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A Design Science Approach for Engaging Managers of Small and Medium Sized Enterprises (SMEs) into ‘IT for green’

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Abstract

In order to influence behavior and inform interventions, we need better understanding of the behaviour of people, social groups and organisations. To address this gap in the research literature, this study’s aim is to investigate how managers engage with “IT for green” technologies and practices and subsequently provide policy on how to engage SME’s into “IT for green” efforts and design interventions or support policies that can encourage “IT for green” uptake by these firms. SMEs usually lack the information, resources, or expertise to deal with environmental issues. They have little know-how in bringing into effect the technical and managerial changes that would enable them to meet emerging environmental and social standards. Worse, they often hesitate to reach out for help without some external stimulus. As a result, SMEs can be a source of environmental risk.

Keywords:

Green IT, IT for green, Environmental Sustainability, SMES

1. Introduction

Many companies have adopted a sustainability strategy to reduce their carbon footprint, save costs, or gain competitive advantage. Geneva Plan of Action (2003) from the World Summit on the Information Society (WSIS) encourages governments, in cooperation with other stakeholders to use and promote IT as an instrument for environmental protection and the sustainable use of natural resources.

The “*green IT*” view sees IT primarily as a problem to be mitigated; for example, data centers are a rapidly growing source of carbon emissions. The “*IT for green*” view on the other hand, sees IT as a possible solution to environmental problems; for example, IT can disseminate information that increases people’s awareness regarding their energy usage and influence their behavior. The “IT for green” *technologies* include collaborative technologies such as video and teleconferencing, enterprise carbon and emission management systems and energy informatics systems. The “IT for green” *practices* cover implementing policies for using information systems (IS) to manage emission, energy and other enterprise assets.

Although IT is the preferred option for emissions-management systems, the uptake of these systems is extremely slow (The European Commission's 7th Synthesis Report of the Sectoral e-Business Watch, 2010). Organizational investment in IT for green is still at the early stage of maturity (Molla et al., 2009), and such investment may take longer to yield a return (Olson 2008). Despite importance of IT to tackle environmental issues, information systems scholarship contributing to knowledge about organizations and environmental sustainability is under-developed (Dedrick, 2010; Melville, 2010).

In order to influence behavior and inform interventions, we need better understanding of the behaviour of people, social groups and organisations. To address this gap in the research literature, this study's aim is to investigate how managers engage with "IT for green" technologies and practices and subsequently provide policy on how to engage SME's into "IT for green" efforts and design interventions or support policies that can encourage "IT for green" uptake by these firms.

The impact of "IT for green" technologies and practices also need to be understood since managers are less likely to make investment decisions with uncertain costs and payoffs. The process-oriented view of innovation value theory contends that the impact of a new technology depends on the extent to which the technology is adopted and adoption of innovation passes through several processes from evaluation through adoption to benefits.

Therefore, this study seeks to establish the individual and contextual factors that can impact "IT for green" adoption by managers and examine to what extent "IT for green" can improve both environmental and economic performance in SMEs. SMEs usually lack the information, resources, or expertise to deal with environmental issues. They have little know-how in bringing into effect the technical and managerial changes that would enable them to meet emerging environmental and social standards. Worse, they often hesitate to reach out for help without some external stimulus. As a result, SMEs can be a source of environmental risk.

1.1 Research Objectives

This aim of this study is to progress our understanding of how managers engage with "IT for green" and subsequently provide policy on how to engage SME's into "IT for green" efforts and subsequently design interventions or support policies that can encourage "IT for green" uptake by SMEs. Therefore, key research questions this proposal aims to answer are:

- *RQ1: What are the essential elements of "IT for green" policies in SMEs?*
- *RQ2: How do individual and contextual factors affect "IT for green" uptake by managers in SMEs?*
- *RQ3: What are the economic and environmental impact of "IT for green" technologies and practices on performance of SMEs?*

This study will address following research objectives:

- *Objective 1: Establish essential elements of “IT for green” technologies and practices.*
- *Objective 2: Further understanding of what makes it possible for managers to make the connection between the information they have about “IT for green”, what they need to do in practice and their behavior.*
- *Objective 3: Identify areas of perceived and actual barriers to “IT for green” adoption and develop the triggers that motivate managers to move beyond intention into action.*
- *Objective 4: Establish the role that “IT for green” can have on improving both economic and environmental performance of the SMEs.*
- *Objective 5: Develop guidelines for governmental and regulatory agencies on ways to design effective interventions for accelerating “IT for green” uptake by SMEs.*

2. Theoretical Background

The process-oriented view of innovation value theory postulates that the adoption of innovation passes through several processes from evaluation through adoption to productivity and benefits (Soh and Markus, 1995; Straub et al., 1997). The theory contends that the impact of a new technology depends on the extent to which the technology is adopted (*Figure 1*).

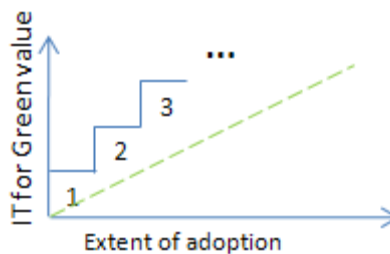


Figure 1. The extent of “IT for green” adoption and its potential Business value

The work builds partly on work carried out by the innovation value institute (IVI), which has developed the IT-capability maturity framework (IT-CMF), an innovative and value focus maturity model for IT management (Donnellan et al., 2010, 2011). IT-CMF presents a high-level process capability maturity framework for managing the IT function within an organization. The framework identifies a number of critical IT processes, and describes an approach to designing maturity frameworks for each process. IT-CMF is extended by a focus on sustainable information and communication technology (SICT), which represents an integrated approach to the management and application of “IT for green” technologies and practices across and beyond the organization. Its purpose is to achieving positive environmental and economic impact of “IT for green” technologies and practices (*Figure 2*).

| | | | |
|--|----------|---------------------|--|
| BUSINESS VALUE HIGH 5 4 3 2 1 LOW | 5 | Optimising | ICT sustainability is a key success factor in setting and delivering enterprise business strategy. |
| | 4 | Advanced | ICT sustainability principles are a core part of the planning cycle across the enterprise. |
| | 3 | Intermediate | Design and operation of ICT systems have sustainability criteria, and reporting is in place. |
| | 2 | Basic | There is limited, reactive sourcing and disposal of ICT assets based on local compliance and policy demands. |
| | 1 | Initial | There is no awareness of IT-related sustainability issues and there is no ICT sustainability strategy, plan, or metrics. |

Figure 2. IT for green - Capability Maturity Framework (IT-CMF)

3. Empirical Approach

This study will use design science as methodological framework (Hevner et al. 2004; Hevner & Chatterjee, 2010), which includes quantitative and qualitative research techniques. Its roots can be traced to Simon's (1969) seminal contribution where he demonstrated that natural science and the science of the artificial are different as the former is about analysis where the later is about synthesis. Based on this distinction Hevner et al. (2004) describe two distinct paradigms: behavioral science research and design science research. The former is known as a “*problem understanding paradigm*”, the latter as a “*problem solving paradigm*”. We structure the study along three key research steps; 1) Literature review, preliminary semi-structured interviews and theory building, which will lead to developing an assessment instrument, 2) Design of research model, assessment instrument, guidelines to engage managers into “IT for green” and 3) Application and evaluation of research models and guidelines.

It is noteworthy that although the methodology for this research is quantitative in nature, the initial data collection which will be conducted through semi-structured interviews by research assistants provides valuable qualitative information. According to Sarantakos (1998), in many instances, qualitative researchers employ qualitative methods in their studies to meet the criteria of quantitative research. In addition, qualitative methods such as interviews are used in addition to quantitative methods as a preparation step to a quantitative study, or to refine conclusions reached by means of qualitative research (Sarantakos, 1998). The goal of the initial exploratory phase is to gain insights about the research problem, discover the most effective factors in relation to IT for green adoption and business value by firms and identify whether other possible factors not explored in previous research are significant in the context under investigation. Findings from the exploratory investigation enable the applicant to articulate and clarify the research propositions generated from the literature.

The second phase employs descriptive research with a cross sectional study in order to validate and test the developed model. A questionnaire survey is a common method of conducting descriptive research in order to gather and analyze data in conjunction with

questions and hypotheses. The questionnaire survey enables researchers to examine and explain relationships between constructs, in particular cause and effect relationships. It is important to note here that this study does not attempt to demonstrate cause and effect relationships, but, rather, it attempts to determine which variables are related to other variables pertaining to the adoption of “IT for green” and its Business value.

Subsequently, a questionnaire survey is chosen for the following reasons: first, the survey method is the most widely used methodology in studies related to IT adoption. Second, it is considered one of the best possible choices of research instrument when attempting to collect detailed information and meaningful data on populations too large to observe directly. In fact, the collection of larger amounts of data is recommended to assuage concerns over study generalizability (Churchill, 1999). Moreover, this method is also economical as it allows the collection of a large amount of data with relatively less labor and resource intensity. Finally, a questionnaire survey is the most effective and efficient method to collect primary data from the research respondents (SME managers) who are very busy most of the time and cannot share much time to provide primary data by other methods. Finally, we will write up the findings of the study, develop guidelines for governmental and regulatory agencies on ways for designing effective interventions for accelerating IT for green uptake by SMEs. Study plan is presented in *Figure 3*.

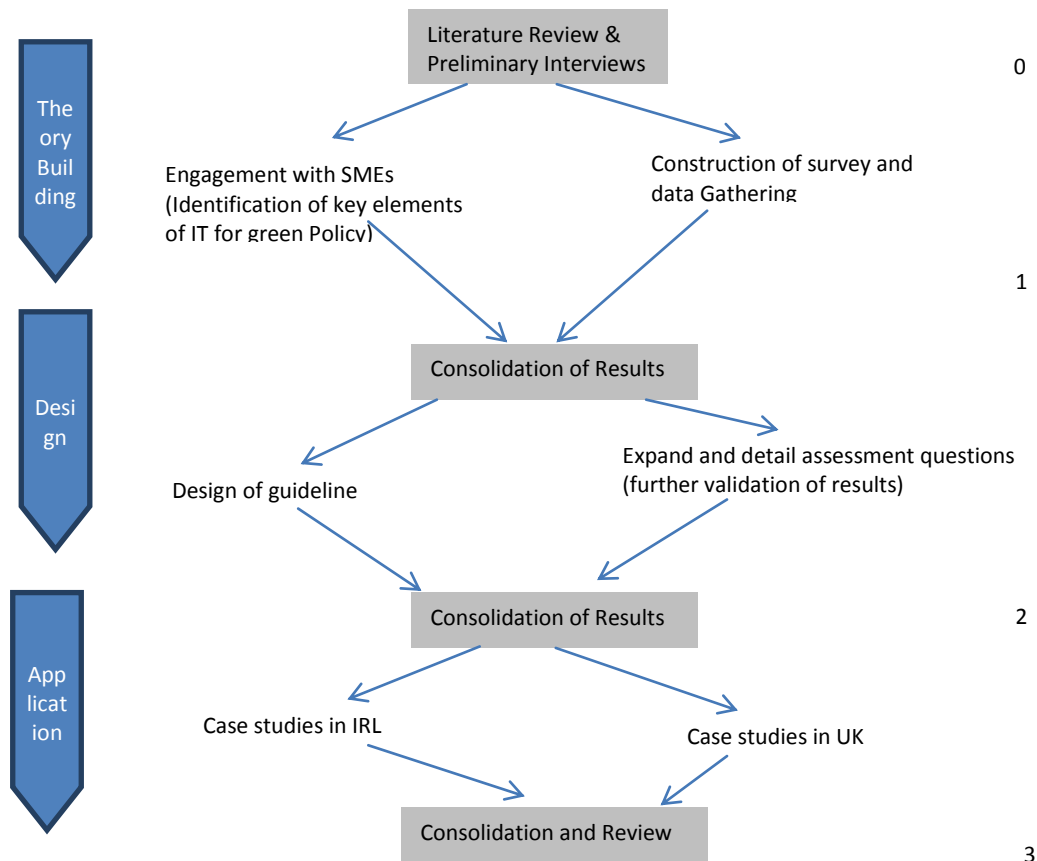


Figure 3. Study Plan

4. Impact Plan

In this impact plan we identify two user groups - UK and Irish policy communities and SMEs with a strategic interest in environmental sustainability. UK's Carbon Trust, Energy Saving Trust and Department of Energy and Climate Change as well as the Sustainable Energy Authority of Ireland that are effectively collaborating with UK and Irish organizations in order to reduce carbon emissions, will benefit from the research outputs from this study.

Both user-groups have, albeit indirectly, contributed to the development of the ideas and proposed analysis of the current study. Discussions between the applicants and MBA students at both Aston Business School and Dublin City University have, for example, emphasized SMEs' interests in "IT for green" technologies and practices. Businesses are under increasing pressure from customers, competitors, regulators and community groups to implement sustainable business practices. Balancing economic and environmental performance to be green and competitive is therefore a key strategic issue. The decision surrounding whether or not to implement "IT for green" strategies, policies, and technologies provides compelling challenges for SMEs.

In the SMEs environmental management stream, there are some studies where the unique characteristics of SMEs in adopting and implementing environmental management, such as less awareness about environmental issues, less environmental pressures from stakeholders, and lack of human, technological, and financial resources required for advanced environmental management, have been considered (e.g., Clark, 2000; Hall, 2000). These discussions have suggested the strategic importance of "IT for green" technologies and practices, and the potential receptiveness of firms to robust evidence on the returns to such investments.

Longer term collaboration between the applicants and policy makers in UK and Ireland has emphasized the potential importance of "IT for green" technologies and practices for national development. In SMEs, some decisions are made by individuals who are influenced by factors beyond pure profit maximization such as whether to allow an employee to telecommute or to set up a videoconference rather than flying to a meeting, may involve several trade-offs. In such cases, a manager who is conscious of the environmental implications of his or her choice might come to a different decision than one who does not care.

The importance of better understanding of how and why individuals and organizations make decisions and how these can be managed or influenced is reflected in recent changes in UK's Economic and Social Research Council (ESRC) strategy. By reviewing the state-of-the art and examining the relation between available information regarding "IT for green" technologies and practices, our research provides a significant impact on the understanding of these decisions. The new delivery plan of ESRC has outlined that it will concentrate strategic funding on three priorities which will be crucial to the economy and society over the coming years. *"Influencing Behavior and Informing Interventions"* is one of the three main ESRC priorities— creating a better understanding of how and why people and organizations make decisions, and how these can be managed or influenced.

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