Review of the book 'Computing research for Sustainability'

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Chapter One

Name of Chapter: Roles and Opportunities for Information Technology in Meeting Sustainability Challenges

This chapter is concerned about the future sustainability facts by using the information technology. Now-a-days, Innovation in computing, information, and communications technology is at the heart of nearly every large-scale socioeconomic system of our life. The advancement of computing is very crucial for the sustainability of our world. It is good that there are opportunities to apply the IT innovation in the sphere of sustainability in different sectors of our life. The focus point is also the termed "greening through IT," the use of computing and green IT also promote the sustainability where the advance information system communication technology have tremendous effects. The National Research Council's (NRC's) Committee on Computing Research for Environmental and Societal Sustainability is also working on the relevant field of interest. The committee believes that some of the most profound fundamentals within the field itself are suggestive of the unique contributions that computer science (CS) and ICTs can make to sustainability. We should keep in mind that sustainability problems are typically heterogeneous in nature. It is also mentioned that most sustainability challenges emerge in part due to interconnection a result of multiple interlocking pieces of a system all having effects.

This chapter is also talking about the opportunities behind the achieving the sustainable objectives. To do this, building infrastructures and systems is important which includes physical factors such as buildings, transportation systems, consumer goods. The understanding, assessing, and positively affecting or not affecting the environment and particular ecosystems are crosscutting challenges for many sustainability efforts. The Socio-technical systems designed to

aid in behavioral assistance and reinforcement and to provide information about progress which is critical element for global sustainability efforts. Later, there are three illustrated examples of sustainability related arenas included in which IT has significant impacts. These examples are smart grid, food systems and the development of sustainable and resilient infrastructures.

Finally, it can be say that IT and computer science could have a major effect in a wide diversity of sustainability challenges. The mentioned examples in this chapter illustrate some of the efforts that are needed. The findings of this chapter is that although sustainability covers a broad range of domains, most sustainability issues share challenges of architecture, scale, heterogeneity, interconnection, optimization, and human interaction with systems, each of which is also a problem central to CS research.

Chapter Two

Name of Chapter: Elements of a Computer Science Research Agenda for Sustainability

This chapter concentrates more specifically the potential for computing and IT research and innovation to help address these different challenges mentioned on first chapter. A principal goal of computer science in sustainability can be viewed as that of informing, supporting, facilitating, and sometimes automating decision making which leads to actions that will have major impacts on achieving sustainability objectives. A key to enabling information-driven decision making is to establish models and feed them with measurement data. Most sustainability challenges involve complex, interacting systems of systems undergoing constant change, all aspects of sensing, modeling, and action need to be refined, revised, or transformed as new information and deeper understandings are gained. In this chapter, four broad research areas are discussed which are

- Measurement and instrumentation;
- Information-intensive systems;
- Analysis, modeling, simulation, and optimization; and
- Human-centered systems.

In context of measurement and instrumentation, sensors, meters, gauges, and instruments have been deployed and used within the vertically integrated situation of a single task or system. Although it has been a long tradition related to measurement and instrumentation, the situation changed from last couple of decades and there are some factors is associated with this such as Embedded Computing, Information-rich operation, Cross-system integration. To cope with self-defining physical information, physical information service could be used for a variety of purposes outside the context of a particular system and hence should have an unambiguous meaning. The Design and Capacity Planning of Physical Information Services is also an important issue regarding the measurement and instrumentation. Software Stacks for Physical Infrastructures will become commonplace rather than rare.

In the context of Information-intensive systems, Computer science has applied itself broadly to problems related to discrete forms of human-generated information, including transaction processing, communications, design simulation, scheduling, logistics tracking and optimization, document analysis, financial modeling, and social network structure. Big data is important as it the vast amounts of structured and unstructured data created every day, growing larger than traditional tools can cope with. However, due to sustainability problems involve complex systems, the data relevant to those systems are typically very heterogeneous.

In the context of analysis, modeling, simulation, and optimization, one key role of computer science in sustainability is to provide technology for model development. Models permit the taking out of meaningful information from context-dependent, potentially noisy measurements and observations of complex engineered and systems in the physical world. The common models are Multiscale Models, Combining Statistical and Mechanistic Models.

In the context of Human-centered systems, it is very critical, for real-world applicability. For example, in the context of introducing intelligence into the electric grid in order to increase sustainability, the essential measures and relevant information are very different when considered from the differing perspectives of the utility, supplier, and customer. Issues such as human in the loop training of machine learning systems, the interpretability of model results, and the possible use (or abuse) of large volumes of sensed data become particularly most important with a human-centered perspective. Design for manufacturing, design for mass customization, and user-centric design can expand on the understanding of design for sustainability. Overall, this

chapter provides examples of important technical research areas and outlines a broad research agenda for computer science and sustainability.

Chapter Two

Name of Chapter: Programmatic and Institutional Opportunities to Enhance Computer Science Research for Sustainability

This chapter actually describes the ways of conducting and managing research so that computer science research can have an even greater impact on sustainability challenges. The global need of sustainability is a challenging issue to achieve. Information is essential to making progress on many fronts of sustainability. We can say that computer science which couples information and innovation is crucial to sustainability. This chapter explores some of the potential obstacles within the field of computer science to making significant progress on issues related to sustainability. In previous chapter centrality of data and information to sustainability has been discussed. In respect of centrality, computer science and information technology (IT) are essential to meeting sustainability challenges. The fundamentals of the computer science field itself offer unique and important contributions to sustainability. Abstraction design, algorithms, operating systems and layering, real-time systems, machine learning, human computer interaction (HCI), and databases are some of these fundamentals. CS is mentioned as the most important and best approach for the solutions to particular, critical problems in sustainability and later seeking to generalize these solutions. Another related issue of sustainability is universality. Universality can be achieved by the development of important advances in Computing science and IT. If we think about the university systems of universality the conceptualization of the bottom-up emergence of universality is relevant to researchers, university systems, and funding agencies in the respects of researchers, university system, funding agencies. To make up global sustainability challenges, CS and IT research has the profound and significant contribution. Information technology is at the main point of nearly every large-scale socioeconomic systems such as financial systems, manufacturing systems, energy systems, and so on. One important consequence, which has been the focus of this book, is that advances in IT have become critical

facilitator of change in these systems. Overall, the computing science and information technology have been highlighted in this chapter with practical examples.