly*, 43(2), 673-691. <u>https://doi.org/10.25300/MISQ/2019/12112</u>
- Yang, Z., Sun, J., Zhang, Y., & Wang, Y. (2019). Perceived fit between green IS and green SCM: Does it matter? *Information & Management*, 56(7), 1-13. <u>https://doi.org/10.1016/j.im.2019.02.009</u>
- Yin, J., & Shi, S. (2021). Social interaction and the formation of residents' low-carbon consumption behaviors: An embeddedness perspective. *Resources, Conservation and Recycling*, 164, 1-12. https://doi.org/10.1016/j.resconrec.2020.105116
- Yu, H., Cai, H., Zhou, J., & Jiang, L. (2018). Data service generation framework from heterogeneous printed forms using semantic link discovery. *Future Generation Computer Systems*, 79(Part 2), 514-527. https://doi.org/10.1016/j.future.2017.09.059
- Zammuto, R. F., Griffith, T. L., Majchrzak, A., Dougherty, D. J., & Faraj, S. (2007). Information technology and the changing fabric of organization. *Organization Science*, 18(5), 749-762. <u>https://doi.org/10.1287/orsc.1070.0307</u>
- Zampou, E., Mourtos, I., Pramatari, K., & Seidel, S. (2022). A design theory for energy and carbon management systems in the supply chain. *Journal of the Association for Information Systems*, 23(1), 329-371.
 <u>https://doi.org/10.17705/1jais.00725</u>