DISCUSSION PAPER

International Institute for Sustainable Development

Institut international du développement durable

iisd

ICTs, the Internet and Sustainability: A discussion paper

David Souter

May 2012

International Institute for Sustainable Development

The International Institute for Sustainable Development (IISD) contributes to sustainable development by advancing policy recommendations on international trade and investment, economic policy, climate change and energy, and management of natural and social capital, as well as the enabling role of communication technologies in these areas. We report on international negotiations and disseminate knowledge gained through collaborative projects, resulting in more rigorous research, capacity building in developing countries, better networks spanning the North and the South, and better global connections among researchers, practitioners, citizens and policy-makers.

IISD's vision is better living for all—sustainably; its mission is to champion innovation, enabling societies to live sustainably. IISD is registered as a charitable organization in Canada and has 501(c)(3) status in the United States. IISD receives core operating support from the Government of Canada, provided through the Canadian International Development Agency (CIDA), the International Development Research Centre (IDRC), and from the Province of Manitoba. The Institute receives project funding from numerous governments inside and outside Canada, United Nations agencies, foundations and the private sector.

Head Office

161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba, Canada R3B 0Y4
Tel: +1 (204) 958-7700 | Fax: +1 (204) 958-7710 | Website: www.iisd.org

ICTs, the Internet and Sustainability: A discussion paper

May 2012

Written by David Souter[1]

[1] David Souter is a senior associate of IISD. He is managing director of *ict* Development Associates, visiting professor at the University of Strathclyde, Scotland, and visiting senior fellow in the Department of Media and Communications at the London School of Economics and Political Science.

Table of Contents

1.0   Introduction

This discussion paper addresses two issues of critical importance for today's world and future generations:

- The challenge of sustainability in the world economy, society and environment
- The transformations in economy, society, politics and culture that are resulting from the spread of information and communications technologies (ICTs) and especially the Internet

A central question arises from the juxtaposition of these issues:

> How far and in what ways do we need to change our understanding of sustainability in the light of the information and communications revolution?

The International Institute for Sustainable Development (IISD) has been concerned about the challenge of sustainability and its relationship with global economic, social and technological trends since it was formed in 1990, in response to the Brundtland Commission report *Our Common Future*, whose work defined "sustainable development" for the subsequent generation. IISD's concern reaches far beyond the environmental preoccupations with which many people associate sustainability, to include economic prosperity and social order. It encompasses a complex matrix of sustainability that is reflected in its work on sustainable markets and international trade; on political leadership and the causes and control of conflict; as well as on more obviously "environmental" issues such as climate change and natural resource management. IISD's Global Connectivity program has focused for more than a decade on the impact of ICTs, and especially the Internet, in changing the underlying parameters of economic, social and environmental policy.[2]

The need for "adaptiveness" in thinking about the future has become a cornerstone of IISD's approach to the political and economic challenges of sustainability, as well as to the practice of environmental management.[3] This is particularly true today. The world economy faces the greatest challenge in sustaining growth and prosperity that it has seen in half a century, one that is accelerating transitions in economic power towards emerging markets in new world regions. Long-standing preconceptions about political order and stability have been undermined by the Arab Spring and the complex, difficult, uncertain but hopeful process of transforming political structures emerging from it. The capability of global institutions to handle complex transitions, such as mitigating climate change, is under question. The impact of ICTs and the Internet in all these areas has been or could be profound. These are the underlying circumstances facing the world community as it holds the third of its decadal summits to address the challenge of sustainable development in Rio de Janeiro in 2012.

This discussion paper is designed to raise questions and provoke debate about the relationships among ICTs, the Internet and sustainable development. It summarizes the meaning and context of sustainability today, the changes that have taken place in information and communications since the first Earth Summit in 1992, and the impact that these have had on the economic, social and environmental dimensions of sustainability.

---

[2] See, especially, Souter, MacLean, Creech & Akoh (2010).
[3] See Swanson & Bhadwal (2006), and related papers on adaptiveness at www.iisd.org.

As companion pieces to this discussion paper, IISD is publishing separate keynote interviews with two global experts who have been involved in these parallel fields for more than 25 years—Jim MacNeill, who was secretary-general of the Brundtland Commission and lead author of *Our Common Future* and Vint Cerf, one of the founders of the Internet and currently Google's Chief Internet Evangelist.

This discussion paper, together with the views of Mr. MacNeill and Mr. Cerf, set the stage for a global discussion in June 2012, in parallel with the events taking place as part of Rio+20, the 20th anniversary the Earth Summit. A separate discussion guide has been prepared for all those wishing to take part in the debate. A series of short, provocative contributions in the form of essays and interviews with other leading thinkers about sustainability and the Internet will inform the debate during June and July. All documents will be available at www.iisd.org/infosoc as they are released.

2.0   The Meaning of Sustainability[4]

The Brundtland Commission defined sustainable development in 1987 in several ways. One of these definitions—the statement of intergenerational equity summarized as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"—has received most attention (World Commission on Environment and Development, 1987, ch. 2, para. 1). However, that was only one dimension of sustainability as understood by the Commission. It also emphasized that sustainable development "at a minimum … must not endanger the natural systems that support life on Earth: the atmosphere, the waters, the soils and the living beings" (para. 9). It related these natural systems to human behaviour and experience by emphasizing that sustainable development must be based on "consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire" (para. 5).

The Brundtland Commission also identified a number of "strategic imperatives," which it saw as necessary if development were to move toward greater sustainability. These included efforts to advance international equity; reduce poverty, energy consumption and resource depletion; achieve sustainable demographic levels; reorient technology; and bring together decision-making concerned with the environment and the economy.

The sustainability framework that emerged from subsequent discussions, and that influenced thinking about sustainability within and beyond the Earth Summits of 1992 and 2002, is made up of three elements, which are considered to be of equal significance:

- *Economic development* – reducing and seeking to eradicate income poverty, achieving higher levels of prosperity and enabling continued gains in economic welfare
- *Social development* – reducing and seeking to eradicate other dimensions of poverty; improving the quality of education, health, housing and other aspects of the welfare of individuals and communities; and enhancing the quality of social interaction, engagement and empowerment
- *Environmental protection* – reducing pollution and other negative impacts on the environment, mitigating the effects of industrialization and human activity, and seeking to achieve sustainable use of resources in the interest of future generations.

---

[4] This section is based on Chapter 2 of Souter et al. (2010).

Sustainable development seeks to achieve these multiple objectives, not by trading them off one against another, but holistically, through government policies, business strategies and lifestyle approaches that reinforce the mutuality of economic, social and environmental goals. Two further elements might be added to these dimensions of sustainability:

- *Cultural diversity* – the continuance of diverse human cultures from past to future within a context of the globalization of communications, economy and society and the more intensive intercultural interactions that result
- *Governance* – the institutional mechanisms, rules and norms that encompass decision-making and behaviour by governments, businesses and citizens, the interactions among these stakeholders and among different policy domains.

These five elements of sustainability are by no means incompatible or necessarily competitive one with another. On the contrary, a sustainability framework considers them mutually interdependent, as illustrated in Figure 1.
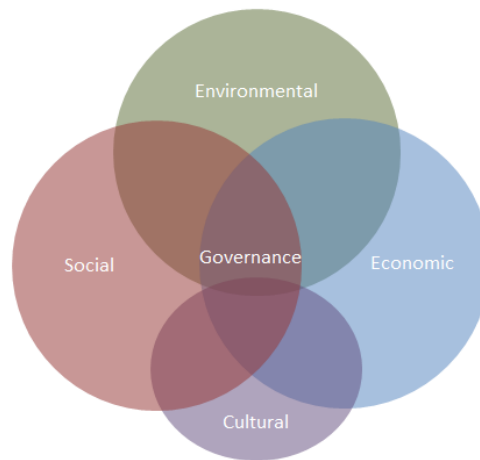

FIGURE 1: DIMENSIONS OF SUSTAINABILITY

However, recent human history shows clearly that individual elements within this framework can be pursued, and have often been pursued by governments and others, in silos or in ways that are detrimental to the pursuit of other elements. Economic growth, most notably, has often been pursued in ways that have proved environmentally unsustainable, more obviously so as our knowledge has grown of natural resource constraints and the environmental impact of greenhouse gas emissions. Achieving the overall goal of sustainability therefore requires governments, businesses and citizens to address each element in ways that are compatible and recognize their interactions and interdependence. This is particularly onerous in a context of ongoing population growth, which requires economic growth at comparable rates in order to sustain current levels of prosperity (let alone achieve greater prosperity) and which puts additional pressure on finite resources including land and water.

The desire for sustainability along these lines is strongly endorsed within the international community, though not all commentators believe it is achievable, and many national and international policies seem to prioritize short-term rather than sustainable growth. Achieving sustainability places a demand on human societies to do three things differently from how they have been done during the industrial period:

- *To produce sustainably* – by increasing efficiency and reducing material used in production
- *To consume sustainably* – by reducing the ecological footprint of consumption patterns while enabling real improvements in the quality of life
- *To organize sustainably* – by engaging stakeholders, by encouraging participation, and by improving the quality, efficiency and sustainability of planning, implementation and evaluation of government policies, business strategies and personal lifestyles

Major changes in economy and society, politics and culture have taken place since the Brundtland Commission in 1987 and the first Earth Summit in 1992. That period has seen growth in the world economy from US$17 trillion to US$63 trillion, with temporary setbacks since 2007 affecting industrialized countries more substantially than most developing countries (World Bank, 2012). Political changes from the end of communism to the Arab Spring have allowed societies to emerge from autocracy to liberalism, while the balance of global political and economic power has shifted significantly from West to East and North to South. The threat of nuclear annihilation has been substantially displaced as humanity's principal long-term anxiety by the threat of climate change. Greenhouse gas emissions have continued and continue to grow in volume, rather than recede. The world is now believed to have crossed four of the "planetary boundaries" that represent tipping points beyond which environmental change may become irreversible (Rockström, Steffen, Noone, Persson, Chapin, Lambin et al., 2009).

Discussion about sustainability, in this context, has been seen by many actors as a matter of balancing positive economic growth against negative environmental impacts, reflecting the high priority attached to both poverty reduction and climate change, rather than seeking ways of achieving positive outcomes across the sustainability framework as a whole. The rapid development of information and communication technologies and their increasingly pervasive influence on human activity have added to this complex and evolving context for sustainability.

3.0   Transition in the ICT Environment

The change in information and communication technologies that has taken place since the first Earth Summit has been as great and rapid as the adoption of any technology in history. Adoption of mobile phones and the Internet, in particular, has been much faster than that of other widespread technological innovations of the last century or so, including the motor car, domestic refrigeration, television or the telephone. Four aspects of this change illustrate the scale of what has happened: the reach of communications networks, their quality, the range of services that they can deliver, and the adoption and use of networks, services and devices by businesses and individual citizens. It is worth contrasting how these stood in 1992 and how they stand today, at either end of the development spectrum.[5]

---

[5] An assessment of changes since the World Summit on the Information Society can be found in United Nations Commission on Science and Technology for Development (2011), *Implementing WSIS outcomes: Experience to date and prospects for the future*, available at http://www.unctad.org/Templates/Download.asp?docid=15060&lang=1&intItemID=4839.

3.1 Reach

Although telecommunications networks were geographically ubiquitous in most industrial countries in 1987, they had only limited reach in most developing countries, where they were often confined to capital cities and other urban areas. Almost all telecoms networks at the time were based on fixed technology. Mobile networks were then in their infancy, but are now the principal mode of telephony worldwide. Although they have not yet achieved total geographical coverage, the International Telecommunication Union (2010) expects that "complete mobile coverage of all rural areas around the world" should be achieved by 2015 "or even earlier."

3.2 Adoption and Usage

Adoption and use of mobile services has grown rapidly alongside the spread of coverage. Three years before the Brundtland Report, the Independent Commission for World Wide Telecommunications Development (the Maitland Commission) (1985) bewailed the very low levels of telephone adoption then prevailing in developing countries, many of which had teledensity rates of less than one telephone per hundred people, and some in Africa less than one per thousand. These figures began to change as mobile networks came onstream. By the end of 2011, the International Telecommunication Union (2011) estimated that there were just under six billion mobile phone subscriptions worldwide (although the number of actual users will be significantly lower than this)—approximately one mobile subscription per world inhabitant, and well over one per adult.

3.3 Quality

The third dimension of change in the ICT environment is the quality of networks, and in particular their ability to deliver high-quality data, including the Internet. This is changing rapidly today through the rapid growth of broadband infrastructure, which has brought always-on Internet at adequate speeds for most likely uses to most Internet users in industrial countries, where it also allows the rapid deployment of sophisticated new applications for government and business. Growth in broadband capacity is accelerating in developing countries, although there is at present a growing gap in broadband provision between industrial countries that are seeing very rapid investment and poorer developing countries where investment, while still substantial, is not so fast.

3.4 Variety of Services

Finally, the user experience of ICTs has been radically changed through the development of new applications and services that enable users to do things that were far beyond their reach in 1987. First, personal computers with graphical user interfaces brought the efficiency and collaborative working of a modern computing environment to small businesses and home users. Then the Internet, and particularly the World Wide Web, enabled anyone with basic literacy skills and the right equipment to access information and interact directly with other users in any part of the world. It has continued to offer radical new services, in recent years most dynamically the social networking and self-publishing phenomena of Facebook and Twitter. Mobile telephones, and especially today's smartphones, are now much more than mere phones, offering their users a wide range of digital device technologies, including camera, radio, games console, music player, personal organizer, wallet, debit card and cybercafé. In low-income countries, they have become the primary mode of Internet access.

4.0   An Information Society?

As these examples illustrate, expansion in the reach and use of ICTs over the 25 years since sustainable development was first defined has been global and pervasive, affecting all countries and all levels of society.

For most populations, that period of one generation has seen transition from a time when information technology played a marginal role in their lives to one in which it is centrally important to most aspects of their lifestyles and livelihoods. The importance of mobile phones and the Internet in domestic and small business environments has been described above. Long-established business sectors, meanwhile, have been uprooted by alternative delivery modes for goods and services, while others have transformed their patterns of production and exchange, and entirely new sectors have emerged to take advantage of the potential of technological innovation. Governments have automated their internal management and offered new forms of service delivery to citizens, who have themselves both been empowered by ICTs and made vulnerable by them to more intense and complex surveillance. Social networking (in its wider, sociological sense) has been transformed by social networking technologies and services. New architectures of information, such as cloud computing (locating information and resources in data centres rather than in terminal devices) and the "Internet of Things" (making objects as well as people and organizations addressable and interactive) are beginning to add further layers of complexity to the interaction between information technology and the wider world.

ICTs, in short, have become general-purpose technologies, which affect economies and social structures in their entirety, rather than specific technologically bounded aspects of economy and society. Rather than being deliberately targeted by specific actors on particular goals, their impact has become pervasive and uncontrolled—changing production and consumption patterns, creating previously unfeasible opportunities, and altering behavioural norms in ways that result from the dynamics of interaction between technology and users rather than the decisions of politicians and businesses. They are also disruptive technologies. It is notable how the impact of many of the mass markets that have resulted from ICT innovations in the past 20 years—from Short Message Service (SMS) to mobile Internet, the World Wide Web to Twitter—has been poorly anticipated by governments and established businesses and/or been led by outsider entrepreneurs who have ridden the wave as dynamic innovations become the spirit of the age.

Some of these dimensions of the evolving information and communications environment, and their implications for sustainability, are explored in this discussion paper. For a good many commentators, their overall impact represents an information revolution comparable with the advent of settled agriculture some ten thousand years ago and the industrial revolution of the 18th and 19th centuries, culminating in an Information, Knowledge or Network Society, in which information/knowledge and the interactions that networking enables among individuals have become the most important factors in changing economies and society, politics and culture. For some, this transition to an information society is an observable reality, for others, an aspirational vision; for many, it is a mixture of the two. Anything that has so fundamental an impact on society as a whole must challenge the assumptions underpinning concepts like sustainable development.

5.0   The Impact of Information Technologies and the Internet on Sustainability

It is also not without its difficulties. The development of an information society has clearly been uneven, as a result of other disparities within and between societies—much more rapid in some countries and for some age and occupational groups than others. The "creative destruction" unleashed by ICT-enabled innovation has generated economic and social turbulence in both developed and developing countries by undercutting traditional economic and social structures, challenging established norms and expectations, and creating new kinds of opportunities for crime, terror, harassment and defamation. While the individualization and personalization of terminal devices has diffused much of the fear of information technology that was evident in dystopian literature and cinema of the 20th century, there is still considerable—and perhaps growing—anxiety about the increased potential that it brings for government surveillance and consumer profiling. Some organizations and individuals have difficulty managing the change in information and communication opportunities before them and integrating these successfully with other aspects of their lives. New opportunities for social organization and for reaching vulnerable communities have been as readily exploited by the criminal underworld as by agencies concerned to benefit the poor.

While the changes that have been enabled by ICTs have brought many benefits to people, they have likewise raised new challenges for sustainability. Even some of the economic and social effects of ICTs that appear directly positive have had the indirect effect of reinforcing trends that are unsustainable in the longer term—for example by increasing overall demand for non-renewable energy and facilitating the exploitation of finite natural resources. The ICT sector itself has become a significant source of environmental harm, through both electronic waste and greenhouse gas emissions. Like almost all technologies and social benefits, mobile phones and the Internet have been adopted more quickly, extensively and comprehensively by the rich and educated than by the poor and illiterate. While they have the potential to benefit all significantly, in the short term at least, they are as likely to widen as they are to narrow inequalities.

This raises three questions from the perspective of sustainable development:

- First, what impacts are new media and the Internet having on the achievability of the core elements of sustainability identified earlier in this discussion paper—economic and social development, environmental protection, cultural diversity and governance—and on the balance between them?

- Second, to what extent do these impacts enhance sustainability and to what extent do they, on the contrary, raise new sustainability challenges?

- Third, do the economic, social, political and cultural implications of these impacts imply that we need to revise, rethink or readjust our understanding of what sustainability means from the ways in which it was defined in 1987/1992, before today's communications cornucopia became available?

One widely used framework for analyzing the impacts of ICTs on sustainability was published by the Forum for the Future in 2002. This framework proposes the assessment of hardware, software and usage from three angles:

- The type of impact that results within the different elements of the sustainability framework

- The level or order of impact (see below)

- The different stages within the product or service life cycle at which impact occurs (for example, in design and manufacture, operation and disposal)

Central to this framework is the distinction between different levels or orders of impact:

- First order (or direct) effects are those that result from the physical existence of ICTs and the processes involved in making them available—for example, the jobs created in ICT manufacturing and services, or the carbon emissions generated by manufacturing, data centres and the use of terminal devices.

- Second order (or indirect) effects are those that result from the ways in which those ICTs are used, in particular those resulting from applications and access to content—for example, the loss of jobs in sectors undermined by Internet-enabled businesses (such as music retail) or the reductions in carbon emissions achieved through automated ("smart") management of electricity generation and distribution.

- Rebound effects are the counterbalancing impacts that occur as a result of behavioural changes that themselves result from these first and second order effects—for example, the likelihood that the reduction in vehicle usage resulting from telecommuting will be accompanied by increased use of vehicles for leisure activities.

- Third order (or societal) effects are the aggregated outcomes of large numbers of people using ICTs over the medium-to-long term in ways that alter how economies and societies work—for example, changes in the nature of work and working relationships, in the relationships between diasporas and home communities, in patterns of consumption and human settlement.

This is a valuable analytical framework. It is relatively easy to draw together evidence concerning the first and second order effects of ICTs on the different elements of sustainable development described above, and there is some consensus about the overall balance of effects. First and second order economic and social impacts are generally considered positive on balance, for example, while environmental impacts are more mixed (see below).

Assessing third order effects is much more difficult, however. Society changes much more slowly than individuals or organizations, let alone technology, and we are only a few years past the transition to mass markets for mobile telephony and the Internet. We can discern significant shifts in economic, social, political and cultural behaviour, but it is hard to predict how they will progress, and just as hard to distinguish how far they result from the information revolution and how far from other economic and social factors, such as the economic downturn of the years since 2007, the ongoing shift in economic and political power from Europe and North America towards Asia and other developing regions, or population change. The future evolution of societal responses to changing ICTs and the Internet is even more difficult to assess because of the very rapid changes that take place in information technology and markets and the difficulty that everyone has had in predicting these. By way of illustration, it is notable that mobile telephony—now generally regarded as the lead technology in communications market development—was not significantly discussed in the outcome documents of the World Summit on the Information Society (WSIS, 2003 and 2005),[6] while Facebook—the world's leading Internet application—begin life as a student start-up while that summit was in progress.

---

[6] There is only one direct reference to telephony, fixed or mobile, in the four WSIS outcome documents, but over 230 references to the Internet. The outcome documents are at http://www.itu.int/wsis/documents/doc_multi.asp?lang=en&id=2316|0.

Sustainability is, of course, about the viability of long-term economic, social and environmental change. It is these long-term, third order, societal impacts of ICTs and the Internet that have most significance for a sustainability agenda, and that are IISD's primary concern in publishing this discussion paper and the other essays and interviews within this project. These essays and interviews set out some of the thoughts of leading figures in the sustainability and Internet communities about the opportunities and challenges involved, from their own distinct perspectives.

Section 6 identifies some of the societal impacts that can currently be discerned in the five core elements of sustainability: in economic and social development, environmental protection, cultural diversity and governance. It aims to set the scene for subsequent contributions.

6.0   Societal Impacts of the Internet: Some Current Trends

The central question in this discussion paper concerns whether the cumulative impact of new communications media, including the Internet, is changing the nature of economies and societies in ways that require us to rethink the meaning of sustainability. To put it another way, does sustainability in the information age—in the Information, Knowledge or Network Society—mean something different from what it meant in the late industrial age of the 1980s and early 1990s? It is not possible in this brief discussion paper to be comprehensive, but it is possible to set out some of the underlying changes that suggest this might be so. Most attention is paid, in this section, to economic and social development, in order to illustrate the diversity of societal impacts that can currently be discerned.

6.1   Economic Development

The balance between economic prosperity and environmental sustainability lay at the heart of many early debates about sustainable development in the 1980s. Although the last two centuries have seen general growth in prosperity and reductions in the proportion of people living in poverty worldwide, the experience of poverty remains widespread and its progressive reduction a core target of global endeavour. Ongoing population growth means that economic growth—of at least 2.5 per cent in Africa—is essential not just to grow prosperity but merely to sustain the levels of prosperity that have already been achieved. Since the 18th century, at least, growth models have been built around the exploitation of natural resources in ways that we now know are not environmentally sustainable. The search for "green growth," for prosperity that does not inflict lasting damage on future potential, is at the heart of the Brundtland Commission's definitions of sustainable development. Two terms in current debates about economic growth are especially relevant to this.

The so-called "green economy" is, in many ways, a reformulation of the aspiration of sustainable development, updated for an age in which greenhouse gas emissions have come to be seen as the fundamental challenge of sustainability. The United Nations Environment Programme (UNEP, 2011) has defined the green economy as one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (p. 16). The OECD (2011) defines its green growth strategy as being "about fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being resides, … about fostering investment and innovation which will underpin sustained growth and give rise to new

economic opportunities" (p. 18). Both of these formulations are quite close to the Brundtland Commission's definitions of sustainable development as that which meets the needs of the present without compromising the ability to meet the needs of future generations, and does so without breaching the boundaries of what is ecologically possible.

The "Internet economy" and "digital economy" are terms that are increasingly used to describe the economic dimension of a post-industrial Information Society, and are often seen as offering ways forward toward "green growth." Discussions of the Internet economy tend to focus on a few defining characteristics. In a digital economy, the ICT sector is itself an important source of employment and contributor to Gross Domestic Product (GDP). ICTs are widely dispersed throughout the economy, and contribute positively to productivity and economic growth. They are widely diffused, too, in social areas such as health and education, and in the delivery of public services. Digital economies tend to have high degrees of innovation and creativity relative to other economies, with much of their innovation emanating from outside established sources of innovation and entrepreneurship, notably from small-scale, rapidly growing business start-ups. Digital economies tend to be open in terms of international trade and subject to limited domestic regulation.

The extent to which Internet or digital economies now exist in industrial (or post-industrial) countries is open to debate. What is undeniable, however, is that modern ICTs and the Internet have changed patterns of economic behaviour substantially since 1987. There is space only to mention some of these here, rather than to offer any full analysis, but together they present a picture of substantial change in economic structures brought about or at least enabled by ICTs.

- Industrial production—generally in the North, in the dynamic sectors of emerging markets, and increasingly in developing countries—is using much higher levels of automation. Industries such as motor vehicle manufacturing have extensively displaced skilled manual with robotic labour. The consequent thinning out of tiers between management and unskilled work has significant effects on labour markets.

- Industrial production has become quite widely globalized, as information technology enables teams of employees to work on projects collectively from diverse locations; employers in areas of high labour costs outsource design, customer management and back office functions to contractors in areas of lower labour cost; and industrial products (hardware and software) can be assembled from components manufactured or developed in different world regions.

- Supply chain relationships have been further transformed by information technology. The automation of customs administration, integrated border management and the introduction of ICT-enabled port and airport community systems have expedited the flow of goods along trade routes, reducing delays and costs, and enabling more efficient and cost-effective management strategies such as just-in-time delivery. Consignments can be tracked securely using radio-frequency identification (RFID) and other ICT-enabled security devices. Producers—from large firms in the United States to small farmers in Africa—have developed more intensive and more interactive relationships with supplier and customer partners along supply chains by using modern telephony, the Internet and other new communications resources.

- The ICT sector itself has become a significant part of many economies. The manufacture of ICT products is important in countries from Finland to China. Business process outsourcing has become significant in parts of India, the Philippines and elsewhere. In all but a handful of countries, the communications sector has created new markets (computer maintenance, Internet service provision, cybercafés, etc.) and provides jobs for large numbers of people, both highly skilled (such as computer programmers) and low-skilled (such as phonecard vendors).

- Financial markets have been transformed by electronic trading. On the one hand, this has made access to financial markets—capital markets, equity markets, commodity markets, currency markets—much more open. On the other, it has made them more volatile, as new forms of trading, including automated trading, can generate rapid and unpredictable swings in market values. For some commentators, this has destabilized these markets, leading to higher levels of risk (including risk of catastrophic failure), and giving greater economic power to speculators at the expense of economic planners and business managers. More positively, at the other end of financial services, mobile banking and transactions have enabled small businesses in some developing countries to access capital and manage transactions much more effectively.[7] The spread of mobile banking into remittances has great potential for facilitating the myriad small-scale capital movements that, collectively, worldwide, now outstrip large-scale foreign direct investment in total value.

- ICTs have enabled major changes in the ways that businesses are run. Most administrative functions are now computerized, in almost all businesses in industrial countries and in large and medium-sized businesses in developing countries. Small businesses, in particular, are able to use software to analyze business activity in ways that would previously have required accounting expertise. On the other hand, continuous availability online and through mobile phones has undermined the boundaries between work and leisure, and altered relationships between employers and employees.

- There has been significant growth in independent working (self-employment) and homeworking (by employees and self-employed) as a result of improved communications. This has enabled those who are in a position to take advantage of them to vary working patterns in order to suit different lifestyle needs and preferences. Some organizations, including international organizations, are now based around virtual homeworkers rather than conventional office spaces. Although homeworking and telecommuting have not taken off to the extent that was once anticipated, and although not all jobs by any means are suitable, they are likely to become increasingly widespread, with increasingly significant impacts on family structure, working hours and, ultimately, settlement patterns.

- Consumers have an increasing range of options for buying products and services, which has altered relationships within consumer markets. The opportunity to compare prices and goods online has introduced a new layer of competition to many markets. It has undermined long-established retail sectors (especially for books and music, also strongly affected by the enhanced opportunity to share goods digitally without purchase), and may well reinforce the decline of traditional shopping venues (high streets and malls). Online purchasing makes it easier for consumers to access a wider range of goods and services, bypassing the limited market ranges that conventional retailers could offer, especially in rural areas (and also bypassing legal constraints, for example, in purchasing pornography or pharmaceuticals). Large secondary markets have developed, in which individuals and businesses trade goods between one another (for example, auction sites). The growth in international online trade has challenging implications for consumer law and protection and has also offered increased scope for fraud.

These ICT-enabled trends have had a substantial impact on the dynamics of the world economy, contributing substantially to globalization, the diversification of products and services and the growing predominance of service sectors and trade in services. They have interacted with other economic trends, including the dynamic investment

---

[7] The best-known example of this is Kenya, where the M-PESA mobile transaction service has been particularly successful. However, relatively few countries have seen Kenya's level of dynamic growth in mobile transactions.

profiles of countries such as Korea and China, the growth of industrial production and consumer markets in regions such as South Asia and South America, and the differential impact of the 2007ff economic downturn on different world regions. What impact have these changes in production and consumption patterns had on the sustainability of economic development? What prospects are there for the future arising from them and the likely further evolution of information and communications technologies?

6.2   Social Development

ICTs and the Internet have likewise had substantial impacts on social relationships and social development in the 25 years since sustainability was defined by the Brundtland Commission. The social dimension of its definition emphasized poverty reduction, improvements in the quality of education, health, housing and other aspects of individual and community welfare, and enhancements in the quality of social interaction, engagement and empowerment. ICTs and the Internet are widely claimed to have had or to enable transformative impacts on access to some critical welfare and livelihoods resources, and to enable greater empowerment and engagement in society. "Information" and "interaction" might be considered the two keywords defining these impacts. They have accentuated individual choice and opportunity, and led to significant restructuring of social relationships. As with economic development, there is space only to mention some of these substantial changes in social structures here, rather than to offer full analysis.

- The Internet has comprehensively changed the ways in which individuals and organizations can access information, conduct research and exploit the work of others to meet their requirements. The most startling feature of this is access to information. At the time of the Brundtland Commission, access to public information was limited to what was formally published and made available through outlets accessible to the citizens concerned (such as broadcasting, newspapers, magazines and public libraries). Access beyond this was highly constrained, whether for journalists and professional researchers or for ordinary citizens. The Internet has made vast resources of information freely available. As a result, information overload has become a more substantial problem for many users than information deficit.

- The Internet has enabled citizens to bypass legal constraints and social norms that would previously have inhibited aspects of behaviour. By extension, it has arguably brought about changes in legal constraints and altered social norms. Bypassing historic constraints in some contexts is uncontroversial—for example, in the way that online shopping overcomes inequalities in access to goods and services. In others, it is controversial and/or problematic. Examples include widespread non-compliance with copyright, which undermines the sustainability of intellectual property rules, and widespread access to pornography, which was previously constrained by a mixture of legal rules and social norms. As well as undermining these specific constraints, it can be argued that the ability to bypass legal and normative constraints on the Internet has undermined the effectiveness of both types of constraint within society as a whole.

- New media, and especially Web 2.0 developments on the Internet, have changed the relationship between content and its users. In the past, citizens were overwhelmingly consumers of content, which was broadcast or published for them by actors operating within certain constraints (proprietorial and advertorial influence, production costs and the need to recover them through sales, political or cultural content regulation, self-censorship). In the Web 2.0 era, anyone who is online can publish anything, in their own names or anonymously: consumers have become "prosumers," "bloggers," critics. Publishing content, and publicizing one's views, has

therefore become much more democratic, in the sense that there are more and more diverse voices available, and this in turn has reduced the authority of established media and other sources. However, at the same time, people have become more able to select the voices that they want to hear, and so greater diversity in the availability of content does not mean that individuals necessarily experience greater diversity of content. It has also reduced the communal experience of news and entertainment that was once the norm.

• New opportunities for communications have changed relationships between individuals and communities. The near ubiquity of mobile telephones means that, for the first time, the majority of adults worldwide can communicate with one another immediately and at a distance. The ability to do this has radically affected individuals' social relationships and community identities, which can much more easily become rooted not in geography but in self-selecting groups of people who are located in many different places. This might be described as the individuation of communal identity, and it has widespread implications not just for friendship groups but also for people's identity with where they shop or how and where they vote. The abolition of distance as a constraint to communication has also significantly affected the interaction between diasporas and their home communities, accelerating and intensifying exchanges of information that once took weeks and relied on the physical movement of people.

• At the same time, it is suggested that reducing the distance between those who live apart has increased the distance between those who share the same family or domestic space. The proliferation of digital devices and applications that are now available has resulted in people spending much more time interacting with devices and communicating with those from whom they live apart at the expense of communication with those who share their homes. Individuals and their social networks are becoming dependent on digital devices. Social networking sites such as Facebook and Twitter have intensified this readjustment of family and other physical relationships. Sociologists and psychologists are increasingly interested in two other phenomena that are associated with high levels of time spent interacting online: the prevalence and uncertain impact on effectiveness and relationships of what is usually called "multi-tasking," and anxieties related to "digital addiction."

• New opportunities for self-expression seem to be changing attitudes towards interaction between individuals, and towards the balance between the rights and responsibilities of citizens. The quality of public debate, in many countries, is much harsher in the blogosphere, where journalistic conventions such as validation don't apply, than in traditional media. Online anonymity has enabled political activists to organize more freely in conditions of repression, but it has also divorced online content authors from the consequences of their writing. The balance between rights and responsibilities lies at the heart of relationships of trust and confidence. The nature of trust between individuals who communicate mostly online and at a distance may be substantially different from that between individuals who have become familiar through physical contact.

• Privacy is another area in which online behaviour appears to be shifting from previous social norms. Online, and especially social networking, behaviour seems to have made people less protective of their personal information and identities, while also giving them more opportunity to edit the identities that they themselves project. Digitally networked societies may be less discreet than those before them. This may offer more space for individuals, especially the young, to escape constraints imposed by families or religious communities. Businesses, employers and government agencies, meanwhile, can gain much more information than before

about individual behaviour, mining data derived from many different sources, which can then be used for purposes that may be considered more or less benign (planning public services, for example, or tracking the contacts of political activists).

- Lastly, the advent of a predominantly online society, which now exists in many industrial countries, is changing the nature of social exclusion. Those who remain offline are disadvantaged in terms of access to much of what the rest of society has come to take for granted. Digital exclusion tends to coincide with and exaggerate other forms of exclusion resulting from poverty, ethnicity, gender, age and disability. If this is so, the digital age may intensify exclusion of those who are economically and socially most marginal, a trend that, evidence suggests, will be exacerbated rather than reduced by efforts to force the marginal online.

The changing nature of citizens' relationships with other actors in society is at the heart of many of the social developments discussed above, which reflect the outcomes of changes in discussion paper, communications and the Internet. One critical relationship, between the citizen and the state, is discussed further below. Other relationships that may be changing systemically include those between individuals and their families, friends, professional associates, employers and the businesses and service providers with whom they interact. New media and the Internet empower individuals, not least to do what was previously impossible or forbidden, and enable new forms of social association. The question is whether they do so sufficiently to require rethinking of the social structures that relate to sustainability.

6.3   Environmental Protection

The impact of ICTs and the Internet on the environment has been explored, not least in previous IISD publications,[8] using the analytical framework developed by the Forum for the Future and described earlier in this discussion paper. The third order effects identified in that framework are, essentially, those impacts on economic and social development, cultural diversity and governance, which are discussed separately in this section. The results from analyzing first and second order effects, which are considered here, are mixed, and there is disagreement about their relative importance.

Net first order effects of ICTs on environmental sustainability are generally considered negative. The production and manufacturing of ICT products, including computers and mobile phones, is carbon-intensive and uses some scarce resources, notably coltan (whose mining has also had significant negative second order effects in the form of armed conflict and land degradation in parts of Africa). The rapid growth in the number of terminal devices (telephones, televisions, computers and peripherals) used by individuals, and the high turnover rate for devices (typically under three years) that results from continuing technological development have led to substantial and growing problems of electronic waste disposal, including that of toxic waste.

The most damaging long-term first order effects of ICTs on the environment, however, are probably those concerned with greenhouse gas emissions. The ICT sector is the fastest growing contributor to emissions, currently contributing around 2.25 per cent of total emissions but with a compound annual growth rate of around 6 per cent (The Climate Group for the Global eSustainability Initiative, 2008). This growing contribution is primarily driven by growth in the range of networks (which enables more devices to reach more users), in the number of devices that are used by individuals and organizations, in the amount of time for which each device is used, in the amount of electrical power required to enable increased access, and in the dependence of individuals and organizations on digital devices. A

---

[8] See, for example, Souter et al. (2010).

significant secondary factor is the growth in data centres (which are highly dependent on power for air-conditioning) that is associated with greater use of services and applications, including the advent of cloud computing (though this may also lead to lower power consumption by terminal devices).

Second order effects of ICTs on environmental sustainability are generally expected to be more positive. They are anticipated in two main areas. One is dematerialization: the displacement of physical goods by virtual goods and of physical travel by videoconferencing, telecommuting and other virtual activity. The other consists of improvements in the efficiency and coordination of economic activity, particularly the generation and distribution of electrical power, the management of transport and other logistics, the design and construction of buildings, and the remodelling of equipment to maximize energy and human efficiency.

The industry-led Global eSustainability Initiative (GeSI) estimates that the accumulated savings in emissions from dematerialization and the introduction of "smart systems" should be substantially greater than the additional emissions resulting from the first order effects described above (The Climate Group for the GeSI, 2008). However, this optimistic assessment should carry two important caveats. First, while the negative first order impacts resulting from increased usage are effectively certain to occur, the second order effects described above are merely potential impacts: whether they are achieved will depend on decisions that are taken by utility and industry managers outside the ICT sector, on the basis of commercial viability rather than environmental sustainability. Second, the net impact of dematerialization is likely to be substantially influenced by rebound effects as, for example, reduced commuting time leads to more leisure travel and reduced prices for online goods lead to increased purchases.

The ICT sector's own impact on environmental protection is already substantial and growing in importance. Its certain and rapidly growing contribution to waste and greenhouse gas emissions need to be factored into strategies for sustainability. Such strategies can likewise promote or discourage the development of smart systems (which will have most impact in industrial countries and large emerging economies with rapidly growing energy requirements). Finally, ICTs also have significant potential for climate change adaptation, particularly in collating, analyzing and disseminating information on weather, land and water resources. Increased attention to climate change has already required changes in our understanding of sustainability since the Brundtland definitions of 1987. The questions that arise for this discussion concern how far these various ICT-related factors require further changes in thinking about the nature of environmental sustainability in the information age.

6.4   Cultural Diversity

As well as the three main elements of the sustainability framework discussed above, discussions of sustainability have paid significant attention to issues of cultural diversity and governance. Some issues related to cultural diversity have already been mentioned—for example, the ways in which ICTs and the Internet have changed the dynamics of relationships between diaspora and home communities, or their potential to enable more rapid transfer of remittances.

The most substantial questions about ICTs and cultural diversity are probably those concerned with the relationship between individual cultures and emerging global cultural norms. These are not new questions. Debates about a New World Information and Communication Order in the 1970s and 1980s, before the Internet became significant, pivoted on anxieties in some countries about the hegemonic power of global media businesses and the predominance of cultural products and values from particular countries and regions. Cultural issues of this kind have moved on substantially from the controversies of the 1980s. Bollywood and Nollywood are now as powerful, in their regions, for example, as

Hollywood. The costs of publishing content have fallen drastically, particularly since the advent of Web 2.0, making diversity cheap for those who wish to share content or just to access it. Concerns about linguistic dominance have been addressed within the ICT sector, especially the Internet, by incorporating multilingualism in mechanisms like domain name systems.

There remains, however, an evolving and dynamic relationship between two trends in the cultural impact of ICTs and the Internet. On the one hand, as a global medium, the Internet enables global access to content which stimulates the development of global brands, including cultural brands such as Lady Gaga, Manchester United and the BBC. A small number of website platforms, including Google, Facebook, Wikipedia and Twitter, have achieved global predominance, at least in the short term. However, as well as representing globalization, these websites also represent a countervailing force to it because they widen access to content production and consumption, and so diversity. Most of the content on Facebook and Twitter, for example, is local rather than global in nature, irrespective of where it is produced (and of interest only to a few). Much the same could be said of file-sharing sites such as YouTube and Flickr. ICTs and the Internet appear, therefore, to be making world culture both more global and more local—or at least making global and local cultures both more visible to ever wider groups of people. Once more, the question is about how far this requires us to adjust our understanding of sustainability.

6.5   Governance

The final element of sustainability that seems susceptible to the impact of ICTs and the Internet is governance. As with economic and social development, a number of different factors are important, which can only be summarized briefly here.

- The role of government itself has been questioned by some advocates of new media, particularly the Internet. Libertarian ideas were quite widely held among early technical pioneers of the Internet, and most famously expressed in John Perry Barlow's *Declaration of Independence of Cyberspace*.[9] Although not many share Barlow's gleeful assertion of the Internet as a means to bypass government, he and others have pointed to an important truth: that the global nature of the Internet and the anonymity of much Internet use make it easy for those who wish to do so to ignore laws that they find inconvenient and hard for governments to enforce them (irrespective of public wishes for or against enforcement). Intellectual property law is a particular case in point. Asymmetries have been emerging in the rule of law, particularly the authority of legal agencies and enforceability of laws online and offline. These asymmetries are implicitly inequitable and seem unlikely to be politically sustainable in the longer term.

- The Internet itself is governed very differently from traditional media and other public policy domains, emphasizing multistakeholder participation and consensus, while eschewing intergovernmental arrangements and state-controlled regulation of the kind found in telecommunications and broadcasting. These alternative governance norms have proved challenging for governments and intergovernmental organizations, and are particularly difficult at the interfaces between Internet governance and governance of other public policy domains that are highly affected by the Internet (such as crime and security, taxation and consumer law).

---

[9] Available, with its original political introduction, at http://w2.eff.org/Censorship/Internet_censorship_bills/barlow_0296.declaration

- The Internet, mobile telephony and social networking have greatly extended the ability of political groups to organize activities, with especial significance in countries where freedoms of expression and association have been suppressed. They have, for example, been credited with significant impact in the Arab Spring and other recent protest movements. While their impact is sometimes exaggerated—the English, American, French, Russian and Chinese revolutions, after all, took place before the Internet—it is nevertheless clear that new media have altered the dynamics of political activity, protest and civil disobedience.

- Likewise, by extending access to information and offering individuals and groups new means to exercise freedom of expression, new media have increased the potential that is available for people to participate in government. Wider publication of official data and freedom of information tend to increase transparency and accountability. More opportunities for freedom of expression make it more difficult for governments to censor political comment (or to prohibit sexual or other content that is held to violate local/national cultural norms). These changes are widely celebrated in the Internet community, and they have changed the scope and parameters of political activity. They have also given the boundaries of information rights and freedom of expression renewed prominence in political debate.

- Discussion about new media and freedom of expression exemplifies a number of issues surrounding rights. The international rights regime—the Universal Declaration, the international Covenants and regional Conventions—dates from before today's media and communications environment. Article 19 of the Universal Declaration of Human Rights declares the right "to seek, receive and impart information and ideas through any media and regardless of frontiers" (United Nations, 1948). A medium such as the Internet is implicitly covered by this article, yet a medium as all-encompassing and ubiquitous as the Internet was not envisaged at the time the Declaration was agreed. Interpretation of this article is therefore challenging. Extensive interpretations have argued that it implies a right of access to the Internet, and therefore an obligation on governments to provide that access (and indeed broadband access). Confusions have arisen between human rights (as endowed by the Declaration and Covenants), civic rights (which are endowed by governments and constitutions) and consumer rights (which are granted in law).[10] Some have argued that the increased significance of information and communications technology today requires the incorporation of a new "right to communicate" in international law.[11] Others have proposed new sets of "Internet rights."[12]

- The changing ICT context has not just raised questions about the meaning of individual rights. It has raised questions too about the balance between different rights that are included in the rights regime. For example, new media have greatly increased the capacity of most people to exercise freedom of expression, beyond what was imagined when the international rights regime was formulated in 1948. Other articles in the Universal Declaration, Covenants and Conventions protect rights that are in balance with freedom of expression, such as the right to privacy, a right to protection against defamation and the right to benefit from intellectual property. Other international rights instruments require governments to protect people against racial hatred and children against sexual abuse. All international rights instruments include clauses reflecting the principle set out in Article 29 of the Universal Declaration that the exercise of individual rights can be limited by law "for the

---

[10] See, for example, debates in the Internet community following a January 12, 2012, *New York Times* column by Vint Cerf, Internet access is not a human right, available at http://www.nytimes.com/2012/01/05/opinion/internet-access-is-not-a-human-right.html?_r=1.

[11] See, for example, C.J. Hamelink & J. Hoffmann (2008). The state of the right to communicate, *Global Media Journal*. Retrieved from: http://lass. calumet.purdue.edu/cca/gmj/fa08/gmj-fa08-hamelink-hoffman.htm.

[12] See for example, Association for Progressive Communications, *APC Internet Rights Charter*, available at http://www.apc.org/en/node/5677.

purpose of securing due recognition and respect for the rights and freedoms of others and of meeting the just requirements of morality, public order and the general welfare in a democratic society," the meaning of which is clearly open to interpretation. The question that arises is whether our understanding of the international rights regime needs to change in the light of these implications of new media.

- Finally, recent years have seen a range of questions arise about the relationship between security, surveillance, rights and privacy. The international rights regime requires governments to protect "life, liberty and security of person." Since 2001 governments have been particularly concerned with the threat of terrorism, and prepared to use electronic surveillance to gather information and otherwise "protect national security." The Internet itself has raised new security challenges for both governments and citizens, from the threat of disruption to the Internet itself (e.g., distributed denial of access attacks) to new forms of criminality (cybercrime). The means that are available to governments to address criminality and security threats in the context of new media are essentially the same instruments as those that governments can/could use to suppress dissent or deny freedom of expression or association. The question that arises here is whether we need a new understanding of the relationship between security and rights, which helps to determine what measures are legitimate in what contexts.

7.0 ICTs, the Internet and Sustainable Development: Questions for Discussion

This discussion paper has sought to provide a frame of reference for discussion about the relationship between ICTs, the Internet and sustainable development. Its purpose has been to raise questions, not to draw conclusions. The two interviews that are published alongside this discussion paper offer perspectives on some of the issues raised in it from two leading figures in the global sustainable development and Internet communities. They provide a basis for further comment and discussion.

As mentioned earlier, this IISD project is concerned in particular with three questions:

- What impacts are new media and the Internet having on the achievability of the core elements of sustainability identified earlier in this discussion paper—economic and social development, environmental protection, cultural diversity and governance—and on the balance between them?

- To what extent do these impacts enhance sustainability and to what extent do they, on the contrary, raise new sustainability challenges?

- Do the economic, social, political and cultural implications of these impacts imply that we need to revise, rethink or readjust our understanding of what sustainability means from the ways in which it was defined in 1987/1992, before today's information and communications technologies became available?

Comments and contributions on these and other aspects of the relationship between ICTs and sustainable development are invited from anyone with an interest in these important issues.

8.0   Reference List

Barlow, J.P. (1996). *Declaration of independence of cyberspace*. Retrieved from: http://w2.eff.org/Censorship/Internet_censorship_bills/barlow_0296.declaration

Climate Group for the Global eSustainability Initiative. (2008). *SMART 2020: Enabling the low-carbon economy in the information age*. Retrieved from: http://www.smart2020.org/_assets/files/02_Smart2020Report.pdf.

Forum for the Future. (2002). The impact of ICT on sustainable development. *European Information Technology Observatory*. Retrieved from: http://homepage.cs.latrobe.edu.au/sloke/greenIT/eito_forum_2002.pdf

Independent Commission for World Wide Telecommunications Development. (1985, January 22). *The missing link*. Retrieved from: http://www.itu.int/osg/spu/sfo/missinglink/The_Missing_Ling_A4-E.pdf

International Telecommunication Union. (2010). *World telecommunication development report 2010: Monitoring the WSIS targets – A mid-term review*. Retrieved from: http://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-WTDR-2010-SUM-PDF-E.pdf

International Telecommunication Union. (2011). Key global telecom indicators for the world telecommunication service sector. Retrieved from: http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html

OECD. (2011). *Towards green growth: A summary for policy makers*. Retrieved from: http://www.oecd.org/dataoecd/32/49/48012345.pdf

Rockström, J., Steffen, W., Noone, K., Persson, A., Chapin, F.S., Lambin, E., et al. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society, 14*(2). Retrieved from: http://www.ecologyandsociety.org/vol14/iss2/art32

Souter, D., MacLean, D., Creech, H. & Akoh, B. (2010). *ICTs, the Internet and sustainable development: Towards a new paradigm*. Winnipeg, MB: IISD.

Swanson, D. & Bhadwal, S. (2006). *Adaptive policy-making: Designing policies in a world of uncertainty, change and surprise*. Winnipeg, MB: IISD

United Nations. (1948). *Universal declaration of human rights*. Retrieved from: http://www.un.org/en/documents/udhr

UNEP. (2011). *Towards a green economy: Pathways to sustainable development and poverty eradication*. Retrieved from: http://www.unep.org/greeneconomy/Portals/88/documents/ger/ger_final_dec_2011/1.0-Introduction.pdf

World Bank. (2012, May 23) *World development indicators*. Retrieved from: http://www.google.co.uk/publicdata/explore?ds=d5bncppjof8f9_&met_y=ny_gdp_mktp_cd&tdim=true&dl=en&hl=en&q=world+gdp

World Commission on Environment and Development. (1987). *Our common future*. Retrieved from: http://www.un-documents.net/wced-ocf.htm