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ICT FOR A GLOBAL SUSTAINABLE FUTURE

PARADISO REFERENCE DOCUMENT
MARCH 2009

PREPARED WITH THE SUPPORT OF THE EUROPEAN COMMISSION
(DIRECTORATE GENERAL INFORMATION SOCIETY AND MEDIA)

EXECUTIVE SUMMARY

The PARADISO initiative has been launched by SIGMA ORIONIS and the CLUB OF ROME, and supported by the European Commission's DG INFORMATION SOCIETY AND MEDIA of the EUROPEAN COMMISSION through the FP7 research funding programme, as one of the projects selected in the framework of THE FIRE INITIATIVE.

PARADISO is an acronym formed by the two words PARADIgm and SOcietal, and an obvious reference to a better world…

The PARADISO vision is that:

- In order to avoid major future crises and ensure the sustainable development of their societal models, all countries (developed, emerging, and developing ones) will need to agree, sooner or later, on an alternative way forward, based on significantly revised social, environmental and economic objectives: a true sustainable development, a more sustainable economic growth, more equally shared resources, eventually the well-being of peoples around the world, measured through a "beyond GDP" index.
- Information and Communication Technologies (ICT) will play not only an instrumental but a decisive role in this "other future" and it is therefore necessary to identify which innovative ICT applications, infrastructures, products and services can usefully be explored in the short and medium term in order that suited solutions can be made available in the perspective of the envisioned disruptive societal paradigm.

The present document is a deliverable of the FP7 PARADISO project coordinated by Sigma Orionis and furthers develops this vision.

It has been prepared on the basis of:

- The information available at the level of the PARADISO partners,
- The outputs of the two events that the project has organised,
- The contributions received through a consultation launched on the PARADISO WEB SITE.

The first PARADISO event was a scientific workshop, held at the European Commission in Brussels on June 12-13, 2008, and attended by 40 experts in societal developments and ICT research from all regions of the world. The second event, the "ICT for a global sustainable future" conference, took place in Brussels on January 22-23, 2009 under the aegis of the European Commission and with the support of many international organisations (OECD, UNESCO, ITU, etc.). It is estimated that over 800 persons from around 70 countries followed the event, either from the event venue or online (a selection of keynote speeches presented at this conference has been reproduced in Annex). This conference provided in particular a key opportunity to bring the message towards, if not having it endorsed by, the various political instances of the European Union.

The first chapter of the document analyses the profound changes the world has experienced during the twentieth century, and particularly during the last few decades, and the increasingly complex issues, unprecedented in the history of mankind, that the world is facing today. These changes have been driven by a number of facts and factors, many of them inter-correlated, the most important ones probably being the growth of the worldwide population (and the changes in its structure), the globalization of markets (trade, monetary, and financial aspects), the new balance of world power pushed by emerging economies, the increased use of world resources and of human impact on the environment, and the overwhelming dimension of Information and Communication Technologies.

The second chapter first gives an overview of the various multilateral organizations that exist to foster dialogue aiming at addressing the changes introduced in the previous chapter and the other challenges the world is facing. It also summarizes the progress made during the last decade in the exploration and definition of "beyond GDP" indexes, in order to measure the progress of societies towards a more sustainable future. It is then argued that considering the risks of major breakdowns that exist today worldwide (on economic, environmental and social issues), the present efforts that can be most often characterized by "business as usual" solutions are not appropriate, and that, sooner or later, all countries will have to agree on an alternative way forward. The scenarios for this foreseeable paradigm shift are investigated and the potential role the European Union can play in pointing the way to this "other future" is underlined.

The third and last chapter first addresses the current role of ICT in general and of the Internet in particular in all human activities, underlining that they have become one of the key drivers of the social and economic development of many societies worldwide. After having evoked the progress expected in the ICT area, it is then assessed that ICT can become instrumental and decisive in moving forward the paradigm shift detailed in the previous chapter. A set of ICT research areas that could be usefully explored in this context is then suggested.

The authors of this document are aware that, after one year of activities, only partial results have been reached, and that a lot remains to be done in order that:

- The PARADISO key messages (a foreseeable paradigm shift worldwide in the definition of societal progress, the proactive role Europe can play to show the way to this better future, the central contribution ICT can bring to achieving revised economic, environmental and social objectives) can be conveyed to the widest possible community and eventually have a true impact on the political agenda.
- The ICT research areas to be explored in the short term so that suited solutions can be made available in the future can be fully investigated and specified.

They are committed to continue their efforts in close liaison with all interested stakeholders so that synergies can be exploited and that the impact of all initiatives can be even greater and best serve the building of a true sustainable future for all peoples around the world.

In particular, contributions submitted on the PARADISO WEB SITE will still be welcomed in the future, so that the inputs from the largest number of individuals and organisations having an interest in the addressed topics can be taken into account when preparing revised versions of the present document.

For any further information you may need or suggestions you may have, please visit the PARADISO WEB SITE or contact ROGER TORRENTI of Sigma Orionis, or ROLAND BURGER of the Club of Rome.

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ABBREVIATIONS

ASEAN	Association of Southeast Asian Nations
AU	African Union
BEPA	Bureau of European Policy Advisers
EIA	Energy Information Administration
ETP	European Technology Platform
ETSI	European Telecommunications Standards Institute
EU	European Union
FIA	Future Internet Assembly
FAO	Food and Agriculture Organization of the United Nations
FIRE	Future Internet Research and Experimentation
FP7	EU's 7th framework programme for research and technological development
GAID	Global Alliance for ICT and Development
GDP	Gross Domestic Product
GNH	Gross National Happiness
GPI	Genuine Progress Indicator
HDI	Human Development Index
ICT	Information and Communication Technologies
IEA	International Energy Agency
IETF	Internet Engineering Task Force
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
JTI	Joint Technology Initiative
MDG	Millennium Development Goals
NSF	National Science Foundation
OECD	Organisation for Economic Co-operation and Development
QoS	Quality of Service
SWB	Subjective Well-Being
TUAC	Trade Union Advisory Committee to the OECD
UN	United Nations
UNCTAD	United Nations Conference on Trade And Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNHDR	United Nations Human Development Report
WSIS	World Summit on the Information Society
WTO	World Trade Organization
WWRF	Wireless World Research Forum
WWF	World Wide Fund for Nature

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INTRODUCTION

The present document is a deliverable of the "PARADISO FP7 project", a project coordinated by SIGMA ORIONIS, involving the CLUB OF ROME, and supported by the DG INFORMATION SOCIETY AND MEDIA of the EUROPEAN COMMISSION through the FP7 research funding programme (see project fact sheet below).

It aims at exploring a disruptive paradigm consisting in a new concept of progress that developed, emerging, and developing countries would share sooner or later, aiming at a true sustainable development, a more sustainable economic growth, more equally shared resources, and eventually the well-being of peoples around the world, measured through a 'beyond GDP' index.

The document also investigates the role that Information and Communication Technologies (ICT) can play in the hypothesis of such global societal developments, and derives a first set of research areas which could usefully be explored in the short term (namely in the field of network and service infrastructures or "the Future Internet") so that suited solutions can be made available in the future.

The content of the document is based in particular on the outputs of two PARADISO events held in Brussels in June 2008 (the "PARADISO scientific workshop") and in January 2009 (the "ICT for a global sustainable future" conference - see in Annex a selection of keynote speeches presented at this conference), and on the contributions received to date following the open consultation launched on the PARADISO WEB SITE.

Online contributions will still be welcomed in the future, so that the inputs from the largest number of individuals and organisations having an interest in the addressed topics can be taken into account when preparing revised versions of the present document.

For any further information you may need or questions you may have, please CONTACT US.

FACT SHEET OF THE PARADISO FP7 PROJECT

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The PARADISO PROJECT has been selected at the first Call for proposals of the FP7 RESEARCH FUNDING PROGRAMME of the European Commission and has developed its activities over the period March 2008 - February 2009. It was one of the FIRE projects supported by EUROPEAN COMMISSION'S DIRECTORATE GENERAL INFORMATION SOCIETY AND MEDIA.

FIRE stands for Future Internet Research and Experimentation: THE FIRE PROJECTS aim at answering a need for advanced experimentally-driven research including large scale experimentation to discover the technical, societal, and economic implications of changes to the Internet.

The PARADISO project, elaborated during the first half of 2007 (well before the present worldwide financial and economic crisis started to develop), has focused on the identification of strategic research directions in the area of network and service ICT infrastructures, in the hypothesis of a disruptive paradigm concerning global societal developments.

ICT stands for Information and Communication Technologies.
PARADISO is an acronym formed by the words PARADIgm and SOcietal, and an obvious reference to a better world…

This possible paradigm shift, which more and more analysts are evoking (particularly when considering the impact of today's worldwide crisis), is based on the vision that, in order to avoid major future crises, all countries (developed, emerging, and developing ones) will need to agree, sooner or later, on an alternative way forward. The European Union is probably one of the best placed world powers to proactively promote such a new concept of progress, based on (significantly) revised social, environmental and economic objectives: a true sustainable development, a more sustainable economic growth, more equally shared resources, eventually the well-being of peoples around the world, measured through a "beyond GDP" index.

The PARADISO project has explored this possible disruptive paradigm, investigated what such a future would precisely be, and evaluated the conditions for this vision to become reality.

Moreover, the project has specifically taken into consideration the role that ICT could and would play in this "other future". The rationale of this ICT focus is the fact that ICT can, whichever societal model is considered, fully contribute achieving sustainable development, prosperity, and economic growth. Therefore, ICT applications and services needed to support new social, environmental and economic objectives related to the envisioned disruptive paradigm have to be analyzed. More precisely the network and service infrastructures, enabling such ICT applications and services, have to be identified.

This is why the PARADISO project has also investigated the role that ICT can play in the hypothesis of new global societal developments, and has striven to derive strategic research areas that can usefully be explored in the short and medium term in order that suited solutions can be made available in the future.

WORK PLAN OF THE FP7 PARADISO PROJECT

The project construction aimed at achieving results in the short term. The paradigm has been explored, and the innovative research topics identified, through a reference document, entitled "ICT for a global sustainable future", prepared on the basis of:

- the information available at the level of the partners of the PARADISO project,
- the outputs of the two events that the project has organised,
- the contributions received through an online consultation.

The first event organised by the PARADISO project was a scientific workshop, held at the European Commission in Brussels on June 12-13, 2008, and attended by 40 experts in societal developments and ICT research from all regions of the world. It succeeded reaching its objectives: providing delegates with an opportunity to exchange views and to discuss the first version of the PARADISO reference document.

The second event, the "ICT for a global sustainable future" conference took place in Brussels on January 22-23, 2009 under the aegis of the European Commission and with the support of many international organisations (OECD, UNESCO, ITU, etc.). While an attendance of 150 delegates was anticipated at the start of the project, the registration process had to be closed 15 days before the event when the level of…. 800 delegates (from 70 countries) was reached. The event can be considered as having reached its two main objectives: further developing and validating the PARADISO vision and bringing the message towards, if not having it endorsed by, the various political instances of the European Union.

The final version of the PARADISO reference document has been released in March 2009 and widely disseminated so that the key PARADISO messages (a foreseeable paradigm shift worldwide in the definition of societal progress, the proactive role Europe can play to show the way to this better future, the central contribution ICT can bring to achieving revised economic, environmental and social objectives) can be conveyed to the widest possible community and eventually have a true impact on the political agenda.

In order to support the organisation of these two events and to ensure the greatest project impact, a lot of dissemination activities have been conducted by the PARADISO partners all along the project period, among which their participation in various external events such as IST Africa 2008 (June 2008, Namibia), the 2008 Korea-EU Cooperation Forum on ICT (June 2008, South Korea), the Club of Rome 40th anniversary events (June 2008, Italy), the FIRE launch event (September 2008, France), the IST 2008 event (November 2008, France), the GNH4 Conference (November 2008, Bhutan), and the Future Internet Assembly meeting (December 2008, Spain).

PARADISO activities have been implemented by two organisations offering complementary expertise and experience related to project issues: SIGMA ORIONIS (project coordinator) and the CLUB OF ROME (through the Aurelio Peccei Foundation, its Italian chapter). These two organisations are aware that if the achievements of the PARADISO project may constitute a milestone, a lot remains however to be done to really influence the political agenda and identify more into details the ICT research areas likely to contribute building a true global sustainable future.

They are thus considering, at the time when the present document was prepared, various options to further develop the activities of their cross-disciplinary and multi-stakeholder "think and action tank" addressing sustainable future issues with a focus on ICT. All options logically include a close connection with organisations involved in similar activities in Europe and in other regions of the world, so that synergies can be exploited and that the impact of all initiatives can be even greater and best serve the building of a true sustainable future for all peoples around the world.

For any further information you may need or suggestions you may have, please visit the PARADISO WEB SITE or contact ROGER TORRENTI of Sigma Orionis, ROLAND BURGER of the Club of Rome or the European Commission's PARADISO project officers: JACQUES BABOT and FABRIZIO SESTINI.

THE WORLD IS CONFRONTED WITH PROFOUND CHANGES

During the twentieth century, and particularly during the last few decades, the world has experienced profound changes, and is today facing increasingly complex issues, unprecedented in the history of mankind.

These changes have been driven by a number of facts and factors, many of them inter-correlated, the most important ones probably being the growth of the worldwide population (and the changes in its structure), the globalization of markets (trade, monetary, and financial aspects), the new balance of world power pushed by emerging economies, the increased use of world resources and of human impact on the environment, and the overwhelming dimension of Information and Communication Technologies.

The next paragraphs will focus on this set of facts and factors, and will not address other important facts (such as local or regional conflicts, the fall of the Berlin Wall, the collapse of the USSR, or the events of 9/11) that definitely characterise the last decades and have contributed to profound geopolitical changes but are less relevant when considering the objectives of the present document.

POPULATION GROWTH AND STRUCTURAL CHANGES

Since the beginning of the twentieth century, and more particularly since the 1950's, the world population has been growing at an unprecedented rate, reaching today a total of around 6.7 billion people (source US CENSUS BUREAU) and expected to reach around 9.5 billion people by 2050.

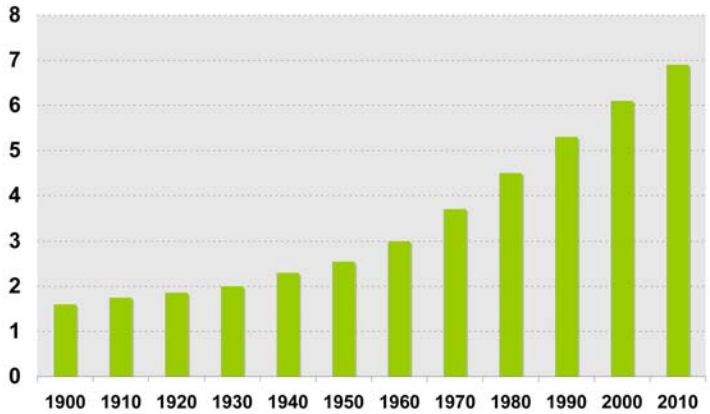

FIGURE 1: EVOLUTION OF THE WORLD POPULATION SINCE 1900 - US CENSUS BUREAU - 2008

This exponential growth has obviously influenced many other factors that will be analysed in the following paragraphs, such as the increase in the use of agricultural and mineral resources, and the impact of human activity on the environment.

Changes in the structure of the world population have been very important too:

- The greatest part of this growth occurred (see Figure 2) in less developed countries, a trend which has been confirmed for the next decades: the POPULATION REFERENCE BUREAU foresees for instance that, over the period 2005-2050, the population of Africa will increase by 117%, while the population of Europe will decrease by 10%.
    - The present rate of natural increase of the world population (the crude birth rate minus the crude death rate) is of 156 persons per minute: 4 of them in developed countries, and 152 of them in developing countries…
- The proportion of those living in urban areas (and particularly in urban areas of 10 million people or more) has significantly increased in the last decades (see Figure 3).
- Under the effect of an increased life expectancy and of a decrease in birth rate, the age pyramid of developed countries has entered a period of long-term structural change: from the post-World War II "baby boom" to the "Greying of Europe" (and of other regions of the world).

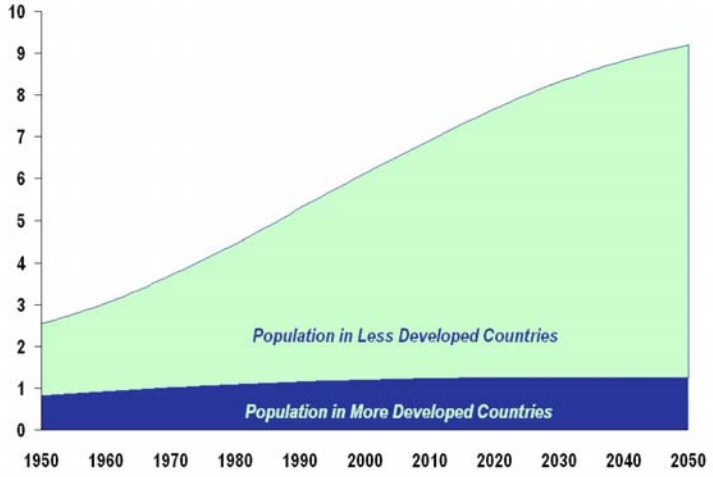

FIGURE 2: COMPARED POPULATION GROWTH OVER THE PERIOD 1950-2050 - POPULATION REFERENCE BUREAU - 2007

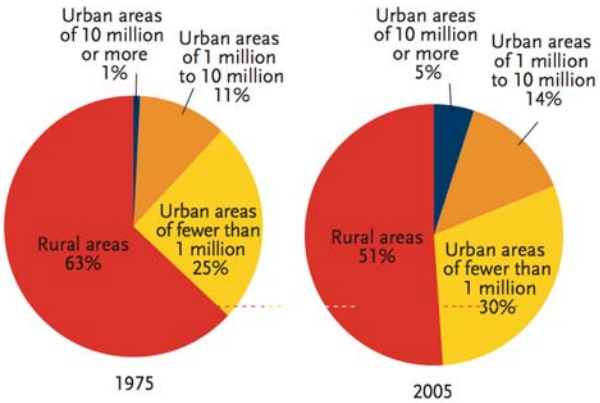

FIGURE 3: WORLD POPULATION LIVING IN URBAN AND RURAL AREAS - POPULATION REFERENCE BUREAU - 2007

MARKET GLOBALIZATION

International trade of industrial and agricultural products has developed at a very quick pace these last 50 years (see Figure 4), driven by advances in transport and communication, but first and foremost by the determination of market stakeholders (companies, governments) to extend the reach of their markets, and to build a world of more freedom: see for instance the EU vision of "four freedoms of movement": goods, services, people, and money.

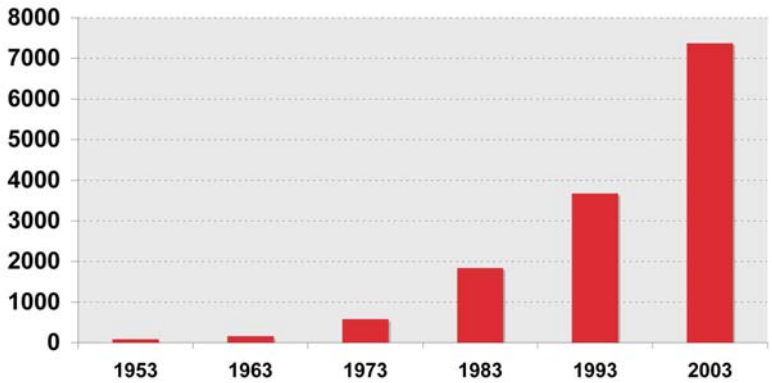

FIGURE 4: EVOLUTION OF WORLD MERCHANDISE EXPORTS (IN BILLION USD) SINCE 1953 - WTO - 2006

Regional free trade agreements such as the one developed by the European Union, by the Association of Southeast Asian Nations, or more recently by the United States, Canada, and Mexico (NAFTA), and worldwide agreements (particularly the General Agreement on Tariffs and Trade - GATT - established in 1947, from which the WORLD TRADE ORGANIZATION - WTO - was generated in 1995) are well-known drivers of these changes that today do not include only trade globalization but also, since the 90's, monetary and financial globalization.

EMERGING ECONOMIES

Taking full advantage of market globalization, China has, over the last two decades, expanded its economy at an impressive rate, followed by the other Asian giant, India, and also by Russia and Brazil. In 2003, this led THE GOLDMAN SACHS GROUP to start identifying the "BRIC countries" (Brazil, Russia, India, China), in their analyses, underlining in particular that their cumulated GDP should become greater than that of the G7 countries (Canada, France, Germany, Italy Japan, UK, and USA) in less than 30 years from now.

The present and expected economic development of these emerging economies, alongside that of the "Next Eleven" that Goldman Sachs has recently identified (Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam), are also logically accompanied by the increased financial and political role of all these countries in the global arena. This, naturally, has a direct influence on other changes analysed in this chapter, particularly on resources and environmental aspects addressed in the next paragraph.

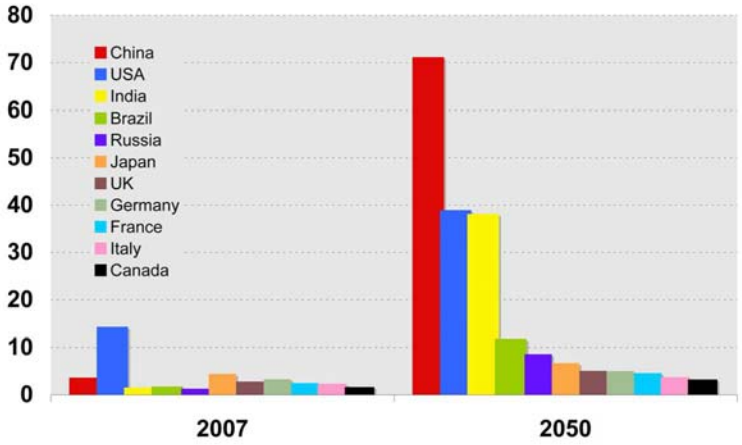

FIGURE 5: GDP OF BRIC AND G7 COUNTRIES FOR 2007 AND 2050 - GS DATA - 2007

INCREASED USE OF RESOURCES AND IMPACT ON THE ENVIRONMENT

The previous paragraphs have shown that, during the last 50 years, the world population has more than doubled, and that China and other emerging countries have experienced very fast economic growth, facilitated by a quickly developing market globalization.

A logical consequence of this increased human activity is a very important increase in the use of the earth's resources, leading in particular (see figures 6 and 7) to serious stresses in the energy sector and first signs of water scarcity, and to some worrying anthropogenic effects on the environment (see figures 8 and 9), in particular concerning the production of greenhouse gases (above all CO_2), and the decline in biodiversity (and more generally the impact on natural systems, among them fisheries).

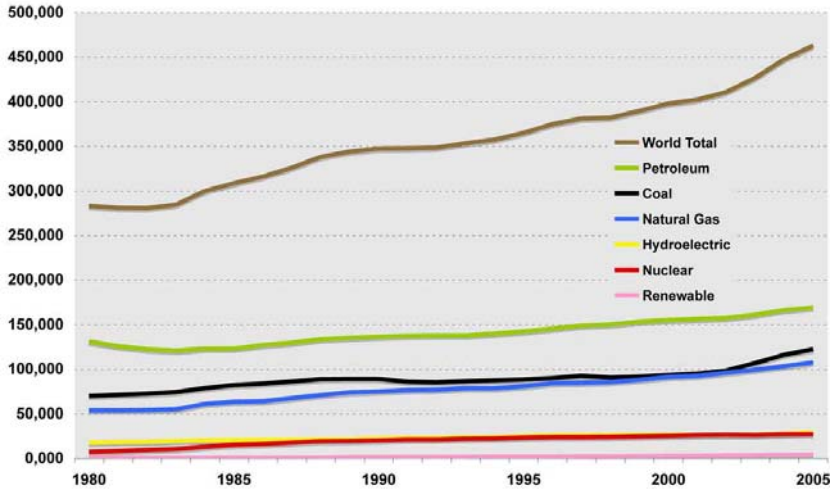

FIGURE 6: WORLD CONSUMPTION OF PRIMARY ENERGY SINCE 1980 (IN 10^{15} BTU) - EIA - 2007

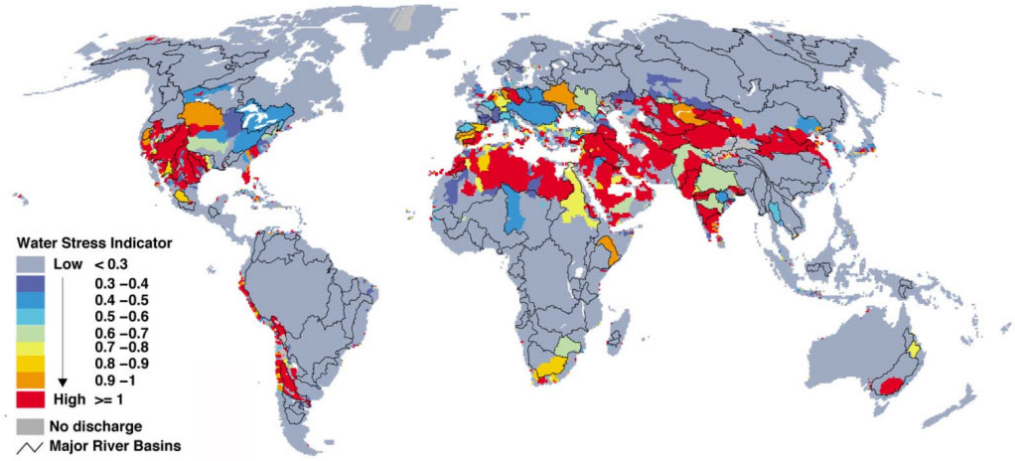

FIGURE 7: WATER STRESS INDICATOR - WORLD RESOURCES INSTITUTE - 2003

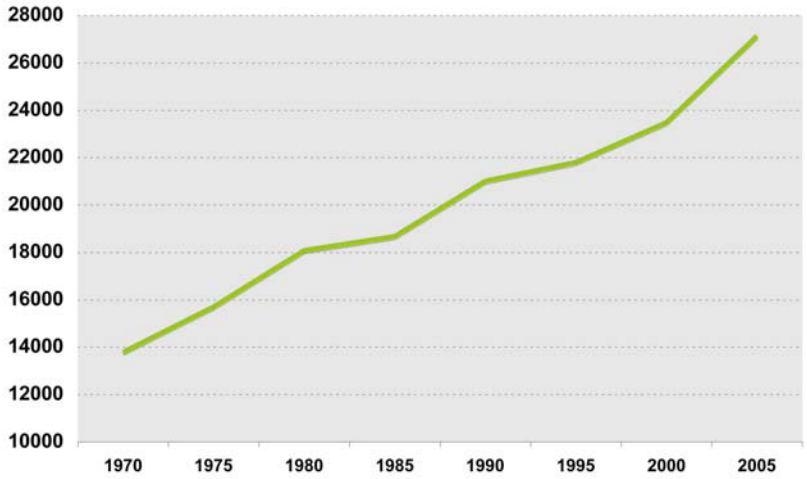

FIGURE 8: WORLD CO2 EMISSIONS - OECD DATA - 2008

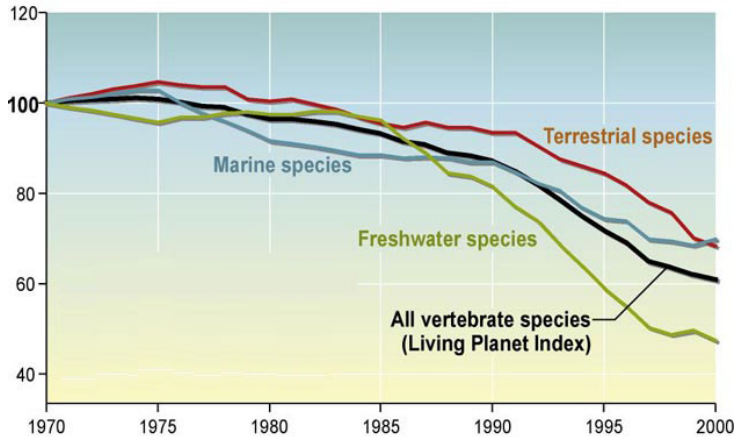

FIGURE 9: EVOLUTION OF THE LIVING PLANET INDEX SINCE 1970 - WWF - UNEP - WCMC

INFORMATION AND COMMUNICATION TECHNOLOGIES

The last fact and factor that will be analysed in the present chapter, the overwhelming dimension of the ICT domain, is not the least important one, even if it not systematically referred to when addressing the profound changes the world has experienced in the last decades.

Information and Communication Technologies have indeed, in less than twenty years, totally changed the way people can communicate, access information and knowledge, work, play, cope with health and safety issues, produce wealth, govern, control energy, protect the environment, etc. and this not only in more developed, but also in less developed countries.

The role of ICT in today's and tomorrow's societies will be analysed in detail in another chapter. At this stage, let us simply underline some figures:

- There are today around 1.5 billion Internet users in the world (nearly one fourth of the population).
- 4 billion people are mobile cellular telephone subscribers (over one half of the total population), China being the leading country with over 520 million subscribers, while over 1 billion mobile phones have been sold in 2008 in the world.
- Some recent Internet applications, such as SKYPE (voice over the Internet) or FACEBOOK (social networking), have expanded to hundreds of million users in just a couple of years.

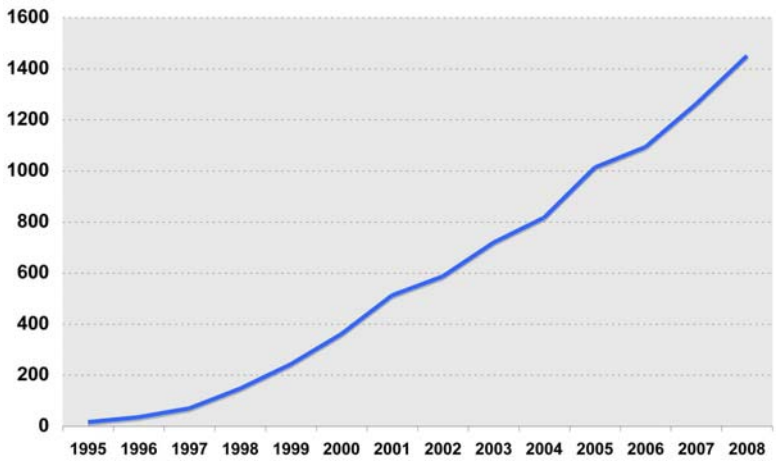

FIGURE 10: INTERNET USERS IN THE WORLD (IN MILLIONS) - GROWTH SINCE 1995 - INTERNET WORLD STATS - 2008

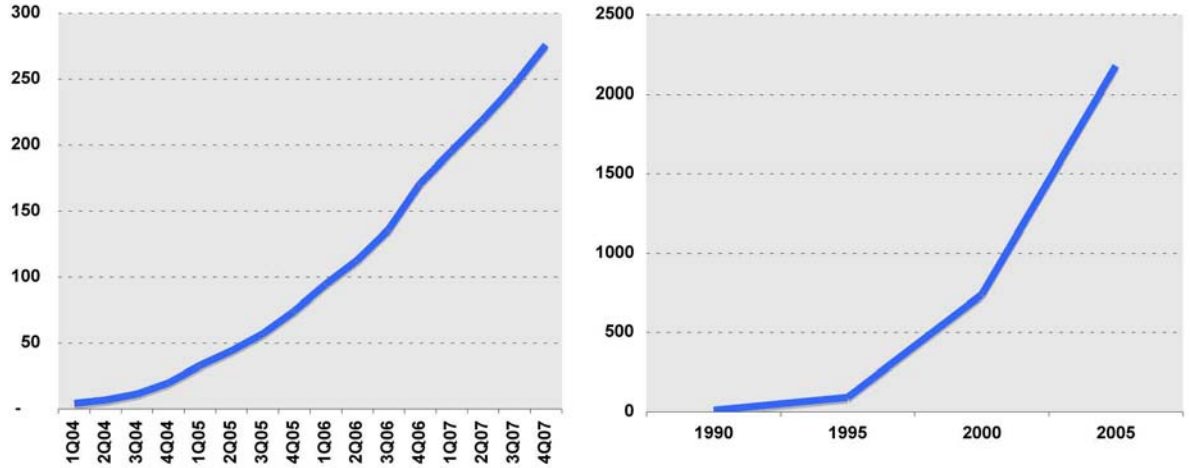

FIGURE 11: EVOLUTION OF SKYPE (LEFT) AND MOBILE PHONE USERS WORLDWIDE (IN MILLIONS) - OECD - 2008

HOW CAN WE ENSURE A SUSTAINABLE FUTURE?

"I hope we can help people to realise that they too have a role to play in shaping a more sustainable future"
Peter Madden - Chief executive, Forum for the Future - PARADISO conference of January 2009

This chapter first gives an overview of the various multilateral organizations that exist to foster dialogue aiming at addressing the changes introduced in the previous chapter and the other challenges the world is facing, so that consensual decisions can be made to ensure a more sustainable future. It also summarizes the progress made during the last decade in the exploration and definition of "beyond GDP" indexes, in order to measure the progress of societies towards a more sustainable future.

It is then argued that considering the risks of major breakdowns that exist today worldwide (on environmental, economic and social issues), the present efforts that can be most often characterized by "business as usual" solutions are not appropriate, and that, sooner or later, all countries will have to agree on an alternative way forward.

This foreseeable paradigm shift is investigated and the potential role the European Union can play in pointing the way to this other future is underlined.

A specific chapter is of course dedicated to the present worldwide financial and economic crisis, which has led, in most parts of the world, to a useful questioning of the overall sustainability of our societal models but has resulted so far in limited political decisions, beyond measures fixing the world's financial system and restoring GDP growth, which, to a large extent, aim at going back to "business as usual".

MANY AREAS OF DIALOGUE

We will start with the example of the EUROPEAN UNION (EU), consisting in joint efforts of nations to build together an integrated area of peace and prosperity while contributing to solve world issues. The example is quite a good one which, despite the various difficulties encountered since the 50's, has proven it could work and succeed in extending its vision to even more nations.

All changes evoked in the previous paragraphs both in Europe and worldwide, have of course been fully integrated since many years now in the political agenda of the EU: taking into consideration the change in population structure, supporting an evolution of market globalization that can benefit Europe and all regions of the world, promoting consensus and action to reduce the impact of human activity on resources and the environment, developing an information society and, beyond, a knowledge based economy that can fully support employment and economic growth.

Other economic, social, and environmental objectives are of course part of the EU's strategy for the future, and this not only for Europe but also worldwide, the EU being in particular the world's leading supplier of development aid. This remains highly

important today to support the efforts of developing countries to reduce poverty and undernourishment, to improve health, education, housing, to develop infrastructures and capacity building, etc.

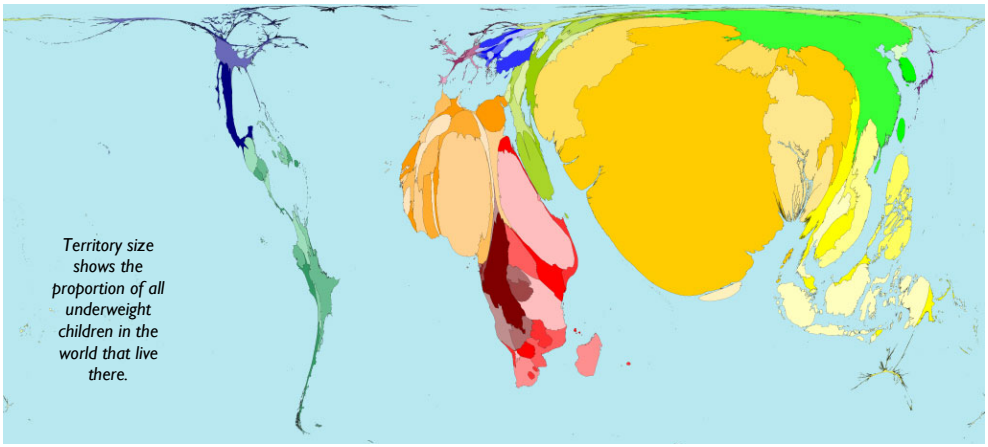

FIGURE 12: UNDERWEIGHT CHILDREN (UNDER 5) - WORLDMAPPER - 2006

Beyond the EU (and similar instances such as ASEAN, or more recently, the AFRICAN UNION), there are many other well-known multilateral consultation and governance bodies that address the challenges of today's world, either on a thematic or overall level: the UN (and its many organisations: UNESCO, FAO, UNDP, GAID, UNEP, etc.) and the OECD, the G8 or the G20, the WORLD BANK, the IMF, the WTO, the WORLD ECONOMIC FORUM, etc.

The present document does not aim to synthesize all initiatives, programmes, decisions, perspectives undertaken by the above listed bodies but will, through the next paragraph, focus on one aspect of them: the "beyond GDP" issue, which is part of an effort by these bodies and other organisations to support the development of a more sustainable future.

GOING BEYOND GDP

"It's time to go beyond GDP"
José Manuel Durão Barroso - President of the European Commission - 2007

For a long time now, the Gross Domestic Product (GDP) per capita - an index slightly different from the Gross National Product (GNP) per capita - has been the main indicator used to measure the progress of societies, even if it only characterizes their economic development.

It measures the economic value of goods and services produced by a country and brings it down to the level of the individual citizen. The GDP ppp and GNP ppp per capita indexes, adjusting GDP / GNP to take into account the "purchasing power parity" (ppp), allow a more elaborate classification of countries (1 euro in one country does not have the same value, in terms of purchasing power, as in another country).

Over the years, other indexes have however appeared, particularly to better evaluate the progress made, or to be achieved, in developing countries. The Human Development Index (HDI) is probably the best example of such new indexes: it was proposed by the UNITED NATIONS (UN) in 1990 with the inaugural issue of the Human Development Report to extend the way development is measured and takes into account more than mere economic considerations (HDI is a composite index based on per capita GDP, life expectancy, literacy, and school enrolment).

Going well beyond simple economic considerations, the MILLENNIUM DEVELOPMENT GOALS (MDG) that the UN member States have agreed to try to achieve by 2015 (see the UN MILLENNIUM DECLARATION of Sept. 8, 2000), deserve to be mentioned here as well. They include:

- halving extreme poverty and hunger,
- achieving universal primary education and gender equity,
- reducing under-five mortality and maternal mortality by two-thirds and three-quarters respectively,
- reversing the spread of HIV/AIDS,
- halving the proportion of people without access to safe drinking water and ensuring environmental sustainability,
- developing a global partnership for development, with targets for aid, trade and debt relief.

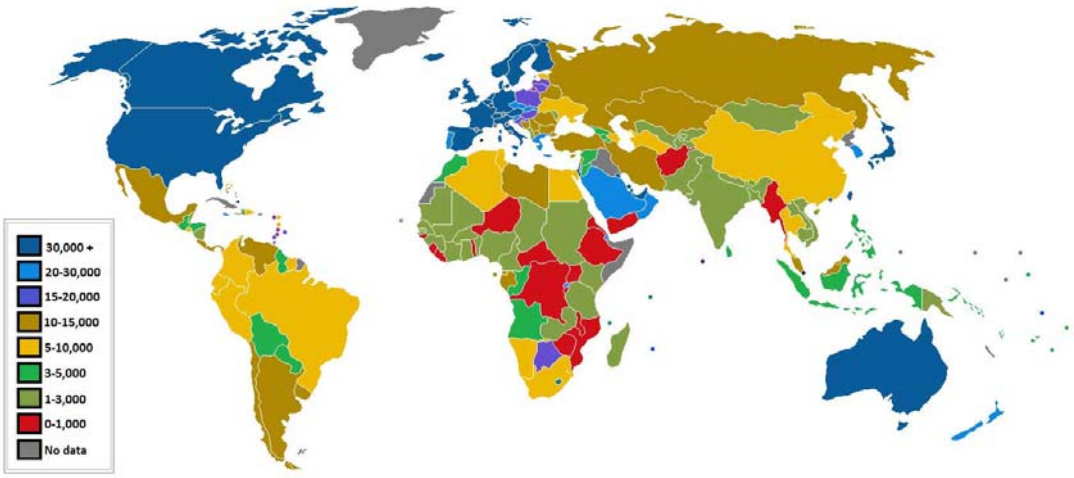

FIGURE 13: WORLD MAP OF GDP PPP PER CAPITA IN 2007-2008 (IMF - 2008)

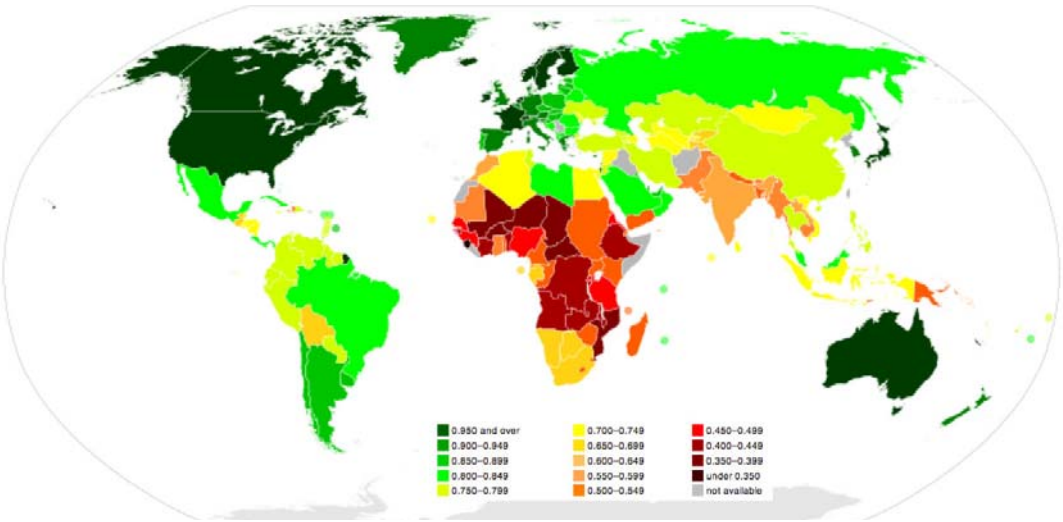

FIGURE 14: WORLD MAP OF HDI IN 2007 (UNHDR - 2008)

In the last decades, a number of new indicators, sets of indicators or indexes have been put forward by research organisations, NGOs or even governments, advocating that time had come to truly go "beyond GDP", to find new ways to drive and measure the progress of societies, particularly when taking into account the profound changes, evoked in the previous chapter, that societies were now experiencing.

Integrating environmental issues into a revised progress measurement has often driven these new approaches, such as the Index of Sustainable Economic Welfare (ISEW) proposed in the 80's, today referred to by FRIENDS OF THE EARTH and leading in the 90's to the development of the Genuine Progress Indicator (see reports and analyses of the REDEFINING PROGRESS NGO for further details), and the following joint statement by 400 leading economists, business leaders, and other professionals, including Nobel laureates:

> ***"Since the GDP measures only the quantity of market activity without accounting for the social and ecological costs involved, it is both inadequate and misleading as a measure of true prosperity. Policy-makers, economists, the media, and international agencies should cease using the GDP as a measure of progress and publicly acknowledge its shortcomings. New indicators of progress are urgently needed to guide our society."***

A well-known initiative of these last decades is the one explored since the 70's by the Kingdom of Bhutan, and more recently by the Thai government (to support the implementation of a "sufficiency economy" in Thailand). It concerns the Gross National Happiness (GNH) index, based on the vision that collective happiness should be the ultimate goal of governance. The CENTER FOR BHUTAN STUDIES is presently working on specifying in detail a set of indicators (then aggregated into a single index) in 9 GNH

domains: psychological well-being, cultural diversity and resilience, education, health, time use and balance, good governance, community vitality, ecological diversity and resilience, living standards.

Happiness as a measurement has not only inspired Buddhist countries: Adrian White from the University of Leicester underlines (in "A Global Projection of Subjective Well-being: A Challenge To Positive Psychology?" - Psychtalk 56, 17-20, 2007) that "a recent survey found that 81% of the UK population agreed that the government's primary objective should be the creation of happiness not wealth". He drafted a World Map of Happiness, a global projection of "subjective well-being" (SWB), using data published by the UNITED NATIONS, the CIA, etc.

Another well-known example referring to happiness is the HAPPY PLANET INDEX (HPI) that the NEW ECONOMICS FOUNDATION launched in 2006. HPI measures the ecological efficiency with which human well-being is delivered, through a combination of three major indicators (HPI = Life satisfaction x Life expectancy / Ecological footprint). The HPI ranking of world countries is illustrated below.

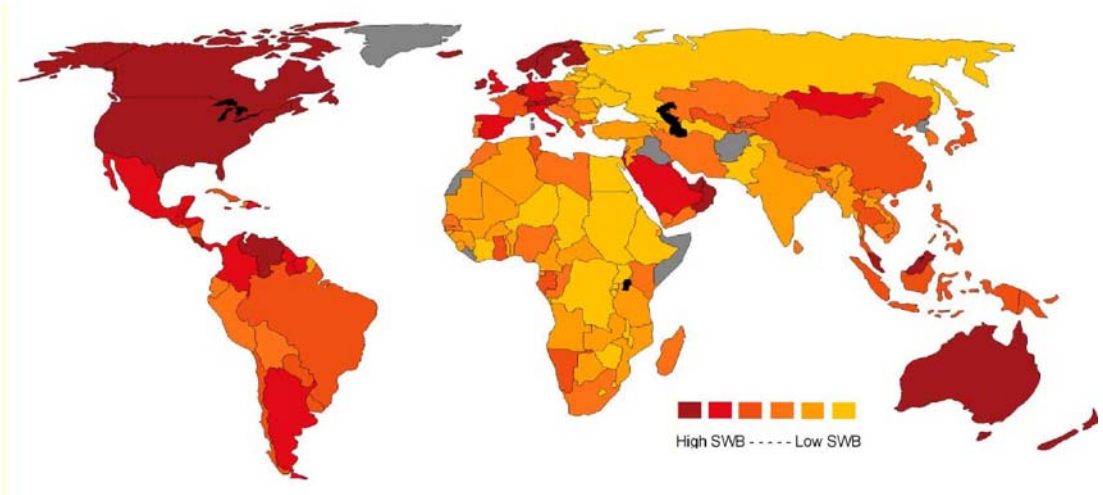

FIGURE 15: A GLOBAL PROJECTION OF SUBJECTIVE WELL-BEING (UNIV. OF LEICESTER - 2007)

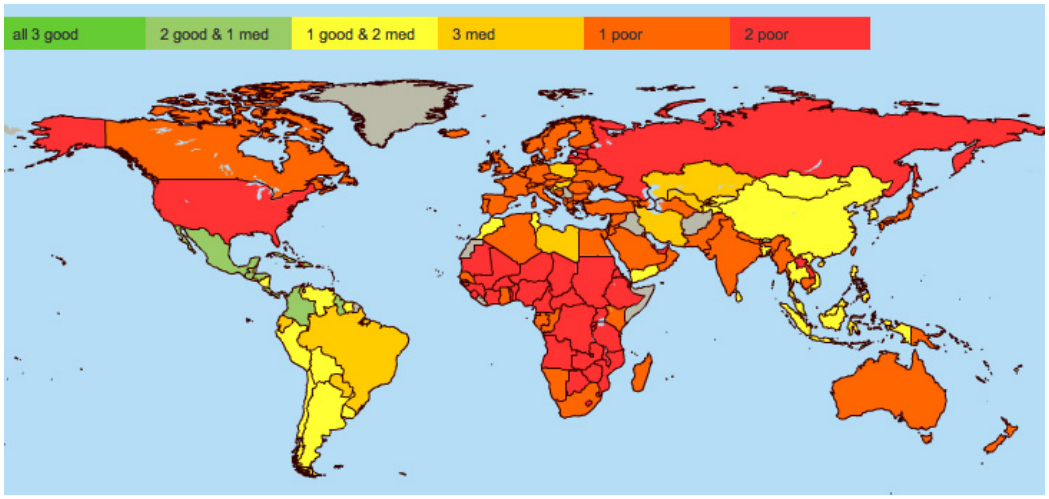

FIGURE 16: THE HAPPY PLANET WORLD MAP (NEF - 2008)

It is difficult to be exhaustive in the mapping of "beyond GDP" initiatives since, while a limited number of such initiatives had developed in the past decades, a great number have seen light in the last ten years, under the pressure of the profound changes faced by modern societies.

One of the most recent announcements is certainly the one made by French President Sarkozy, who in January 2008 appointed a commission chaired by Joseph Stiglitz, Nobel laureate in economics, to make recommendations on "how to (go beyond GDP and) more completely measure the nation's collective performance".

Should we expect that a single index, a common set of indicators be agreed on at a regional or global level in the near future? Most probably not, because time is needed to agree on the relevance, reliability, accuracy of indicators or indexes (particularly if a multilateral consensus has to be found), and because "one size may not fit all" (national or even local characteristics requiring different instruments).

In this context, the OECD GLOBAL PROJECT ON MEASURING THE PROGRESS OF SOCIETIES can be seen as fully relevant. This project, hosted by the OECD and run in collaboration with other international and regional partners (including statistical agencies, such as the European EUROSTAT), fosters the development of sets of key economic, social and environmental indicators to provide a comprehensive picture of how the well-being of a society is evolving. It also seeks to encourage the use of indicator sets to inform and promote evidence-based decision-making, within and across the public, private and citizen sectors. The project is open to all sectors of society, building both on good practice and innovative research work.

During the 2nd "World Forum on measuring and fostering the progress of societies", held in Istanbul in June 2007, the OECD, the European Commission, the United Nations (and UNDP), the World Bank, and the ORGANISATION OF THE ISLAMIC CONFERENCE affirmed in a declaration (the "ISTANBUL DECLARATION") their commitment to measuring and fostering the progress of societies in all dimensions, with the ultimate goal of improving policy making, democracy and citizens' wellbeing.

OECD also took a leading role in the BEYOND GDP CONFERENCE hosted by the European Commission in Brussels in November 2007 that particularly gave the opportunity to thoroughly discuss the way environment issues should be taken into account when measuring the progress of societies.

RISKS OF MAJOR BREAKDOWNS EXIST

"We are all passengers of the Titanic, even if some of us are travelling first-class"
Susan George

From the information developed in the previous paragraphs should we conclude that the challenges the world is facing are appropriately addressed by relevant organizations, through suited dialogues and that relevant decisions have been agreed on to ensure a true sustainable future for our planet, in a few words that the situation is under control? It is unfortunately not the case.

It seems in fact that the pace at which the challenges are growing is quicker than the one at which countermeasures are being implemented, and that, consequently, the effective stability and soundness of the current development paths of our societies can be legitimately questioned.

Risks of major breakdowns are indeed being underlined more and more frequently and these are related not only to economic and environmental issues, but also to social ones.

ENVIRONMENTAL RISKS

"The timeframe available to us to decisively mitigate climate change is very limited. We have seven, maybe eight years at our disposal to act"
Hans-Gert Pöttering - President of the European Parliament - PARADISO conference of January 2009

More and more people are well aware today of the environmental risks that the world is facing, even if a lot remains to be done to fully inform all stakeholders and if these risks do not necessarily lead to the right countermeasures which they would require.

This level of awareness, and the fact that the term "sustainable" has been historically associated to environmental issues, even make many people still "limit" the vision of a sustainable future to a future when environmental risks would have disappeared, not taking into account economic and social risks. Which, of course, is a vision to be corrected whenever possible.

These environmental risks do not only come from the "global warming" situation that Al Gore's movie "An inconvenient truth" has usefully helped to make clearer to the public at large, but from the quick loss of natural resources and biodiversity.

On global warming, there is today a scientific consensus that most of the recent and foreseen increases in the Earth's average temperature are caused by the increase in atmospheric greenhouse gases (first and foremost carbon dioxide CO^2) caused by human activity. The Intergovernmental Panel on Climate Change (IPCC) has extrapolated that the average global surface temperature could rise a further 1.1 to 6.4°C during the present century, which would lead to tragic consequences: major climate changes (shrinking ice caps, rises in sea levels, more frequent and intense weather events), leading to natural disasters, major loss of life and economic disasters, scarcity of water and agricultural products, species extinction, increase in diseases, etc.

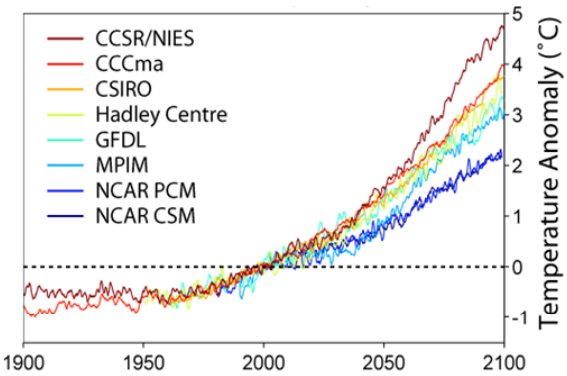

FIGURE 17: GLOBAL WARMING PROJECTIONS (IPCC A2 SCENARIO) - ROBERT A. ROHDE

Beyond global warming, important risks also exist concerning the use of the earth's resources.

In its 2007 "World Energy Outlook" the INTERNATIONAL ENERGY AGENCY stresses that "the emergence of China and India as major players in global energy markets necessitates taking decisive and urgent collective action" in order to avoid serious risks in the next decades.

As for the use of Earth's biocapacity, the GLOBAL FOOTPRINT NETWORK has estimated that the ratio between the world's demand and its biocapacity already became greater than 1 (a situation of "ecological overshoot") in the early 60's.

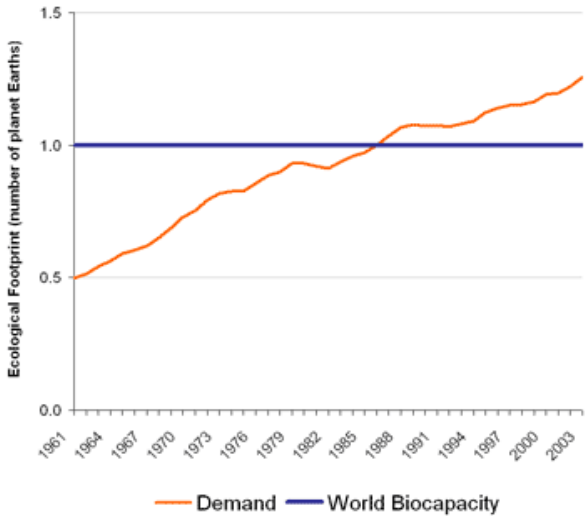

FIGURE 18: HUMANITY'S ECOLOGICAL FOOTPRINT - GLOBAL FOOTPRINT NETWORK

ECONOMIC RISKS

The present crisis has unfortunately underlined the important financial and economic risks all countries were facing today.

It started in mid-2007 by the US subprime mortgage crisis, and became truly global in mid-2008 when the collapse of the housing bubble centered in the US became, through complex vicious circles, the collapse of the biggest speculative financial bubble the world has ever known, which has led most countries in the world to enter a deep and long term recession (see figure 19), characterized in particular by a quick increase of unemployment rates, not only in developed countries but also in emerging economies, and by an even more fragile situation of developing countries.

An insufficiently regulated financial system and a lack of control from governments are the main causes evoked to explain this meltdown of the world's financial system and corrective actions have been discussed these last months at national and international levels while impressive recovery plans were prepared: a global effort of over 1000 billion US dollars (to be compared to the global public aid for development, amounting to around 100 billion US dollars per year).

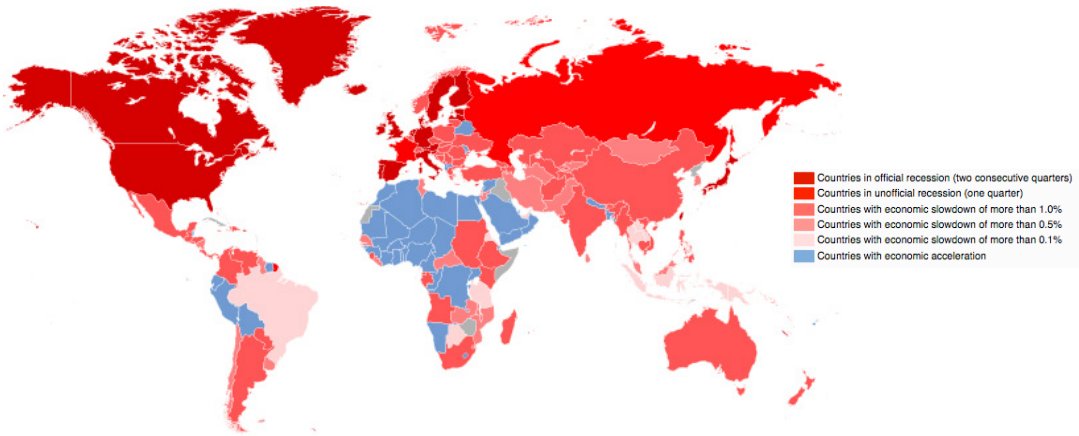

FIGURE 19: WORLDWIDE RECESSION IN EARLY 2009 - JOAO FELIPE FROM IMF ESTIMATES OF DECEMBER 2008

SOCIAL RISKS

"When will the next French revolution spark?"
Georges Pébereau - Hon. President of Alcatel - September 2008

As Anna Maria Darmanin, member of the European Economic and Social Committee, underlined it at the PARADISO conference of January 2009: "*sustainability is not only dealing with climate change but really with the effective management of our resources: our natural resources, our financial resources, and our peoples resources in terms of social sustainability*".

Social risks could already be anticipated before the present economic turndown; they are even clearer today.

Indeed, if the GDP of most countries has significantly evolved over the last decades, the distribution of wealth and resources within and between countries has not evolved as it should have during the same period.

In the US, for instance, the GINI index (measuring inequality in income distribution, from 0 "perfect equality" to 1 "perfect inequality") increased from 0.397 in 1967 to 0.470 in 2006 according to the US CENSUS BUREAU. In recent analyses, the United Nations Conference on Trade and Development (UNCTAD) and the World Bank came to the conclusion that even if poverty had globally decreased (apart from sub-Saharan Africa), the number of people living with less than 2 US$ per day has remained unchanged since 1981. Recent reports from the OECD and the INTERNATIONAL LABOUR ORGANIZATION have also demonstrated that inequalities within and between countries (particularly between the North and the South) had globally increased in the past decade.

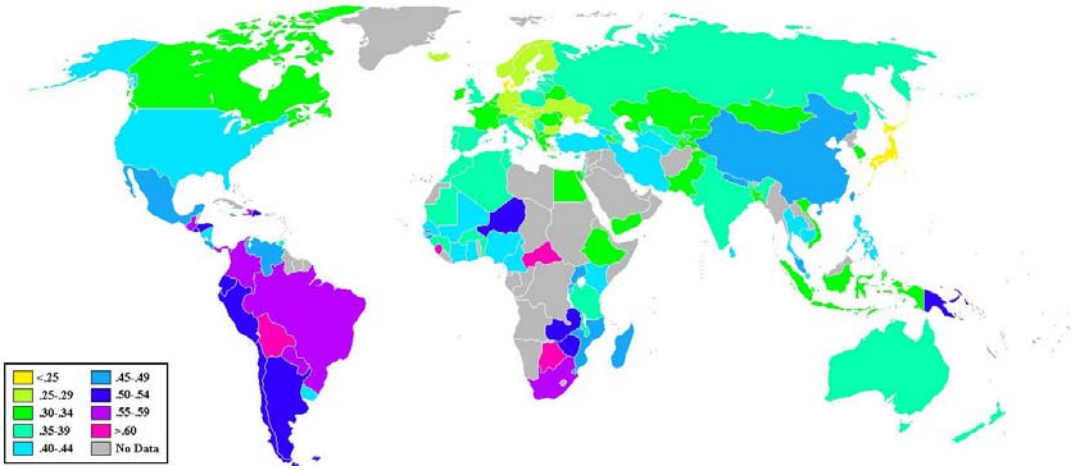

FIGURE 20: INCOME DISTRIBUTION PER COUNTRY (GINI INDEX) - UNHDR 2007-2008

The financial crisis that started in 2007 and eventually led to the worst worldwide recession since the Great Depression of the 1930's, has underlined that social risks were real. In many countries, a large part of the population just did not accept that the behaviour of some may jeopardize a whole system, and that wealth had been concentrating these last decades in the hands of a few.

During the food and oil price crisis of 2007-2008, serious social demonstrations when not riots sparked in many places of the world, and not only in developing countries; the present crisis has led to a quick development of social and political instability in most regions of the world. Revolution may never spark again (in France or in other regions of the world) but risks cannot be underestimated if nothing is done to ensure more equally shared wealth and resources within and between countries.

FIGURE 21: SHARE OF TOTAL INCOME EARNED BY TOP 10% IN THE US (INCL. CAPITAL GAINS) - EMMANUEL SAEZ - UC BERKELEY - 2007

THE FORESEEABLE PARADIGM SHIFT

"We can decide to stay with business as usual and watch our modern economy decline and eventually collapse, or we can consciously move onto a new path"
Lester Brown
Plan B 3.0 - Earth Policy Institute 2008

Considering the risks outlined above, can we conclude other else than "Business as usual is no longer an option", that our societies, similarly to some past societies (see JARED DIAMOND's book published in 2005) have today "to choose to fail or succeed facing the risks of collapse", that there is an urgency to envision a new disruptive paradigm for the world, to adopt (following Lester Brown's recommendations) a "Plan B", to agree on an alternative way forward, a way that most, if not all developed, emerging and developing countries could follow, leading to truly sustainable development, more sustainable economic growth, more equally shared resources and wealth and eventually the well being of peoples around the world?

Are we moving towards "this other future"? Unfortunately not, or not yet at least:

- Environmental risks are, as already evoked, quite well apprehended today and the urgency to implement suited solutions is more and more widely acknowledged (in its 2008 report "Environmental outlook to 2030", OECD underlines for instance that "the cost of inaction is high while ambitious actions to protect the environment are affordable"). However, the international fora, summits and other gatherings on the occasion of which key decisions are expected to be made are most often disappointing, many factors leading to a situation which is better than "business as usual", but not fully suited to challenges however.
- Concerning economic risks, if one of the outcomes of the G20 London Summit of April 2009, during which a "Global plan for recovery and reform" has been adopted, is the decision "to build an inclusive, green and sustainable recovery", we may fear that, by the end of the day, the plan will just lead to go back to business as usual, the main real efforts being put on restoring GDP growth and better supervise the present financial system, while promoting global trade.

Did the world miss a historical chance to "take advantage" of the present crisis and globally cope with economic, environmental and social challenges at the same time in order to find global solutions truly ensuring an alternative way forward? It may just be a question of time since the good news when considering the present crisis is that it has been leading to an increasing number of people around the world questioning the relevance of our societal models, and considering that time has come to promote such a global solution, to ensure a better life in the future (see figure 22).

The success of the PARADISO conference of January 2009, on the occasion of which the PARADISO vision has been welcomed when not endorsed by the various political instances of the European Union can be considered as a very positive sign, even if, of course, there is a long distance between political statements and political decisions.

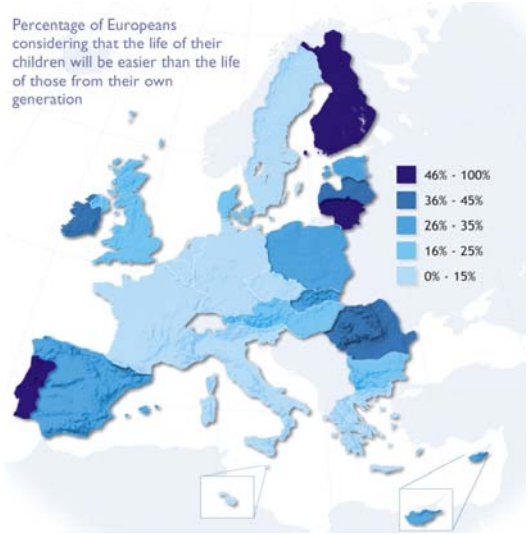

FIGURE 22: AN EASIER LIFE IN THE FUTURE? - BEPA - 2007

Let us be now more specific about what the paradigm shift would consist in, what would effectively change in societal objectives, how differently people would live, how the progress of societies can be redefined "beyond GDP", in a few words what this vision of "a true sustainable future" is concretely.

What is foreseen is in fact not bad news either for citizens (this future is about sustainability, easier life, well-being, happiness) or for companies (innovation is needed).

In many countries over the last years, a number of NGOs, foundations, associations and think-tanks have done a substantial amount of work to address and answer the above listed questions, through events, publications, forums, and even support for experimental apartment buildings, communities, or urban areas.

It is impossible to be exhaustive in the description of these developments but we would like to cite here the CLUB OF ROME, WWF, the WORLD FUTURE COUNCIL, the FORUM FOR THE FUTURE (who has recently elaborated with HP LABS interesting "Scenarios to explore social response to climate change"), or NEF, who has published "A well-being manifesto for a flourishing society" (inspiring the "Manifesto for well-being" of the AUSTRALIA INSTITUTE) listing eight areas where governments could usefully act:

- Measure what matters,
- Create a well-being economy,
- Reclaim our time,
- Create an education system that promotes flourishing,
- Refocus the health system to promote complete health,
- Invest in the very early years and parenting,
- Discourage materialism and promote authentic advertising,
- Strengthen civil society, social well-being and active citizenship.

"We have to recognize that the demand for non-material aspects of personal and societal well-being is emerging everywhere"
Enrico Giovannini - Chief Statistician and Director OECD - PARADISO conference of January 2009

Summarizing in a structured way what could characterize a consensual vision of "this other future" is quite difficult because not all visions are similar, approaches are different and environments or objectives may differ.

However, we would like to list some keywords and concepts that seem to represent to a large extent a consensus of what revised policies should focus on (and will also be necessary to evaluate, in the next chapter, the role ICT can play to support the emergence of the envisioned paradigm shift):

- **SUSTAINABILITY BEFORE GROWTH**. The overall vision is not to necessarily go for "anti-capitalism" and "de-growth" and is compatible with economic growth; the objective is to ensure sustainability first (this is why the PARADISO vision refers to a "sustainable future" and not to "sustainable development").

- **CHANGING CONSUMPTION PATTERNS**: no more "western consumerism". Again the idea is not to say goodbye to comfort in our homes and go back to standards which those living in the 19th century have known but to consume less and differently, only what is more meaningful and useful (no more expensive gadgets or useless advertised products), what is durable, can be upgraded along the years or recycled.
- **STRONG REDUCTION OF RESOURCES USED AND OF IMPACT ON ENVIRONMENT** (far beyond what is done today). The present challenges require that strong reductions in the use of resources (mineral resources, energy…) can be obtained by the way we live, move, work, produce, consume, etc. In the same way, strong reductions in the impact on the environment (waste, biodiversity, ecological footprint…) in the different activities have to be reached.
- **New social paradigms**. Beyond the overall objective of truly achieving more equally shared wealth, within and between societies, changes are expected at individual or community levels: development of informal economy and of social networking, of local services and local economies.

"At both European and global level, a sustainable future means doing more with less"

Hans-Gert Pöttering - President of the European Parliament - PARADISO conference of January 2009

CAN EUROPE POINT THE WAY TO THIS BETTER FUTURE?

"I feel that there must be some convergence among nations on the idea of what the primary objective of development and progress should be, something Gross National Happiness seeks to bring about"

H.M. Jigme Khesar Wangchuck, King of Bhutan
1st GNH Conference - Bhutan - Feb. 2004

Bhutan is a well-known example of a country where a strong political desire does exist to develop a "beyond GDP society" and to enter a paradigm shift suited to the well-being, the happiness of its citizens. However, very few other countries have followed this example today and if substantial changes are to be expected worldwide, a world power has probably to show the way to this other future.

It seems indeed that Europe is one of the best placed world powers to do so, proactively taking on board an initiative of this kind, and promoting a new concept of progress. We may even consider that Europe has no other choices today in the global arena, in order to maintain and develop its influence, than developing a proactive leadership on global issues, such as the one addressed here.

This other future has in fact not very different objectives, or relies on not so different values than the ones driving the construction of the European Union. This next stage should thus be reached quite seamlessly and at a time when the European Union has the ambition to become "the world's most dynamic knowledge based economy", it would make sense to demonstrate what a true knowledge based economy is developed with the ultimate goal of ensuring the well-being of the citizens.

Many countries and regions of the world may all follow and support Europe in this direction: China, that is already questioning whether economic progress is really the "be all and end all", and India, who will soon be asking the same question, Japan and South Korea who are starting to question their societal models (particularly when considering critical social costs - such as pollution or suicides - of economic growth), South America and Africa that are searching for ways to develop. Could a momentum be created so that the United States, by defining a new "American dream", will, eventually, also adhere to?

KEYNOTE SPEAKERS AT THE PARADISO CONFERENCE OF JAN. 22-23, 2009
(from left to right)
Mario Campolargo, Director, Directorate-General Information Society and Media, European Commission
Hamadoun I. Touré, Secretary-General, International Telecommunication Union
Viviane Reding, Commissioner for Information Society and Media, European Commission
Hans-Gert Pöttering, President of the European Parliament

Maria da Graça Carvalho, Principal Adviser to the Bureau of European Policy Advisers, European Commission
Vittorio Prodi, Member of the European Parliament

THE KEY ROLE OF ICT IN ENSURING A SUSTAINABLE FUTURE

"ICT can play a crucial role in the making of a more sustainable world"
Maria da Graca Carvalho - Principal Adviser to the Bureau of European Policy Advisers - European Commission
PARADISO conference of January 2009

This chapter first addresses the current role of ICT in general and of the Internet in particular in all human activities, underlining that they have become one of the key drivers of the social and economic development of many societies worldwide.

After having evoked the progress expected in the ICT area, it is then assessed that ICT can become instrumental and decisive in moving forward the paradigm shift detailed in the previous chapter.

A set of ICT research areas that could be usefully explored in this context is suggested in conclusion.

THE ROLE OF ICT IN TODAY'S SOCIETIES

"ICT are at the very heart of all societies worldwide today, both in the developed and developing world"
Dr Hamadoun Touré - Secretary-General, International Telecommunication Union
PARADISO conference of January 2009

In the first chapter of this document, it was concluded that the overwhelming dimension that ICT had taken in today's societies should and could be considered as one of the major changes the world was confronted with. ICT are indeed not only a way to support the evolution of societies; they are closely linked to, and even directly influence, the evolution of societies. These last twenty years, progress in the ICT area has been spectacular, particularly as far as the Internet is concerned, since it has today become a critical social and economic infrastructure, key in the globalisation of services and knowledge, has led to an increased convergence of networks, services, and businesses. The OECD estimates that ICT have contributed to more than 25% of GDP growth in the last ten years.

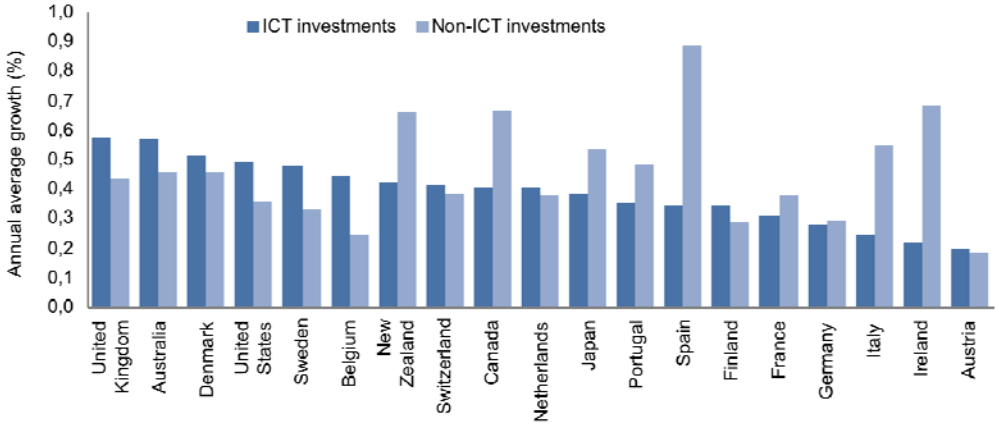

FIGURE 23: CONTRIBUTION OF ICT AND NON-ICT INVESTMENTS TO GDP GROWTH FROM 1985 TO 2006 - OECD - 2008

Enabled applications have evolved rapidly, from web and mail to P2P and voice, and then to video streaming, IPTV, web 2.0, online gaming, etc (a list expected to expand quickly, namely thanks to the ongoing deployment of IPv6, the new Internet layer protocol, which has much larger address space than its predecessor IPv4).

In the last years, WIRELESS and MOBILE have become two keywords in our everyday lives where the information is more and more available "anytime, anywhere, on any device".

Beyond the Internet, ICT systems have become familiar in all human activities, allowing information to be efficiently monitored and controlled and improving for instance the way we can, at home, ensure safety, manage energy, automate daily tasks, control household equipment, etc.

In their plans for the future, most societies thus logically today set as a priority the development of a true "Information society" (see the i2010 EU's strategic initiative launched in 2005: "A European Information Society for growth and employment") or of a prosperous "knowledge economy" (the recent creation of a huge "Ministry of Knowledge Economy" by the Korean government has to be noted in this context).

We will not in the present document further detail the role ICT has today in societies, the way they can precisely contribute to achieving economic, social or environment objectives in the different human activities, and thoroughly address issues related to eCommerce, eGovernance, eHealth, eLearning, eInclusion, eHome, etc. We will simply recommend a visit to EUROPE'S INFORMATION SOCIETY WEB PORTAL where a lot of information is made available.

We would like however to underline here how ICT can effectively support environment objectives, allowing energy to be more efficiently managed, environment management systems to be implemented, transportation needs to be reduced, etc. At the PARADISO conference of January 2009, the ITU has estimated that "*ICT can help cut global greenhouse gas emissions by 15% to 40% by enabling intelligent transport systems, smart buildings, better supply chain management, etc.*"

Some information sources addressing these issues can be usefully referred to for further information:

- The OCDE sponsored "WORKSHOP ON ICTS AND ENVIRONMENTAL CHALLENGES" of May 2008 in Copenhagen.
- The Club or Rome "RESOURCE EFFICIENCY IN THE IT-BASED SERVICE ECONOMY" recently launched project portal.
- The "Information Society and Sustainable Development: Exploring the Linkages" 2003 report by the International Institute for Sustainable Development (IISD).
- The Forum for the Future 2008 report on "CONNECTED - ICT AND SUSTAINABLE DEVELOPMENT".
- The COMMUNICATION OF THE EUROPEAN COMMISSION of May 13, 2008 addressing the challenge of Energy efficiency through ICT.
- The already cited "BEYOND GDP" CONFERENCE of November 2007.

"ICT: last chance for Haiti to avoid collapse in the future?"
Frantz Verella - Former Minister for Public works, Transport and Communication, Haiti - PARADISO conference of January 2009

Last but not least, we would also like to underline that the key role of ICT in today's societies is of course not limited to developed countries but is also a reality in emerging and in developing countries. As far as developing countries are concerned, ICT have been recognised as an efficient way to help achieving the already evoked UN's MILLENNIUM DEVELOPMENT GOALS, and more generally to reduce poverty, strengthen democracy, support education and health projects, ensure economic growth, etc. For instance, Leonard Waverman, from the London Business School, has demonstrated that every extra 10% increase in mobile teledensity in the developing world leads to an additional 0,59% point in GDP per capita.

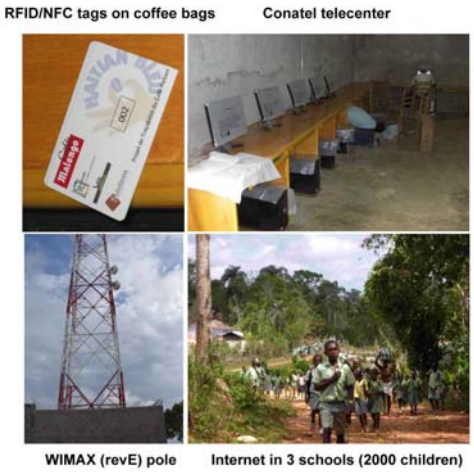

FIGURE 24: FACETS OF AN ICT4D PILOT PROJECT IN RURAL HAITI SUPPORTED BY THE UNIVERSITY OF NICE - 2008

Further information on these issues can be found in the outputs of the UN and ITU sponsored 2003-2005 World Summit on the Information Society (WSIS), and in the activities developed by some leading organisations addressing "ICT for development" (or ICT4D), among which:

- UNCTAD (see in particular their Information Economy Report 2007-2008: "Science and technology for development: the new paradigm of ICT").
- The World Bank's INFODEV (see in particular their "Extending ICT Benefits To All: Overview" report of February 2008).
- The Global Alliance for ICT and Development (GAID) launched by the UN in 2006 in continuation of the UN ICT Task Force.
- The Canadian IRDC (International Development Research Center) Crown Corporation.

- The DIGITAL WORLD FORUM FP7 project.

THE CENTRAL ROLE ICT WILL PLAY IN "BEYOND GDP" SOCIETIES

"Our future lies in our capability to fully reap the benefits of ICT and in particular of the Internet"

Viviane Reding - Commissioner for Information Society and Media - European Commission - PARADISO conference of January 2009

ICT are today instrumental in achieving social, economic, and environment objectives in developing, emerging, and developed societies. They will logically be instrumental tomorrow in achieving revised objectives that "beyond GDP societies" will require to set in motion a true sustainable world future.

In order to better understand their role for tomorrow, it is necessary to assess the progress we can expect from ICT in general, and the Internet in particular, in the years and decades to come.

The exercise is not so easy since the recent past has shown that some ICT technological developments and many ICT-based applications or services were just "surprising" and could not have been predicted some years before.

We can however derive probable technological advances from today's trends. It is thus quite foreseeable that important progress can be expected on issues such as SPEED, QOS, SECURITY, MOBILITY, AFFORDABILITY, SIZE, (RICHER) CONTENT. Similarly, the perspective on an "INTERNET OF THINGS", with trillions of devices connected worldwide, is quite probable for the short to medium term. It is also logical that the already evoked possibility of accessing the information "ANYTIME, ANYWHERE, ON ANY DEVICE" will become more and more effective in the years to come.

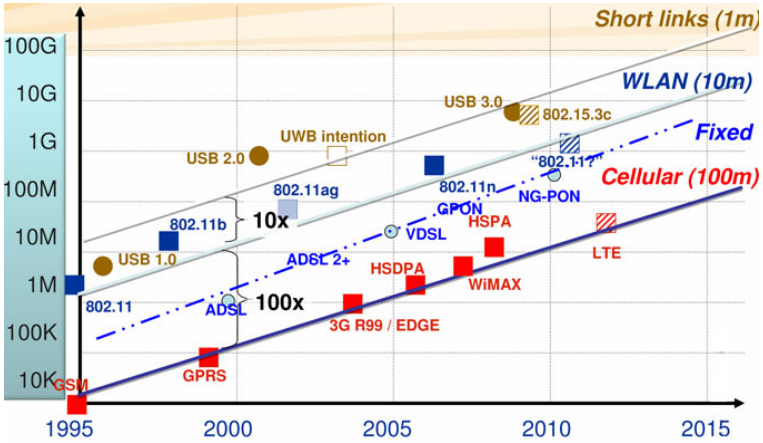

FIGURE 25: INCREASED PERFORMANCE OF COMMUNICATION NETWORKS (IN BIT/S) - EUROPEAN COMMISSION - 2008

In his welcome address delivered to the participants in the PARADISO workshop of June 12-13, 2008, Leonard Kleinrock, Professor at UCLA and one of the fathers of the Internet, has envisioned "*a future of extreme mobility, mass personalisation, video addiction, location-based services, considerable convergence, continued surprising applications and very serious societal and lifestyles changes*".

Concerning the major trends to be expected, we would like to also mention here the trends identified by the Korea Information Society Development Institute (KISDI) in their 2007 report on "Great transformations in the digital age". KISDI lists twenty "mega-trends" and the following four "meta-trends":

- Society connected to network: anytime, anywhere,
- Mix of the virtual and the real,
- Blurred boundaries,
- Rise of minorities.

The future of ICT in general, and more particularly the future of the already 30-year old Internet (do we have to go for "clean slate" or evolutionary approaches?) is obviously, considering their key societal and economic role worldwide, thoroughly discussed in many governmental and industrial organizations and through many workshops and conferences, and far more in detail than through the limited set of characteristics listed above.

Among such organizations, we would like to cite here ITU, ETSI, IETF, WWRF, and the ETPs and JTIs addressing ICT research in Europe (such as NEM, NESSI, ISI, EMOBILITY, EPOSS, and ARTEMIS).

Concerning "the Future Internet" the recent years have seen important developments. In particular, the FIRE (FUTURE INTERNET RESEARCH AND EXPERIMENTATION) initiative was launched in 2007 by the European Commission to investigate and experimentally validate new, visionary, multidisciplinary paradigms for the Future Internet. This initiative can be compared to the FIND (Future Internet Design) and GENI (Global Environment for Network Innovation) ones supported by NSF in the USA, to the Japanese AKARI PROJECT, or to the Korean FUTURE INTERNET FORUM.

Additionally, following the "Future Internet Conference" organised in Bled, Slovenia, in early 2008, a "FUTURE INTERNET ASSEMBLY" (FIA) has been created, involving an important research and industry ICT constituency, also under the aegis of the European Commission.

Among the various recent events devoted to the future Internet, we would like to mention the OECD MINISTERIAL MEETING held in Seoul in June 2008 on "The Future of the Internet Economy", and concluded by quite a substantial Declaration endorsed by many countries.

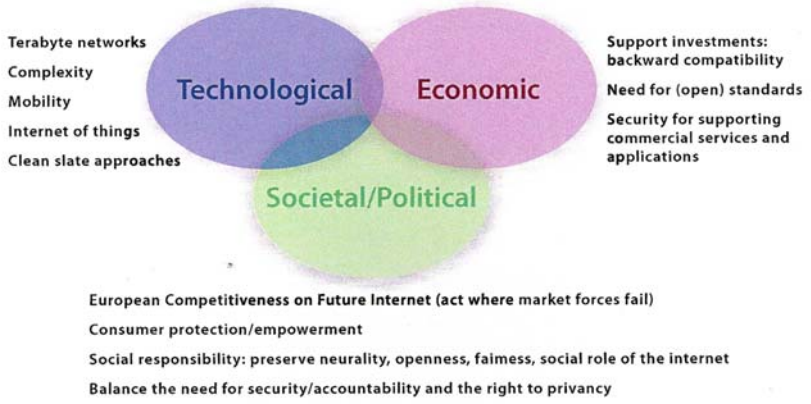

FIGURE 26: THE DIMENSIONS OF THE FUTURE INTERNET - EUROPEAN COMMISSION - 2008

Can we consider that the expected progress in ICT and the various areas of dialogue evoked above fully take into account the requirements of a true sustainable future, of "beyond GDP societies"?

A simple answer is "no", since societal paradigm shifts are not really referred to in the afore-mentioned organizations and events, the major reasons being that the ICT community is not aware enough of the possibility or probability of this other future, but also that current approaches often remain "technology-oriented".

On this point, many ICT stakeholders still think that technologies and infrastructures will simply drive applications, that we just have to ensure technological progress and make infrastructures available and that the right applications will then follow, naturally emerge. It is of course true to a certain extent but it is essential to remind that analysing needs, changing lifestyles, societal paradigms, etc. is also key in enabling the development of relevant technologies and infrastructures, the right approach being definitely a combined "technology-oriented" and "need-based" approach

FIGURE 27: TECHNOLOGY-ORIENTED VERSUS NEED-BASED APPROACHES - PARADISO - 2008

We have however to acknowledge that encouraging signs can be noted in current developments.

First of all, the potential negative impacts that ICT may have on economic, social or environment issues, are more and more systematically and wisely considered. The risks linked to an increased inequality between and among nations due to a "digital divide" have been evoked and addressed for a long time now. Other risks have been identified more recently: during the PARADISO workshop of June 2008, Prof. Gwin Prins from the London School of Economics raised the question "*When does (an*

overload of) information become the enemy of knowledge?" while, at the same workshop, "big brother" risks linked to an increasingly pervasive and powerful technology, and social risks linked to a more and more virtual world were discussed too.

As for risks related to the environment and the use of natural resources (energy consumption of ICT equipment, waste generation and use of hazardous substances, life-cycle audits, etc.) they are more and more widely acknowledged as important, given the growing dimension of ICT in our economies.

This risk has however to be apprehended at its right, and relatively modest dimension, to avoid that more and more people limit the use of their computers to save money (while keeping switched on many other household equipments which could be switched off and consume far more energy):

- The production and use of ICT is estimated to correspond to only 8% of the electrical power consumption in the EU,
- A 10km car drive leads to the production of 1 to 2 kg of CO^2, while an Internet search to 0,02 g.

Beyond this increasing awareness that ICT have to mitigate their economic, social and environmental impact, the ICT community seems to be more and more aware that "What for?" is a key question when considering technological developments, that socio-economic (and environmental) aspects have to be fully taken into consideration when paving the way for the future, that ICT and the Internet have to truly contribute to making the world a better place, that the well-being of peoples may be the ultimate target of envisioned developments.

Many examples can be given to testify that such changes are occurring:

- At the OECD meeting in Seoul in June 2008, TUAC's Declaration included the recommendation that "the success of the Internet economy should be measured by the well-being of citizens, and not simply the extent of technology diffusion".
- Many ICT bodies listed above have recently created Working Groups focusing on socio-economic issues: FIA is thus including a Future Internet Socio-Economics (FISE) working group, while WWRF now counts a working group on "Human perspective and future service concepts" and has organised a meeting in October 2008 in Stockholm on "Sustainability and the Future Internet".

Last but not least, the projects launched in the framework of the FIRE initiative introduced above (PARADISO being one of these projects), and the FIRE study "Towards a future Internet: interrelation between technological, social and economic trends" launched at the beginning of 2009, have to be mentioned here.

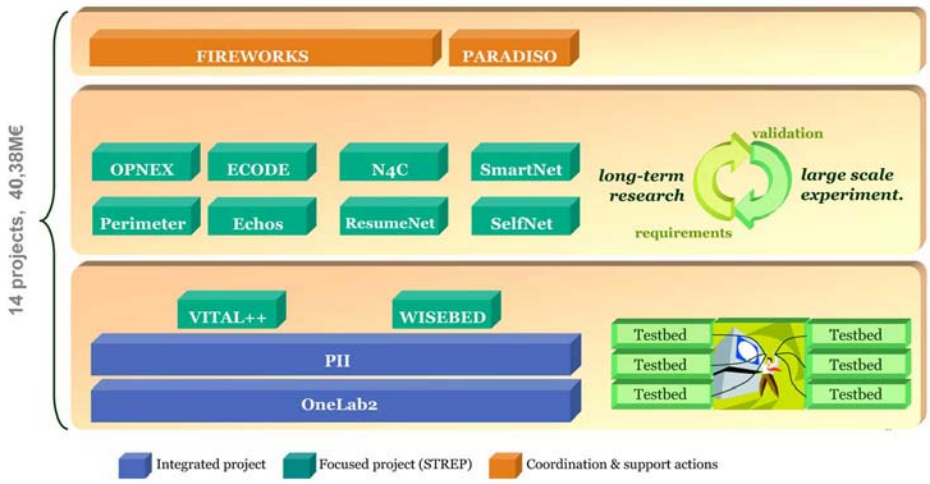

FIGURE 28: AN OVERVIEW OF THE FIRE PROJECTS SELECTED AT FP7 ICT CALL 2

RESEARCH AREAS TO BE EXPLORED

"Just because we can't predict the future doesn't mean we can't prepare for it"
Peter Madden - Chief executive, Forum for the Future - PARADISO conference of January 2009

To summarize the previous section, we might say that even if, at the moment, the possibility or probability of the societal paradigm shift introduced in the second chapter of this document is not indeed considered by the ICT community when addressing the future of ICT or of "the Future Internet", there are interesting signs that some awareness has started to develop, and that there is a more and more propitious environment making us confident that innovative approaches necessitated by this paradigm shift can be positively welcomed by the ICT community as a whole.

Now, what can be precisely suggested in the light of the work that PARADISO has developed these last 12 months and namely on the basis on the scientific workshop of June 2008, of the "ICT for a global sustainable future conference" of January 2009, and of the contributions received following the PARADISO online consultation? In particular, which research areas can we suggest to explore in the short term, including on network and service infrastructures, so that more relevant technologies, services, and applications can be available in the future?

FURTHER DEVELOPING AWARENESS OF THE ICT COMMUNITY

Even if some encouraging signs can be noted, a lot remains to be done to further develop the awareness of the ICT community concerning a possible or probable societal paradigm shift:

- It is not only a question of taking into consideration some socio-economic aspects in today's research projects; it's about being aware that ICT is not only a tool or a mean, is not only instrumental but decisive in the evolution of our societies and that, in consequence, adequate consideration of societal aspects have to be taken into consideration.
- consumer patterns are changing: consumers are expected to consume less or at least differently, looking for more "meaningful" and affordable products and services, for durable, upgradeable and easily recyclable characteristics. Research leading to infrastructures, products and services offering such characteristics has to be encouraged.
- New social paradigms are emerging: innovative social platforms have to be developed that are suitable for Beyond GDP societies, including not only networking aspects but also characteristics adapted to an expected development of local social and cultural services, of an informal economy in local communities.

Can such recommendations and suggestions be inserted into future versions of the FP7 work programme or even be part of evaluation criteria referred to in the selection of proposals submitted for funding?

MAKING MORE EFFORTS ON ALREADY IDENTIFIED TOPICS

Some significant efforts are already put on research related to ICT for environment (including climate change issues), ICT for development, and e-Inclusion, and on the mitigation of ICT negative impacts or aspects. But more efforts have probably to be done knowing that the pace at which challenges are increasing is obviously faster than the one at which appropriate answers are provided.

Greater effort should be put in particular into specific research aiming at strongly mitigating (and at precisely monitoring) the impact of ICT on the environment and natural resources (energy consumption of ICT equipment, waste generation and use of hazardous substances, life-cycle audits, etc.). Relying on more durable, upgradeable, and easily recyclable equipment (see above) is one of the options, but not the only one. ICT have to become champion in terms of mitigation.

Concerning ICT for development, time has truly come to include more SICA's (Specific International Cooperation Actions) into the FP7 work programme for the ICT theme.

PROMOTING CROSS-DISCIPLINARY AND MULTI-STAKEHOLDER RESEARCH AT INTERNATIONAL LEVEL

Considering the key role of ICT in achieving the economic, social and environment objectives of societies, cross-disciplinary and multi-stakeholder research has to be widely encouraged. In this context, it appears as relevant that ICT research can be launched involving other DGs (on ICT for environment and ICT4D issues for instance, or on issues addressed by the SOCIO-ECONOMIC SCIENCES AND HUMANITIES programme)

Increased international cooperation has to be encouraged and not only with developed countries, in particular via Infrastructures or connected testbeds, and this because addressed issues are global (consumer needs or response to advanced applications and services have to be evaluated globally for instance), and because some possible developments can be usefully shared (for instance the market for more affordable products or infrastructures can include not only less developed countries but also less developed groups of developed countries - see "Exploring new horizons" below).

ENSURING THE AVAILABILITY OF SUITED "BEYOND GDP" ICT TOOLS

ICT tools are needed to demonstrate the relevance of Beyond GDP societies to all stakeholders (from policy makers to the public at large), to simulate the impact of policies on social, economic and environment issues, to test new Beyond GDP indexes or indicators.

Some tools are already developed today, such as the OECD EXPLORER online visualization tool, or the NEF TOOL related to national accounts of well-being. But cross-disciplinary cooperation is required to develop even more reliable and attractive tools taking advantage of the latest ICT developments (such as "serious games", virtual worlds, and social networking platforms).

EXPLORING NEW HORIZONS

Taking the above into consideration, a set of research projects could usefully explore which kind of network and service infrastructures, which kind of products and services could be developed to go beyond the present split between:

- Advanced solutions suited to developed countries of the one hand,
- Low-cost solutions suited to developing countries of the other hand.

The idea is close to the LONG TAIL niche strategy referred to in businesses, particularly in ICT ones, or to the POGE (Principle Of Good Enough) software design theory, but extended to different countries, as illustrated below. It suggests that new market segments can be usefully explored, that, in the perspective of a true "sustainable future", could lead to attractive markets, targeting middle-low classes of developed countries and middle-high classes of developing countries at the same time.

Which applications, products, services would be derived from this? It's open but they will more likely be in line with many of the above specifications and recommendations.

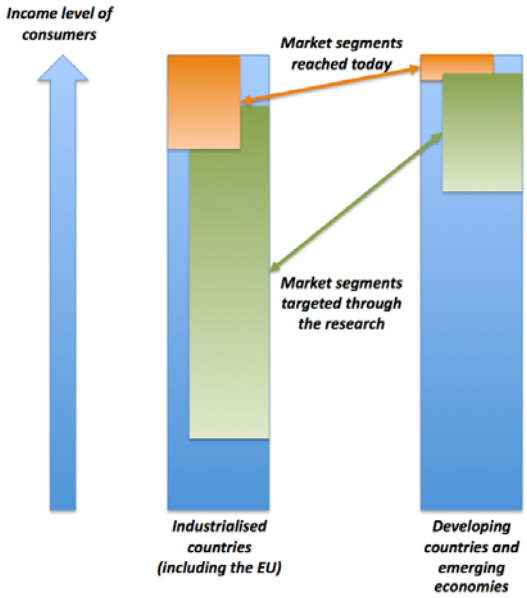

FIGURE 29: NEW HORIONS TO EXPLORE - PARADISO - 2009

The authors of this document are aware that, after one year of activities, only partial results have been reached, and that a lot remains to be done in order that:

- The PARADISO key messages (a foreseeable paradigm shift worldwide in the definition of societal progress, the proactive role Europe can play to show the way to this better future, the central contribution ICT can bring to achieving revised economic, environmental and social objectives) can be conveyed to the widest possible community and eventually have a true impact on the political agenda.
- The ICT research areas to be explored in the short term so that suited solutions can be made available in the future can be fully investigated and specified.

They are committed to continue their efforts in close liaison with all interested stakeholders. In particular, contributions submitted on the PARADISO WEB SITE will still be welcomed in the future, so that the inputs from the largest number of individuals and organisations having an interest in the addressed topics can be taken into account when preparing revised versions of the present document.

ANNEX: KEYNOTE SPEECHES PRESENTED AT THE PARADISO CONFERENCE OF JAN. 22-23, 2009

VIVIANE REDING, COMMISSIONNER FOR INFORMATION SOCIETY AND MEDIA, EUROPEAN COMMISSION

Ladies and Gentlemen,
Honourable President of the European Parliament,
Distinguished Members of Parliament,
Excellencies, Distinguished Guests,

I am delighted to welcome all of you to the PARADISO conference, a crucial event to address issues of paramount importance for the future of our society.

The need to ensure a global sustainable future is indeed a major concern and a top priority for policy makers worldwide.

The presence of so many distinguished speakers and the impressive attendance is a sign of the importance that this issue has taken.

Let me warmly thank all of you, especially those who have travelled from other regions of the world. I wish you a most enjoyable stay in Brussels.

Facing the economic crisis: lessons and opportunities

Let me start with some general considerations on the current socio-economic context.

Our society is facing increasingly complex issues, unprecedented in the history of mankind. We are witnessing a period of instability that has called on Member States and International Institutions to invest considerable budgets to face the ongoing financial and economic crisis. These remarkable efforts were necessary to contain the economic downturn. But, what can we do more to ensure that these interventions will generate lasting and structured effects on our economies and societies?

I believe that there are three essential lessons we can already draw from the ongoing crisis:

- Firstly, we need to build solid and sustainable businesses and economies based on real high-value goods and services and responding to real market needs.
- Secondly, we must reinforce our investments in research to improve our future capacity to innovate and grow. It is only through research that new technologies and innovation can be developed for the benefit of all businesses and citizens around the world.
- Lastly, we need to work all together not only to find short term remedies, but also for achieving ambitious goals that no country or region alone is strong enough to tackle by itself.

Ladies and Gentlemen, history tells us that global economic crises often occur in the context of socio-economic transformations that bring us not only risks, but also opportunities to build more solid foundations for a new phase of growth and prosperity. These opportunities lie in our capability to fully reap the benefits of scientific and technological innovations.

Because of their increasing pervasiveness in our society, I believe that Information and Communication Technologies (ICT) are main drivers of this epochal change, impacting at least three dimensions: economic, social and environmental.

ICT driving the economic transformation

ICT is the enabling technology underpinning the entire economy. Recent OECD studies have shown that ICT has contributed to more than 25% of GDP growth in the last 10 years.

One of the main vectors of this impressive impact is the Internet. A new economy of Internet-based services is flourishing, characterised by new trends in content creation and delivery, where services are paid as they are consumed. The emergence of Web 2.0 as a business tool and as a way of delivering government services will further accelerate this trend. In the near future, we will see the advent of a mobile and wireless Internet and of the Internet of Things connecting not only computers but also cars, machines of all sorts, household appliances, energy meters, lights, they can all be connected. The Internet will be the highway to connect and better manage all type of critical infrastructure in the field of transport, power supply, health, banking, enabling consistent cost savings and increasing quality of services.

All these new applications and services will create new opportunities and even more structural market changes that need to be tackled at global level.

To address these challenges and ensure economic sustainability, new business and economic models are required that combine the need to build and maintain an open, secure and reliable network and service infrastructure with the need to ensure a free competition on the future Internet-based services market.

It was stated in last year's OECD Ministerial Declaration on the Future of the Internet Economy that all these developments will have to be articulated with appropriate regulatory environments that protect and empower users and ensure a level playing field for competition.

ICT driving the social evolution

But the importance of ICT cannot be measured only in economic terms: think of the impact that mobile telephony, e-mail, electronic databases, and of course the Internet, has had on our way of living and interacting, on our access to knowledge, on our political choices.

ICT played its role during the last US electoral campaign, when President Barack Obama used Web 2.0 technologies to communicate with millions of Americans.

In most industrialized countries, new generations cannot even conceive a world without the Internet, and their lifestyle is strongly dependent on the Internet developments. I cannot stress enough the key role of Internet, in connecting the citizens of the world, allowing them to share knowledge and opinions.

Social networking has emerged as a phenomenon changing our lives and contributing in particular to shaping people's participation to communities and groups of interest for professional reasons, for entertainment and knowledge sharing. According to some sociologists, this provides the extraordinary opportunity to our society to go beyond individualism and pure quest for material wealth, for building together the world of tomorrow.

However, this increased freedom of communication and networking is jeopardised by two factors:

- Firstly, the increased ability of hackers, organized crime and terrorists to attack people's identities and their online lives in cyber-space. It is detrimental to the trustworthiness of the Internet.
- Secondly, the increased anti-terrorist measures based on massive gatherings of data on individual basis poses concerns related to civil liberties and privacy protection.

To ensure the sustainability of our Internet-based society, it is therefore important to stimulate the development of new technologies that provide the required security and trust for organisations and the citizen, while respecting human values and supporting privacy.

ICT enabling a new revolution in energy efficiency and environmental sustainability

ICT and the Internet are also bringing about several other possibilities to tremendously improve the sustainability of our environment: think of the applications of ICT for improving energy efficiency, for monitoring environmental changes, for implementing smart power grids, for integrating new sources of renewable energy in the power supply.

The Commission has recognized that ICT provides cost-effective means to achieve the 2020 targets (by 2020, Europe must cut greenhouse gas emissions by 20%, produce 20% of its energy from renewable sources and increase energy efficiency by 20%) , in particular in respect of improving energy efficiency and reducing carbon emissions. We are currently aiming at creating a policy framework that will allow the energy-saving potential of ICT to be widely recognized and exploited.

The opportunities for energy-savings are clear and wide-reaching, but there are challenges that we need to overcome.

The production and use of ICT currently accounts for about 8% of electrical power consumption in the EU and about 2% of carbon emissions. However ICT are becoming more pervasive and their energy consumption will continue to grow. We need to take measures to ensure that as their use increases, their carbon footprint does not.

Perhaps more significantly, we can exploit ICT to increase energy efficiency across the whole economy and thus help reduce the other 98% of carbon emissions. ICT can be used for monitoring and controlling complex infrastructures and societal interactions to achieve more energy-efficient use of resources.

Furthermore, ICT can enable changes in business models, working practices and lifestyles that are inherently more energy-efficient. The Internet, for example, has enabled the substitution of physical products and processes by digital ones. However changes in behaviour are unlikely to happen where the advantages are not clear to all concerned.

The European commitment towards a sustainable future

Ladies and Gentlemen, the European Commission has undertaken several actions to ensure a strong contribution to a more sustainable future.

Firstly, let me illustrate an important policy initiative we are taking on energy efficiency.

According to a recent consultation made by the Commission, there exists an "information deficit" among consumers about the possibility offered by ICT in terms of energy efficiency. What cannot be measured cannot be managed! Making energy and carbon footprints visible, transparent and measurable is one of the key pre-conditions for meeting the 2020 targets. The technologies that enable us to collect, manage, analyse and share energy information, are a crucial part of the solution. It is clear therefore that ICT-based innovations are essential to provide the tools that enable business and citizens to really begin the process of reducing their energy and carbon footprints.

To this end, the Commission is currently working on concrete measures in the form of actions addressed to the industries concerned and to the Member States in the very near future.

We plan to announce these actions in the context of a high-level event in March this year under the auspices of the Czech Presidency.

Secondly, in our research programmes we have recognised the Internet as a fundamental catalyser to ensure a future sustainable economy and society. Its role is crucial not only to foster innovation and competitiveness of European industry, but also as a fundamental tool to enable social networking, enhancing e-democracy, allow the participative development of knowledge and more equal sharing of resources.

The Future Internet Assembly (FIA) has been set-up, consisting of more than 90 projects and 6 related European Technology Platforms. It represent a collective European investment in the order of 400 M€, a very significant amount compared to the programmes launched in other regions of the world.

One of the main contributors to these endeavours is the initiative FIRE - "Future Internet Research and Experimentation" which includes strategic research on Future Internet with high attention to socio-economic issues, which are so difficult to assess without a real experimental environment. FIRE puts together a very ambitious research programme that is essential for real innovation, with industrially driven experimentation to enable early testing and assessment of new technologies and solutions. The project organising today's event, PARADISO, has been launched under the FIRE initiative.

Conclusions: a new path to growth and prosperity

Honourable guests, dear colleagues,

I have made a clear statement today of my belief that, especially in these days of economic uncertainty, we must continue to invest in our future, and that our future lies in our capability to fully reap the benefits of Information and Communication Technologies, and in particular of the Internet.

Combining future Internet research with experimentation, as remarkably done within the FIRE initiative, is crucial to better understand the transformative effect of the Internet on our economies and societies. However, research needs to be done hand-in-hand with policies to ensure that the new technologies will meet the expectations of the future economy and society. From our side we will, through the ongoing European Research Framework Programme, put greater emphasis on technologies which will have a positive social, economic and environmental impact contributing to future growth and prosperity.

The subject addressed by this conference, global sustainability, calls for a global dialogue. I hope your work today and tomorrow, will lead to significant progress in the understanding of these issues and in identifying common targets to ensure a more sustainable world.

Thank you for your attention.

DR HAMADOUN TOURÉ, SECRETARY-GENERAL, INTERNATIONAL TELECOMMUNICATION UNION

Friends,
Colleagues,
Ladies and gentlemen,

- We are living through one of the most challenging periods in human history – faced with a meltdown of the world's financial systems on one hand, and the prospect of irreversible global climate change on the other.
- Last year, the biggest speculative financial bubble in history finally burst – and this year we will all experience the consequences.
- Consequences that include unemployment for millions of people and a dramatic slowdown in investment.
- With US interest rates close to zero, and the Bank of England's rates at their lowest in the bank's 315 year history, there is also a real risk of deflation, and little further room for manoeuvre at the policy level.
- In a world where new financial business models have proved themselves totally inadequate to the needs of the real world, 'business-as-usual' is simply not an option.
- At such dramatic times, climate change may suddenly seem a less pressing issue.
- But climate change is also happening right now, and poses far greater long-term threats than the current financial crisis.
- We've had a cold couple of months recently, and last year was relatively cool compared to what we have become used to. But 2008 was still the tenth hottest year on record, and the past decade was the hottest on record – with global temperatures an average of 0.2 degrees warmer than the previous hottest decade (which was the 1990s).
- Climate change presents us with incredible challenges, including food and water security, with new forecasts suggesting that half the world's population could face climate-induced food crisis this century.
- Inevitably, most of those people will be the ones who are least well equipped to deal with such challenges – the peoples of the developing world.
- So, for climate change, as for financial crisis, business is also very much *not* 'as-usual'.

Distinguished colleagues,

- That makes this conference *uniquely* important.
- Fortunately, in this dangerous and frightening new world, ICT can play an important – and indeed vital – role.
- They will help us – as Paradiso, the organizer of this event, has said – to 'proactively promote a new concept of progress, based on revised social, environmental and economic objectives: a true sustainable development, more sustainable economic growth, more equally shared resources, and eventually the well-being of peoples around the world'.
- I am a true optimist.
- I firmly believe in the power of ICT to make the world a better place – and most especially during these challenging times.
- ICT are the great enabler of modern society, helping people communicate across distance and across cultural divides, facilitating trade, and providing access to vital resources – especially in health and education.
- In under two decades, ICT have totally transformed not just the way we work and play, but the whole way we communicate, access information, manage health and produce wealth. They are at the very heart of all societies worldwide today, both in the developed and developing world.
- ICT are ubiquitous. Indeed, the number of mobile cellular subscribers globally has just passed the four billion mark. And well over one and a half billion people now have access to the Internet.
- So ICT is now a significant sector in its own right – typically accounting for around 5% of global GDP and an even higher proportion of GDP growth, in addition to its important facilitating role in many other sectors.
- ICT therefore have a key role to play in sustainability.

Ladies and gentlemen,

- In the current financial crisis, ICT can help governments and industry alike weather the economic storm – by reducing costs, boosting efficiency and increasing productivity. And while economic crises come and go, the basic human need to communicate continues.
- Also, we should not forget that technological transformation is at the very heart of our industry. So while the crisis will inevitably be very tough indeed for many ICT businesses, I believe it will also revitalize the industry and enable new entrants with new technologies to thrive.

- It also makes sense to adopt 'Green IT', even when times are hard. The upfront investment – even with a relatively short ROI of just two or three years – might seem hard to justify in today's economic climate. But look at the global climate – and climate change – and remember that our whole future is at stake here.
- Green IT helps businesses cut both immediate and medium-term running costs – through energy-efficient technology, server virtualization and reduced travel expenses, for example. And cost-efficiency is a critical factor in determining which players survive, in a tough economic recession.
- As the leader of ITU, the UN specialized agency responsible for ICT, it is my mission to connect the world and ensure that all people, wherever they live, have access to the vast range of benefits ICT offer.
- This of course presents not just a huge development challenge, but a huge ecological challenge too. Today, the ICT sector produces some two to three per cent of total greenhouse gas emissions; a share which is forecast to rise as we roll out more mobile and broadband networks.
- The pursuit of energy-efficient ICT is therefore vital, and I am pleased to say that ITU is doing a great deal of work in this area – from promoting the creation of new energy-efficient devices and networks to developing technical standards to limit and reduce the power requirements of ICT equipment and services.
- ITU is also working to identify radiofrequency spectrum that can be used for climate monitoring and disaster prediction, detection and relief, and is a strong supporter of the Global e-Sustainability Initiative, in partnership with the United Nations Environment Programme and ICT service providers and suppliers.
- ICT may themselves contribute to global warming, but they are also a critical tool in helping reduce global greenhouse gas emissions. Indeed, forecasts estimate that they could help cut emissions by 15 to 40% – by enabling intelligent transport systems, smart buildings and better supply chain management, for example.

Distinguished colleagues,

- Before I close, I would like to say a few words about a subject very close to my heart: ICT and the developing world, and in particular the 49 UN-designated least developed countries, the LDCs.
- If we think ICT are important to our society, and our sustainable future, then this is doubly true for the LDCs.
- Already, ICT have brought remarkable change and progress to LDCs, particularly in the early years of the new Millennium.
- Since the year 2000, the number of fixed-line subscribers in the LDCs as a whole has risen almost 30-fold, from 3.8 million to 107 million. Mobile cellular subscriber growth has been even more rapid, giving LDCs a combined total of over 110 million cellular subscribers – up from just 800,000 mobile connections at the start of the Millennium.
- This is absolutely crucial for both social and economic progress.
- At both the macro-economic and micro-economic levels, it has been clearly demonstrated that mobile subscriber growth in developing countries directly supports economic growth.
- At the macro-economic level, Leonard Waverman, of the London Business School, has demonstrated that every extra 10% increase in mobile teledensity in the developing world leads to an additional 0.59 percentage points in GDP per capita.
- And at the micro-economic level, a Harvard University study found that Southern Indian fishermen's profits rose by an average of 8% on average – and consumer prices fell by 4% – once they had mobile phones.
- The next great ICT challenge for LDCs will be broadband, which is becoming essential basic infrastructure in a globalized economy – as vital to economic and social development as networks like transport, water and power.
- There are positive growth trends – with 11 million Internet users in the LDCs by the beginning of last year – but growth rates and access speeds are still nowhere near fast enough.
- Accessing information via a dial-up connection today is like being stuck on the hard shoulder on the Internet superhighway, watching the rest of the traffic rushing by. Locking users in developing countries out of the full online experience will come increasingly close to locking them out of the modern economy altogether.
- So ICT can help us meet the Millennium Development Goals. But if we are to build a sustainable future, we must ensure not just any old ICT for the developing world, but the latest, most energy-efficient, and cost-effective ICT are developed, rolled-out and deployed for the benefit of all.
- This is only right and just. The world's poorest countries gained little from the global economic boom of the past few years and they generate only a minute proportion of greenhouse gases. Yet they seem set to suffer disproportionately from tighter economic conditions and the effects of climate change.
- Let me therefore make a heartfelt appeal to keep the developing world in mind during this conference and during our ongoing debates on ICT for a sustainable global future.

Thank you.

HANS-GERT PÖTTERING, PRESIDENT, EUROPEAN PARLIAMENT

Madam Commissioner, dear Viviane Reding,
Mr. Secretary General of the International Telecommunication Union, dear Hamadoun Touré,
Dear Maria da Graça Carvalho

Ladies and Gentlemen,

Distinguished guests,

It is a great pleasure for me to be here today for the opening of this landmark Conference on the role of Information and Communication.

Technologies (ICT) for a sustainable future.

I wish to thank the European Commission not only for organising this event, but also for inviting me to take the floor and to say a couple of words from the perspective of the European Parliament.

When first looking at the title and topic of this conference, you easily get the impression that this meeting will primarily be dealing with highly technical and scientific issues, and rightly so, as these questions need to be discussed and dealt with in depth and detail.

But at the same time allow me not wish to enter into this debate about ICT myself, as we have many highly recognised specialists and engineers amongst us today who will certainly do that with much more talent than I could.

As president of the European Parliament I would rather wish to point out the importance of the topic we are addressing today, the importance of information and communication technologies for our everyday life, for the well-being of our European citizens and that of future generations.

Not only has the ICT sector profoundly transformed the way we live, work and learn: From mobile phones and micro-computer chips to the Internet, ICT has delivered new products and services that have become part of everyday life.

We have become fully used to the presence and often unnoticed support of ICT in our life. But yet have not made full use of the opportunities information and communication technologies can play in increasing the quality of our life.

Information and communication technologies can without doubt contribute to improving our prosperity, to enriching our society and to ensuring our future.

We are in the midst of two global tides - the financial and economic crisis on the one hand and our dire need to fighting climate change on the other. Economic growth is slowing down and likely to become negative in a number of countries of the European Union.

At the same time, the timeframe available to us to decisively mitigate climate change is very limited. We have seven, maybe eight years at our disposal to act. These are major challenges we are facing, not only in the European Union, but also in other countries and regions around the world.

We need to take action now at a global level. But we also need the means and the innovation boost to do so effectively.

That's where the Information and Communication Technologies' sector comes into the picture. As a major and constant source of innovation, as a driving force for enhancing competitiveness in the European Union, but also as a means of better assessing the evolution of our environment, ICT can play an important part in the future, not least in achieving the economic, social and environmental objectives we set ourselves with the Lisbon strategy.

These technologies will have a massive impact on our economy and society. Therefore, the role of the ICT sector should be planned strategically both in the short, medium and longer run in the European Union.

That is also why, in the name of the European Parliament, I have very much welcomed the initiative of this conference and expressed my support for the objectives it is aiming at.

I. What is quality of life? How can we achieve sustainable development?

Before getting more into detail, it is important in my view to clarify what we actually mean when speaking about promoting a sustainable future and a better quality of life.

Let me remind you: Prosperity is not simply equal to ensuring economic growth, nor is increased economic growth equal to better life quality.

Development is only then sustainable, when it also improves the quality of life of our citizens in terms of social well-being, health and a clean environment. That is the core meaning of prosperity.

Thus, the social environment and the sustainability of economic production methods have a major impact on our well-being. Ultimately, well-being results not least from a reconciliation of the people with their national heritage.

There is a major change in thinking taking place since a couple of years.

When nowadays, as a consequence of pollution in cities, people are increasingly suffering from asthma or allergies, can one then seriously say that our well-being has improved and that our way of living is sustainable?

Knowing that climate change is accelerating and that millions of people may be threatened by storms and floods, by the real danger of having their livelihood destroyed or diminished, we need to be able to better prevent these phenomena and their impact on the world population.

Ladies and Gentlemen,

The topic of today's conference indeed reminds us that we in the European Union are committed to shaping our policies on the basis of our common values - we put the citizens and their interest at the centre of political objectives.

My deep conviction is that the European Union is far more than just an association of economic interest. We are a community of values. And as such, we carry a major responsibility for the well-being and cohesion of the European society.

Now, please do not think that I might have misread the subject of today's conference. Rest assured, I have not.

The reviewed Lisbon strategy is nothing else than the concrete implementation of a new sustainable development model based on the strategic triangle of market economy, social cohesion and environmental protection. It requires the promotion of sustainable production and consumption patterns that decouple economic growth and environmental damage.

At both European and global level, a sustainable future means doing more with less. Information and Communication Technologies can help us achieve productivity growth and economic growth with fewer resources - that means to become more efficient, and to move on by substituting older, more polluting means of production to new ones.

For instance, to fight climate change we need to adapt our production patterns and show the way towards a low-carbon society. This is what our friend Jeremy Rifkin calls the third industrial revolution.

It is economically and technically feasible to overcome the hitherto damaging production methods without cutting back on economic growth, but even increasing it. ICT can help us adapt to this new framework.

Therefore, we must raise awareness of the potential and environmental benefits of ICT and promote their development.

II. How can ICT help achieve a sustainable future and improve the quality of life of citizens?

To highlight the growing importance of ICT, allow me to give a number of examples of possible contribution of this crucial sector.

Firstly, ICT is an important factor to promote growth, competitiveness and create jobs, which will be decisive in the coming months and years. The European Parliament has worked in favour of redirecting our focus to sustainable growth and jobs.

Future economic development and prosperity in Europe are strongly dependent on future investments and innovation. This importance has been underlined by designating 2009 as the European Year of Innovation & Creativity.

The target Europe long has set is for a 3 percent Research & Development intensity by 2010, yet the results of our efforts have stagnated since the mid-nineties, and today the level has still not risen above the 2% mark. ICTs feature strongly in the priority areas identified by the Lisbon strategy.

And, ladies and gentlemen, the ICT sector is indeed the largest R&D investor in Europe.

The current debate on the Lisbon strategy in the European Parliament focuses on the economic crisis and the medium and long-term effects that the Lisbon Strategy can have to alleviate the consequences of the crisis.

The "i2010 strategy" dating back to 2005 aims for a true single market for the digital economy and promotes the positive contribution that information and communication technologies can make to the economy, society and personal quality of life.

With this in mind, my colleagues in the European Parliament are already debating what is to follow the current Lisbon Strategy after 2010.

We are looking forward with a lot of interest to what the next European Commission will propose to follow "i2010", as there are still many challenges to tackle towards 2015 or even 2020.

Secondly, as already mentioned previously, ICT can have a decisive part to play in the move towards a low carbon society, and thus help us protect the environment and improve the well-being of citizens.

As politicians responsible for our society and for its sustainable future, we need to legislate and foster the transition to the third industrial revolution. But we cannot work in the dark; we need accurate information on our natural environment to justify our legislative steps and policy action.

ICTs provide the means to improve our understanding of the natural world and the impact of human activity on it. They offer us valuable tools to protect the environment and reduce the damage we cause.

Thus, using ICT can help us manage finite natural resources and energy consumption much more efficiently, so improving environmental protection without holding back economic development. Now we need to demonstrate to citizens, businesses and policy-makers alike that investing in ICTs is worthwhile!

Of course, no technology can protect us from the power of nature or prevent an earthquake, but ICTs can certainly help reduce the scale of possible destruction and damage by providing more extensive and more systematic monitoring systems.

Permanent monitoring of areas at risk, linked to emergency response procedures, is the key to saving lives and minimizing devastation so that normal life can resume as quickly as possible.

But the largest-potential direct influence of the ICT sector on a global sustainable future is by enabling energy efficiency. ICTs should make it possible to change our energy consumption patterns and reducing carbon footprint whilst maintaining growth and quality of life.

The European Parliament is due to vote its resolution on Energy Efficiency through ICT at its February I Plenary session. In its draft resolution drawn up by my colleague Vladimir Remek, the European Parliament calls on both the European Commission and the Member States of the European Union to promote the testing, validation, introduction and further dissemination of computer- and ICT-based methods to improve energy efficiency.

Notably, this resolution also puts emphasis on the building sector, which accounts for 40 percent of the European Union's energy requirements. The resolution underlines the need to develop smart energy efficient buildings and to create better conditions for the uptake of ICTs for intelligent buildings.

The potential of ICT in the field of energy has already been addressed in the energy package, which was so successfully approved before Christmas by both COuncil and the European Parliament. The implementation of the resulting measures will contribute to achieving the energy and climate targets and realising the gains to which ICT can contribute.

Other fields within the energy sector where ICT plays an important role are for instance eco-innovation, renewable technologies, and sustainable ICT strategies to reduce carbon emissions.

Ladies and Gentlemen,

These few examples illustrate the importance of the ICT sector for our society and its future, and the need to promote it. You will have the occasion throughout this conference to discuss more in depth the role ICTs can play in ensuring a sustainable future and the ways to foster the development of larger access to ICTs.

I just want to thank again the Commission for taking the initiative of this conference. Allow me to conclude by saying that even if ICT were just a means and not a policy objective in itself, their promotion is indeed means to a greater good and will help promote the common values our European Union is built upon.

Promoting information and communication technologies in the European Union can and will give us a major competitive edge. Failing to seize the chance by investing more into these technologies would create a problem for which future generations would have to pay an enormous price in terms of loss of well-being and quality of life.

It is therefore our responsibility towards future generations to urgently develop these technologies and to promote, what some would call, an ICT connected governance.

Thank you.

MARIA DA GRACA CARVALHO, PRINCIPAL ADVISER TO THE BUREAU OF EUROPEAN POLICY ADVISERS, EUROPEAN COMMISSION

Dear Members of Parliament,
President of European Parliament,
Commissioner Reding,
Secretary General ITU
Ladies and Gentlemen:

• I would like to thank the organizers for the invitation to the Bureau of European Policy Advisers of the Commission to be here today.
• The role of ICT in boosting economic growth is today well known. ICT has fostered the restructuring of markets and changed the ways we do business, and continues to offer a great opportunity for innovation.
• We need to invest in ICT as one of the main pillars to foster growth and create jobs, especially in the context of the dramatic economic downturn that the world economy is facing.
• But this conference is not just about growth but also about sustainability. And if the role of ICT in fostering the growth is rather obvious, much more can be said about sustainability. ICT can play a crucial role in the making of a more sustainable world.
• Such a role is not new. ICT had a major impact not only on the growth of wealth but also on its distribution.
• The ICT revolution is fundamentally distributed in nature. It allowed an increasing share of individuals and organizations to play an active role in the economic, political and social life.
• Such a trend towards distributed intelligence and power will not just continue but will also change in nature. As many have argued, from the information world, the ICT revolution will move "outside" to be increasingly embedded in our reality. And this is already happening.
• We will increasingly leave in an "intelligent ambient" in which humans will be surrounded by intelligent devices embedded in everyday objects for the health and comfort of human society.
• These ICT enhanced realities give us the possibility to address today's global challenges in new ways. Challenges that, today more than ever, are at the same time about growth and sustainability.
• Let me start with the major challenges of our century and how ICT might contribute to address them.

Global challenges and the role of ICT

Health and ageing society
• A first challenge is about the ageing of our societies and how this impacts not just on our capacity to grow, but also on our health and social protection systems.
• Thanks to sixty years of peace, advancement on research, medical progress and better living conditions, a growing proportion of people are now enjoying longer and more active retirement.
• But ageing also poses a series of social risks such as old- age dependency and loneliness, the need for informal care, and poverty particularly for those exposed to low pensions as a result of incomplete careers.
• But thanks to ICT we can improve the life of older people at home, in the workplace and in society in general; allow them to stay active for longer and leave independently.
• And ICT can also dramatically improve our capacity to deliver home care services in health, with a reduction in hospital stays, reduced costs and an increased quality of the service.

Poverty and social exclusion
• A second challenge is about poverty and social exclusion.
• Only in Europe 78 million Europeans are at risk of poverty. Poverty strikes in particular the unemployed, the disabled and the elderly; women are disproportionately at risk. Even employment is not a guarantee against poverty: in-work poverty is on the increase, with some 8% of employed people at risk of poverty.
• There are barriers preventing or discouraging certain groups from gaining full access to employment, training, education, housing and health-care. Of course such an issue requires policies and actions that go far beyond ICT, ranging from labour market integration to investing in knowledge and life-long learning.
• But ICT can help here. On the other hand, for many people at risk of exclusion due to physical and cognitive disabilities, ICT offers essential tools for overcoming barriers to social and economic integration.
• ICT also plays a fundamental role in the developing world to bring information, education, health to people in remote places.

Climate change
• Last but not least, a third major challenge is Climate Change and the consequent need to move towards a greater energy efficiency and role for renewable forms of energy.

• Such a move has far reaching environmental, but also social and economic implications. Renewable energies are everywhere. This implies that there will not just be few locations where energy is produced and stored, but there will be also an increasing number of distributed energy power plants.
• But this also means that energy will become an opportunity for many to play an active role in its production and benefit from its value. Distributed energy means distributed wealth.
• And here ICT will play a fundamental role. Through ICT and grid technologies, an increasing number of actors will be able to produce renewable energy locally and use it off-grid for their own electricity needs.
• But ICT can also increase the efficiency of our energy consumption. ICT will assist us in organizing our cities, working places in a complete different way with the objective to achieve a low carbon society.
• Furthermore, ICT is crucial for the energy efficiency in buildings, in industry and in the transport sector.

Critical issues
• But we have to bear in mind that ICT is a tool. And like any tool, they can be used in positive and negative ways. Only if we look also at the critical aspects of ICT we can better understand how they can be used to address major challenges. I would briefly go through three of them.
1. ICT as part of the problem
• A first issue is that the more we move towards information and knowledge based economy and society, the more those that do not have access to information and knowledge will suffer from poverty and social exclusion.
• For this reason I believe that, besides policies to foster technological development, we have to pay an increasing attention to those that ensure diffusion and access to technology.
2. The illusion of control
• A second issue is that having more information does not mean necessarily to be more informed. Information overload is one aspect but not the only one. Yet our increased access to information can also give us the illusion to be more informed and to be able to control the situation more than we actually do.
• For this reason I believe that, besides having more information, we need to think about new ways to ensure the quality and reliability of information.
3. All becoming big brothers
• A third and last issue that I would like to refer is related to privacy and ethics. The risk of loosing our privacy caused by ICT has been already outlined by many. But I think that the more ICT will be embedded in our daily life, the more this problem may exacerbate.
• The same concern goes for ethics. The capacity of ICT together with other technologies to control, extend and model human life poses a series of ethical issues on the obvious side effects of such a possibility.
• In this sense, I believe that we should take in due consideration, the ethical implications of our ICT policies.
Conclusions
• To conclude, I would like to stress that ICT are tools and not ends. As such they need to serve a purpose which today is and should be broader than the simple growth of our economies. They should assist us in the process of building a healthier, cleaner society, with more social justice and where people feel happy.

Thanks.

ANNA MARIA DARMANIN, MEMBER, EUROPEAN ECONOMIC AND SOCIAL COMMITTEE

We are used to hearing that the greatest challenge being faced by the world this century is that of climate change. Recent worldwide events have proven to us that global sustainability is not only about dealing with climate change but really with the effective management of our resources, our natural resources, our financial resources and our people resources in terms of social sustainability.

ICT is key to global sustainability; this conference is a testimony to such. In the EU's Recovery plan related to the financial crisis our countries are facing, ICT has been identified as one of the tools for successfully dealing with this unprecedented crisis. The Recovery Plan places a huge amount of importance on broadband infrastructure, ICT services and sustainable telecommunications. This is the opportunity to have a "green' economic recovery and definitely economic activities which are part of such a green economy, including ICT, stand to benefit.

Moving on the sustainable management of our natural resources I will focus on 2 issues.

The advancement of technologies in the field has made it possible that today management of resources can be fragmented further and spread across the globe so as to minimise the impact of exploitation of land by spreading it more evenly across the earth.

Traditionally people aggregated in cities and businesses in industrial zones. The need to aggregate, and population concentration, was partly brought about by our communication requirements, and the need to be in close proximity to central working areas attune to business development. ICT is a fundamental tool in bringing about a fragmentation of population conglomerates, which by nature do restrain sustainability of land and natural resources. By having a strong communication infrastructure businesses can operate not only from remote locations in which labour tends to be economically viable, as is currently the case, but also from remote locations which are sustainable in terms of the impact to their surroundings. One may highlight that such a model would be particularly easy for SMEs to take up.

At this point I believe noteworthy is the emphasis the EU recovery plan makes on the aspect of High-speed Internet for all, which targets to reach 100% coverage across the member states by 2010.

Another area in which ICT has a key role in sustainability is that of energy efficiency. The EESC has in fact often pronounced itself in this respect and also recently adopted a position vis a vis the Commission's Communication on the Addressing the Challenges of energy efficiency through Information and Communication Technology (COMM (2008) 241 final).

Technology is instrumental in achieving the efficiency of our energy grid by effectively monitoring and measuring our man made systems in order to ensure that energy is being utilised in a maximised manner. It is needed so as to identifying possible losses within the grid and dealing intelligently with the proper distribution of energy within the grid; analysing consumption patterns and adapting flow accordingly. Third generation web platform enables the management of the inputs and outputs within the power grid by achieving communication between systems.

The application of ICTs in different economic areas, at both the production and consumption stages, will allow "dematerialisation" of many procedures and replacement of physical and material exchanges by online services, also saving energy. However, the Committee also believes it is important to introduce energy-saving throughout the process of manufacturing and using technological devices rather than focusing solely on energy-efficient consumption during the useful life of the device. Our manufacturing technologies not only need to be High Value in terms of their engineering but also in terms of the methods and processes involved in the manufacturing process.

Furthermore the EESC believes that ICT is the answer to having more energy efficient equipment in terms of:

- Household appliances
- Smart buildings
- Smart transportation
- Smart lighting

None of all we mention here is easy. It is achievable, it is required but it is not easy. The R&D can be done, the industry can supply the hardware and software, but the biggest challenge is the "wetware" as the Economist puts it – the people, economics and politics.

This is primarily what the European Economic and Social Committee deals with. The aim of the EESC is to be a bridge between Europe and Civil society. In its consultative capacity the Committee brings together representatives from the economic, social and special interest groups. Embracing the true principle of participatory democracy. The committee is in fact composed of Employer organisations, Worker representatives and Civil Society representatives from the 27 Member States who together come up with a common position on issues consulted upon by the Council, the Commission and the Parliament. This makes the Committee a unique institution based upon consensus of the different economic and social partners.

Sustainability has been a key area to the Committee in the last few years and this has been materialised with the establishment of the Sustainability Observatory within the same Committee who specifically takes positions in relation to the area of sustainability so as to effectively influence People, Economics and Politics.

A final remark goes to the key role of ICT in education. Change, painful as it may be, is brought about by education. Education for Global Sustainability is vital across the globe. Achieving this in a fast and effective manner can only be done through the use of ICT, not only in our schools, with our children; but across the globe with policy makers, educators and civil society.

Furthermore we should not forget that first and foremost technology is for the service of people and people should be the focus of our endeavours so as to also achieve sustainability in social terms. People should be the focus of our technological developments.

We are living in difficult times and experiencing unprecedented circumstances. Nonetheless this is truly the period of opportunity for the "green" economy, opportunity for sustainable production and consumption and definitely ICT is a key instrument in achieving this. Never as much as today has ICT such a key role in ensuring sustainability.

VITTORIO PRODI, MEMBER, EUROPEAN PARLIAMENT

Can anyone say when exactly the wheel was invented? Or when man discovered fire? Of course we tend to think of civilization in terms of phases of development that changed our life and so it is also for information technology: almost 15 years have passed since Dr. Nicholas Negroponte forecasted in his book "Being Digital" how the interactive world, the entertainment world and the information world would eventually merge, but the transformation related to ICT has been much more dramatic than initially foreseen and has really changed our way of living. One of the major consequences of information and communication technologies has been the globalization of cultures and markets from which there is no return: we are bound to proceed on a path where the dynamics of sharing of knowledge and exploitation of resources play a crucial role. Two other elements must be added to this mix: a growing population and the looming threat of climate change. The result is the actual uncertainty about our future, about the sustainability of our civilization and as regulators, we feel called to offer an answer and a vision for its implementation.

At the dawn of ICT era, the promises looked appealing: with the use of information and communication technology everything seemed possible, from a new participation model to democracy, to cleaner production processes, to reduction of energy consumption, to wider access to knowledge... Those promises have been kept. ICTs are without any doubt very powerful tools to be applied in different social and economic fields: just think of how videoconferences, tele-working, e-learning and e-government can reduce physical mobility and consequently the pollution related to transportation. ICTs changed consumer patterns by providing an ideal environment for the production of ideas and innovation; they opened the access to knowledge while introducing a new diffusion and sharing of data. Our life is on-line: we can make use of on-line financial services, we can shop on-line, we can study on-line, we can consult our doctors on-line, and we can express our opinions and votes on-line. Some have doubts about the security of these networks, some abuse of them, but in the end the system works for the best.

ICT applications, as a matter of fact, grow more and more in complexity: let's just think of how they can help in reducing dangerous emissions through intelligent traffic management, with speed control devices or through the implementation of smart energy grids. Let's just think of how we can avoid major calamities through an intelligent satellite monitoring of our land: forest fires, droughts, floods, subsidence phenomena, earthquakes, tsunamis and other natural disasters would be less dangerous and relief operations less complicated. Even the search and the management of natural resources and materials become easier with ICT and make life bearable for less lucky people, in underdeveloped areas. Isn't this marvelous? But my vision goes further: I imagine a world where, in the words of Thomas Friedman, "IT meets ET", that is, Information technology merges with Energy technology to create a fantastic future. A world where your home appliances, your phone, your heater and air conditioner, your car, your office, your school, your supermarket, all "talk to each other" in order to find the best solution for the minimum possible consumption of energy at the best available price, readjusted each hour according to the trends of the markets. A world where a citizen can not only interact with utilities and institutions but also actively contribute to the functioning of common entities, through the use of widely spread information and communication technologies. Finally, a world where our whole approach to life is different from the actual one, a world where the common values of sharing, efficiency and equity prevail on personal interests or on a linear exploitation of resources. I am convinced that only when a systemic approach is provided to the global challenge we face now, we can talk about sustainability. I am talking of a real alchemic transformation here: we must take advantage of the technological progress to transform our reality; after all, ICT is the most successful example of dematerialization of values! Briefly, ICT support a new civilization where wealth is measured according to different paradigms: we can overcome the mere GDP concept and reach new indicators including the quality of life. A world focused on the production of immaterial goods and values is finally at hand reach and this immaterial society and economy can even boost, in its turn, the material economy.

Our task now is to give certainty to the future I outlined above; we need to set up targets and regulations because only from rules can come the incentive to compete and only from competition can come the necessary innovation that makes attainable the goal of sustainability. Why? Because a system can change when everybody is called to be part of that change and becomes a relay of new ideas and practices. That is also the reason I always stress the importance of research and innovation at all levels of production and in all areas of activity. I am confident that the same sparkling enthusiasm that initiated this ICT era will be capable of leading us towards the brilliant and peaceful future that awaits us and in this framework a particular hope is represented by the youth sector which first has been able to receive and promote the diffusion of new media technologies. Of course, technology in itself does not guarantee sustainability as much as the use of satellite phones in Africa does not guarantee a balanced economic development in those areas where energy poverty is the norm, but they are the first sign of the big change to come and, as a scientist, I know that once an element in a system changes, the whole system follows. We only need to pay attention to give the right input, the right content, at the right level and trust our good intention: wisdom will consequently emerge.

ANTTI PELTOMÄKI, DEPUTY DIRECTOR GENERAL, EUROPEAN COMMISSION

Ladies and Gentlemen,

Good morning and welcome to the second day of the PARADISO conference.

Yesterday was a very successful day with many interesting views on a true sustainable future. We heard messages on several global concerns: income differences, the recent financial crisis, global warming, the demographic expansion and the energy problem. According to many of the speakers, these alerts indicate the need to raise the level of discussion on the economic, environmentaland social objectives, to achieve a more sustainable developmentfor our societies. Today we will continue our work on how the European Commission meets the challenges of a sustainable future, and what the future holds for ICT research.

I would like to pose the questions and the leitmotif of this conference again, how can ICT help to achieve a global sustainable future? And how can ICT improve the well being of the citizen of the world?

The ICT industry clearly plays an important role in the European and global economy, it was said yesterday and it will be said today. However, if we want to achieve a true sustainable future, we must not forget the social values that are embedded ICT. The advanced tools, developed to meet the needs of the user, are a big part of the ICT industry's contribution to growth. We communicate through social networks and communities, through videoconferencing and podcasting. But not only do we communicate; we also contribute to these phenomena in various ways. It is the small contribution of millions of people that creates a multiplier effect on the market. This immense population of users without a doubt impact technology and, as citizens, also impact society. Indeed, ICT has great potential to contribute to a sustainable future, not only through a quantifiable economic growth, but also through empowering users and citizens, improving quality of life.

ICT can and must play a central role in society, and it is our task today, to present what has already been done by the Commission and to anticipate possible ways forward for the best use of research investments. Even beyond promoting industrial growth and innovation. The impact of ICT is pervasive and multifaceted. Just think of the influence that radio, television, mobile telephony, e-mail, electronic databases and Internet has had on our way of living and on our way of interacting with each other, on our access to knowledge and on our political choices. ICT also embodies other possibilities to improve life. Think of the applications of ICT for improving energy efficiency, for monitoring environmental changes, for implementing smart grids, for creating new sources of renewable energy, for creating truly sustainable ways of transport, for enabling e-learning and distance learning, improving health and enhancing e- democracy.

As Commissioner Reding said yesterday, we must respond to the real needs of the market, reinforce our investments in research and we must cooperate. ICT does not only drive the economic transformation, but also the social evolution and enables improvements of energy efficiency and environmental sustainability.

I believe that a multidisciplinary approach is imperative. Traditionally, we have seen that the most valuable innovation originates from the intersection of different disciplines, when people with different backgrounds meet and discuss new perspectives. This is what we are about to do today, in the following three panel sessions. We have brought together experts and personalities from the different sectors of technology, society and economy.

The first session will cover ICT related initiatives funded by the European Commission in order to achieve a sustainable future.

What kind of European ICT research has the potential to change and meet the needs of the future, is the main question discussed in the second panel session. It is time to improve our understanding of the social and environmental potential of new technologies and to identify research directions which can effectively pave the way to a better world.

I am also delighted to see so many interesting contributions to our afternoon session. Featured presentations are the result of an open call arranged by the Club of Rome in order to involve the most appropriate organisations engaged in this topic. I would also like to welcome Mr Keith Walters who is the first vice chair of the EDUC Commission at the Committee of the Regions, and Ms Anna-Maria Darmanin, member of the European Economic and Social Committee. The regions of Europe suffer hard from the financial crisis but do tremendous work to contribute to a sustainable future. The economic and social development of Europe is our main priority and a precondition to the development of our societies. It is an honour to have you both present.

I wish you all an inspiring and productive day. Thank you for your attention.

KEITH WALTERS, FIRST VICE-CHAIR OF THE EDUC COMMISSION, COMMITTEE OF THE REGIONS

The Committee of the Regions was set up in 1994 to address two main issues. Firstly, about three quarters of EU legislation is implemented at local or regional level, so it makes sense for local and regional representatives to have a say in the development of new EU laws. Secondly, there were concerns that the public was being left behind as the EU steamed ahead. Involving the elected level of government closest to the citizens was one way of closing the gap. The EC Treaties oblige the European Commission and the Council to consult the Committee of the Regions whenever new proposals are made in areas that have repercussions at regional or local level. One area of such compulsory consultation is in the area of technological development.

The CoR attaches much importance to increasing the role of ICTs for more sustainable economic growth both by making full use of all the opportunities already existing ICT can bring in this regard, as well as by encouraging regions to engage in ICT innovation, and research & technology developments.

In general terms, local and regional authorities have a crucial role to play in exploiting the potential of ICT in promoting coherence between economic, environmental and social needs for the following reasons:

- Firstly, they can take leadership in using ICT for new models of workplace and mobility management or for increasing energy efficiency of public buildings as well as applying green public procurement.
- Secondly, they support ICT for social and territorial cohesion. For the CoR it is crucial to ensure broadband access in less-favoured and rural regions where the market fails, so to support territorial cohesion. Public authorities within such regions have already successfully used public intervention for broadband supply.
- Thirdly, local and regional authorities are responsible for e-governance of their communities. We believe that e-government provides a major opportunity to modernise government service delivery and the interaction with citizens and businesses.
- Fourthly, local and regional authorities manage natural resources. In many Member States, local and regional authorities are vested with direct responsibilities and powers in services and policies such as land use and urban planning, regional innovation and business development, water and energy supply, transport systems, even in disaster management or consumer education.

ICT for a Sustainable future - the local and regional dimension

Firstly the CoR underlines that every citizen has the right to know what their elected representatives are doing to ensure the sustainability of their environment for future generations. Secondly, local action is key to meeting the 20% energy efficiency targets. Sustainable development objectives cannot be effectively implemented without the involvement of local and regional authorities given that in many Member States local and regional authorities have a central role to play in educating the public about new technologies available that can contribute to a sustainable consumer behaviour.

Having said that. the contribution to a sustainable future is particularly difficult in regions which face special technological challenges because of location or the structure of the community such as in remote areas and the outermost regions, or owing to insufficient infrastructure, poor purchase and maintenance budgets, unequal opportunities for accessing information. We know that there are profound differences between regions. We know that some of them may be particularly affected by climate change, and that the ability to adapt, which is distributed unevenly among the various sectors and regions, is closely bound up with socioeconomic development; in this regard, regions and local authorities have an important role to play.

The Covenant of Mayors1

The CoR supports the European Commission's initiative on the Covenant of Mayors. We believe that by promoting sustainable energy and energy efficiency, the Covenant of Mayors can spur on the cities and regions to implement changes to protect their most vulnerable citizens, particularly those on low and fixed incomes, from the effect of high energy prices and from suffering fuel poverty. In doing so, however, care should be taken to avoid subsidising energy use and to allow scope for strong incentives to improve energy efficiency and, as far as possible, reduce energy use.

Regional and local authorities have already started to undertake activities and initiatives which will contribute to the goals and objectives of EU climate change policy, showing leadership with the bold and necessary decision to increase energy efficiency for the benefit of their citizens and the environment.

The **Covenant of Mayors** is an ambitious initiative of the European Commission that will bring together the mayors of Europe's most pioneering cities in a permanent network to exchange and apply good practices across these cities and beyond to improve energy efficiency significantly in the urban environment. The Covenant of Mayors is the response of the most active cities to global warming: a formal commitment by the cities to reduce their CO2 emissions even beyond the EU 20% objectives. Almost 100 cities throughout Europe, including 15 capitals, have expressed their willingness to join.

Regions, like towns and cities, are key players in the field of ICT for sustainable growth having responsibilities in numerous activities which deal with planning, permitting, investment, procurement, production and consumption. Transport, housing and public buildings, and public lighting infrastructure, which are planned for and provided by local and regional authorities, are both areas where significant CO2 reductions and energy savings can be achieved.

We emphasise the impact which a general goal of reduction in consumption of both consumer goods and natural resources such as water will make on reducing emissions and energy use. In many cases, regions can have a wider impact on behavioural change than individual local authorities and thus are well placed to influence citizens to change behaviours as they operate across both urban and rural areas.

Therefore we advocate a major role for regions and hope that the competent regional bodies will encourage the numerous municipalities within their respective areas to take part.

We must also emphasise the leadership role regions could play in identifying local ICT opportunities for action, sharing technological best practice, identifying project partners, allocating funding to invest in ICT tools, measuring progress and communicating success. Local initiatives should be embedded in a regional or national framework to maximise the impact and enable opportunities for partnerships to emerge. In addition they should be free to set themselves ambitious targets, which are sustainable, exceeding those in national frameworks.

However, short term budgetary pressures challenge regions and cities who take medium to long term investment and policy decisions to improve their own energy efficiency, to promote the use of sustainable energy sources and reduce CO2 emissions. National performance assessment targets should take this into account.

The CoR calls for EU funding and financing to be adapted in order to prioritise actions to promote sustainable energy use such as an increase in the percentage of regional funding to be spent on improving the energy efficiency of domestic homes from 3% to 5%. EIB loans should be readily accessible for local authorities and regions willing to invest in technologies that increase energy efficiency, to promote the use of sustainable energy sources and to reduce CO2 emissions.

The CoR suggests therefore that the mid-term review of EU funding programmes needs to look at how the full range of programmes can be adapted to support energy efficiency, promote sustainable energy sources and reduce CO2 emissions, and ensure programmes to improve energy efficiency are accessible to regions and cities. Thus, for instance, possible revisions, in addition to an increase of regional/cohesion funding to support the energy efficiency of domestic homes, should include greater investment to support the commercialisation of new technologies under programmes such as FP7. A review of the regulations governing state aids may also be necessary in order for measures to be taken in the area of industrial change and energy conversion.

Conclusion

In conclusion, Europe's regions and local authorities can be key movers for driving forward ICT applications which improve sustainability. The Committee of the Regions is willing to raise the awareness of this local and regional potential.

Local and regional authorities have a strategic place in promoting a sustainable future through ICT. They are able to promote multi-dimensional partnerships and networks bringing together all relevant actors benefiting the whole community.

We have continuously in this respect called for the promotion of networks at EU level and the promotion of exchanges of best practice, in particular coordinated by local and regional authorities. These exchanges like today are particularly valuable in tackling the challenges of the information society by discovering together new projects and learning more about the creativity that exists in bringing forward educational success by means of ICT.

ENRICO GIOVANNINI, CHIEF STATISTICIAN AND DIRECTOR, OECD

1. Introduction

"*We have used GDP to determine wrongfully what is in fact the state of well-being of a country, it does not give any indication of the well-being of society, it does not measure the health of the environment, it does not measure the psychological well-being of our citizens, it does not measure the vitality of our community, and so on. What I want to say is that GDP is necessary but inadequate, and we need to develop additional indices that would tell a more comprehensive, a more holistic story about how human society is progressing. … So, it's a paradigm shift that we need to make*". This strong and clear message was given by Lyonpyo Jigmi Thinley, the current Prime Minister of Bhutan, to the participants in the second OECD World Forum on "Statistics, Knowledge and Policy". He also added that economists and statisticians have significantly contributed to destroy our world when they invented the Gross Domestic Product, which has become since then the main driver of policy making. "*But now",* he argued*, "they have the possibility to repair their mistake by developing new measures of societal progress*".

This position is not isolated to the academic world, but exists also in the political arena and especially among non-governmental organisations (NGOs). Moreover, the number of scientific papers dedicated to the measurement of well-being and happiness has grown rapidly over the last decade. The number of indicators developed around the world to measure phenomena other than GDP, or to integrate GDP and other dimensions of personal and social life, is huge. Concepts like "sustainable development", which emphasises the trade-offs between the well-being of current generations and that of future generations, are more and more used to build policy-oriented frameworks.

In this paper I argue that measuring societal progress, in all its dimensions, is a "must" for the functioning of a modern democracy and for the conduct of balanced policy making. It is also a "must" to sustain the role of national statistical offices and ensure their future in a fast changing world.

2. Statistics, citizenry and democracy

For many years, policy makers and other relevant decision makers (i.e. businessmen and representatives of NGOs, media experts, etc.) were considered "the" users of statistics, while the layman was considered to be mainly interested in "curious" data. Of course, nobody disagreed on the social function played by statistics to keep policy makers accountable, but statistics were seen as an input into the media's watchdog job and not something in which citizens were really interested. The abovementioned transformations in society are leading to a change in this approach. For example, according to a survey conducted in 2007 on the citizens of 27 European countries, almost 70% think that it is necessary to know key economic indicators. Unfortunately, when asked about the growth rate of GDP, or unemployment and inflation rates only a very small fraction of the population are able to indicate roughly correct values for these statistics (e.g. 8% for GDP).

Should we be worried because of these results? Yes, at least to a certain extent. In fact, if we look at the individual as a "voter", "public choice" models based on game theory conclude that:

- a higher probability of observing the policy outcomes through reliable and independent statistics narrows welfare losses needed to give the right incentives to the incumbent politicians for examining projects and enlarges the range of examined policies. This suggests that it is in the interest of the citizens to know the economic, social and environmental conditions of their country.
- Elections are not an appropriate "stick and carrots" mechanism to enforce an effective political process. Information, instead, plays the main role. As long as indicators about concrete actions and achieved results are a correct measure of policy and are properly publicised, they may help society to achieve better goals with less resources.

In other words, knowledge about statistical indicators about policies' outcomes allows for a shift from a game with incomplete information to one with complete (shared) information and this has a relevant impact on the way in which democratic societies work: in fact, in the Nash-Bayesian equilibrium position, a Pareto improvement would appear because of the better definition of incentive constraints and the higher ability that the voter would have to influence the politician. This means that, even for day-by-day decisions, consumers do not need to be aware of all economic and social data. Nonetheless, as participants in the democratic game they should be very much interested in them.

3. Measuring the progress of societies

Statisticians have always adapted their measurement systems to the changes observed in the economy and society. Of course, all measurement systems rely on a particular theory. What we use today to measure economic systems relies on the Keynesian theory and its translation into the neoclassical framework. Importantly, we should not forget that such a theory was developed in response to a large economic and social crisis in the 1930s, and that for several years the main users of national accounts have been economic ministries and central banks, i.e. the authorities in charge of macroeconomic management.

We have to recognise that over the last decade, both in developed and developing countries, people's attention has been shifting from purely economic issues to other dimensions of well-being. Without forgetting the huge number of people who still suffer because of material deprivation and the inability to satisfy their basic needs, we have to recognise that the demand for non-material aspects of personal and societal well-being is emerging everywhere. The growing number of scientific papers devoted to studying and measuring well-being, multidimensional poverty, social exclusion and happiness, as well as the growing number of initiatives launched at national and sub-national levels to assess economic, social and environmental trends clearly show how attentive our societies are becoming to the non-material aspects of life.

3.1 The Istanbul Declaration

From what was described above, it is quite clear that official statisticians can strengthen their role in all modern societies (no matter what level of economic development) by contributing to provide answers of fundamental questions that we, as society, seem currently unable to answer, such as: "is life getting better"? and "is our society making progress?". In June 2007, three years after its 1st World Forum on "Statistics, Knowledge and Policy" held in Italy, the OECD, in collaboration with other international organisations, ran the 2nd World Forum in Istanbul on "Measuring and Fostering the Progress of Societies". Some 1200 people, from over 130 countries attended. Presidents and ministers mixed with civil society leaders, captains of industry met the heads of charitable foundations and leading academics. They all shared a common interest in wanting to develop better measures of how the world is progressing.

The conference led to the *Istanbul Declaration*, signed by the European Commission, the Organisation of the Islamic Countries, the OECD, the United Nations, the Organisation of the Islamic Conference, the United Nations Development Programme, UNICEF, UNESCO, the United Nations Fund for Partnership, the World Bank, and several other organisations. The Declaration states that "*a culture of evidence-based decision making has to be promoted at all levels of government, to increase the welfare of societies*". Moreover, the institutions who signed affirm their "*commitment to measuring and fostering the progress of societies*" in all their dimensions and to supporting initiatives at the country level and to "*urge statistical offices, public and private organisations, and academic experts to work alongside representatives of their communities to produce high-quality, facts-based information that can be used by all of society to form a shared view of societal well-being and its evolution over time*".

The Declaration also calls for action to identify what "progress" means in the 21st century and to stimulate international debate, based on solid statistical data and indicators, on both global issues of societal progress and how societies compare. Finally, the Declaration calls for actions to:

- Encourage communities to consider for themselves what "progress" means in the 21st century.
- Share best practices on the measurement of societal progress and increase the awareness of the need to do so using sound and reliable methodologies.
- Stimulate international debate, based on solid statistical data and indicators, on both global issues of societal progress and comparisons of such progress.
- Produce a broader, shared, public understanding of changing conditions, while highlighting areas of significant change or inadequate knowledge.
- Advocate appropriate investment in building statistical capacity, especially in developing countries, to improve the availability of data and indicators needed to guide development programs and report on progress toward international goals, such as the Millennium Development Goals.

The World Forum participants shared the view that the world needs leadership in this area and encouraged the OECD to begin a Global Project on "Measuring the progress of societies" in collaboration with others (see below).

3.2 A world movement

As the OECD World Forums, as well as the investigations recently carried out on this issue, have demonstrated, the number of initiatives launched around the world to measure progress/well-being/sustainable development of countries and local communities is simply amazing. The US-based Community Indicators Consortium, the French Forum for other indicators of wealth (FAIR), the Latin American initiative *Como Vamos*, the Italian network *Sbilanciamoci*, the UK initiative on the measurement of wellbeing of local communities, the experiences promoted by the Council of Europe for the measurement of well-being of local communities with the involvement of citizens, the reports promoted by the Australian and Irish statistical offices on measuring the progress of their societies, the *State of USA* and *Canadian Index of Well-Being* initiatives, the more recent activities carried out in South Africa, Hungary and Mexico to establish roundtables to measure progress are just few examples of a growing movement.

More recently, the French President Nicolas Sarkozy has established a Commission on the "measurement of economic performance and social progress". Led by Prof. J. Stiglitz and participated in by four other Nobel Laureates and well-known experts from all over the world (HTTP://WWW.STIGLITZ-SEN-FITOUSSI.FR), the Commission is addressing the limitations of current statistical frameworks (for example, national accounts) to provide meaningful measures of societal well-being in the short and long term, and is developing research work to overcome such limitations. The Commission will present its final report in April 2009.

In June 2008, the World Economic Forum established a Global Council on "Benchmarking the progress in societies", with the participation of experts from several institutions and chaired by me. A first meeting of the Council will take place in Dubai in November, while a session on this issue will be scheduled during the January 2009 Davos Forum.

3.3 The Global Project on "Measuring the progress of societies"

In July 2008, the OECD Council officially established the Global Project on "Measuring the Progress of Societies" (WWW.OECD.ORG/PROGRESS). The Project exists to foster the development of sets of key economic, social and environmental indicators to provide a comprehensive picture of how the well-being of a society is evolving. It also seeks to encourage the use of indicator sets to inform and promote evidence-based decision-making, within and across the public, private and citizen sectors. The Project is open to all sectors of society, building on good practice and innovative research work.

The initiative aims to assist societies to measure their progress, by assisting with:

- ***What to measure***? Encouraging discussions about the ***what***? To measure progress one needs to know what it looks like. Progress undoubtedly means different things to different societies, and we will encourage and assist societies to have a dialogue about what progress means to them.
- ***How to measure?*** Working with experts from around the world the Project will develop a better understanding of how progress can be measured – especially in emerging and complex areas not yet covered by statistical standards.
- ***Ensuring that the measures are used***. When good statistics exist, they too often go unnoticed or are misunderstood by a broad audience. New ICT tools have the potential to bring dramatic improvements: the Project will foster the development of new tools and approaches to help decision makers and citizens develop a better knowledge of their society using statistical information.

The Global Project is quite ambitious, but it still in its early stages and much is yet to be decided. It has already received firm offers of support from international organisations, development banks, academic experts, NGOs and governments to help take the work forward. The OECD is now working closely with several organisations to implement a work programme and deliver specific outputs. The activities of the Project range from training courses, research activities, organisation of events, development of ICT tools, etc. The third World Forum will take place in Busan (South Korea) on 27-30 October 2009. 1500 participants are expected to attend the conference. 3500 people are expected to be involved in preparatory events.

In the meantime, several countries have already established initiatives to measure societal progress (Australia, USA, Canada, Mexico, Hungary, South Africa) or are going to do so in the near future (Morocco, Italy, Finland, etc.) also thanks to the OECD initiative. Others have already similar processes focused on sustainable development, poverty reduction, etc. and are interested in linking them to the Global Project.

The Global Project is working towards the establishment of a global platform to serve all people in the world to understand and debate, using statistical indicators, whether the world itself, or a particular country or region, is making progress. Given all the objectives mentioned above, as well as considering the technical and resource constraints, such a platform cannot follow the "classical" approach of web building. Fortunately, the development of Web 2.0 tools makes the problems less insurmountable. Wiki-Progress should be able to represent the catalyst of initiatives existing around the world on the measurement of progress, as well as their use for raising awareness amongst stakeholders, informing them on key economic, social and environmental trends and allowing them to discuss relevant issues based on solid evidence. Therefore, while Wikipedia answers questions like "Who is this person?", "What is this?" and so on, Wiki-Progress should mainly answer the following questions:

- Who is developing initiatives on measuring progress (well-being, quality of life, etc.);
- What type of taxonomy do these initiatives use?
- Which indicators are being used to measure the different dimensions of progress?
- How is my country/region/community achieving over time and in comparison to other similar territories?

Moreover, Wiki-Progress should represent "the" place where both experts and practitioners could share their practices on indicator design, calculation and dissemination, as well as where stakeholders interested in developing initiatives in this field can find reference documents and assistance on how to establish progress initiatives, design websites, download software, etc. Finally, Wiki-Progress should represent a tool for the Global Project, to enable extraction from existing initiatives of the information necessary to identify good practices, run comparative studies, show similarities and compare the differences between various initiatives, etc.

4. Conclusions

It is not possible to conclude this paper without trying to evaluate how the current financial crisis could impact on what we have discussed so far. Actually there are two possible impacts of the crisis on the public opinion and individuals' mindset: the first is to pay more attention to economic factors, pushing people to do their best to rebuild their previously achieved level of income and economic wealth. The second is to recognise that the race to maximise income in the short run does not lead to a better society or a sustainable path and that policy has to pay more attention to elements like vulnerability or insecurity in people's life, and therefore to focus on aspects linked to social capital.

Recent positions taken by several political leaders (including US President Obama) and scholars is that we definitively need new measures to underpin new policies. We should not forget that what we today call "national accounts" was developed after a similar crisis. So, why should we assume that this time will be different? Maybe this crisis will represent for the social dimension what global warming is representing for the environmental dimension. Maybe this will lead to better measures of what economists call "relational goods", i.e. those immaterial factors that underpin the functioning of markets and societies. Statisticians have a great opportunity: they have to read the early signals emerging from society and policy, and react as quickly as possible to measure them, finding innovative and effective ways to join forces with economists, social scientists and other researchers. It is a matter of contributing to successfully overcome the crisis, to respond to the growing demand of accountability of policy makers and to underpin the development of new visions for our societies. Finally, it is about contributing to the improvement of people's lives.

PHILIPPE QUEAU, DIRECTOR, UNESCO OFFICE IN RABAT

Until the 70's, Information and Communication Technologies (ICT) were still considered as a very powerful means. Obviously they had a strong impact on economy and society, yet they still were viewed only as a means. It was not before the 80's and the 90's that the concepts of Information Economy and Information Society gained wide acceptance, and metaphors like "Information Highways" started to appear too technical and too narrow to capture the magnitude of the incoming impact of ICT on the very fabric of the society. Freed from the narrowness of a technical interpretation, ICT were to look for a wider paradigm. The concept of Knowledge Society was then progressively introduced, including by UNESCO, to recognize the fact that it is not only information as such, but also the transformation of information in human knowledge that make it socially effective.

Yet, the word "knowledge" was not without its own ambiguities. Etymologically, in English, "knowledge" refers to power and utility. In French, "savoir" has the same root as "sapience" or "sagesse", and in Russian "□□□□□□" (knowledge) comes from the Indo-European root <gen> : "to give birth to, to generate". We then have at least three paradigms for "knowledge": power, wisdom, creation. It is important to keep that in mind, not only to embrace correctly the vastness of knowledge role in human societies, but also to articulate more precisely the impact of ICT and knowledge on power issues, such as the level of freedom and control in a given society. Knowledge considered as sapience and wisdom can indeed have an impact on social justice, on community building or on the establishment of a more just society. Knowledge as creation and generation is at the core of all processes of invention, cognition, research. It is also worth noting that knowledge is in no way independent of the contradictions and the antinomies that plague the political field. I am not referring here to the profound dispute of philosophers and scientists on what is actually knowable in our world through pure reason or through empirical experiments, but to series of very political issues, in which ICT and knowledge under one form or another play a role, such as freedom and security, privacy and surveillance, equity and deregulation or public interest and private interests…

If ICT are not just a means, and if knowledge is an acceptable, though multiform paradigm, the question still is: for what ends do they stand? Let us evoke a few complex but concrete issues, of growing complexity. In what measure ICT and knowledge can help repair the global financial system? Put an end to fiscal paradises? Deal with global warming and "climate neutral" energy and transportation? Avert new wars? Guarantee fair elections? Reduce poverty, put an end to human rights abuses? No doubt that they can play some role, but is this role purely instrumental or actually decisive? Or is "decision" of another nature, political rather than cognitive, for instance?

Another aspect of the role of ICT and knowledge in our societies is the rapidly evolving nature of the paradigms they incarnate. Virtual and augmented worlds, fusion reality, convergence and singularity are a few recent examples, that we cannot afford to ignore if we try to understand the future context of knowledge societies.

Virtual worlds do now represent a reality of its own, where modelling, simulation, or even virtual communities, tend to create a kind of a "second world", not really aiming at replacing the "first world", the world of real reality, but aiming at augmenting it with new functions, and new potentials. Geospatial tagging, location-based technologies (GPS, RFID, Internet of things), augmented realities, ubiquitous computing, lifelong record of users and objects (Lifelogging) are only but a few areas that contribute to create alternate realities that can complement or sometimes substitute the old reality. Of course one could again argue here that retinal scanners, augmented presence, nano- or tele-presence with haptic feedback, "spimes" and "blogjects" are only tools.

One could also argue that the accumulation, densification and systemization of such tools do contribute to the emergence of a new "fusion reality", characterized by an increased convergence and a "blurring" of reality and virtuality, of simulation and augmentation tools and models, producing in short a culture of "everyware".

The Future of Internet, in this context, what will it really be? Simply answering IPv6 will not be enough, of course, nor quoting slogans like Web 3.0, the Semantic Web or the "Giant Global Graph".

Of course, it is easy to predict that at some point in time we will benefit of a global, low-cost network, with mobile, wireless communications available to anyone anywhere on the globe at an extremely low cost. It should be wise, should such a prediction come true, to start asking questions on the intelligent agents and distributed control that may end cutting direct human control out of some key activities such as surveillance or security. One should also ask questions on the ultimate consequences of permanent, systematic and universal tagging, not only of objects but also of words and their use, of concepts and of any personalized

conceptual associations, quite useful to generalize data-mining into personal profiling and idea-mining. Web ontology languages (OWL) and "knowledge collider" such as the FP7 LarKC give an hint that "a brain the size of a planet" is indeed on construction, and that we should take a closer look at it.

After the technological convergence of Computer, Telephone, Television, that made up for the Digital Revolution, it is also strategic to take into account the building up of a new global convergence of Bits, Atoms, Neurones, Genes (BANG), that should compel us to think even harder on ways to handle and orient this coming revolution. The fact that nanotechnology, biotechnology, ICT and cognitive science converge can be interpreted as the inevitable march of electronics towards "nanocosm". When the semiconductor industry reaches the 20 nm node and is truly being built around nanotechnology, a point of no return will be reached. But BANG can also be observed through the proliferation of nano-products, the development of synthetic biology, the manipulation of ecosystems and climate, the fertilization of ocean (CO2-Plancton) by geo-engineering, and extreme genetic engineering, making possible a structural modification of the human body. The impact of BANG convergence will also imply new concerns for privacy and control with the proliferation of nano-sensors and nano-RFID. A surveillance "powder" small enough to be hidden in any kind of support will make the protection of privacy impossible. Transparency will then be routinely imposed on individuals and privacy will become a luxury, not a right. However, it is not assured that, reciprocally, citizens will gain more transparent access and control on governments. Collusion, market manipulation, power money over politics, bribery, lobbying, will not necessarily be reduced by the generalization of BANG convergence. Finally, it is possible to consider as quite serious the hypothesis of some futurologists, such as Ray Kurzweil, that we are heading fast towards a "singularity": our intelligence will become increasingly nonbiological and trillions of times more powerful than it is today—the dawning of a new civilization that will enable us to transcend our biological limitations and amplify our creativity.

Let's assume that all these hypotheses will come true. The question will again be: all those "means" may be fine, for what "ends"? Will answers such as "To contribute to the well being of all citizens around the world" (Paradiso project) or "A more peaceful, prosperous and just world " (UN Millenium Declaration) be enough ? These one-liners embed a spirit, of course, but when we have to translate them into action, they are often declined as long shopping-lists that do not always convey the multiplicity, the complexity, the transversality of issues at stake. If we were to define, for instance, a "global sustainable future", the innumerable and intertwined issues concerning Energy, Population, Education, Environment, Governance, Economy, Finance, defy imagination. If we may intuitively adhere to the idea that solutions will be based on multi-stakeholders partnerships, it is far from evident what mixture of politics, of technology, of societal evolution and participation will be more productive and more respectful of Human rights. In other words, the exact impact of national or international "Policies" vis-à-vis global, systemic, immanent societal dynamics has yet to be tested, and to stay in line with the theme of this conference, the role that ICT really play in this global, auto-emerging societal fabric has yet to be refined, conceptually, and politically.

As a conclusion, I would like to stress that, as far as ICT are concerned, we are paradoxically still at the stone age… Our screens are sort of "caves", phenomenologically and philosophically speaking. We have not really evolved since Plato, from that particular viewpoint. However, enormous potentials are indeed within our reach, if strategic paradigm shifts are made. In spite of this, Knowledge Societies may also further increase divides between haves and have-nots, if no proper strong political decisions are taken. Huge political, societal and philosophical implications may depend on these future decisions… which are not yet conceptualized nor understood. For instance, it will be difficult to predict with certainty if Cognitive Economies and Knowledge Societies will thrive more out of political and social models based on "Cooperation" or more on models based on "Competition".

DR. JUN LI, CHIEF EXECUTIVE OFFICER, CCID CONSULTING

It is my great honor to give this speech named ICT for a Sustainable China Economy. The presentation will go from these 3 aspects: overview of China Economy and ICT industry; history of China informatization; and some conclusions about ICT and informatization for China's economy.

From the chart of China's economy development path from 1978 to 2008, we could see in the past 8 years, the GDP fluctuated from the peak with 15.5% growth rate in 1998 to the valley load with 3.8% growth rate in 1992. And from 2004-2007, the GDP keeps growing with double-digit GR, which indicates a healthy economy development in China. In 2008, the GDP of China is expected to reach to 27.3 trillion rmb.

In the diagram of China's ICT industry growing history from 2001-2008, there are two key indicators—China ICT industry revenue and China ICT industrial added-value, and both of them are increasing very quickly, the CAGR for ICT industry revenue and add-value are 27.4%, 25.2%, respectively. Also, it's easy to find out that the GR of both are becoming slow down gradually, which indicates that China's ICT industry is maturing in the first place.

Concerning to China ICT industry's contribution to the national economy development, we can see, the ICT industry becomes a very import role in China's economy, the proportion of China ICT industrial added-value to GDP is increased from 2.2% to 4.2% form 2001 to 2008.

After that, we are going to see the structure of China ICT industry. It is obvious that manufacturing still dominates the whole ICT industry. The revenue of computer system plus electronic elements and components plus communication equipments plus home audio & video products account 80% of the overall ICT industry revenue. Also, there is a big shining star in the industry—software. In the past 8 years, China software industry's proportion in the whole ICT industry increased from 6.3% to 11.7%. It is a very encouraging phenomena, which suggests that China ICT industry is being greener than before, which is good for a sustainable China economy for sure.

From 2001 to 2008, the CAGR of national total export is 27.4%, while, the CAGR of ICT export is 35.2%, which is far way quick than the total export.

And still, the exporting is very important for China ICT industry. 2002-2008, the average ratio of export dependency is 59.4% which remains at a high level. Noticing that, under the pressure of demand decline from international market, the ratio of domestic needs began to go up. Actually, domestic demand is growing quickly year by year with the healthy China economy development strategy and higher national income, domestic needs boosting will be the main steam of China ICT industry in the near future.

For China's informatization history, there are some important informatization projects conducted from 1980s to now. Among these, the golden projects series is very comprehensive and fruitful. It includes the Golden Environment Project Golden Land Project, etc., and some environment related databases construction as well. These projects improved the informatization level of almost all industries in China practically and greatly.

As an important symbol of informatization, China's computer and internet penetration rate was greatly increased in the past 6 years. In 2001, computer penetration rate in China urban household break 10%, and from that on, the popularization of computer becomes quicker and quicker. But also it's important to see in 2007, every 100 rural households have 3.7 computers only, which is far way behind the urban area. Rural areas' informatization level still needs to be progressed. About the internet, by the end of June, 2008, the internet users in China reached to 253million, ranked No.1 in the world, and the penetration rate is over16%. Specifically, by the end of 2007, the broadband internet users reached to 163.38 million, which accounts for 77.8% of the total internet users in China This indicates that both the quantity and quality of the internet utilization are improved evidently in China.

Recently, the informatization application is developing in-depth. Every industry has conducted related informatization projects. Such as the finance informatiztion, including the advanced payment system research and development, key business system concentration E-bank system, etc. Noticing that, one of the important emphases for manufacturing informatization is energy saving and pollution reduction. In other words, it reveals that the essence of the informatiztion is to upgrade Chinese economy grow mode to a sustainable one.

From 2002-2008, China has released several laws and regulations to help promote the informatization. It includes Encouraging the Development of the Software and Integrated Circuit Industries Several Policies. The National 11th Five-Year Plan for Economy and Social Informatization. And the informatization strategy emphases from 2006-2020 mainly focuses on improving national IT application information security systems, promoting national economy informatization, carrying out E-government etc. Chinese government makes great efforts to enhance the national informatization.

In the end of 2008, Chinese government announced a 4 trillion rmb investment plan, aimed at boosting China's domestic needs which attracts close attention worldwide. It covers almost every aspect of the social development from traditional industry to living quality improving affairs, and it will consequently promote related industries'informatization construction for certain.

From the information above, the conclusions easily come to the surface: China ICT industry coordinates and accelerates China economy growth effectively; While informatization boosts the industrialization practically, and the convergence of them is becoming a major trend in China. Behind these, it is Chinese government's great efforts of promoting ICT industry development and "the convergence of informatization & industrialization".

JEFFREY A. MCNEELY, CHIEF SCIENTIST, INTERNATIONAL UNION FOR CONSERVATION OF NATURE

ABSTRACT

The 1992 Earth Summit in Rio de Janeiro agreed the Climate Change Convention, the Convention on Biological Diversity and the Convention to Combat Desertification. But at the Earth Summit, nobody had a cell phone, the internet was not yet operational, laptops were virtually non-existent, so forth. In little more than 15 years, information and communications technology (ICT) has made remarkable advances, using everything from miniature transmitters for tracking butterflies by satellite, using tools like Google Earth to assess policies on forest management, and preparing hand-held field guides to species such as plants and birds. Perhaps more important, the cell phone is now virtually ubiquitous, and enables even the poorest of the poor to gain access to important information, such as weather forecasts, prices of agricultural products, and e-learning opportunities. ICT has led a productivity revolution, as well as supporting new forms of democracy in resource management that enable rural people to leapfrog technology development and use ICT to gain greater control over their natural resources. All indications are that these technological advances will continue to accelerate, providing quick and easy access to an increasingly broad range of important information, ranging from DNA analysis to soil micro-organism richness to calculating our ecological footprint. All of this provides an opportunity to use ICT to enhance significantly the management of biological resources, a marriage of technology and biology that can lead to a more sustainable future. But like all powerful technologies, ICT also has a dark side. Used in the wrong way, it can accelerate resource depletion, contribute to climate change, and pollute the environment. The major challenge in the coming years is to ensure that ICT is used to enhance sustainable resource management, and prevent over-exploitation of nature.

INTRODUCTION

The world in 2009 is preoccupied with economic problems. The global stock markets lost more than US$30 trillion and pensions lost 15% of their value in 2008, commodity prices are fluctuating wildly, food prices are increasing, and unemployment is rapidly approaching 9% globally.

While the state of the global economy therefore is certainly miserable and well deserving of the attention it is receiving, another crisis is going virtually unnoticed: the global decline in ecosystems and the biodiversity upon which they depend. The economic crisis can eventually recover, but the loss of biodiversity may be irreversible, and the implications of the degradation of ecosystems are likely to undermine the basis for economic recovery. An important tool for addressing these linked problems is information and communications technology.

THE CHALLENGE

Plants, animals, and micro-organisms live together in ecosystems, which also include air, water, minerals, and nutrients. Ecosystems can provide sustainable streams of benefits to people, known as "ecosystem services". These include providing food and timber, ensuring regular supplies of freshwater, maintaining a healthy climate, pollinating crops, preventing soil erosion, regulating diseases and pests, minimizing the impact of extreme natural events, and cycling nutrients through natural systems to enable our economies to flourish.

Society as a whole -- individuals, households, businesses, governments -- are all completely dependent on the ecosystems of our planet, and the services these ecosystems provide. Surprisingly, most people are at best vaguely aware of their dependence on these natural systems.

One of the most important scientific enterprises in recent years has sought to repair this ignorance. The production of the 2005 Millennium Ecosystem Assessment involved over 1300 scientists who worked for nearly five years to assess the status and trends of these ecosystem services. The four main findings of the MEA were:

- Over the past fifty years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history. These changes were a response to the rapidly growing demands for food, freshwater, timber, fibre and fuel, resulting in a substantial and largely irreversible loss in the diversity of life on earth. About 60% (15 of 24) of the ecosystem services examined by the MEA were found to be degraded or being used unsustainably.

- The changes that have been made to ecosystems have provided substantial gains in human well-being and economic growth. But these gains were achieved at substantial, but largely unnoticed, costs in the form of the degradation of many ecosystem services, increased risks of accelerating, abrupt, and potentially irreversible changes, and increased poverty for many people. Note, for example, that at the end of 2008 FAO reported that 936 million people in the world are chronically malnourished. The costs of ecosystem degradation, unless successfully addressed, will substantially diminish the benefits that future generations will be able to obtain from ecosystems.
- The degradation of ecosystem services, and the loss of the biodiversity upon which such systems depend, could grow significantly worse in the coming decades, substantially reducing the opportunities for achieving the Millennium Development Goals agreed by the United Nations.
- The challenge of reversing the degradation of biodiversity and ecosystems, while meeting increasing demands for their services, will require significant changes in policies, institutions and practices. Many options exist to conserve or enhance specific ecosystem services that will provide comprehensive solutions to the challenges of sustainability.

A critical element in improving or enhancing the productivity of ecosystem services is "biodiversity", namely the variability among living organisms and the ecological complexes of which they are part. Biodiversity provides the foundation upon which a sustainable future can be built. It is relevant to virtually all parts of sustainability, including fields as varied as agriculture, energy, forestry, health, trade, security, and many others. A few examples, among many that could be cited, will demonstrate the point.

In the field of agriculture, biodiversity provides the genetic variability from wild relatives of domestic plants and animals that enables farmers to continually improve the food supplies upon which we depend and from which scientists to develop biotechnology to enhance productivity. Of the world's over 250,000 plant species, more than 30,000 are edible, but only about 120 are cultivated and nine of them provide 75% of human food. All of them are under threat from pests, diseases, climate change, and so forth, requiring fresh infusions of genes to enable them to adapt to changing conditions.

Biodiversity also supports much of our energy system, especially in developing countries where firewood is by far the most important source of energy used for cooking and heating. Biofuels are becoming increasingly important in providing energy security, potentially helping to address the problems of climate change, and providing new sources of income to poor farmers. Biodiversity also provides the most effective way to sequester the high levels of carbon produced by fossil fuels, with millions of tons of carbon per year absorbed by the plankton of the seas, the soils of the land, and the trees growing in forests.

And forests themselves are the most biologically rich ecosystems on earth, supporting over half of all terrestrial species. Forests provide multiple benefits to people, improving air quality, protecting and regulating watersheds, protecting wild species and habitats, pollinating both wild and domestic plants, sequestering carbon, forming new soils and enhancing their fertility, degrading wastes, and (not least) providing landscapes of outstanding beauty that contribute to human happiness.

Biodiversity also makes substantial contributions to human health, with over half of the pharmaceuticals consumed by people having originated from wild plants or animals or been inspired by them. Medicinal plants continue to provide the main source of drugs in many developing countries, and in Europe over 2000 medicinal and aromatic plants are used on a commercial basis. Ecosystem services help to provide clean air and water, also essential to human health.

In terms of trade, some 40% of world trade is based on biological products or processes, and the increasing dependence of many countries on imports of food and other biological resources underlines this important contribution biodiversity makes to economies.

Finally, biodiversity also affects national security. Conflicts over water, fisheries, and other shared resources are endemic in many parts of the world. Natural resources also help feed some conflicts. For example, civil conflicts in the Philippines, Sri Lanka, central Africa, and Colombia are being fought in tropical forests, and the illegal harvesting of timber and other natural resources helps to provide the income that enables insurgent groups to purchase arms. Better resource management can help contribute to peaceful relationships among nations.

THE CONTRIBUTION OF ICT TO IMPROVING THE MANAGEMENT OF BIODIVERSITY AND ECOSYSTEMS

The sustainable management of natural resources can be greatly improved though better use of ICT, thereby helping to meet international development objectives such as the United Nations Millennium Project and agreements such as the Convention on Biological Diversity, the Convention on Climate Change and many others.

Information and communications technology is increasingly being mobilized to improve the management of ecosystem services and biodiversity. The following is an indicative list of some of the contributions that are being made. It is reasonable to expect even more rapid advances in the coming years, as the technology improves in sophistication and applications.

Already, the United Nations Environment Programme (UNEP) and the International Union for Conservation for Nature (IUCN) have joined forces to produce the World Database on Protected Areas (WWW.WDPA.ORG), which is an open access and

downloadable source of information on the world's over 100,000 protected areas. It is being used for ecological gap analysis, environmental impact assessment, private-sector decision making, and the creation of new data products.

Some of the most interesting applications are in studying elusive creatures that could not previously be studied effectively. For example, many species are now being studied through radio-tracking, wherein small transmitters are attached to the animal, enabling its movements to be recorded. Tiny transmitters have already been applied to butterflies, indicating the degree of miniaturization that has been developed. Miniature video cameras have been attached to the critically endangered New Caledonian crow, enabling scientists, for the first time, to fully understand the complicated life these intelligent tool-using birds lead. Remote camera traps have enabled scientists to carry out censuses of elusive species such as snow leopards and tigers, to carry out detailed inventories of species present in many national parks, and even to take the first photographs ever of some newly-discovered species. One example of the latter is the Saola, a new species of antelope recently discovered in Vietnam and seen by scientists only as electronic images.

At a larger scale, elephants have also been fitted with radio transmitters so that they can be followed by radio-tracking, both for scientific purposes and to help warn farmers when their fields might be raided by hungry pachyderms seeking a free meal.

New ICT has also been developed to provide electronic field guides to plants and animals, enabling both scientists and tourists to identify species they encounter in the forest. This greatly facilitates both more productive science and more rewarding tourism.

Remote sensing has become a fairly mainstream management technology, enabling satellite imagery to be used to plan new developments, assess how policies on forest management are being implemented on the ground, and track migratory species.

Especially in remote tropical forest areas, remote sensing is an essential tool to enable policy-makers and conservationists to enhance the management of threatened species and ecosystems. For example, on the island of New Britain, east of New Guinea, satellite imagery has enabled scientists to assess the conservation status of an entire endemic avifauna, of which 37 bird species are found nowhere else in the world. The remote sensing of the status of the forest habitat of these birds has enabled conservationists to identify the most important areas for their conservation.

Climate change is a major threat that is receiving top priority by governments through the UN Framework Convention on Climate Change. Most of the attention has focused on reducing emissions, but much less has been given to the impacts on biodiversity and indeed to human well-being. ICT is helping to assess the real impacts of climate change, for example, comparing the size of glaciers in remote areas, measuring the change in polar ice caps, and remotely taking the temperature of the earth. Without ICT, the knowledge available on climate change would be far less comprehensive than the solid data now available to guide policy makers on issues such as water supply, changing weather patterns, and impacts of climate change on the distribution of species and ecosystems.

ICT can also help to assess some of the measures for addressing climate change, such as measuring the spread of forest fires in Borneo to clear land for growing oil palm for biofuels that are expected to produce less greenhouse gas than fossil fuels emit. ICT also enables measuring the changes in atmospheric chemistry, essential to understanding climate change, and packaging this information in ways policy-makers can use.

For farmers, even relatively simple forms of ICT, such as cell phones, enable them to greatly enhance their productivity and profitability. A cell phone can help them to determine prices that are being paid for their crops, forecast climate, improve irrigation regimes, and provide many other benefits that enhance productivity. By cutting out the 'middle-man' such ICT can help empower farmers and help lift farmers out of poverty.

The most sophisticated use of ICT is being made by scientists. Without modern technology, we would have little chance of understanding the genetic structure of the many species whose genomes have now been mapped. Dozens of knowledge-sharing genomic databases have now been established, covering everything from rice to rats to zebra fish to humans. These model organism databases are providing a highly advanced research tool for scientists, enabling them to leap years ahead in the sophistication of the kind of research questions they are able to answer. Entire new fields of enquiry have been born from the marriage of biology and ICT.

The research tools made available by Google and other search engines are helping to accelerate research in highly complex fields, such as genomics and genetic engineering, and helping scientists to better understand the full wealth of species and ecosystems on our planet. For example, the "Encyclopedia of Life" (WWW.EOL.ORG) is an open-access system that intends to provide information on all of the known species on our planet.

ICT is also essential in reaching out to the public. For example, advanced computer games such as "Venture Arctic", a nature sim which allows children and adults alike to participate in an ecosystem simulator, allowing players to balance natural forces, human and environmental interaction and a wide variety of native species, all in the Arctic.

In many parts of the world, members of the public can now follow the life cycle of nesting birds, keep in video contact with their favourite animals at the zoo, obtain rapid access to the information they need for writing a term paper at school, or simply help them be more informed about the state of their planet. For example, IUCN has worked with Nokia to involve young people in discussing their views on ecosystems, including through videos, YouTube, and webstories; the site called Connect2Earth has created a link between mobile phones and PCs and has received over 3 million visits since it was launched in March 2008. With close to one billion people using Nokia devices every day, and with the help of the right kind of eco-innovations arising from communities such as Connect2Earth, the mobile phone can become a catalyst to drive both social and environmental development. IUCN has also linked its marine protected areas data with Google Earth, as a means of enhancing public communication.

Social networking sites and blogs also enable the public to organise themselves around key conservation issues, perhaps acting as a watchdog or providing a weighty voice for or against certain developments. Public awareness campaigns can also be affected through such Web2.0 applications. One amusing example where both worlds meet is that of Mr Splashy Pants, the humpback whale that was being tracked by Greenpeace, and whose naming poll attracted more than 100,000 votes but was heavily influenced by the website *Boing Boing*. Despite the unexpected name, Mr Splashy Pants featured on over 100 websites and was a factor in Japan's decision to abandon hunting humpback whales that summer.

In the very near future, information technology will be available to home-owners to significantly minimize the amount of electricity that they require to manage their homes. By reducing energy consumption, the human impact on climate can be minimized. Expanding these ICT applications to natural resources can help ensure that quality of life can be improved without increasing the quantity of resources consumed, and indeed by even reducing human impact on biodiversity and ecosystem services.

When considering how ICT can help biodiversity, it should also be considered how the environment can support ICT, both theoretically (improving the efficiency of communication systems by mimicking natural systems) to the more practical examples, such as Nokia's commitment to develop renewable energy options as a choice for remote base station sites by 2011.

For many of the applications of ICT in the field of conservation, the organizations involved are leaders in open access. A group of organizations from all parts of the world has joined together in a "Conservation Commons" to ensure that conservation information is made freely and widely available. While the generation of such information still requires money and human resources, the fundamental principle is that information required for conservation should be communicated as freely and openly as possible. The new information and communications technologies that are constantly being improved are essential to enabling the conservation of the living wealth of our planet, an essential foundation for a sustainable future.

THE ENVIRONMENTAL DOWNSIDE OF ICT

So far this paper has focussed on the benefits of linking ICT and biodiversity for a sustainable future. But ICT also poses some serious sustainability challenges. While ICT can provide information on how to live more lightly on the earth, it can also be a major contributor to the problem itself. ICT is already being used to accelerate resource harvesting and consumption, for example through helping locate new forest resources for harvesting.

Information technology is contributing to other environmental problems as well. The IT industry contributes about 2% of human-produced carbon dioxide, roughly equivalent to the amount produced by air travel. The tens of millions of computers being used around the world today consume huge amounts of electricity. The internet makes massive energy demands through server farms to provide the computing power to run search engines. According to the US Environmental Protection Agency, a standard PC, left on continuously, consumes 746 kilowatts per year. A medium-efficiency refrigerator, on the other hand, uses about 500 kilowatts per year. In 2005, used electronic equipment amounted to about 2 million tons of waste, most of it disposed of in landfills. Fewer than 20% of cell phones are recycled each year. In the UK alone, 1700 mobile phones are thrown away every hour, 15 million every year. Mobile phones are updated on average every eighteen months and old ones are discarded in the bin. Their heavy metals and other pollutants like mercury, lead, cadmium, and brominated flame retardants are left to pollute the soils. Much of the electronic hardware disposed by industrialized countries goes to poor countries in Africa or Asia that have ineffective environmental protection policies.

ITC technologies can contribute to the transition to sustainability, but the way such technologies are produced and consumed also needs to be transformed. Changing our own behaviour can dramatically reduce our ecological footprint. For example, shutting our computer down when it is not being used can reduce its power consumption by around 500 kilowatts annually. Setting the power settings on our computer to automatically go into sleep or standby mode after 15 minutes or so of inactivity is an environmentally intelligent thing to do. Recycling cell phones reduces greenhouse gas emissions, keeps valuable material out of landfills and incinerators, and conserves natural resources. Recycling just one million cell phones can reduce greenhouse gas emissions equal to taking 1,368 cars off the road for a year.

Big strides are being made to improve the energy efficiency of ICT. For example, in 2007 Google built a massive 1.6-megawatt solar-powered system at its headquarters in California. It generates 30% of Google's peak demand, and its production of around two million kwh a year makes it the largest corporate solar installation in the U.S.

People are showing a greater willingness to reduce their impact on our earth's living systems today, but a huge disconnect remains between what people want to do and what they can do. This is where the ICT industry needs to step up. It is important that we support the work of interested companies to develop the targets and strategies to reduce their negative impacts on the environment.

REMAINING CHALLENGES

Recognizing the remarkable speed with which ICT is moving, what challenges are particularly important for the conservation sector? Some of the major ones include:

- We need to make all of the relevant data on biodiversity accessible in formats that are easily machine readable;
- We need to solve some systemic problems related to long term archiving, management, and "curation" (i.e. determining who becomes data custodian once the producer "publishes" to a database);
- All relevant institutions need to be convinced or encouraged to share data, even though they may have invested significant resources in compiling the information;
- A sustainable, self-financing, business model for open access needs to be developed and implemented; and
- Financial support needs to be provided to the developing countries, which arguably have the greatest need for access to biodiversity data.

If these few challenges can be met, the future can see significant improvements in the analyses that can be conducted, the knowledge products that can be generated, and the contributions conservation can make to sustainability. These steps will enable resource managers to influence policy and decision making and conduct comprehensive analyses on robust repositories of biodiversity data (as economists do with compilations of trade, capital markets, and employment data – to mention a few). So the biggest challenge is in ensuring that comprehensive knowledge of biodiversity is contributing to effective policy and decision making.

In conclusion, contemporary ICT is helping us develop an unprecedented awareness of our planet, the impact we are having on biodiversity, and the interconnections between local and global systems. Technology can be considered the art of applying scientific knowledge to practical problems. As a series of machines, systems, ideas, and organizations, ICT can be a positive force for a sustainable future, but we also need to encourage the ICT industry itself to become more sustainable. At the end of the day, we can have all the information and communications that we need for lighter living, but all this is meaningless and irrelevant unless we know how to translate it into practical action. ICT can start us on our way, but we ourselves must make the decisions and implement the actions that will ensure a sustainable future.

PETER MADDEN, CHIEF EXECUTIVE, FORUM FOR THE FUTURE

Sustainable futures

The year is 2022. A building crowned with wind turbines and glistening in solar panels towers over the city. No-one lives here, and only a handful or people work on its eight floors. It used to be a high-rise car park. Now it's a farm - a shining example of the new "urban agriculture" that generates its own energy, harvests its own rain water and sells produce in a marketplace on the ground floor.

That's one vision of 2022. Here's another. Picture this: shopping today takes place in two very different two ways. Part of it's entertaiment, a social activity, where visitors sample foods, watch cookery displays and enjoy some retail theatre in vibrant local high streets.

But they don't shop at all for everyday items. Instead, milk, bread, pasta, and household goods simply turn up whenever they are needed, triggered by automatic messages from their cupboards and fridges, delivered by an efficient fleets of electric vans and stored in a password protected bunker where they're kept fresh until the owner returns home.

Those are just two visions of the future from some work we did on low carbon living.

> ***Of course, no-one can predict the future – that's impossible. Think back to when you were a kid, what did you think the future would be like? Who today is eating meals in tablet form, wearing the jet packs or living on the moon?***
>
> ***But just because we can't predict the future, it doesn't mean we can't prepare for it. We can think about the possibilities, make informed guesses and find ways of dealing with uncertainty. We can help prepare for what might happen. And perhaps most importantly, we can help to shape it.***

The importance of 'futures' for sustainability

Anyone can benefit from having some sense of what the future might hold. If you are setting out on a journey, it helps to have an idea of where you are heading.

But most importantly, you'd want to have an idea of where you want to end up, and the opportunities and the pitfalls that may lie along the way.

We need long-term thinking. In no area is this more true than with sustainability. Short-termism is the enemy, the very opposite of sustainability.

Having a clear idea of the trends just makes good sense. Whether it's climate change or consumer buying habits, regulatory changes or resource shortages, looking ahead helps develop preparedness, open-mindedness, and resilience.

Our experience has shown that pushing that extending time horizon out, extending it by only a small degree, can be a huge wake-up call for an organization. It can raise awareness of critically important issues as well as bringing countless benefits.

But more than just looking ahead, what about where you want to end up? Having a positive and inspiring image of where you want to be – an ambitious but realistic vision of the type of world you want to see - can open up opportunities to thrive and shape that future. It can sharpen up strategy; inspire innovation; and build inspirational leadership.

Why environmentalists are not good at talking about the future.

So are environmentalists any good at talking about the future? You'd think that with all our rhetoric of "future generations" and "our children's children" that we'd make some great futurists.

Unfortunately, when environmentalists talk about the future, it often suffers from three problems: it sounds negative; unrealistic; and doctrinaire.

From many environmentalists, the narrative is overwhelmingly pessimistic – a story of apocalypse, disasters, doom and gloom.

Most normal people find this very unattractive. It turns them off. They disengage. They stop listening.

But we have a real conundrum here: we need some negativity and fear to raise awareness of some quite frightening prospects. But too much becomes counter productive.

So we need to find a balance between fear, and inspiration. But that positive message is so often the missing bit. Martin Luther King didn't stand up and declare: "I have a nightmare".

Secondly, when Greens do talk about the future we often sound naïve or unbelievable. There's a sort of 'hippy utopianism', the idea that we will all live like 'Little House on the Prairie'. That rightly turns many people off who simply don't buy into that narrative. So we need to be credible and accessible in our images of the future.

Finally, environmentalists often sound too doctrinaire. Because we are passionate about our cause and firm in our beliefs, we tell people there is only one future, whether that's a spiral to chaos or one true path to enlightenment. But that's neither helpful, realistic nor democratic.

Yes, some of the issues are unavoidable: our planet's heating up. Yes, some of the trends are unstoppable: we're using more resources and they're running out.

But how we respond, how we cope, the opportunities we seize and those we ignore, will depend on our awareness, our dreams and our actions.

Telling people there's only one true future just stifles that debate, shuts down the discussion and then we wonder why people don't feel motivated to act.

Forum for the Future's approach

Futures thinking underpins a large part of the work we do at Forum for the Future to promote sustainable development.

We try to build stories of the future that are aspirational and credible. And in painting these pictures we work with the organisations who can help shape that future.

We've recently published scenarios on the future of retail with Tesco and Unilever and the future human responses to climate change with Hewlett Packard. And we've got exciting new projects looking into the futures of tourism, fashion and population.

But in order to create the future we want to see, we know it's essential to really embed that thinking. It can't just be an academic exercise or a report that sits on a shelf. That's why we use a partnership-based approach to embed the thinking, resulting in real actions and creating real change.

Concluding Remarks

So how well we tell our stories will determine not just whether people listen, but whether they act.

The challenges of sustainability are immense.

But we need to tell stories that are positive and inspiring, not negative.

We need to be credible and believable, not fanciful.

And we need offer a range of futures and not declare there is just one.

That way, I hope we can help people to realise that <u>they</u> <u>too</u> have a role to play in shaping a more sustainable future.

JAKOB VON UEXKÜLL, FOUNDER, WORLD FUTURE COUNCIL

We all have one common value: we want to hand over a healthy planet to our children. The World Future Council works to make this possible. We identify 'best policies' which help protect and heal our planet, and build a peaceful and equitable global order. We then work with parliamentarians worldwide to help implement these policies, via hearings, publications, mailings, films and a special website which enables them to adapt such legislation to their national requirements.

This is out 'carrot'. Our 'stick' is our Future Justice Programme, identifying crimes against future generations, i.e. "future-foreclosing" activities. We recently held a hearing with judges and prosecutors at the various international courts in The Hague, to identify ways of building taboos and eventually criminalising such activities.

Our 50 global councillors do not work in isolation but dialogue with children and youths worldwide through our KidsCall Project.

Climate chaos is today the overriding global threat to our common future, so the council is prioritising policies which can slow and reverse it.

ICT has a key role to play in the urgent energy revolution, both in enhancing the productivity and efficiency of existing energy sources and in harnessing new, renewable ones. There is enough sunshine to provide the world with energy abundance and ICT can open the door to making this a reality, e.g. through smart national and international grids, which can cope and distribute renewable energy mixes over wide areas.

But this future is not guaranteed. The current financial crisis reminds us that mighty empires can collapse very quickly! If we allow climate chaos to reach the predicted tipping-points, then we may face a collapse of our civilisation, growing global conflicts and a rejection of rationality. As we know, after Rome fell, it took centuries for lost knowledge to re-appear. ICT needs to show that it can enhance solutions and minimize problems. I understand that one avatar in Second Life consumes as much energy as an inhabitant of Costa Rica…

Today even the recent past is a foreign country… Policies, which were unthinkable a few months ago, are today mainstream, e.g. the debt-free creation of money by governments and plans to nationalise whole banking sectors. Two days ago The Financial Times' Commentary Page was topped by the headline: "Shoot the bankers and nationalise the banks"…

The collapse of trust in the old order opens opportunities to take large problem–realistic steps. Are we ready? I was an MEP in 1989 and remember how civil society in Eastern Europe soon lost out to special interests, because they were not prepared for power…

Visions need timetables! Coming up with new ideas is easy. Overcoming old ones is not. The first precondition for a sustainable future is the rehabilitation of the political space and of political action. In ancient Greece, the politically active citizen was known as a 'polites' while one who did not participate in political life was known as an 'idiotes'…

Politics today is too important to be left to career politicians. If we want change, we all – civil society activists, scientists, entrepreneurs etc – have to become politically active. I was an MEP for one electoral period and found my experiences there of huge value in my subsequent work! We do not need more lifelong politicians but we do need more of us prepared to move in (and out) of the political space, to ensure that we get the laws our common future needs, and not those the lobbyists of the protectors of privilege are fighting for.

Laws are very important. As Martin Luther King said, 'they do not move the heart, but they restrain the heartless'!

A sustainable future requires the right indicators of progress, measuring reality and not ideology. Last year, the President of the European Parliament, Mr Pöttering, opened a conference on Alternatives to GDP with the words: "We cannot say that we have seen our well-being increase because of economic growth." When you consider the sacrifices we – and our planet – have already made to achieve this economic growth, his statement has wide-ranging implications.

The author of Small is Beautiful, E.F. Schumacher, once said that the aim of a civilised society should be to achieve maximum

wellbeing with a minimum of consumption.

GDP growth ignores the depletion of social wealth (trust and reciprocity) when market rule takes over. It also ignores natural capital destruction, not just by over-use but also by under-use (of our daily renewable energy potential).

Economic cycles come and go but an environmental collapse can last forever! You cannot negotiate with melting glaciers, nor does nature provide bailout packages. A sustainable future requires a shift from a cowboy economy to a co-operative spaceship economy, in which equity issues can no longer be postponed by trickle-down promises. If globalisation is to survive, it will have to mean what the word implies: the distillation of the interests of all the globe's peoples, and not the imposition of the will of a privileged minority on everyone else.

We need corporate law reform to re-introduce personal responsibility and liability – before the shooting of bankers begins! We need to re-regionalise and re-localise economic power, so that negative externalities become more manageable and positive externalities can be enjoyed where they are created.

A sustainable future requires that we start taxing 'bads,' not 'goods'. The World Future Council is currently studying eco-taxes in order to identify what works best where. Pavan Sukhdev of Deutsche Bank, now seconded to UNEP, has proposed a value-depleted-tax, offsetting the environmental costs of production (as far as this is possible). A tax on speculative land value gains has been proposed for 200 years. It is fair and could provide many of the resources we need to build e.g. improved public transport systems.

A recent book by Harvard economist Prof. Stephen Marglin – a member of the World Future Council – is subtitled "How thinking like an economist destroys community". The ideology of selfish capitalism not only threatens to destroy the health of our planet, but also undermines the human qualities needed to change course. This is no accident. As Margaret Thatcher said, "Economics is the method, but the object is to change the soul."

So how do we implement our vision of a sustainable future? In times of crisis, big steps are often easier than small ones – as they can mobilise and inspire. And, to quote the US anti-slavery campaigner William Channing, "there are times in history when to dare is the highest wisdom"!

Today, we can see solutions everywhere, as long as we do not allow 'experts' to undermine the power of our vision. It now depends on each one of us whether or not (to quote the 'Philosopher of Hope' Ernst Bloch): "the great historical moment encounters too small a human race" – one not up to the challenge.

In 1940 fascism was winning the war. The British army was borrowing canons from museums in preparation for the expected Nazi invasion. Then President Roosevelt inspired his reluctant country to shift to a war economy, producing over 300,000 planes and 93,000 ships by 1945. A recent study of Roosevelt's role concludes: "Ironically, while the leaders of industry clung to a more or less static view of the American economy, rooted in prevailing notions of limited annual growth, it was Roosevelt and his 'impractical theorists' who held a powerful vision of the country's potential to produce more than anyone had ever dreamed possible".
Today our common future depends on us all doing 'more than anyone had ever dreamed possible'!

Thank you!

STEVE BRATT, CEO, WORLD WIDE WEB CONSORTIUM

Exec Summary

The World Wide Web Consortium (W3C) and the recently announced World Wide Web Foundation (Web Foundation) share the vision of an Information Society in which ***everyone can create, share, access, benefit*** *from information made available through a free and open Web.*

As we "collectively enter a new era of enormous potential", to quote the UN WSIS Declaration of Principles, the mission of the W3C and Web Foundation align with the goal of a more sustainable future through lowering the digital divide and improving governance of the Internet.

In this paper, we present the role of W3C's open Web standards and how existing and emerging Web applications (e.g. in areas such as mobile, accessibility, internationalization) are delivering on the promise of a better Information Society. We also preview the supporting and complementary role of the new Web Foundation, with its broader focus on advancing Web science, Web standards and the empowerment of people through the Web.

Introduction to the World Wide Web Consortium

The World Wide Web Consortium (W3C) is the international body responsible for the development of the free and open standards that make the Web work. Sir Tim Berners-Lee, who invented the World Wide Web in 1989 while working at the European Organization for Nuclear Research (CERN), has served as the W3C Director since establishing the body in 1994.

W3C's mission is to **lead the World Wide Web to its full potential,** through the development and standardization of core Web specifications and guidelines, including well-known standards like HTML and XML, and guidelines that make the Web accessible for people with disabilities. W3C has published more than 110 such standards, called W3C Recommendations. A key aspect of this work is ensuring that these core standards are compatible with one another, and that they allow any person using an expanding variety of hardware and software to access the Web. W3C refers to this goal as "Web interoperability." By publishing open (non-proprietary) royalty-free standards for Web languages and protocols, W3C's work opens new markets, avoids market fragmentation and ensures the growth of a single Web, where the same information and knowledge is available to all who have Web access.

W3C is a vendor-neutral forum -- a gathering place, dedicated to building consensus around Web technologies within the framework of a fair and open Process. W3C Members include representatives from industry, academia, government, and non-profits. The work is conducted largely in the public, and public input is critical to quality and acceptance of W3C's work. The Consortium, supported by a dedicated full-time staff of technical experts, has earned international recognition for its contributions to the Web.

W3C has headquarters in 3 countries and World Offices in 17 additional countries. The W3C Offices work with their regional Web communities to promote W3C technologies in local languages, broaden W3C's geographical base, and encourage international participation in W3C Activities. Operations are supported by a combination of Member dues, research grants, and other sources of public and private funding, and the Supporters Program.

Introduction to the World Wide Web Foundation

Though the Web is the most powerful medium for communication and commerce the world has ever known, close to 5 million people do not have access to it, and no organization is focused on the full range of challenges and solutions needed to accelerate the value that the Web can bring to the world.

To help fill this gap, the World Wide Web Foundation will be launched in 2009. The Web Foundation will mobilize interest and expertise from the Web community and beyond to advance the Web to benefit humanity. In support of this goal, the Web Foundation will work to ensure that the Web remains free and open, that we understand the Web and see that it improves in a robust manner, that the Web is usable by all people, and that the Web is useful as a means of improving lives. An important part of this will be providing additional support for Web standards, like those produced by W3C. The Foundation will also support the

new field of Web science, as promoted by the Web Science Research Initiative (WSRI).

Most importantly, the Web Foundation seeks to **lower the barriers** of accessing the Web for people who are not able to find usable and useful information, especially in under-served populations. It will work to ensure the Web is accessible for all people, including people with disabilities, from different cultures, and with language and literacy skills that span the range of the Earth's population. A reduction of barriers to life-critical services is particularly important.

The Web Foundation will be registered in Geneva, Switzerland, and will have a presence in other countries. Its creation has been seeded by a $5 million / 5 year grant from the John S. and James L. Knight Foundation. The Web Foundation will leverage this generous gift to raise additional funding to fuel its work. The Foundation will fund qualified teams to execute projects, and will take an active role in the development, coordination and conduct of these projects to ensure their success.

Primary Issues: Digital Divide, Internet Governance

Two issues of concern at this conference and within scope of the W3C and Web Foundation are: the Digital Divide (how to help the ones that need it most) and Internet Governance (who is in charge?). W3C has already a strong stake in addressing both of these issues, and the new Web Foundation will make the Digital Divide a central focus.

Standardization has always been one of the essential building blocks of the Information Society. The development of Web standards and relevant policies has always been at the heart of the W3C's work.

The W3C process and actions illustrate that:

- **Open Standards**: W3C has been developing open Web standards for over 14 years. The W3C Process encourages the creation of standards that promote openness, fairness, and decentralization.
- **Principles and Policies that Promote Universality**: One of W3C's primary goals is to make these benefits available to all people, irrespective of their hardware, software, network infrastructure, native language, culture, geographical location, or physical or mental ability. W3C technologies are designed for universal access. W3C policies, including its document license and the Patent Policy promote both the wide distribution of these technologies and their **royalty-free** implementation.
- **Digital Inclusiveness**: W3C's Internationalization Activity, Device Independence Activity, Voice Browser Activity, and Web Accessibility Initiative all illustrate our commitment to universal access and "digital inclusiveness."
- **International Stature**: W3C is by construct completely open to the World, is present on all continents, and is continuously trying to increase its presence and outreach to new countries and World regions. See also this article on the topic: *Worldwide Participation in the World Wide Web Consortium*.

To reach its vision, the Web Foundation has to do more than support open Web standardization. It will mobilize the world's Web community to tackle the most significant challenges and opportunities facing the Web now and in the future. Most prominently, the Foundation will coordinate and fund, in an integrated manner, projects in the Web community that leverage the community's strengths across new axes:

- **Web Leadership** – gather the Web community and its immense expertise to become a global resource for governments, media, and other organizations seeking advice on challenges and opportunities facing the current and future Web. Summits, conferences, blue-ribbon panels, and community networks will be initiated to share knowledge, develop recommendations, and coordinate actions on topics including global availability, education requirements, research requirements, next-generation technologies, privacy, security, accessibility, and societal impacts, among other topics.
- **Web in Society** – empowering people through the Web. While all of the Foundation's work will ensure that the Web serves society, the Foundation will focus on increasing -- in the field -- the free and open availability and usefulness of the Web for the 80% of the world's population who do not currently have access. One important goal is that the presence of local expertise be expanded in under-served regions of the world.

The next two sections look deeper at the issue of Internet Governance and the Digital Divide, and how the W3C and Web Foundation are mobilizing to help.

Internet Governance: Focus on Broad Issues

W3C develops the foundation of the World Wide Web. The Web builds upon Internet technology, and other systems, in turn, build upon the Web standards published by W3C. In a sense, Web technology development places us in the "middle" of the Internet Governance discussion, somewhere between underlying protocols and overlying social issues. Consequently, our position on Internet Governance, or on Internet coordination more generally, is summarized as follows:

- **Cooperation**: We believe strongly in the value of interoperability and of consensus-based processes to achieve the required interoperability. Therefore, we seek a cooperation among parties.
- **Stability**: Stability of the Internet protocols and core Web technologies enables the Internet to scale and promotes innovation. We promote stability of the underlying layers (in particular the DNS), even as they evolve to meet new and expanding requirements on a global scale.

- **Broad Social Issues**: We are more concerned with broad issues of governance than specific operational issues. Privacy, internationalization, accessibility, and universal access are examples of broad social issues of great interest to W3C in the discussion about Internet governance.

The Web 'sits' on the Internet, and the new Web Foundation will need to understand clearly what are the technical responsibilities for all the organizations impacting the development of the Internet and the Web, even though it is specifically created by the Web technical community.

But we're well equipped: the technical standards of the Internet and the Web have been, and are still, developed in a multi-stakeholder way, with an open and participative bottom-up style. This style is based on simple principles, such as **interoperability** (i.e., it should work on any hardware, with any operating system, and from any software), and **universality** (i.e., it should work irrespective of culture, language, character sets used; and it should be accessible to people with disabilities).

Our message for policy makers is simple: You should do whatever you can to help narrow the gap between the "haves" and the "have-nots" for information access, just as for clean water and health care. National, regional, international government organizations should play an important role as **sponsors** (thanks to the EC and other agencies for having supported W3C for all these years) and **users** of the Internet technologies (eGoverment advocates of open standards). We must make sure policy makers worldwide are aware of the ongoing evolution of open decentralized information networks by **joining** the community that we represent.

Digital Divide and Role of the Web

Today half of the World's population is living on less than $2.5 a day (source "Poverty Facts and Stats"). This part of the population is suffering from a lack of all types of services (health, government, education, finance,...) which prevents them from increasing their income and from entering into a sustainable development phase. Using the Web would be the easiest and best way to develop and deploy the services needed. During the last few years, the potential of simple services to provide solutions in these area has been largely demonstrated (see e.g. The Digital Provide: Information (technology), Market, Performance, and Welfare in the south Indian Fisheries Sector) . It is therefore critical to work towards bridging the Digital Divide to have a significant positive impact on the future of the Developing World, and to have a chance to realize the UN Millennium Development Goals.

In this regard, by the end of 2008, only around 1.5 billion people are connected to the Web (source Internet World Statistics), and almost 5 billion people are not benefiting from the Information Society. The World Wide Web Foundation will investigate how to make the Web relevant, accessible, usable and useful for a large part of these 5 billion people, who are, in a vast majority, living in developing countries, and below the poverty line.

There are indeed three specific aspects to consider to bridge the digital divide:

- connectivity
- accessibility and usability to information
- usefulness of information

The first challenge is about providing devices and appropriate bandwidth to connect people to people and people to information. By some estimates, there will soon be almost 4 billion mobile phones in the world, providing connectivity and at least minimal computing power. The explosion of mobile telephony and the growing penetration rate even amongst the poorest segment of our population is a promising sign, and a great opportunity. The Web Foundation will not work directly to increase connectivity.

Given at least the potential for connectivity, it is next critical that relevant, accessible, usable and useful content is available, searchable and findable by people. This is the focus of the Web Foundation's future work. We believe that this technology has the capacity to empower a very large segment of humanity, by bringing the capability of the Web to them through inexpensive mobile instruments such as the mobile phone. The mobile Web has the capacity to bring rich and relevant information to individuals when and where they need it. The information available to them in this way consists not only of services specially targeted for them, but is in fact the sum of human information and knowledge that has been transferred via the entire World Wide Web. Local applications can take advantage of this by referencing this information, no matter where it exists in the World.

The Web Foundation will particularly explore two complementary directions to make significant advances in the Information availability and accessibility for people who can benefit from it the most:

- **Usability**: This first direction is primarily about technology: investigating, identifying and resolving gaps in Web technologies to address the specific needs, requirements and profiles of the targeted populations. This covers, but is not limited to, three major aspects:
    - Accessibility. Tremendous progress has been made under W3C's Web Accessibility Initiative, focused on making the Web accessible for people with disabilities. However, there is still a lot of work to be done. For example, one critical gap is around making the Web accessible by illiterate and semi-literate people.
    - Local languages. Significant progress has been made by W3C's Internationalization activity. This work

needs to be expanded, completed and disseminated.
    - Inexperience. Very little investment has been made in studying the usability of the Web by people without prior Web experience and without a technological background. It is essential, to understand and develop guidelines on how to make content easily usable, searchable, findable and understandable across cultural and experiential barriers.
- **Usefulness:** A goal is to focus support to provide people with information that improves their lives. This includes information on health care, nutrition, agriculture, education, commerce and other life-critical areas. We will investigate, identify and lower barriers that prevent potential content providers from developing, implementing and deploying their data, information and knowledge. Example activities include development of tools, guidelines, training programs and academic curricula. We will also fund ethnographic research on the potential impact of the mobile Web on people's lives, and their foreseen usage.

In summary, the potential of information and communication technologies to address development challenges has been funded heavily in the last 15 years, with less-than-satisfactory results. The availability of expanding mobile phones and networks offer new opportunities to shift the focus from the connectivity problem to providing useful and usable information and services that could improve people's lives. In this domain, new technologies have to be developed to meet the specific profiles of targeted populations, and authoring and deploying development-oriented content have to be fostered through proactive actions towards empowering people. The Web Foundation has been setup to drive such an effort but, to have a real impact at the global level, it requires the participation and investment, in time, energy, and resources, of all parties and stakeholders that are part of the picture: international organizations, governments, regulators, computer and telecommunication companies, NGOs, civil society, grassroots organizations, academics, and, most importantly, people in the field.

NB: Some of the results and directions that are described in this section are built on the work of the W3C Mobile Web for Social Development Interest Group, which is part of the EU-FP7 project Digital World Forum focusing on the use of ICT to leverage economic development in Africa and Latin America.

Conclusion

For the World Wide Web Consortium and the World Wide Web Foundation, every paper and speech is an opportunity to solicit interest, dialog and participation to support the important missions of our organizations. This paper outlines our plans to work with other global organizations and individuals on the critical issues of internet governance, the digital divide and other challenges. W3C's recently started eGovernment activity is an invitation to work together toward better administration practices in the technology area. Our new Web Foundation offers an invitation to work together to help those with the most pressing needs leverage the Web to benefit their lives. Please contact us if you are interested in participating in our work:

- Steve Bratt (steve@webfoundation.org)
- Daniel Dardailler (danield@w3.org)
- Stéphane Boyera (boyera@w3.org)

LYNN ST AMOUR, PRESIDENT AND CEO, THE INTERNET SOCIETY

Dear Commissioner Reding, ladies and gentlemen, it is a pleasure to be here in Brussels to address you today. I would like to thank our hosts, the European Commission and the Club of Rome, for the opportunity to contribute to this important discussion.

First, a word or two about the organization I represent.

The Internet Society is an independent, international, nonprofit, cause-based organisation established in 1992 by two of the fathers of the Internet - Vint Cerf and Bob Kahn. We are dedicated to the stability, continuity, and advancement of the Internet for the benefit of all people. We work to advance critical Internet technologies and best practices, provide information, advice, and training programs, and promote national and international policies that support the growth and improvement of the Internet throughout the world.

We provide the organizational home for the groups responsible for Internet standards and protocols, including the Internet Engineering Task Force (IETF), the Internet Architecture Board (IAB), and the Internet Research Task Force (IRTF).

The Society has more than 80 organisational and more than 28,000 individual members with over 90 chapters around the world, including a Chapter Coordination Council here in Europe. We are located in Washington, DC, and Geneva, Switzerland, with a distributed workforce in 12 countries including Regional Bureaus in Africa, Latin America, and Asia.

This conference asks: "How can ICT durably contribute to the wellbeing of all citizens around the world?" And, the Paradiso Reference document talks about a paradigm shift - a new concept of equitable, sustainable progress and development, based on revised objectives in economic, social, and environmental spheres.

In what may be a surprise to some, the Internet Society, the IETF, and the inventors of the Internet have always had this paradigm shift in mind, not as a consequence, but they saw the free flow of information as an enabler of increased well-being for individuals and forsociety as a whole. So, naturally, I am very excited to be involved in this effort.

ISOC's mission is to promote the open development, evolution, and use of the Internet FOR THE BENEFIT OF ALL PEOPLE THROUGHOUT THE WORLD. At the Internet Society's creation in 1992, many people may have considered this mission more optimistic than prescient.

But when launching ISOC, Vint Cerf and Bob Kahn remarked that "a global renaissance of scientific and technical cooperation is at hand". How true that statement was then; and its truth rings louder today. The Internet has enabled collaborative research across all disciplines (not only scientific and technical fields), allowing for an unprecedented sharing of information, cooperation, and collaboration that continues to build humanity's knowledge and our awareness of ourselves and our environment.

The Internet has become central to societal and economic development at the level of the individual, as well as at national, regional, and global levels.

The IETF (which is by the way, 22 years old) also has a Mission statement, whichincludes the following: *The IETF community wants the Internet to succeed because we believe that the existence of the Internet, and its influence on economics, communication, and education, will help us to build a better human society.*

Indeed, we all believe that by creating opportunities for people to communicate, cooperate, and collaborate, the Internet will play ***a key role*** in bringing about a more EQUITABLE, sustainable future for all of us. Issues or interests that once were the purview of the few are now within the grasp of the many, and their voices can now be much more readily heard.

The Internet is like no other medium (and I make a distinction here between the world wide web and the Internet, as the web is an application enabled by the Internet, albeit an application of astonishing influence and importance). The Internet has encouraged community building and networking; it bridges divides and creates unparalleled experience sharing. It has allowed communities of interest to proliferate around issues ranging from the very local to the truly global – the same application that helps you stay in touch with your neighborhood.

Activities can also help you build a business with a global reach – from anywhere, or track the latest developments in agricultural processes, social sciences or green developments.

At the Internet Society we have been involved since our inception in capacity building, through Internet education and technical training around the globe. We have witnessed first hand how the availability of information and know-how enables great things. We recognize and understand that change is driven by empowered, involved individuals and communities – and we KNOW that the Internet is a fundamental enabler of change, supporting individual's needs and the opportunities they see.

Today, the world is witness to an unprecedented groundswell of civic involvement in the future of society and the environment. Empowered and involved citizens and communities, collaborating and cooperating around the globe – and using the Internet as their communication medium – are bringing about a pervasive and global awareness of issues related to inequality, resource scarcity, sustainability, and opportunity. We need distributed concerted actions.

So, if we accept that the Internet is essential to a sustainable future, what can we do to ensure that this incredibly successful, breathtakingly useful medium continues to evolve in a way that allows future users around the world to build upon, benefit from and use it toimprove their lives and our world?

The voices of those on the front line of Internet development tell us of the incredible value that the Internet, and its underlying principles, brings to them, from encouraging communication, to enhancing openness, supporting choice, enabling creativity, and empoweringc ommunity.

These benefits radiate out to the edge (to the user and consumers) – which is, of course, vital. And, at the same time, our world is an increasingly complex place. As the volume of data and information we can access increases exponentially, so too does the task of analysis.

But the power of the Internet itself is now being harnessed to allow researchers and scientists to virtually extend their laboratories. Distributed computing techniques allow ordinary computers connected to the Internet to help solve extraordinary problems. Citizens with no academic training can play their part in tackling some of humanity's biggest challenges by allowing their computers' downtime to be put to productive use.

The Human Genome Project decoded the very essence of our being, using this approach. Distributed computing projects are also underway to help us create more effective medicines, develop better understanding of epidemics, and build more sophisticated climate models.

These types of projects, which have such enormous potential for improving the lives of people everywhere, are only possible with open standards, open networks, and collaborative models of development. The Internet both arose from, and taught the world about, this way of working. There was nothing like it before, ***and*** there has never been a more important time in history to learn its lessons.

In the Internet community, we talk a lot about the open, collaborative Internet Model and it is worth spending a moment on it here, because the success and value of the Internet unequivocally lies in its development and management model.

The Internet is a network of tens of thousands of networks, drawing overall resilience from this distributed responsibility.

It works because of the collaborative engagement of many organizations and individuals from across the world. People and organizations from many backgrounds and with different expertise are involved: private sector, civil society, government officials, academics, and researchers.

The development of the Internet is based on open standards, mainly developed through the IETF. They are openly developed, and broadly and freely distributed. Participation is based on knowledge, need, and interest, rather than formal membership.

And finally, the Internet Model is based on widely supported key principles, such as the "end- to-end principle," which supports the global deployment of innovative and often surprising applications. Those who create applications don't need permission to deploy them on the Internet. And perhaps most importantly, users themselves choose which applications best meet their needs (hopefully with no intermediate filtering).

The openness and transparency of the Internet's technical development, its associated policy development and management processes, are intrinsic to the success of the Internet itself, and to maintaining the global Internet.

The Internet's development has always depended upon and involved broad and diverse inputs. This is essential, as the Internet is a platform on which individuals, organizations, and consumers themselves build the infrastructure and services that are then globallyaccessible.

As the Internet grows and continues to spur economic and social development around the world, the policies and practices of tomorrow must grow from the shared principles andthe shared vision that gave us the Internet.

This global platform has enabled an unprecedented scale of human communications, revolutionized how we express ourselves and collaborate, and in so doing has already contributed unimaginably to the wellbeing of citizens around the world.

However, for ICT to durably contribute to the wellbeing of all citizens around the world, we all must work to ensure that:

1. people have unfettered, affordable access to the network, whether from PC's, phones or other devices, and can choose from a diversity of suppliers, services, applications, and products;
2. the communications environment is unencumbered by excessive governmental or private controls;
3. the services and applications are trusted, reliable, and stable; and
4. the user's identity is sacrosanct.

Effectively, the Internet thrives, and its contribution to society is greatest, when conditions ensure that users have the ability to freely:

- Connect
- Communicate
- Innovate
- Share
- Choose, and
- Trust

To understand why these abilities are so important, we must recognize that technologies and infrastructure are required for progress, but do not ***drive*** progress. People drive progress, and their needs and the opportunities they see, drive applications, solutions and innovations. A model exists for the paradigm shift called for in the Paradiso document. It is the Internet Model. The Internet Model shows how equitable, sustainable progress and development can be achieved.

But we cannot take the Internet Model for granted. Governments that appreciate the benefits the Internet Model brings must understand how the key abilities I described are affectedby both the opportunities governments create and the restrictions they resist.

The Internet continues to evolve at a pace that has exceeded virtually all expectations, and defied most predictions. It continues to amaze us in terms of the technology, what it allows users to do and to create, and in the way that it empowers users and communities around the globe. And while the Internet's emergence was unpredictable, it was not an accident, but rather the outcome of vision, commitment, collaboration and the faith or perhaps courage to let it develop organically.

We live in exciting times. On many fronts, we now face some of the greatest challenges in humanity's history.

"Hope" is a word that has been popular this past year. But, we are fortunate, we have more than hope.

In the Internet, and the Internet Model, we have the most powerful tools and methods that have ever been at our disposal. Tools and methods to learn. To analyse. To communicate.

And to understand. Tools and methods that are flexible, responsive, and through enabling mankind's creativity - self-developing. We have tools and methods to bring together the power of people's creativity like never before – assuming we unleash the power of the individual through the use of ICT to make a contribution, to truly make a difference.

It is easy to make the mistake of talking about how the Internet ***was*** developed. The Internet ***is*** developing. And if we heed the lessons of its short history, it always will continue to develop restricted only by our imaginations.

The genius of the Internet is that its decentralized architecture maximizes the power of individual users to choose (or create) the hardware, software, and services that bestmeet their needs. If the Internet is to continue to be a platform for innovation and creativity, itsopen, globally addressable, decentralized nature must be preserved.

I cannot emphasize this enough; **this** is what gave us the Internet; it is fundamentally what makes the Internet "the Internet".

As we stand before these big challenges, it is vital to preserve the conditions that sustain Internet development, for by so doing, we preserve the conditions by which we can use the Internet to help sustain our own progress and development.

Ladies and gentlemen it has been a great pleasure. Thank you for inviting me here today.