

Chapter 23

The Role of a Sustainability Informatics Framework in Transportation Systems

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ABSTRACT

This article develops a Sustainability Informatics Framework, a framework that connects Information Technology with sustainability and is based on the Belief-Action-Outcome and Energy Informatics frameworks. The triple-bottom line (People, Planet, and Profit) is adopted as a criterion for measuring sustainability and three sustainability indices are first formulated and then visualized using Sustainability Dashboards. This framework is then used to analyze transportation systems. This leads to the development of research propositions that can expand the role of the Information Systems discipline to research on areas of sustainable nation building.

INTRODUCTION

Information Technology (IT) is at times a disruptive technology that contributes to reshaping of industries and redistribution of power within organizations and even societies. IT-enabled processes lead not only to organizational efficiencies, but also to new products, markets, and means of interaction and communication. Amid the dramatic changes that are associated with IT are many contemporary challenges, for one, heightened attention to *corporate social responsibility* (Porter & Kramer,

2006). Yet operating an organization that is both profitable and responsible is no small task.

At the heart of the corporate social responsibility is sustainability, or “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987: p. 43). Business scholars call for organizations to embrace sustainability, not as an addendum, but as an integrated component to strategy and operations. However, they also recognize that “without a framework to give direction to pollution prevention, product stew-

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ardship, and clean technology, their impact will dissipate” (Hart, 1997: p. 73). This charge did not fall on deaf ears among Information System (IS) scholars, who since formulated frameworks dealing with environmental sustainability (Melville, 2010; Watson, Boudreau, & Chen, 2010) that seek to increase the triple bottom line (3BL) of social, environmental, and economic measures; put another way, the 3BL are people, planet, and profit (Fisk, 2009). The 3BL is a means to measure success of sustainability (Elkington, 1997) and an important aspect of this concept is the argument for the *stakeholder* view over the *shareholder* view concerning an organization’s responsibilities (Bengtsson & Gerfalk, 2011).

A perennial issue of sustainability and our everyday lives is transportation. Transportation systems underpin nearly every aspect of business and society; whether it is the daily commute of employees, tourists on travel, supply chain logistics, or moving people and resources for public safety. Additionally, transportation as the movement of people and goods from one location to another is energy dependent, a huge energy consuming sector, and is the first on many *green* economy agendas. According to criteria proposed by Sterman (2009), non-sustainability occurs when resources are used faster than they are regenerated, waste is generated faster than it is rendered harmless, and future plans rely on non-renewable resources. By this assessment, the current transportation system is not sustainable, and as noted by Wolf and Mujtaba (2011) it is important to know definitively when one industry is not sustainable. If it is indeed unsustainable, the transportation system needs to change to continuously afford to all people access to the economic and social opportunities necessary for meaningful life (Richardson, 2005).

Keeping in line with the 3BL, this paper builds on the *Energy Informatics* (Watson et al., 2010) and *Belief-Action-Outcome* (Melville, 2010) frameworks to develop the *Sustainability Informatics Framework* (SIF). The *Energy Informatics* framework is a practical supply-and-demand

schematic whereas the *Belief-Action-Outcome* framework is explanatory, delving into the interplay between society and individuals. We connect *energy informatics* with *sustainability informatics* to then extend the *Energy Informatics* framework to include sustainability. We then incorporate the *Belief-Action-Outcome* framework to explore beliefs in IT, incorporate stakeholder behaviors, and conceptualize sustainability outcomes according to 3BL. From here, we develop formulas for sustainability indices for each of the 3BL components, which is the primary value and contribution of this paper. Going further, these indices are presented in a *Sustainability Dashboard* visualization that reflects best and worse case scenarios together along with initial and actual values.

This article proceeds as follows. A background section in four parts introduces the concept of sustainable transportation systems, reviews the *Energy Informatics* framework, reviews the *Belief-Action-Outcome* framework, and summarizes the background as a basis for developing the *Sustainability Informatics Framework*. This framework is then presented and described, iterating through IT-based stakeholder beliefs and actions. Special attention is given to the indicators of outcomes, which are presented as Sustainability Indices and visualized in a Sustainability Dashboard. Following the establishment of this new framework, it is then applied to the context of the transportation system. This effort leads to the identification of four research propositions with the intention to expand the role of the IS discipline into areas of sustainable nation building. Lastly, the limitations and future research directions are considered before concluding with a reiteration of the contribution of (1) extending previous frameworks to developing a *Sustainability Informatics Framework*, (2) formulating indices visualized in *sustainability dashboard*, (3) studying the issues of transportation using the framework, and (4) developing research propositions that connect IS discipline with sustainability and nation building.

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