

The Role of Data Centers in Advancing Green IT: A Literature Review

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Abstract

The explosion in data consumption and data generation has led to expansion of data centers, which are significant stakeholders in obtaining sustainability. This paper investigates what role data centers can play in advancing sustainability and green IT by performing a literature review. The purpose of the review was to provide a holistic framework that can help to position current and new research on the factors influencing the implementation of green IT in the data center. The review was limited to peer-reviewed journal articles and conference papers. The reviewed papers were analyzed by inductive content analysis, which created the five categories of 1) power savings, 2) cost savings, 3) sustainability and green energy, 4) information technology for greening data centers, and 5) aligning business requirements with resource utilization. Based on these categories, a framework describing how data center can contribute to green IT was created. Power savings and cost savings were found to influence as well as contribute to choices and development of information technology for greening data centers. Also, the categories of sustainability and green energy and alignment of business requirements of business utilization have a bi-directional relationship with information technology used in data centers. The findings further indicate that there is a need to study the alignment of business requirements with resource utilization due to a lack of publications in this area.

Keywords: Data center, Green IT, Green IS, Sustainability, Literature review

1. Introduction

In 1987, the Brundtland Commission proposed sustainable development to comprise of three pillars; social, economic and environmental sustainability (Brundtland, 1987). According to Murugesan and Gangadharan (2012), green IT is an economic, technical as well as environmental imperative. The concept of green IT “denotes all activities and efforts incorporating ecologically friendly technologies and processes into the entire lifecycle of information and communication technology” (Hedwig et al., 2009, p. 2). There is sometimes an overlap between the concept of green IT and other concepts, such as green IS (information systems) and sustainability.

Green IT refers to “the direct impact of energy consumption and waste associated with the use of hardware and software” (Boudreau et al., 2008). Green IS, on the other hand, refer to “environmental systems that can be developed with or without green IT to support sustainability initiatives” (Boudreau et al., 2008; Jenkin et al., 2011). Other researchers attempt to separate Green IT from Green IS (Brooks et al., 2012; Ereik et al., 2012) while some regard green IT as a part of Green IS (Brooks et al., 2012; Melville, 2010). Other authors use these terms synonymously (Huang, 2008; Mithas et al., 2010). Based on a structured literature review, Chasin (2014, p. 348) defines sustainability in information systems as a:

“characteristic of a stakeholder activity (organizational process or individual behaviour), which impacts on natural and social environments and meets the (economic) needs of the present without compromising the ability of future stakeholders to meet their needs.” According to Chasin (2014), the central implication of this definition is a need to analyze ecological, economic and social dimensions at the activity level of the stakeholder.

The Brundtland commission (1987) formulated the definition on sustainability which has become the most widely adopted definition on research in sustainability. The present scientific discourse on sustainability in information systems appears marginal in comparison to other disciplines such as engineering, mining etc. (Penzenstadler, 2013; Dovers, 1989; Brown et al., 1987; Owens, 2003; Kuhlman and Farrington, 2010; White, 2013; Glavic and Lukman, 2007).

Simmonds and Bhattacharjee (2012) state that environmental sustainability research in IS is sparse. Some IS researchers have developed frameworks in their research on environmental sustainability in IS. Some of the most notable are the energy informatics framework developed by Watson et al. (2010), a conceptual model on four key environmental issues and six stakeholder categories by Elliot (2011) and the Belief Action Framework (BAO) by Melville (2010).