This is the submitted version of a chapter published in *Industrial informatics design, use and innovation: perspectives and services*.

Citation for the original published chapter:

Green IS: steps towards a research agenda
In: Jonny Holmström; Mikael Wiberg; Andreas Lund (ed.), *Industrial informatics design, use and innovation: perspectives and services* (pp. 187-195). Hershey: IGI Global
https://doi.org/10.4018/978-1-61520-692-6.ch014

N.B. When citing this work, cite the original published chapter.

Permanent link to this version:
http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-35303
Green IS: Steps Towards a Research Agenda

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ABSTRACT
In this chapter, we investigate the role of ICT in dealing with environmental challenges facing contemporary industrial organizations. Green IS research can essentially be divided into two groups, focusing on technology per se or on providing tools that decreases environmental impact. Building on a planned research project we propose innovation of ICT-based services, and especially collaborative services, as useful strategies for providing firms with sense and respond capabilities in relation to environmental challenges. We also argue research that research relevance and multi-disciplinary competencies are key themes that IS researcher needs to acknowledge in order to contribute to practitioners efforts.

INTRODUCTION
During the past decades decision makers worldwide have been faced with the accumulated and threatening effects of industrialization. The far-reaching effects of industrialization include pollution of land, water and air and most decision makers are in agreement that we urgently need a change in direction. To this end, almost all business decisions today involve the consideration of environmental
issues. Decisions about productivity, efficiency and maintenance are all deeply entangled with environmental issues as both economical and technological advances need to be sustainable (Bryson & Lombardi, 2009). But despite the pervasiveness of environmental issues, most firms remain confused about the meaning of sustainability. In fact, managers for industrial firms are faced with a complex nested system as they are forced to recognize how the firm’s economy is part of a larger ecological system. However, most firms persist in treating environmental and economic performances as independent components. The link between economic and environmental performance remains enigmatic, despite the myriad of laws and regulations established the past few years.

The growing attention to environmental issues and the need for sustainable development in today’s industrial landscape have brought to the surface some significant challenges in the way in which many firms generate, process, and manage information (Fairbank et al., 2006). Taking the process industry as an example, process industry firms rely on information and communication technology (ICT) in their daily operations. The scale and complexity of the information required and produced in their operations are massive, and as the demands for sustainable production increase this puts additional pressure on the information processing capabilities for these firms. Without some mechanisms in place to manage and process information, decision makers in these firms might not fully understand the financial, operational, and environmental implications of their operations.

These challenges derive from three distinctive yet interrelated aspects. First, it derives from the incompleteness of information available for planning and decision making (Fairbank et al., 2006). Such incompleteness may be associated with the lack of systematic efforts in collecting information, or result from information being managed by one part of the organisation but not shared with others (Holmström & Boudreau, 2006). Second, the challenge can derive from ineffective understanding of information requirements from internal or external stakeholders (Sauer & Willcocks, 2002). Third, the challenge can derive from the demand for speed in obtaining and processing information (Prahalad & Krishnan, 2002). Many organisations are recognizing their failure in effectively using ICT to leverage their businesses and the inability to address some, or all, of the above challenges is connected closely to an organisation’s information processing capability (Fairbank et al., 2006).

Building upon the need to simultaneously address financial and environmental goals, the emphasis of this paper is on how organisations can address such demands and challenges by innovating their information processing capability enabled by ICT. We conclude the paper by discussing challenges posed by the environmental goals for the information systems field to further improve our research skills and methods. We are particularly interested in what ways ICT-based services can help to steer decision making in paths that are in concert with a sustainable development for the firm. If one takes a closer look at the conditions under which decision making are made in industrial firms – with all the associated economical and environmental consequences – the most fundamental condition concerns the incomplete knowledge on the part of the industrial firm. This is clearly the case when a company is forced, either by a new regulation or a local opinion, to reconsider its production rationale. The above suggests that the most rational strategy for a company facing changes in their production processes is to engage in open innovation projects to engage external expertise in solving the problem. We see two reasons for this: (1) today’s industrial firms lack the knowledge needed to successfully address the environmental challenges facing them, and (2) the uncertainty and equivocality related to these challenges are high.

In this chapter, we investigate innovation of ICT-based services as a potential solution to the aforementioned problems. These services would have to leverage each firm’s existing information infrastructure, they would have to effectively utilize available knowledge about sustainability, and, not least, they would have to effectively integrate information for decision making so that financial, technological, and environmental issues were treated in a coherent and systemic fashion. Specifically we will investigate the following research questions:
• The Sustainability Decision Platform: How can you design an enterprise information architecture that leverages internal information services and integrates them with external information services to facilitate inclusion of sustainability issues into the firm’s core decision making?

• The Sustainability Innovation Process: How can you organize an innovation process supported by focused assessments and contingency tactics to help individual enterprises effectively transform existing information services and resources to implement a Sustainability Decision Platform?

This chapter discusses a planned research project that will be conducted in the context of an open innovation project, involving industry firms such as Norrmejerier and SCA Packaging. We also collaborate closely with Argentum, an ICT-firm providing ICT-based services to the process industry with a particular focus on environmental issues. The project activities will, in practical terms, be carried out by means of qualitative case studies. The reason for picking the open innovation rationale for the project is because of the complexities involved in the challenges facing the industries in becoming more sustainable in their operations. They cannot cope with these complexities themselves, and it seems as if existing ICT-based services aiming at dealing with the equivocality and ambiguity of the situation fall short of the expectations both the process industry and the ICT industry have on them. We need to build a stronger competence in this domain and working closely together in the context of an open innovation project seems advisable.

RELATED RESEARCH

There is by no means an agreement in the literature on what the pervasive phenomena known as IT services really covers. It can appear in quite different contexts starting from ICT consulting and system delivery stretching to e-commerce and infrastructures for information search in the Internet. Such a broad use of the term is probably well justified, because ICT artefacts are not usually purchased as mere material products. This observation opens the challenge to regard them as services.

Services are often characterised by comparing them with material products. For example, Levitt (1981) distinguishes ‘intangibles’ from ‘tangibles’ – with special characteristics. This is of course an apparent distinction to make. Services are attributed with further characteristics such as inseparability, heterogeneity, and perishability, that are compared with those of physical goods (see e.g., Wolak et al., 1998; Shostack, 1977; Johns, 1999).

Grönroos (2000, p. 47) summarizes characteristics that are identified for most services:

• services are processes consisting of activities or a series of activities rather than things;

• services are at least to some extent produced and consumed simultaneously;

• the customer participates in the service production process at least to some extent.

There are two parties to the service, the producer and the customer. The delivery of the service is not mere exchange, since the service is produced typically on the spot. The producer must be seen as an actor, and the same holds also to the customer in particular if (s)he is participating in the production.

While the general notion of service applies directly to business-level services (Lovelock, 1983; Grönroos, 2000), the distinction between encounters and relationships (Gutek, 1995; Zuboff & Maxmin, 2002) need to be adapted and translated to information-level services. First, services in general focus on relationships...
between people in particular forms of business interactions. In the context of information processing, we adopt services to capture human interaction mediated by technology (e.g. email, repositories, mobile phones, video conferencing, and various forms of collaboration technology). Second, the distinction between encounters and relationships is quite similar to contemporary perspectives on information processing, e.g. Mathiassen & Nielsen’s (2000) distinction between transformations and interactions. Third, encounter and relationship information services apply directly to Daft & Lengel’s notion of equivocality (1986). Information requirements must be simple and easy to understand if information services are to be organized similar to encounters. Relationship information services are, in contrast, highly situated and sensitive to the evolution of the interaction between the involved actors. When organizing information processing as services, situations with low equivocality can therefore be addressed through encounters. However, as equivocality increases, relationships will allow the involved actors to develop shared experiences and mutual trust to generate and dissipate the information necessary to execute the task.

In their recent paper Mathiassen and Sørensen (2008) have expanded on this. They consider the ICT artefact situated in a situation of use where it supports the performance of tasks. Based on this idea they develop a taxonomy of information services by using the classification of tasks given by Mintzberg (1983) and another classification of services by Gutek (1995). The service dichotomy between encounter services (short-term) and relationship (long-term) services coincides with the first dichotomy of tasks, that of low or high complexity. The second task dichotomy is based on low versus high uncertainty, and this is reflected as a division between information processing and information generation services. The information services are thus divided in four classes: computational, networking, adaptive, and collaborative services.

**Figure 1: The diversity of organizational information services.**

This typology builds on existing research on information processing. While uncertainty is related to the availability and reliability of the information needed to execute a task (Mintzberg, 1983) equivocality refers to the multiple and conflicting interpretations surrounding a situation (Daft and Macintosh, 1981). The theory of information services is resulting in a typology of information services where each type fits well with certain conditions. Given that high ambiguity and equivocality may effectively hinder managers to find sustainable solutions for their firms (Montiel, 2008) a well working ICT-based service holds a great potential for improving the current state of affairs.

**PROJECT DESCRIPTION**

In what follows we will outline the planned Green IS project and the research agenda guiding the project

**Theory and methodology**

The research reported in this paper is grounded in the interpretive approach to case studies (Klein and Myers, 1999; Walsham, 1993, 1995; Yin, 1994). For data collection, we will employ ethnographically inspired methods conducting interviews, observations of daily work and process management/control sessions, documents analysis, and participation in discussions and meetings. In doing this, we build on an extensive methodological experience (e.g. Holmström & Boudreau, 2006; Holmström & Robey, 2005;
We have a unique possibility in this project to build on a theory developed by one of the project members (e.g. Mathiassen & Sørensen, 2008). The purpose of using the information services theory is to contribute to the understanding, assessment, and design of information services in organizational contexts, in particular to its relation to sustainability issues for the industrial firms participating in the project. The theory is hence intended to support understanding of practice, guide action, and prove helpful in continued efforts to develop knowledge about organizational provision and consumption of information services. The theory can be applied to study information services portfolios across a variety of industrial firms and situations to expand and improve existing classifications of technologies and organizational arrangements, e.g. as offered by Broadbent et al. (1999). Through its core reliance on equivocality and uncertainty, the theory may also be suitable for studying information service portfolio types across different work domains with varying degrees of need for individual discretion.

**Project organization and activities**

This project builds on open innovation ideas (Chesbrough et al., 2006; Vanhaverbeke and Clooxt, 2006; West & Gallagher, 2006). The project will also draw on a number of ongoing research activities that involve the participating industry firms. This is major advantage in terms of the level of access and confidence that is required for conducting this type of strategy-related innovation project. In our own innovation research (Jonsson et al., 2008; Rönnbäck et al., 2007) we have learned that are many barriers to learning how to transcend traditional boundaries. A key to successful innovation in the traditional industry sectors is the development of new innovation models that draw on the increasing flows of ideas, people, and resources over traditionally closed boundaries. The traditional industries can learn a lot from other parts of the economy when it comes to adapting to the new information landscape with new models of innovation and management of innovation. Most open innovation research has been done in high tech firms in the context of corporate-based hardware/software and community-based open source development (Chesbrough and Kardon Crowther, 2006). There is clearly a need for new knowledge applicable for adopters of open innovation in other settings.

The research will be conducted as collaborative practice research (Mathiassen, 2002) where we follow collaborative practice research as a way of realizing engaged scholarship (Van de Ven, 2007). We have secured a strong collaborative network in the process industry, including Norrmejerier and SCA Packaging. We also collaborate closely with an ICT firm, Argentum, providing ICT-based sevices to the process industry with a particular focus on environmental issues. This project will be conducted by means of a series of case studies.

The use of ICT in organizations has undergone dramatic changes the past 30 years. As a result, it has become increasingly common to adopt a services rather than a traditional systems perspective to more accurately capture contemporary practices. There is, however, a lack of theories that can help us understand, assess, and design information services in organizational contexts. On this backdrop, we build on Mathiassen & Sørensen (2008) to investigate innovation of ICT-based services as a potential solution to the sustainability challenges facing today’s process industry. In this project, we investigate innovation of ICT-based services as a potential solution to the aforementioned problems. These services would have to leverage each firm’s existing information infrastructure, they would have to effectively utilize available knowledge about sustainability, and, not least, they would have to effectively integrate information for decision making so that financial, technological, and environmental issues were treated in a coherent and systemic fashion. To this end, we address the following research questions: How can you design an enterprise information architecture that leverages internal information services and integrates them with external information services to facilitate inclusion of sustainability issues into the firm’s core decision
making? How can you organize an innovation process supported by focused assessments and contingency tactics to help individual enterprises effectively transform existing information services and resources to implement a Sustainability Decision Platform? Drawing upon the concept of information services the project seeks to answer these questions and to make a contribution to the demands for sustainable production for the industry firms.

**STEPS TOWARDS A RESEARCH AGENDA**

Green IS can essentially take two different directions, both focusing on green issues albeit in very different ways: (1) Green IS that focuses on technology per se and the ways in which it can be designed in a more sustainable fashion, consuming less energy etc. (2) Green IS that focuses on the green consequences of IS use, for instance how IS can help firms to sense and respond to the sustainability challenges they are faced with. Our approach follows the latter route.

We recommend that Green IS research efforts closely pay attention to the following points:

1. **Research relevance**

   Given that the sustainability challenge is urgent, it is safe to say research need to inform practice. Thus, in addition to its contributions to theory, this project also will offer relevance to practice. We urgently need to address the problem of sustainability, as it becomes a problem not only for a specific firm but also for its broader environment. The implications for a breakdown in the process industry’s information processing capability can be dramatic, and we need to understand the risks surrounding process industries and the technologies they rely on in more detail. The scale and complexity of the information required and produced in their operations are massive, and as the demands for sustainable production increase this puts additional pressure on the information processing capabilities for these firms. Without some mechanisms in place to manage and process information, decision makers in these firms might not fully understand the financial, operational, and environmental implications of their operations.

2. **Multi-disciplinary competencies**

   Give the aforementioned complexities associated to the sustainability challenge, we argue that multi-disciplinary efforts need to be established in order to face the challenges at hand. To this end we argue that the open innovation approach is a viable way to pursue in order to face these challenges. This project will build on the open innovation paradigm as we will closely collaborate with both industry firms and IT firms in an open fashion.

3. **Collaborative services**

   Information services are urgently needed in order to better face the sustainability challenges we are faced with. Given that the challenges can be characterized as being best met with what Mathiassen & Sorensen refer to as collaborative services we need to not only design such services but also better understand their socio-technical consequences. Building upon the need for simultaneously addressing financial and environmental goals, the emphasis of this project is on how industrial firms can address such demands and challenges by innovating their information processing capability enabled by ICT in general and information services in particular. Our own previous research indicates how iterative attempts to address the problem of managing information brought about an unplanned creation of a larger problem which contained the initial one. More specifically, the initial quest for information management brings about an information production that tend to escalate out of control, creating vast data sets which cannot be comprehended easily thus creating new risks (see e.g. Holmström and Robey, 2005).
We consider these three points important points to consider for the Green IS research community. In our minds they represent a good starting point in our effort to establish a Green IS research agenda.

REFERENCES


