paradiso

EXPLORING NETWORK AND SERVICE INFRASTRUCTURES SUITED TO "BEYOND GDP SOCIETIES"

ICT FOR A GLOBAL SUSTAINABLE FUTURE

DRAFT VERSION OF THE PARADISO REFERENCE DOCUMENT
SEPTEMBER 2008

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UNDER THE FP7 RESEARCH FUNDING PROGRAMME

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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 PARADISO project (see WWW.PARADISO-FP7.EU) launched with the support of the European Commission (DG INFORMATION SOCIETY AND MEDIA) aims at identifying strategic research directions on network and service infrastructures suited to the perspective of a global (truly) sustainable future.

The European Union is undoubtedly one of the best placed world powers 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, eventually the well-being of peoples around the world, measured through a new "beyond GDP" index related to the progress of societies.

Which ICT (Information and Communication Technologies) applications and services will be needed to support these new objectives? More precisely, which network and service infrastructures will have to be developed?

The PARADISO project, launched in March 2008 and run by SIGMA ORIONIS and the CLUB OF ROME (through its Italian Chapter: the Aurelio Peccei Foundation) will investigate this disruptive paradigm and identify the ICT research areas that have to be explored in this perspective.

The paradigm is being investigated - and the innovative research will be identified - through "The PARADISO reference document", based to a large extent on the outputs of two international events organised by the project: a scientific workshop (on June 12-13, 2008 in Brussels) and an open conference (on January 22-23, 2009 in Brussels).

The present document is the very first version of the PARADISO reference document, prepared after the PARADISO scientific workshop. It will be extended in the second half of 2008, taking in particular into account the feedback from the participants in this workshop (see attendee list on next page), and the inputs received from other individuals and organisations, since the document will be made available in the public area of the PARADISO WEB SITE for open consultation. A more substantial document will thus be prepared before the end of 2008 and discussed on the occasion of the PARADISO open conference of January 2009.

The final version of the document will be released following this conference 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 an impact on the political agenda.

In the meantime, the PARADISO project stakeholders are considering options to build on these first modest achievements, and 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 worldwide, in order 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 peoples around the world.

ROGER TORRENTI
PARADISO project coordinator

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Raoul Weiler	Club of Rome	Belgium
Piotr Wiench	Warsaw Agricultural University	Poland
Gennaro Zezza	Università di Cassino	Italy
Gaston Zongo	Panos Institute West Africa	Senegal

EXECUTIVE SUMMARY

This summary will be drawn up at a later stage, more precisely when a revised version of the present document is prepared, based on the discussions held at the PARADISO open conference of January 2009,.

It is envisioned that an appropriate form for this summary could be a “manifesto” that would be proposed for endorsement to any organisations sharing the views expressed in it. In this way, the main conclusions of the PARADISO reference document will be more easily and widely disseminated and have a greater impact.

This manifesto would also be the basis of, or even directly serve as, the main “statement” or “declaration” expressed during the open conference, and publicised in the European media on this occasion.

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, financial, and cultural 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 is expected to reach around 9.5 billion people by 2050.

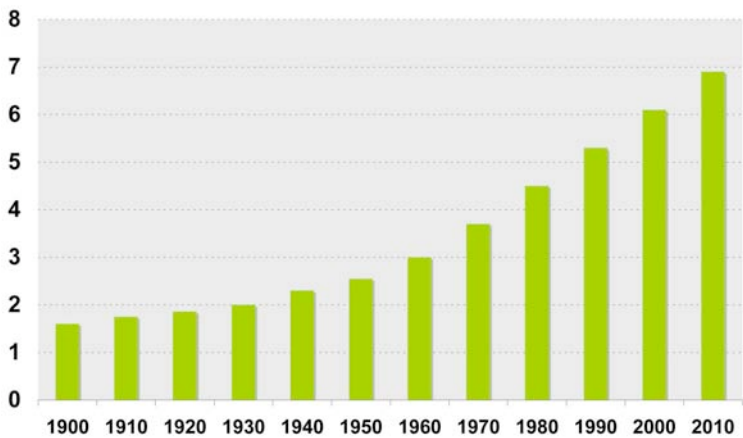


FIGURE 1: EVOLUTION OF THE WORLD POPULATION SINCE 1900 - US CENSUS BUREAU - 2008

This tremendous 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 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.

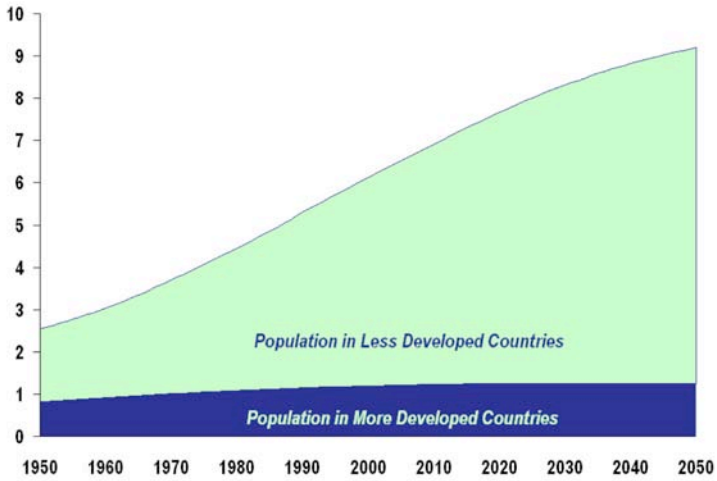


FIGURE 2: COMPARED POPULATION GROWTH OVER THE PERIOD 1950-2050 - POPULATION REFERENCE BUREAU - 2007

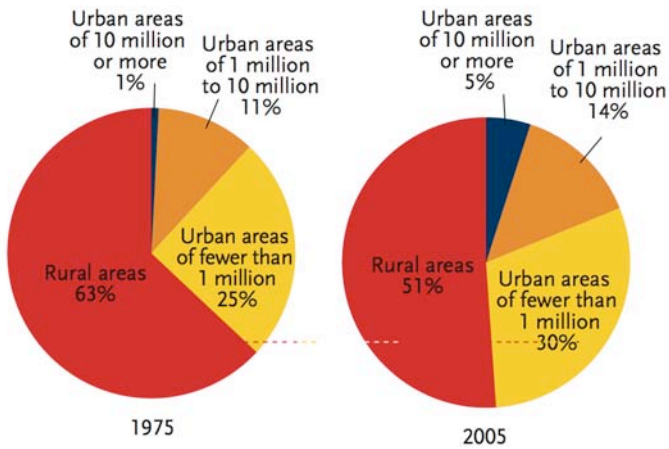


FIGURE 3: WORLD POPULATION LIVING IN URBAN AND RURAL AREAS - POPULATION REFERENCE BUREAU - 2007

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 governments to extend the reach of their markets, to build a world of more freedom (see for instance the EU vision of "four freedoms of movement": goods, services, people, and money).

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, financial, and cultural globalization.

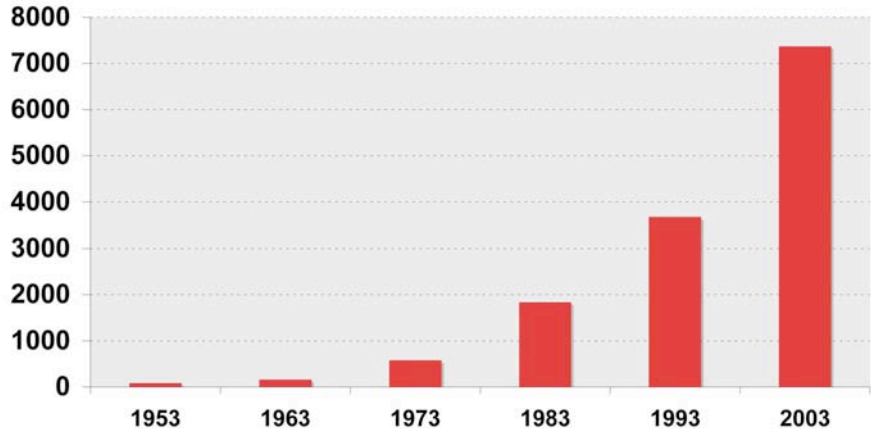


FIGURE 4: EVOLUTION OF WORLD MERCHANDISE EXPORTS (IN BILLION USD) SINCE 1953 - WTO - 2006

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 probable future 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.

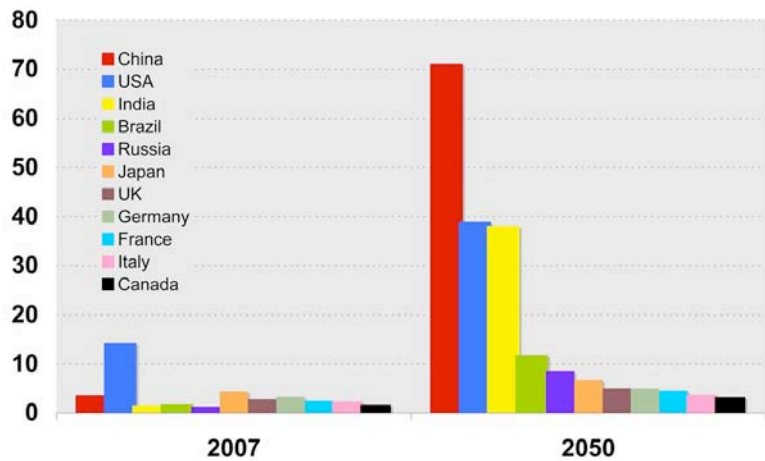


FIGURE 5: GDP OF BRIC AND G7 COUNTRIES FOR 2007 AND 2050 - GS DATA - 2007

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 CO2), and the decline in biodiversity (and more generally the impact on natural systems, among them fisheries).

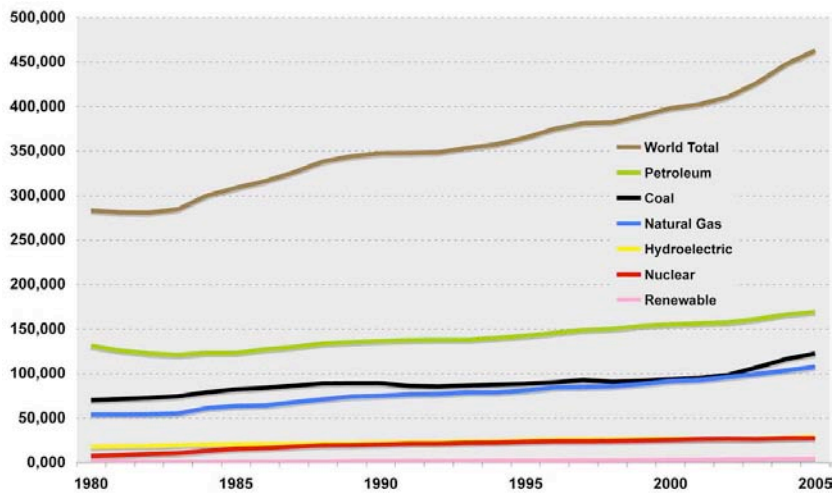


FIGURE 6: WORLD CONSUMPTION OF PRIMARY ENERGY SINCE 1980 (IN 10^{15} BTU) - EIA - 2007

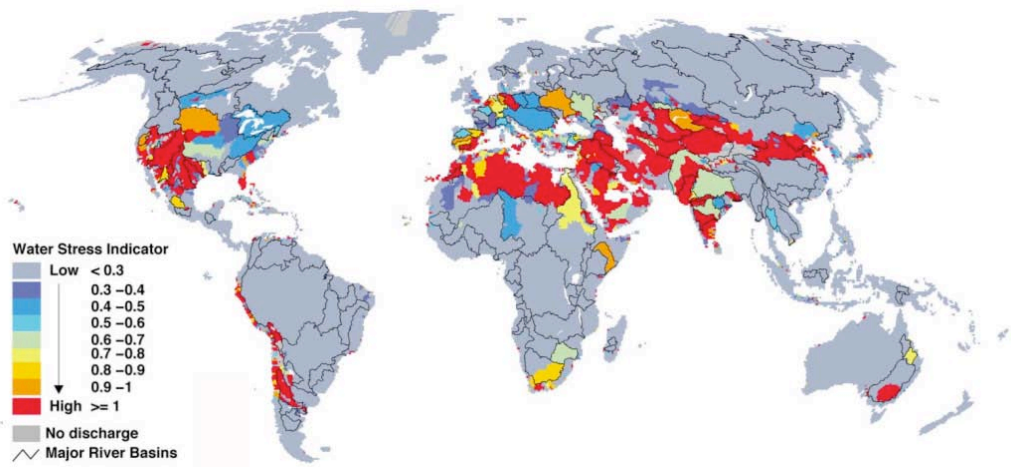


FIGURE 7: WATER STRESS INDICATOR - WORLD RESOURCES INSTITUTE - 2003

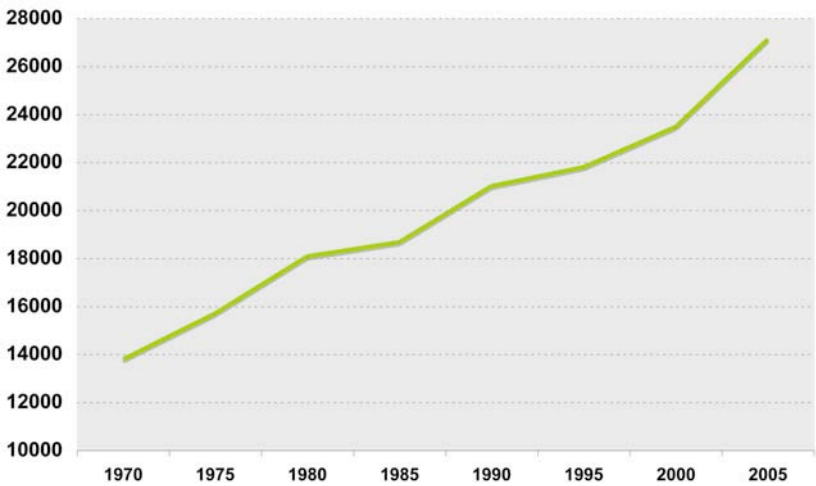


FIGURE 8: WORLD CO2 EMISSIONS - OECD DATA - 2008

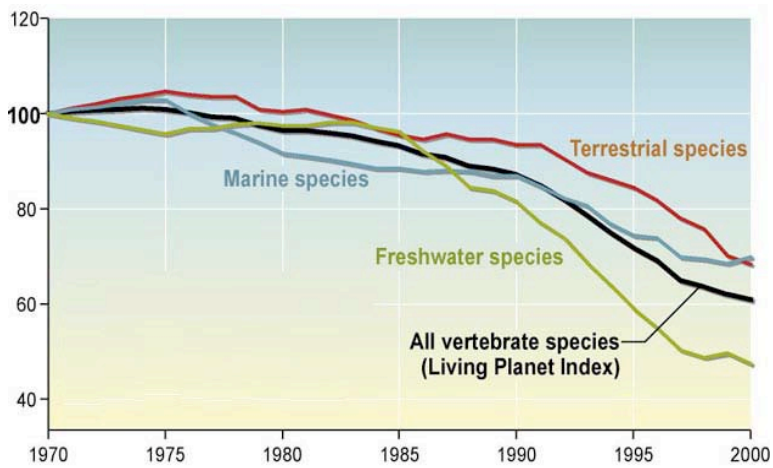


FIGURE 9: EVOLUTION OF THE LIVING PLANET INDEX SINCE 1970 - WWF - UNEP-WCMC

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).

- 3.5 billion people are mobile cellular telephone subscribers (over one half of the total population), China being the leading country with around 520 million subscribers, while over 1 billion mobile phones will be 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.

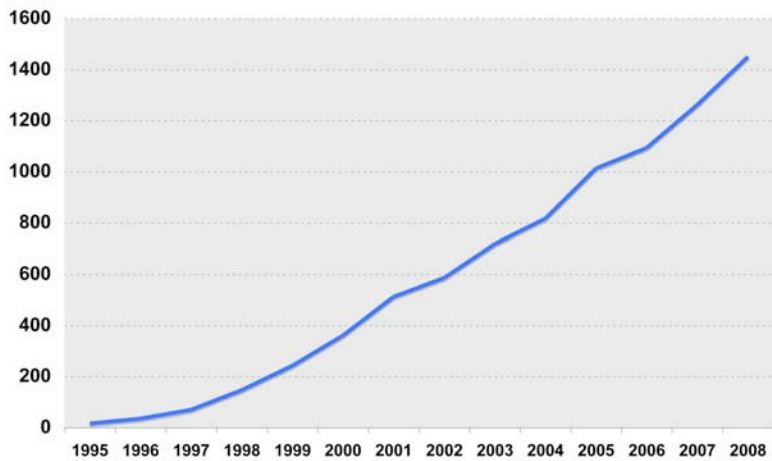


FIGURE 10: INTERNET USERS IN THE WORLD (IN MILLIONS) - GROWTH SINCE 1995 - INTERNET WORLD STATS - 2008

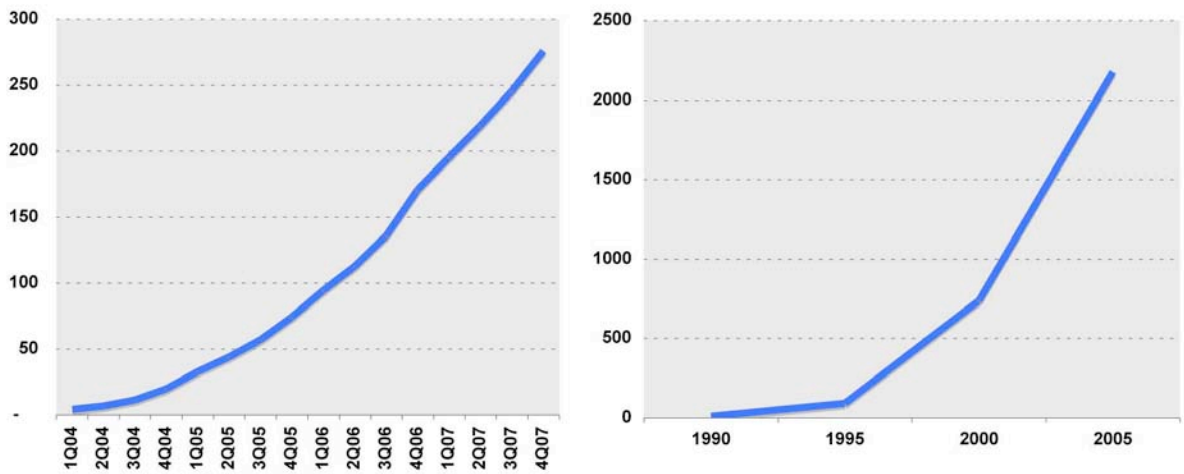


FIGURE 11: EVOLUTION OF SKYPE (LEFT) AND MOBILE PHONE USERS WORLDWIDE (IN MILLIONS) - OECD - 2008

HOW CAN WE ENSURE A SUSTAINABLE FUTURE?

This chapter first acknowledges that a number of organizations do exist today to cope with the changes introduced in the previous chapter and with other relevant challenges the world is facing in order to build a more sustainable future. It also recognizes that in these organizations, issues going beyond GDP are more and more frequently addressed.

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

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.

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 addressing and solving world issues. The example is a very 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.

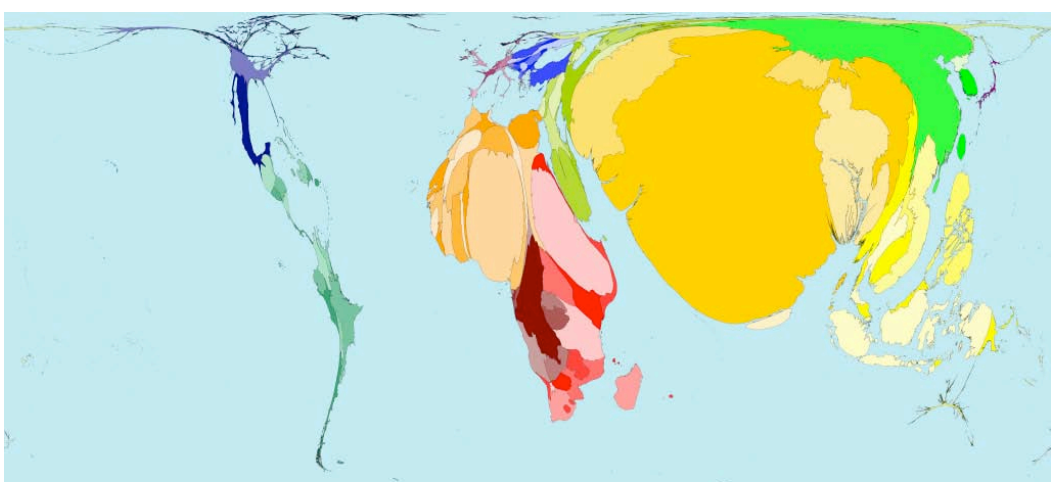


FIGURE 12: UNDERWEIGHT CHILDREN (UNDER 5) - WORLDMAPPER – 2006

Territory size shows the proportion of all underweight children in the world that live there.

Beyond the EU (and similar organizations such as ASEAN, or more recently, the AFRICAN UNION), there are many other well-known multi-lateral 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 OECD, the G8, the WORLD BANK, IMF, 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 it will, through the next paragraph, focus on an 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).

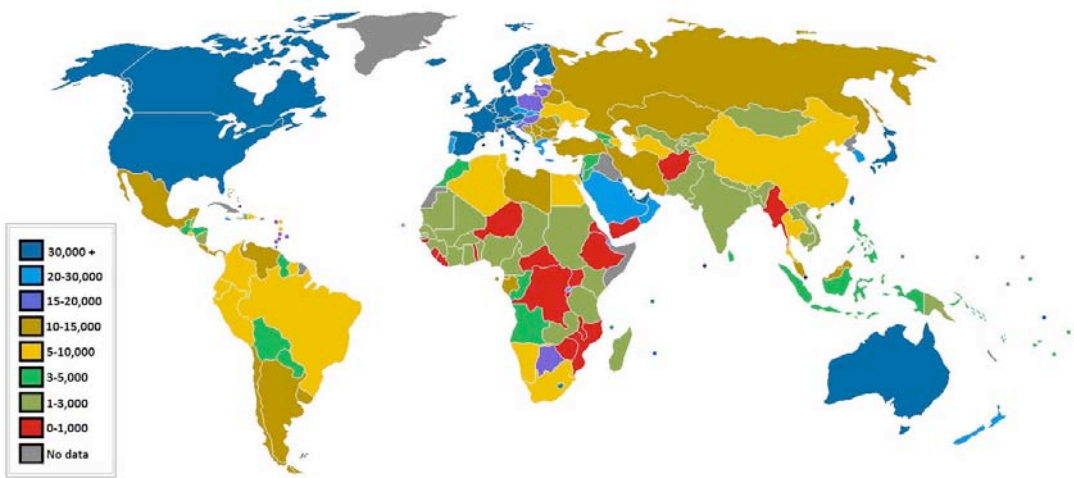


FIGURE 13: WORLD MAP OF GDP PPP PER CAPITA IN 2007-2008 (IMF - 2008)

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).

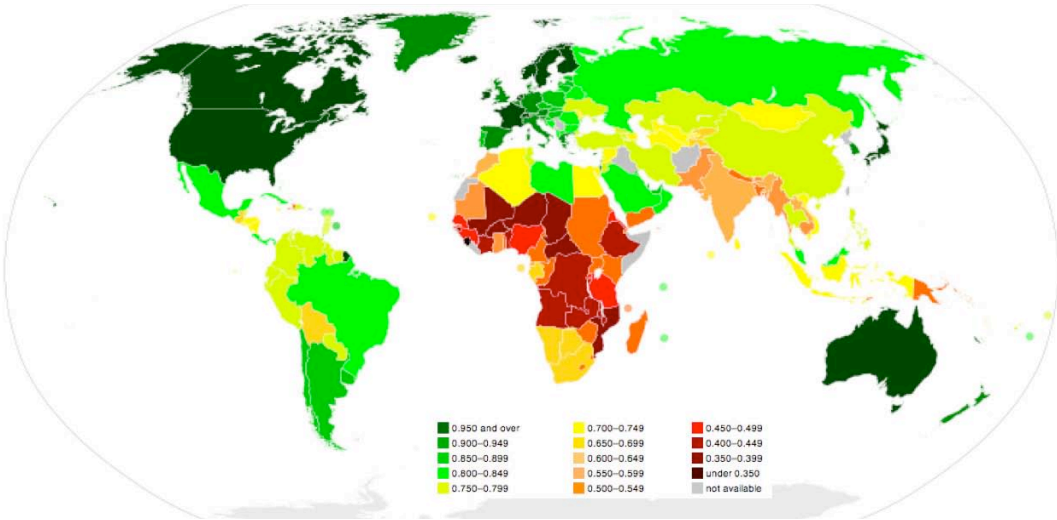


FIGURE 14: WORLD MAP OF HDI IN 2007 (UNHDR - 2008)

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, and developing a global partnership for development, with targets for aid, trade and debt relief.

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 the 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"). 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 ("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.

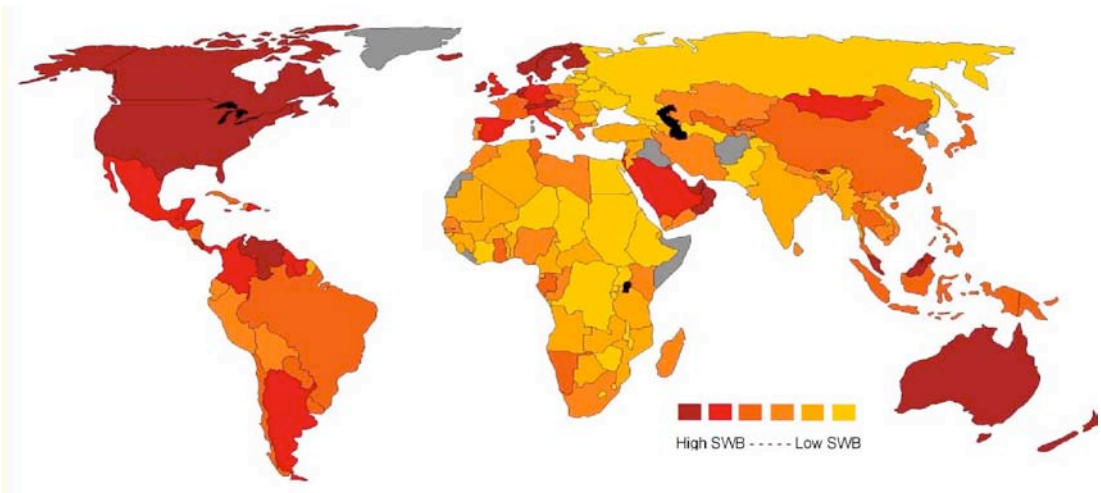


FIGURE 15: A GLOBAL PROJECTION OF SUBJECTIVE WELL-BEING (SWB) (UNIV. OF LEICESTER - 2007)

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 * Life expectancy / Ecological footprint). The HPI ranking of world countries is illustrated below.

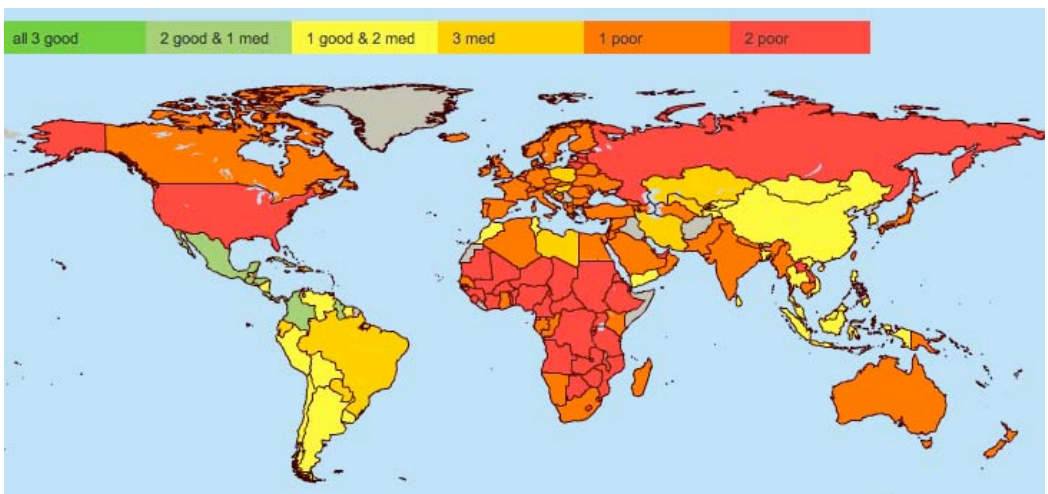


FIGURE 16 : THE HAPPY PLANET WORLD MAP (NEF - 2008)

It is difficult to be exhaustive in the mapping of "Beyond GDP" initiatives since, while a limited number of such initiatives had been 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, which is hosted by the OECD and run in collaboration with other international and regional partners (including statistical agencies, such as the European EUROSTAT), 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 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 (read the "Istanbul declaration" HERE) 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

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 pertinent dialogue and that relevant measurements have been agreed on to ensure a 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 being proclaimed more and more frequently and these are related not only to environment issues, but also to economic and social ones.

Concerning the environment, risks of breakdown do not only come from the "global warming" issue 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 worldwide, more frequent and intense weather events), leading to natural disasters, major loss of life and economic disasters, scarcity of water and agricultural products (in some regions), species extinction, increase in diseases, etc.

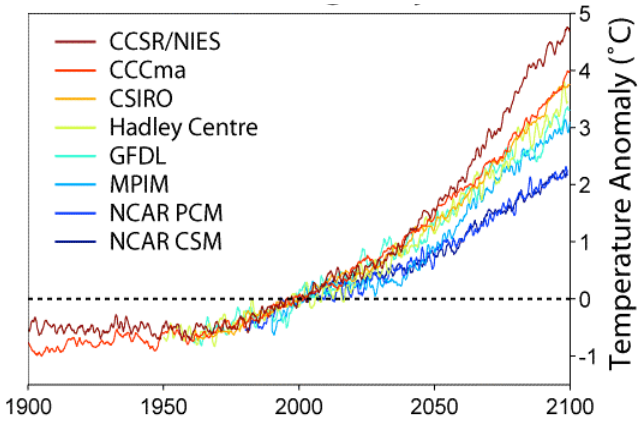


FIGURE 17: GLOBAL WARMING PROJECTIONS (IPCC A2 SCENARIO) - ROBERT A. ROHDE

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 became greater than 1 (a situation of "ecological overshoot") in the early 60's.

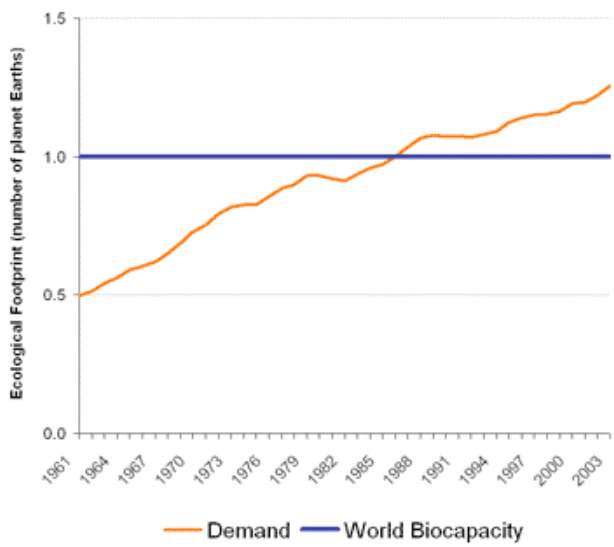


FIGURE 18: HUMANITY'S ECOLOGICAL FOOTPRINT - GLOBAL FOOTPRINT NETWORK

The above-mentioned risks of major breakdowns related to environment issues are not the only ones that the world can expect in the near future and major risks related to economic and social issues can be foreseen too.

The recent subprime mortgage crisis and food price crisis have increased the feeling of an insecure economic and financial environment that might quickly lead to serious global breakdowns, and this, at a moment when a

long-term recession is predicted by many experts for most developed countries, when the effective stability of the development path of China is more and more often questioned, and when WTO has been facing serious difficulties in finding a consensus on the future of market globalization.

Concerning social aspects, 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 come to the same conclusion: even if poverty has globally decreased (apart from sub-Saharan Africa) the number of people living with less than 2 US$ per day has remained unchanged since 1981.

These facts, and the consequence of other facts mentioned previously (the World Bank estimates for instance that the present oil and food price crisis could send 500 million more people into poverty) are obviously sowing the seeds of serious social and political instability.

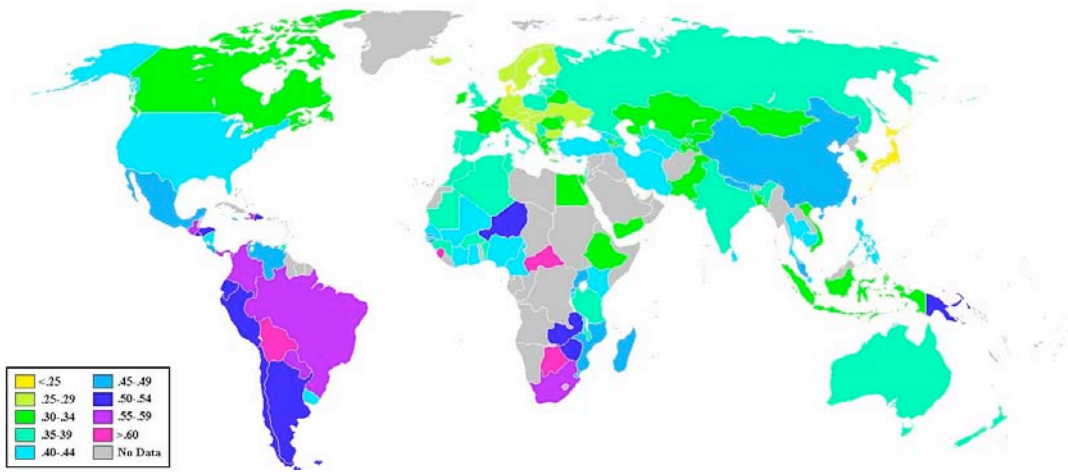


FIGURE 19: INCOME DISTRIBUTION PER COUNTRY (GINI INDEX) - UNHDR 2007-2008

BUSINESS AS USUAL IS NOT AN OPTION

"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"?

There is an urgency indeed 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.

"Serious risks of collapse are in sight", "business as usual is not an option", "we have to prepare ourselves for a disruptive paradigm"… Yes, but can the world truly move towards this alternative way without a strong political will?

And can it be expected, considering that political leaders:

- Are slow to deal with future and long-term issues.
- Have a tendency to procrastinate.
- Are reluctant to follow revolutions, or support paradigm shifts.
- Don't want to be in a position of announcing bad news or decisions not answering the express needs of their citizens.
- Do not welcome policies requiring unexpected huge investments.
- Are surrounded by industrial and financial lobbies limiting their capacity to make changes, etc.

Although this may be true for many leaders, one should not globally underestimate their leadership and we must acknowledge that there are today, in Europe and in other regions of the world, leaders able to understand that:

- We have no other choices, if we want to avoid the collapse of our societies (which can indeed be seen as a relevant political decision by citizens and companies!).
- 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), that it does not necessitate implementing a revolution and it is economically feasible.

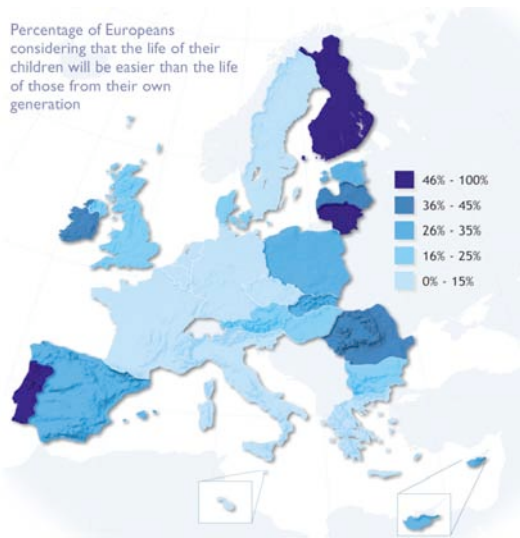


FIGURE 20: AN EASIER LIFE IN THE FUTURE? - BEPA - 2007

Now, in order that political leaders can fully understand and be ready to take action, we need to be more specific about what the paradigm shift will consist in, what will effectively change in societal objectives, how differently people will live, how the progress of societies can be redefined "beyond GDP" (and which new indexes and indicators should be chosen), what this vision of "a true sustainable future" is concretely, and eventually how new policies can be implemented economically.

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 these 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

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 go for "anti-capitalism" and "de-growth" and is compatible with economic growth but the objective is to ensure sustainability first, this is why the vision is here rather called "sustainable future" than "sustainable development" (which is anyway a term that may be too restrictive, being, for many people, purely linked to environment issues).
- 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 that those living in the 19th century have known but to consume less and differently, only what is 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, inside societies and beyond societies, changes are expected at individual or community levels: development of informal economy and of social networking, of local services and local economies.

FIGURE 21: SOME KEY-WORDS AND CONCEPTS CHARATERISING THE ENVISIONED PARADIGM SHIFT - PARADISO - 2008

Is “this other future” economically feasible? To convincingly answer this question, it is necessary of course to evaluate precisely which changes will be implemented and at what pace in this country or that region. However some recent analyses (focusing on environmental challenges) have shown that the economic feasibility could be effectively demonstrated in specific cases, which makes us confident that similar conclusions can be reached in other cases:

- in its “Plan B” report already evoked, Lester Brown has precisely evaluated the cost of his “enthusiastic” alternative Plan and proven it was reasonable.
- in its 2008 report “Environmental outlook to 2030”, OECD underlines that “the cost of inaction is high while ambitious actions to protect the environment are affordable”.

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 to develop a “Beyond GDP society and to enter a paradigm shift suited to the well-being, the happiness of its citizens does exist. However, very few other countries have moved forward today and if substantial changes are to be expected worldwide, a world power has 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 very 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.

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, South America and Africa that are searching for ways to develop and other countries and regions of the world may all follow and support Europe in this direction. Could dynamics be created so that the United States, by defining a new "American dream", will, eventually, also adhere to?

When can such a perspective be inserted into the European political agenda? Let us hope it happens before a major crisis pushes Europe and the world to take action…

THE KEY ROLE OF ICT IN ENSURING A SUSTAINABLE FUTURE

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 development of many societies worldwide. After having evoked the progress expected in the ICT area, it is then assessed that ICT can become instrumental 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 are suggested. The chapter concludes with the acknowledgement that a lot remains to be done and the commitment from the PARADISO partnership to promote further cross-disciplinary and multi-stakeholder work, addressing the way forward for a true sustainable future but focusing on ICT, and this in close synergy with similar initiatives worldwide.

THE ROLE OF ICT IN TODAY'S SOCIETIES

In the first chapter of this document, it was concluded that the overwhelming dimension ICT had taken in today's societies should and could be considered as one of the major changes the world was confronted with. ICTs 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, and has led to an increased convergence of networks, services, and businesses.

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. 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, use household equipment, etc.

In their plans for the future, most societies will 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).

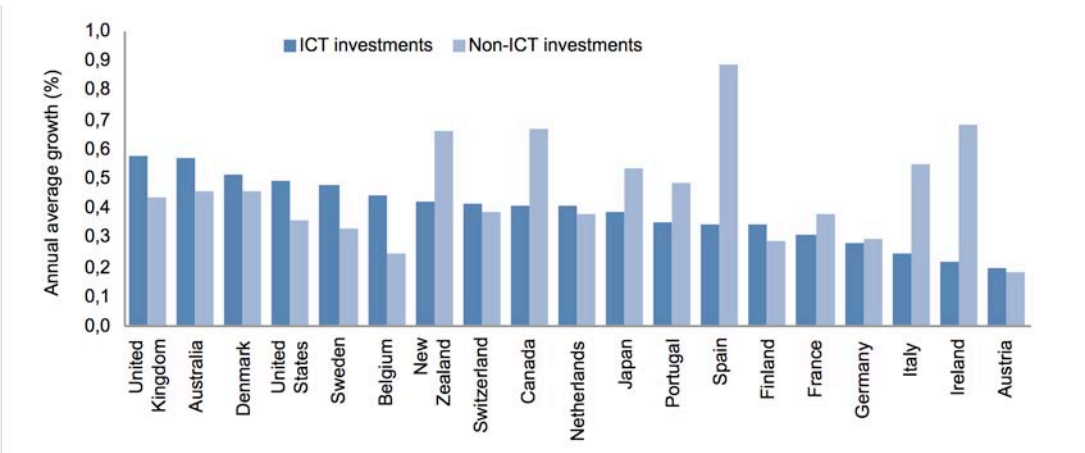


FIGURE 22: CONTRIBUTION OF ICT AND NON-ICT INVESTMENTS TO GDP GROWTH FROM 1985 TO 2006 - OECD - 2008

We will not in the present document further detail the role ICT has today in societies, the way ICT can precisely contribute to achieving economic, social or environment objectives in the different human activities, and thoroughly address issues related to eCommerce, 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. 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.

Last but not least, we would also like to underline that the key role of ICT in today's societies is not limited to developed countries but is also a reality in emerging and in developing countries. As far as developing countries are concerned, ICTs have been recognised as an efficient way to help achieve 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.

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 released 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.

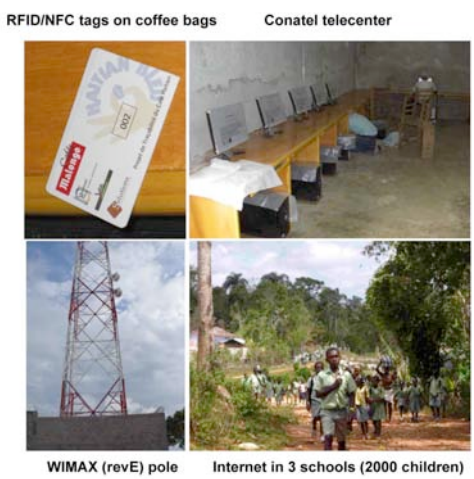


FIGURE 23: FACETS OF AN ICT4D PILOT PROJECT IN RURAL HAITI SUPPORTED BY UNIVERSITY OF NICE - 2008

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

ICTs 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 define 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 three to five 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.

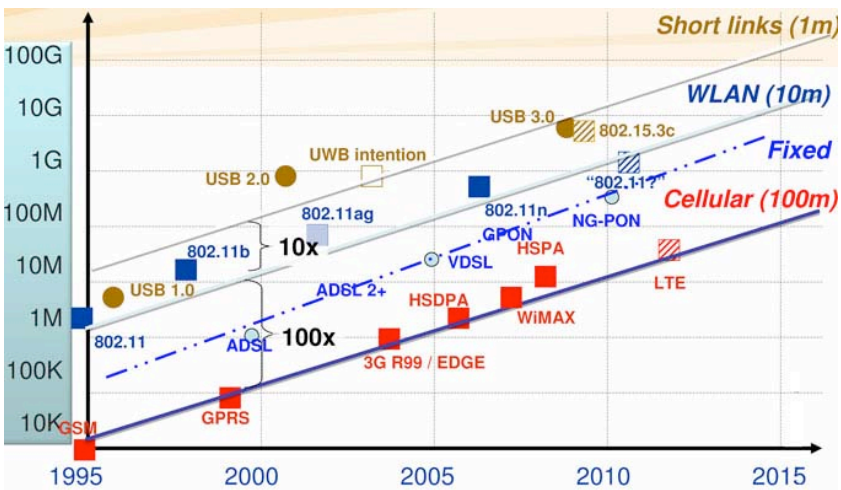


FIGURE 24: INCREASED PERFORMANCE OF COMMUNICATION NETWORKS (IN BIT/S) - EUROPEAN COMMISSION - 2008

In his welcome address delivered to the participants in the PARADISO workshop of June 12-13, 2008, Leonard Kleinrock, Professor at UCLA, 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 Europe, the FIRE (FUTURE INTERNET RESEARCH AND EXPERIMENTATION) initiative was launched in 2007 under the aegis of the European Commission to investigate and experimentally validate new, visionary, multidisciplinary paradigms for the Future Internet. The FIRE 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.

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?

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 drive applications, that we just have to ensure technological progress and make infrastructures available and that the applications will then follow. 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 25: 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 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 information become the enemy of knowledge?" while, at the same workshop, the social risks linked to a more and more virtual world were discussed too.

As for risks related to the environment and the used 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.

Beyond this increasing awareness that ICTs 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 will organise a meeting in October 2008 in Stockholm on "Sustainability and the Future Internet".

In this context, we should obviously not forget the FIRE (Future Internet Research and Experimentation) projects supported by the European Commission under FP7 (among them is PARADISO), aiming 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". We should also not forget the FIRE study "Towards a future Internet: interrelation between technological, social and economic trends" which will be launched at the beginning of 2009.

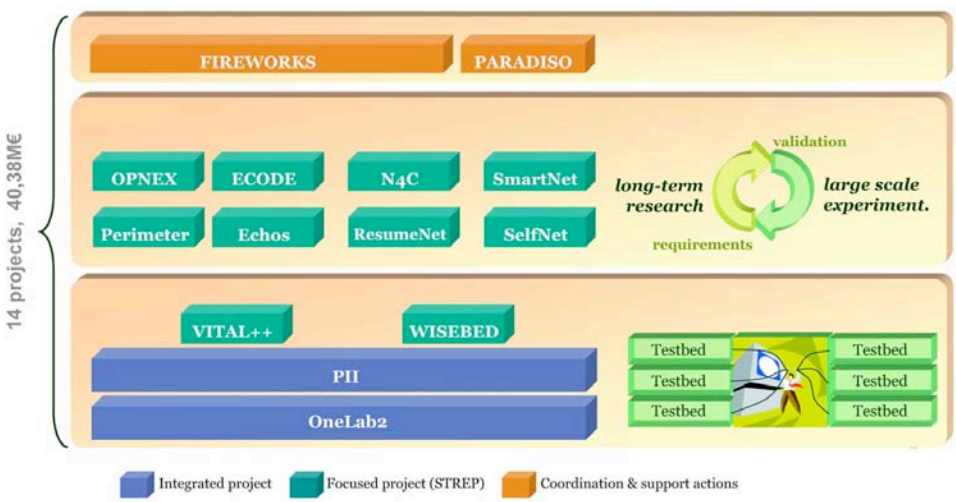


FIGURE 26: AN OVERVIEW OF THE FIRE PROJECTS SELECTED AT FP7 ICT CALL 2

To summarize this section, we might assess that even if, at the moment, the possibility or probability of a societal paradigm shift similar to the one analysed in the second chapter of this document is not indeed considered by the ICT community when addressing the future of ICT or "the Future Internet", there are interesting signs that an awareness has been quickly developing, that there is a propitious environment making us confident that the research areas to be explored (these will be addressed at the next paragraph), can be positively welcomed by this ICT community.

RESEARCH AREAS TO BE EXPLORED

Now that the progress we can expect in the coming years concerning ICTs in general, and the Future Internet in particular, has been addressed and that the potential role of ICT in "Beyond GDP societies" has been assessed, which research can we suggest to be developed in the short term, including on network and service infrastructures, so that relevant technologies, services, and applications can be available in the future?

At the present stage of the document, we can only propose a first set of research areas, topics or priorities derived from the description we have reached so far of the envisioned societal paradigm shift and (to a lesser extent) of expected technological advances.

- Cross-disciplinary and multi-stakeholder research
    - 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 SSH programme)

- Changing consumer patterns
    - Consumers are expected to consume less or at least differently: looking for "meaningful" and affordable products and services, for durable, upgradeable and easily recyclable characteristics. Research leading to products and services (including service infrastructures) offering such characteristics has to be encouraged.

- New social paradigms
    - 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.

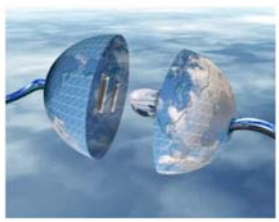
- International cooperation
    - Increased international cooperation has to be encouraged and not only with developed countries, in particular via Infrastructures or connected testbeds, and this not only because addressed issues are global (consumer needs or response to advanced applications and services have to be evaluated globally for instance), but 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).

- "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. Cross-disciplinary cooperation is required to really develop reliable and attractive tools taking advantage of the latest ICT developments (such a "serious games" and social networking platforms).

- ICT for environment, ICT4D, and e-Inclusion
    - More effort should be put into ICT for development, e-Inclusion, and ICT for environment (including climate change issues), i.e. into applications for which the pace at which challenges are increasing is obviously faster than the one at which appropriate answers are provided. To

be noted in this context: EIGHT LEADING US ORGANISATIONS representing thousands of researchers, technicians and specialists have recently urged the US federal administration to launch a 9 billion US$ investment and research programme devoted to climate change over the period 2010-2014 (satellite network, computing infrastructures, observation networks), a sum claimed to be lower than the cost of natural disasters which would be thus avoided.

- Mitigation of ICT impact
    - (Greater) effort should be put 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. ICTs have to become champion in terms of mitigation. A perspective that must be avoided is that of people switching off their computer, for instance, because its energy consumption is too great, while many other actions they could take would lead to a far higher reduction of consumed energy .



Cross-disciplinary and multi-stakeholder research
Changing consumer patterns
New social paradigm
International cooperation
ICT Beyond GDP tools
ICT for environment, ICT4D, and eInclusion
Mitigation of ICT impact

FIGURE 27: A FIRST SET OF RESEARCH AREAS, TOPICS OR DIRECTIONS TO BE EXPLORED - PARADISO - 2008

CONCLUSIONS

ICT in general and “the Future Internet” in particular, can be instrumental in moving forward new societies in which social, economic and environment issues will be addressed with a stronger determination than today in order to avoid major risks of breakdowns of our societal models, and thus ensure a truly sustainable future.

This chapter suggests exploring a set of research areas likely to lead to the innovative infrastructures, products, services, applications that “this other future” will require in developed, emerging and developing countries.

These research areas will be further specified and expanded in the coming months, through further work that the PARADISO partnership will develop, through the inputs received following the online consultation to be launched on the PARADISO website and through the discussions to be held at the PARADISO conference of January 22-23, 2009 in Brussels. At this stage, they might be considered as solid enough to be formally taken into consideration in the revision process of the FP7 ICT Work Programme.

Moreover, being fully aware that, in early 2009, a lot will remain to de done, the PARADISO partnership is already considering options to ensure long-term activities of their cross-disciplinary and multi-stakeholder “think and action tank” addressing sustainable future issues with a focus on ICT, all these options logically including close synergies with organisations involved in similar activities in Europe and worldwide.