

Chapter 1: Roles and Opportunities for Information Technology in Meeting Sustainability Challenges:

In this chapter, the author presents examples of domains of potential impact by the roles and opportunities of ICT in achieving sustainability challenges. Sustainability of ICT can be divided into three broad areas according to the SMART 2020:Enabling the Low Carbon Economy in the Information report. They are consists of:

1. Built Infrastructure And Systems
2. Ecosystems Services And The Environment
3. Sociotechnical Systems

However, the identified fields are at some point intersecting with each other as well. Built infrastructure consumes much more energy, this consumption can be optimised by using IT systems. Similarly geographical information systems can be used to optimise the transportation network problems and can reduce the consumption of fuels. Other examples could be usage of smarter water and sewerage management systems, etc.

Similarly in the field of ecosystem and environment the advanced technologies in computational modelling and simulation of earth can play a vital role in predicting changes in carbon and hydrological cycles that can affect the global climate changes and other future impacts. In addition sensing, data management and model formation can be utilised to understand the flow of nitrogen, carbon and other gases of interest. These tools can also be better decision making tools for managing water and other resources and developing policies for future.

Sociotechnical system can also benefit from advanced IT and ICT because of its ability to provide real time information for individuals and organisations in a dynamic situation so that a response can be generated with the aid of these advanced technologies. Similarly smart devices such as smart phones not only provide information to the user but also to the researchers which they could miss without these devices. These devices enables its user to check the quality of air and provide other indications for different purposes at any time and at any place they wish to find. The author further describes three examples in which IT have significant impact on sustainability. These impacts can be observed currently as well as in the future it can have more significant impacts by doing more research in this field.

Chapter 2: Elements of Computer Science Research Agenda for Sustainability

In this chapter, the author presents methods and approaches in order to help the challenges have been addressed in the first chapter by using sustainable ICT. There are four broad research areas:

1. Measurement and instrumentation
2. Information-intensive systems
3. Analysis, modelling, simulation, and optimisation
4. Human-cantered systems.

Technology has progressed so rapidly that manual measurement of any variable hardly exist for instance, to measure temperature electronic devices are available everywhere with cheap prices. Output from one system can be utilised as an input for another system for example in cross integration system and combined heat and power generation. These systems eliminates the production of energy for each system individually.

However, computer science enables to retrieve and store the data from any system. This stored data can be analysed and the behaviour of the system can be inspected to take more insight of the system by utilising different software tools. All of these benefits of IT can lead to development of sustainable innovative systems.

In sustainability issues the role of computer science could be provision of technology for model development. Models allow a system to extract meaning full information from a given set of data analyse this data and provides some useful solutions. Different forms of models exists such multi scaled model, mechanistic and statistical models and optimisation and decision taking models. To solve todays complex sustainable issues there is a need to understand the needs of a people and solve their needs in the context of sustainable solutions. It means a human centred approach should be adopted in developing a system by utilising all of the above discussed technologies. There is still need for more research in the field of computer science to find solutions to sustainability issues.

Chapter 3: Programmatic and Institutional Opportunities to Enhance Computer Science Research for Sustainability

In this chapter, this book presents how the interplay between addressing sustainability challenges and computer science research merits attention. It describes some ways of conducting and managing research so the IT research have an even greater impact on sustainability challenges by programmatic and institutional opportunities.

In addition, information technology field is applicable and useful in nearly every large scale socioeconomic system such as financial systems, manufacturing systems, energy systems etc. advancement in information technology has enabled to bring significant changes in these systems. In this way computer science can contribute a lot in developing and solving sustainability related issues.