IISDCOMMENTARY

ICT Innovation and Sustainable Development

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This is one in a series of papers being published by IISD's Global Connectivity team to inform and stimulate discussion and debate on the relationship between information and communication technologies (ICTs), the Internet and sustainability, surrounding the UN Conference on Sustainable Development in Rio de Janeiro in June 2012 (Rio+20), the UN Internet Governance Forum in Baku in November 2012 and the International Telecommunication Union World Conference on International Telecommunications in Dubai in December 2012 (WCIT-12).

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Expectations are high that progressive innovation in information and communication technologies (ICTs) can be harnessed to sustainable development and, specifically, to environmental sustainability, goals. As environmental sustainability gains a high profile internationally, so too do hopes that digital technologies, globally interconnected networks, and increasingly inclusive Internet applications will lock ICT innovation into step with policy agendas aimed at curbing environmental threats. Such hopes are evident in aspirations for a "green" information or knowledge society. They translate into calls for research and development on green ICT products and services, organizational change aimed at substituting virtual interaction for travel, or efforts to harness the full potential of ICTs. ICTs can provide a basis for improved control systems for managing energy consumption and other changes in household and firm behaviour, but the question is, how can ICTs contribute to the development of a sustainable world?

Environmental sustainability goals sit uncomfortably alongside the drive to achieve a more inclusive and interconnected information society. The expectation is that innovations in ICTs will stimulate economic growth through investment in broadband infrastructure or in "e" applications in the health, education, agriculture, commerce, government and other sectors.

[1] Biography abstracted from http://www2.lse.ac.uk/media@lse/whosWho/AcademicStaff/robinMansell.aspx

The ambition is to extend the reach of the Internet and the mobile phone into every corner of the planet. However, this ambition neglects the fact that innovations in ICTs are implicated in exacerbating environmental threats. This is because the spread of digital devices and control systems is consuming and wasting natural resources at an increasing rate.

There is a pervasive utopian belief that the spread of digital ICTs eventually will secure a cleaner post-industrial society but, unfortunately, ICTs are Janus-faced. ICTs support environmental monitoring, but they also foster environmental decline. Satellites are used to monitor deforestation, desertification, and to support climate modelling, but space junk from satellites is a growing problem. These contradictions have been around for a long time. The ICT revolution has led to major changes in production, expansion of economic dependence on services, increasing virtualisation of production and consumption, disruption in business models and competitiveness strategies, and changes in the way geographical space and time influence, social, cultural, political and economic activity. Yet from the standpoint of sustainable environmental change, the promise of the potential of ICTs to contribute to sustainable development is receding. This is because of the comparatively slow pace of change in the practices needed to achieve environmental goals.

A persistent problem is the decoupling of efforts aimed at stimulating the development of an ICT-based information society from those aimed at encouraging changes consistent with sustainable development. The former is driven overwhelmingly by a focus on the impacts of ICT. These are often seen as exogenous shocks to other components of the social and economic system. Impact studies usually zero in on the effects of ICT innovations on greenhouse gas emissions, efficiency gains in power production and consumption, or reductions in physical movement as a result of online interaction, for example. However, such studies ignore evidence of the complex, systemic and unpredictable ways that ICT innovation is coupled with changes in all areas of society.

The idea that progressive innovation in ICTs holds the solution to environmental problems is a symptom of this exogenous thinking. In exogenous models of change, it is assumed that processes external to the operation of the economic system generate technological progress. The long-run rate of economic growth is seen as being determined exogenously because technological change is modelled as being exogenous to the system. An overemphasis on the importance of investing in leading-edge ICT innovations is consistent with this exogenous vision. The primary focus is on the speed of diffusion of ICTs, with the assumption being that the diffusion process is linear and reasonably predictable. This is consistent with studies of first, second and third order effects of ICTs on the economy and society. The focus on effects distracts attention from the recursive character of innovation, from choices that are leading to the design and applications of some ICTs and not of others, and from possibilities for altering the trajectory of innovation so that it becomes consistent with sustainable development.

Empirical studies of changes in ICTs demonstrate that there is no pre-determined or linear relationship between innovation in the sphere of digital technologies and the consequences for society. In reality, innovations are influenced by the preferences and actions of people and organizations with conflicting interests. Some ICT innovations fall by the wayside, while others, as in the case of the unexpected flourishing of online social media, lead to unforeseen pervasive changes in organization.

The information society describes societies whose populations aspire to the wide-scale appropriation of digital ICTs and information. The knowledge economy is associated with a privileged role for virtual commercial activity. Both these labels are being used to depict societies that are consistent with the values of democracy. But only very rarely is it noticed that such societies must embrace the goals of environmental sustainability if they are to be consistent with

long-term sustainable development.

The changes in train in ICTs are the results of human decisions that are reflected in the trajectory of ICT innovation. The ways in which the fruits of technical progress are coordinated, accommodated or resisted, come from within a complex system, not from exogenous shocks to the social and economic system. They are endogenous to the system and they are responsible for the direction of economic growth and development based on ICTs. The challenges for sustainable development are not simply about faster, cheaper or more ubiquitous ICTs. They are about choices on the part of stakeholders, including civil society, companies and governments, about which technological developments should be favoured and how they should be deployed in ways that achieve sustainable development. This endogenous approach to these challenges is messier than the idea of technological shocks to society, but it is close to the reality of the way change happens. This approach means treating the origins and consequences of ICT innovation as part of a complex system, which not only requires explanation, but also requires coordinated changes in production and consumption practices and policies.

This approach evokes the idea that change proceeds from within a system with all its complexity. It draws attention to discontinuities or mismatches in the institutional (social, political and economic) environment that are associated with the development of ICTs. Instead of treating ICT innovation as part of a rag-bag of exogenous factors, ICT innovations can be seen, like earlier innovations such as electricity, to have widespread consequences for all sectors of the economy and society.

The digital ICT paradigm is accompanied by new types of organization, skills, product mixes and patterns of investment. ICT innovations significantly reduce the cost of storing, processing, communicating and disseminating information and they become linked to new patterns of behaviour and practices. Whether problems like unsustainable energy consumption or other environmental risks are reversed is a matter of choice. Since this is a choice, it is possible to examine alternative arrangements that might be feasible for ensuring that labour standards are established for online work, that policy curtails unwanted intrusions in online worlds and, in the case of sustainability issues, that the design and deployment of ICTs is encouraged in a way that ensures that environmental risks are tackled. In this perspective, we cannot assume that the existing trajectory of ICT innovation is "fit for purpose" just because it exists.

ICT innovation, including the trend toward convergence, is spawning huge numbers of new applications, but the trajectory of change can be altered, abandoned or subordinated to cultural, social, political and economic values. When we emphasize the complexity of interdependent systems of technology and society, we can see that learning occurs through time and that this has the potential to change habits and to redefine cultural, social or economic goals, consistent with environmental priorities. This way of seeing the challenges gives us an opportunity to move away from the false impression that the progress of technological innovation is fixed. It creates a basis for assessing technological innovation in a way that acknowledges conflicting interests and it draws our attention to existing incentives and disincentives for change and how they might be altered.

With attention focusing on these issues, it is possible to turn to governance approaches for ICT innovation that are consistent with what is valued in society, including aspirations for sustainable development. Focusing on the prevailing visions of the information society or knowledge economy alone offers little guidance for building a sustainable information society. Acknowledging that ICT innovation is linked both to stability and instability in different components of the social and economic systems, helps to draw attention to how stakeholders are acting in patterned ways influenced by power relations and to how this can change. While a short-run, market-led vision of ICT innovation is dominant

now, making it difficult to shift ICT innovation onto a more sustainable trajectory, a novel (better) outcome could emerge if decisions are made to alter the incentives motivating the different stakeholders. A system perspective on ICT innovation sensitizes us to the idea that a system that destroys its environment, ultimately destroys itself!

ICT innovation is not a one-way street with impacts on society and outcomes that hinder environmental sustainability. ICT innovation is a complex system of interactions involving all areas of production and consumption and civil society activities. The trajectory of ICT innovation is neither "natural" nor pre-determined. It emerges from self-fulfilling visions based on the decisions of multiple actors and their expectations about the future.

In the current ICT paradigm there are possibilities for more accurate monitoring and control of industrial processes. ICTs can be applied in support of inventory control and the miniaturization of digital components. But what is overlooked is that "the realm of the scientifically conceivable is infinitely greater than the realm of the technologically feasible and the realm of the technologically feasible is far greater than the realm of the economically profitable and the socially acceptable" (Freeman, 1992). The message is that ICT innovation can be shaped in an environmentally friendly direction, but that ICT itself does not embrace environmental objectives. If hopes for the contribution of ICT to environmental sustainability are to be transformed into reality, policies need to foster bottom-up local initiatives and top-down market incentives to stimulate changes in the ICT trajectory. This will only start to happen when long-term environmental objectives are embedded within every dimension of information society developments.

Reference

Freeman, C. (1992). A green techno-economic paradigm for the world economy. In *The Economics of Hope* (p. 203). London: Pinter Publishers.

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Acknowledgement