Executive Summary

Recent global conferences and meetings have brought into focus the unacceptable disparities that exist among nations in human development and economic growth. The poor and undernourished outnumber the healthy and wealthy by billions. The member states of the United Nations have adopted the Millennium Declaration that embodies quantitative goals in many areas of human development, thus providing a roadmap for sustainable development.

Information and Communications Technology (ICT), by its performance and potential, offers numerous options to *help* realize the Millennium Development Goals. Two workshops organized by Carnegie Mellon University, one in Washington, DC, and the other in Bangalore, India, discussed the challenges to development and identified opportunities that ICT provides. The workshops also discussed the technical innovations that are to be realized and the policy options that must be initiated to transform ICT into a veritable tool for sustainable development.

The following findings and recommendations highlight the initiatives required to make the ICT engine drive sustainable development (SD).

1) ***Improve ICT across the 4C dimensions:***

   a) ***Computing:*** ICT is more than computers, and the various thematic areas of sustainable development require innovations in hardware and software for applications such as sensors, controls systems, etc. Computers and other devices must become affordable, and rugged for use without extensive maintenance, security efforts or other specialized skills. They must become easier to use, with interfaces in all local languages, and even in non-text interfaces (pictorial and spoken).

   b) ***Connectivity:*** Developing countries, especially rural areas, typically are without connectivity, let alone broadband (data) connectivity at affordable prices—the "digital divide." Universal access requires new networking and business models, perhaps combining public and private partnerships. ICT is more than connecting to the Internet—human development programs require integration of all forms of ICT and media, such as mobile telephony, TV, radio, etc., as well as interconnecting systems such as sensors, controllers, etc.

   c) ***Content:*** ICT will become relevant to sustainable development (SD) when it provides relevant content (value) to end-users. Often, this would be locally-specific content. One requirement is for tools to make it easier for people to become producers of content and information, instead of just consumers. Ultimately, we would like to achieve the Information Bill of Rights: Getting the right information to the right people in the right timeframe in the right language in the right level of detail. This requires extensive development of appropriate solutions that overcome barriers of language, information complexity, and incompatible or missing structure.

   d) ***(human) Capacity:*** Most people lack an awareness of the potential of ICT, and, beyond technical barriers, many limitations to incorporating ICT are social, cultural, or economic. A first goal for governments must be to increase literacy amongst its populace, especially for the historically disadvantaged, such as women. Often, the success of development projects is driven by complementary (non-ICT) institution building, such as the development of appropriate regulations, legal framework, and supply-chains.

2) ***Success of ICT for SD requires Integration, Scalability, and Sustainability:***

   a) ***ICT can only help achieve development – it is a means and not an end:*** ICT cannot directly achieve the Millennium Development Goals. To be meaningful, ICT needs to be integrated into development as well as engineering and societal systems. Often, proponents or developers place too much focus on raw ICT (or even just connectivity), instead of optimally delivering value and services.

b) ***Active efforts must be undertaken for global inclusiveness:*** Without concerted effort, ICT for SD, like many interventions or projects, would exacerbate existing divides. Solutions must be locally adapted, and extend into rural and other underserved areas. A solution might appear beneficial at a pilot or small scale, but replication and scaling are enormous challenges.

c) ***ICT for SD must be economically viable, and provide value for end-users:*** ICT for SD cannot thrive as a charity—it will become sustainable only when it delivers value. This is not to say that governmental intervention or subsidies have no role, especially during the initial stages. However, markets alone will not drive penetration into underdeveloped regions. The challenge is that the required research and development to make solutions viable can be costly and long-term.

d) ***ICT for SD research must be participatory and collaborative for the solutions to be globally relevant and sustainable:*** The challenges of development are vast, and no single or group of developers can solve all of them. This requires collaboration, sharing experiences, and scaling the programs to make them relevant. Many groups or even smaller countries lack the critical mass for them to undertake the full spectrum of effort required. All stakeholders, including beneficiaries and end-users, must have a voice in assessing its needs, responsibilities, and measures of success.

3) ***ICT for SD must become a recognized and funded enterprise:***

a) ***Bring together all the stakeholders and increase their interactions:*** ICT for SD is an interdisciplinary field and thus requires technologists, social scientists, and development professionals working together. Even within traditional disciplines, ICT for SD must become incorporated into R&D and deployment projects. In the medium and long term, ICT for SD should be categorized as a distinct field with its own defined challenges, support structures, professional societies, peer recognition, etc.

b) ***Develop metrics for success and efficacy, and introduce academic rigor:*** ICT for SD is a nascent field, but attention is often focused on isolated or niche successes. Very few solutions have been impartially assessed as to their claims and still fewer have been verified as to their global validity or scalability. Funding, R&D, and implementation strategies require development of metrics for relevance, effectiveness, scalability, and financial and social sustainability.

c) ***Focus on real innovations and new challenges:*** R&D should focus on real innovations instead of concerning itself with incremental changes to existing solutions, which are often touted as breakthroughs. The required innovations cannot not be just technical, but also in business models and implementation strategies. It is important to identify at least a few “grand challenges” in ICT that can lead to radical innovations in sustainable development. Some suggestions for further research are presented in this report.

d) ***Develop new models for R&D:*** Innovations in ICT that are now available have largely been designed to meet the needs of the developed world. R&D and technology development projects addressed specifically to meet the requirements of developing countries should not be left just to market forces as these markets may not appear lucrative. “Linear” models of R&D lack the feedback loops required to capture economic, social, and cultural compatibility. To help balance technology-push and market-pull, R&D needs to be supplanted by an RD&D (research, development, and demonstration) paradigm, with real-world deployments and testbeds. Such activities should take place in a network of centers and institutions, both in the developing and developed world with contributions from the governments and global organizations. A similar initiative taken some years ago led by the World Bank for forming a strategic alliance of laboratories for agricultural research resulted in significant contributions to developing countries’ agriculture.