Industry as a partner for sustainable development

Information and Communications Technology

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Disclaimer

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Contents

Foreword

The ICT industry is used to change – indeed in many ways it's a catalyst for change.

But no one was prepared for events of the past three years.

Dotcom mania infiltrated every part of our industry and gave rise to a mad scramble for hidden riches reminiscent of the Klondike gold rush. For those that survived, and some big names didn't, share values have tumbled and many companies are now indebted at previously unimaginable levels.

In the midst of this chaos a number of telecommunication network operators and equipment providers recognised the imperatives of sustainable development and in June 2001 formed the Global e-Sustainability Initiative.

This report is our first 'product' and serves both to demonstrate the progress that has been made by the industry since the first Earth Summit in 1992, and to highlight how much more there is still to do.

Indeed there is still much individual ICT companies can do to address the direct sustainability impacts of their own operations and their products.

However, we fervently believe that there is an even bigger potential for the targeted application of ICT to contribute to a more sustainable society – through material and travel substitution, sharing knowledge, encouraging transparency and involvement, and by stimulating economic growth and supporting competitiveness.

But these benefits will only be achieved if people around the world are connected; if environmental gains are not wasted by simply stimulating additional capacity to consume; if sustainability is conceived as a holistic strategy; if organisations are prepared to enter imaginative partnerships; and if the right economic and regulatory conditions prevail.

For these very reasons, and while we continue to live in a capitalist society, the main incentives for change will undoubtedly lie in the marketplace, not through philanthropy.

Our report makes some recommendations in this regard and we welcome a continued and progressive dialogue in the future.

Dr Chris Tuppen
Chairman, GeSI

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Executive summary

The telecommunications industry has undergone a transformation in the years since 1992. Privatisations and deregulation have created widespread competition, technology has brought mobile communications, the Internet has revolutionised business life, new service and escalating transmission speeds have opened up exciting new applications.

One important consequence is that this industry has become pivotal to the knowledge-based economy of the future. Competitiveness – the key to economic and social development – is increasingly based on knowledge and skills rather than physical resources. The information and communications technology (ICT) sector is crucial in widening access to knowledge, spreading information and opening access to markets.

Telecommunications will be a critical player in the development of economies around the globe in the 21st century. It provides the infrastructure of the knowledge economy, and it can enable other sectors of the economy to move towards sustainability.

Economic development

Communication technologies are changing how business is done, especially through wireless technologies and the development of the Internet. They open up the possibility of dramatic productivity growth analogous to the productivity burst which emanated from the first industrial revolution.

These developments are vitally important for sustainable development because they offer the chance of decoupling economic growth from resource use. Telecommunications is a low-mass industry and can help to cut energy and resource use through transport substitution and dematerialisation of physical products.

International development

ICT can make a dramatic contribution to achieving sustainable social and economic development goals. By transforming communication and access to information, the industry can create powerful social and economic networks that can underpin sustainable development in emerging economies.

Examples from Africa, South America and Asia demonstrate that telecommunications can help to achieve improved health, better education, employment and empowerment of local communities, as well as delivering direct economic benefits. There is considerable international concern, therefore, over the low penetration of ICT in the less developed economies, which could inhibit these advantages.

The Internet

The digital revolution has the potential to spread access to knowledge, information and markets to people who have traditionally been excluded from these crucial aspects of development.

The Internet has increased the power of connectivity because of the wealth of resources it has made available to those who are connected and have the skills to tap this abundant resource. It can enhance the capability of those with access in the fields of education and health, as well as providing new opportunities for economic activity and democratic participation.

This is a double-edged opportunity, however. There is a clear risk that a 'digital divide' will emerge, both within and between countries. Only those with sufficient capability in the first place can capitalise on these opportunities.

Otherwise the technology can add to exclusion by increasing the gaps between those with access and those without.

There are also potential downsides in the content of this new abundance. The dominance of the English language in general, and American culture in particular, threatens to drown local cultures. And the power of electronic networks offers tempting opportunities to authorities around the world to engage in invasions of privacy and censorship of dissonant voices. It is important that industry and governments work to build maximum benefit from the digital revolution and minimise the potential negatives.

Environment

The ICT sector has made significant progress since 1992 in improving its internal environmental performance, such as energy and resource efficiency, waste and the use of ozone – depleting chemicals. For example, signatories to the Environment Charter of the European Telecommunications Network Operators Association (ETNO) improved energy use by 21% and fuel consumption by 26% between 1997 and 1999.

The telecommunications industry has also improved resource efficiency by developing systems and equipment with higher capacity but less material, through miniaturisation and 'light-weighting'.

But the industry's role as an enabler of greater sustainability in other industries is more significant than its own internal impact. Through the intelligent use of telecommunications products and services, all sectors of industry, commerce and agriculture (and potentially the domestic sector) can improve the impact of their operations, reducing their use of resources through:

- smart energy management,
- more efficient transportation systems,
- transport substitution,
- dematerialisation,
- electronic commerce,
- substitution of products by services.

For example, the industry in North America estimates that 540,000 tonnes of carbon dioxide emissions were avoided in 2000 through tele- and video-conferences enabled by telecommunications services. Millions of commuter miles can similarly be replaced by home working.

Other applications such as home banking, video on demand and distance learning combine transport substitution with dematerialisation. The precise benefits for climate change and resource use depend on complex interactions in specific circumstances. In particular some of the gains may be lost subsequently through the so-called 'rebound effect' – whereby increased demand offsets efficiency gains, such as home workers undertaking new leisure journeys because they are travelling less for work.

Electromagnetic fields and health

The industry continues to work for a better understanding of the risks associated with electromagnetic fields from mobile handsets and base stations. The current understanding is that exposure is not likely to cause any harm to human health, but research is continuing. The industry will follow the development of research and help to increase understanding of the issues.

Goals

Over the next five years GeSI aims to build the industry's contribution to sustainable development in the following ways:

- extend membership throughout the ICT industry;
- encourage members to measure and

publicly report their environmental and social impacts on a regular basis;
- encourage companies to move towards independent verification of published information;
- continue to enhance product stewardship for minimising energy and resource use, for reducing health risks and for working towards a zero waste ambition;
- build engagement with stakeholders to improve mutual understanding and assessment of the industry's progress on sustainable development;
- work to understand and improve the industry's impact on human rights;
- continue to reduce the mass content of our products and infrastructure;
- stimulate other industries to use ICT as a key to dematerialisation;
- to extend access to ICT services and work to combat exclusion.

Issues for policy-makers

The industry's contribution to sustainable development can only reach its full potential within the right policy framework. We therefore suggest that policy-makers should pursue the following goals:

- markets should be open to new technologies and new providers who can make the most of those technologies in pursuit of sustainable development;
- governments should aim for harmonisation of standards and stability of regulatory frameworks;
- in countries at all stages of economic development ICT should be seen as an integral component of sustainable development strategies, not merely as a valuable industry in its own right;
- policy-makers should consider economic instruments which would help to extract the maximum social and economic benefits from ICT and speed the development of sustainability applications throughout society.

In conclusion, the transformational characteristics of ICT are best demonstrated and developed through application. Companies and governments throughout the world and at all stages of economic development are encouraged to apply the technologies to help achieve their sustainability goals.

Part I: Introduction

This report sets out the progress made and challenges facing the information and communications technology (ICT) industry ten years after the Earth Summit in Rio de Janeiro. It has been compiled by the Global e-Sustainability Initiative (GeSI) by invitation of the United Nations Environment Programme (UNEP).

Members of GeSI share a common vision 'to make a key contribution to a global sustainable future' by the following means:

- creating an open global forum for improving and promoting products, services and access to ICT for the benefit of human development and a sustainable environment;
- stimulating international and multi-stakeholder co-operation for the ICT sector;
- gradually adopting a full corporate responsibility agenda, starting from environmental issues;
- encouraging continual improvement in environmental management and development and sharing of best practice;
- encouraging companies in developing countries to join GeSI and share benefits from the initiative;
- promoting and supporting regional initiatives and liaising with other international activities;
- promoting and supporting greater awareness, accountability and transparency.

Approach

The report addresses the three elements of sustainable development – economic, environmental and social – in accordance with guidance developed by UNEP. It covers the areas identified in UNEP's guidance, based on Agenda 21, but the approach has been adapted to address the particular circumstances of the ICT sector.

Sustainable development requires industry to meet the needs of the current generation without compromising the future. This challenge requires industry to contribute the maximum economic and social benefits to society, while minimising environmental impacts, (especially on climate change and biodiversity).

It is important that each industry looks beyond its own boundaries to examine its impact on society as a whole. While each sector must strive for continuous progress in reducing the direct environmental impact of its own operations, it is also crucial – and in many cases more important – to manage the environmental impact in the supply chain and in the use of products or services through to end of life. Likewise, industries must look beyond their direct contribution to employees, shareholders and other stakeholders and understand their contribution to economic and social development as a whole.

This is the approach that has been adopted here. Telecommunications is a relatively low-impact sector in terms of its direct contribution to climate change, and while it is a significant employer, its impact on economic development has traditionally been overshadowed by manufacturing industries. But it can be an important contributor to economic development, especially because use of the industry's services can be significant in enabling progress throughout the economy towards lower energy and resource use and greater social equity.

This enabling function is the most important aspect of the sector's contribution towards sustainable development and it has accordingly been given considerable prominence in the report.

Part 2 sets out the position of ICT in the global economy. It describes the contribution to economic development, including direct employment, as well as touching on key social issues such as human rights and diversity.

The digital revolution will be critical to the development of society over the next decade and **part 3** is devoted to this important trend, where the ICT sector is a key player. The industry's products and services can open up, through the Internet, public access to information and knowledge that will build transparency in society. They also offer the potential for new ways to access learning and new ways to work which can bring major social and environmental benefits. There are potential downsides, however, in the impact on local cultures and a possible widening of divisions within society between those with access and those without (which has been dubbed 'The digital divide'). Security and privacy issues are also important and these are also covered in part 3.

Part 4 deals with the industry's environmental impact. It describes the progress made within the industry on key issues such as carbon dioxide (CO_2) emissions, eco-design and recycling. But the bulk of this section is concerned with the broader contribution to sustainability by enabling transport substitution and other facets of energy-saving, and by saving physical resources through developments such as dematerialisation. This section also addresses concerns about the health impacts of mobile handsets and masts.

Part 5 describes the measures which have been used by companies in the industry to advance sustainability, before ending in **part 6** with goals for the industry over the next decade. This concluding section also highlights key issues for policy makers in determining appropriate frameworks for the industry to make the maximum contribution to sustainable development.

Scope and coverage

Until recently telecommunications companies have developed their environmental programmes individually and as part of cross-industry bodies. The ICT sector had not created a global sustainability initiative until the formation of the GeSI in June 2001. It is a voluntary industry initiative, supported by UNEP and the International Telecommunication Union. It builds on work done by regional bodies, which began to address shared sustainability issues in the late-1990s. The European Public Telecommunications Network Operators' Association produced its first environmental report covering its charter signatories in 1998, the North American Communications Environmental Excellence Initiative first reported in 2001. An Asia and the Pacific ICT and Environment Group is under development and the Asociación Hispanoamericana de Centros de Investigación y Empresas de Telecomunicaciones (AHCIET) has been working on social inclusion and digital divide matters.

Because these developments occurred only recently, industry-wide systems are not yet in place to gather common data in a form which would present a comprehensive, quantified picture of industry performance. Data in this report therefore tends to refer to individual company's achievements, which are illustrative of the sector as a whole.

The report also discusses the broader impacts of telecommunications, especially as part of the digital revolution – indeed this is where the most significant contributions to sustainability will come. But for various practical purposes a line has been drawn between communications and computing. So this first global report concentrates on communications technology rather than information technology.

An attempt has been made to report on the industry around the world, but due to the short timescale between the creation of the GeSI and the deadline for the report there are inevitable gaps. Current GeSI membership consists mostly of North American and European operators and suppliers, although the aim is to include companies from other regions such as India, East Asia and South America.

Typically, European companies tend to have more mature environmental management systems. Companies in North America have sound policies and programmes, but they tend to be less structured. As a result, developments in Europe tend to be over-represented here. North America is covered adequately, while other regions tend to be under-represented, although the impact of telecommunications on developing countries is dealt with in some detail (in parts 2 and 3).

The industry in context

Telecommunications has undergone a transformation in the years since 1992. At the beginning of the 1990s the industry in most parts of the world was dominated by state-owned monopolies. Private sector involvement was primarily concerned with manufacturing end-user and network equipment. The emphasis was on technical performance rather than customer satisfaction, and basic user-to-user communication via fixed lines was virtually the sole service.

In the intervening years the majority of national monopolies in OECD countries have been privatised and technological developments have also changed the face of the industry. Wireless communication, which emerged as a significant consumer service in the middle of the decade, has now grown to such an extent that it is overhauling fixed line services in some countries.

In the same period the Internet has invaded both business and domestic lives, transforming communications, but also bringing exciting opportunities for mass access to information and the creation of new kinds of services in many fields such as online commercial transactions.

Rapid growth in transmission capacity and speeds has been an essential ingredient. In 2001 more information could be sent over a single cable in a second than was sent over the entire Internet in a month in 1997 [UNDP, 2001].

The phenomenal growth rates in bandwidth have led to some massively reduced prices. For example the cost of transmitting a trillion bits of information from Boston to Los Angeles has fallen from USD150,000 in 1970 to 12 cents today [UNDP, 2001].

Combined, these processes have resulted in spiralling competition. It is estimated that in the year 2000 more than 2,800 companies worldwide were authorised to build facilities to offer international telephone services. Three years before, there were less than 600 [TeleGeography, 2001].

The industry's economic output has also exploded. Revenue from the provision of telecom services and equipment was estimated at USD1,160 billion in 2000. This is more than double the figure in 1990. The number of main telephone lines grew from 520 million in 1990 to about 970 million in 2000. But over the same period the number of mobile subscribers soared from 11 million to about 650 million. It is forecast to reach 1,000 million in 2002 [ITU, 2001].

The sector is a major employer. In 1997 telecommunications employment in OECD member countries was estimated to have been 2.5 million people [OECD, 2000]. The introduction of wireless systems and technologies for very high bandwidth long-

distance transmission also bringing new employment opportunities in developing countries.

Telecommunications is a critical player in the development of economies around the globe in the 21st century. It provides the infrastructure of the knowledge economy. While it needs to manage carefully the impacts arising from its own activities, it can also enable other sectors of the economy to move towards sustainability.

Part 2: Telecommunications in the global economy

Communications are the lifeblood of a modern economy – the equivalent of the railways in the 19th century, providing the links which enable the industrial and commercial machine to move smoothly. This is the true economic significance of the telecommunications industry: its role as an enabler of sustainable economic growth and especially as a driver of productivity growth.

Direct impact

The industry makes a significant contribution to employment and economic activity in its own right. Telecommunications revenues as a proportion of GDP range from under 2% in low income countries to more than 3% in several developed countries. For example the figure for Norway is 3.4%, while Cameroon's telecommunications sector accounts for just 0.6% of GDP. On a regional basis, the industry accounts for just 1.9% in Africa, but 3.6% in Oceania [ITU, 2001].

In 1999 (the latest available year) the industry employed a total of 5.8 million staff. This was an increase of 200,000 over five years, an annual growth rate of more than 2%. The highest growth was in the Americas and Asia.

The industry has invested heavily, especially over the past few years as capacity has been expanded and new technologies such as mobile, Internet communication protocols, fibre optic cables and ISDN lines have been developed. Total world investment in 1999 was USD188 billion. This was equivalent to almost a quarter of revenues and almost 3% of gross national investment (in the countries covered). The figures were particularly high in Africa, demonstrating the contribution of telecommunications to developing countries'. Telecommunications organisations in Africa invested almost half their annual revenues and accounted for more than 5% of all capital formation.

Companies also make major investments in research and development, and human capital. This is essential to ensure that employee skills keep pace with technological developments and service requirements. Skill shortages can be a significant problem – it has been estimated that a shortage of computer-networking skills across the European Union (EU) could cost the EU economies up to USD90 billion a year [BT, 2001].

The sector has experienced considerable volatility over the last two years as the 'dotcom bubble' inflated and then burst. The bubble was the consequence of inflated expectations for entrepreneurial Internet opportunities, driven largely by over-enthusiastic investment funds. This resulted in excessive flows of investment funds to Internet businesses and general over-pricing of ICT stocks. The highly positive stance of the capital markets towards the sector encouraged companies to take on high levels of debt, especially to finance third generation mobile licences. The bubble burst in 2000 when it became apparent that the financial returns from most Internet businesses would be much lower than had been anticipated, and grow over a much longer timescale.

The resulting collapse in ICT sector stocks had a destabilising effect on world stock markets, and left many telecomm companies with excessive debt levels. In some cases this has led to forced disposals and restructuring.

The affair reinforces the need for caution in assessing the financial impact of new technologies. But it should not be allowed to obscure the genuine potential of the Internet, and communications in general, to help deliver sustainable growth.

An enabler of sustainable growth

Communication technologies are changing how business is done, especially through the development of the Internet. They open up the possibility of dramatic productivity growth analogous to the productivity burst which emanated from the first industrial revolution.

Investment by businesses in ICT equipment and services can deliver widespread productivity gains. These improvements stem partly from the direct benefits of swift, simple communications but are also linked to enhanced innovation – better products, delivered faster and more efficiently. The convergence of communications and computing is particularly important in accelerating the process of innovation. It accelerates the rate at which new knowledge and technologies can be shared and exploited to improve business competitiveness.

E-business is an important part of this trend. It is speedier and more efficient than paper-based transactions and therefore cuts costs. This is particularly the case for business-to-business (B2B) e-commerce. It will enable firms to lower costs in procurement, production, selling and distribution as well as stimulating the development of new markets and services. Goldman Sachs has estimated that cost savings from B2B e-commerce will bring sustained extra economic growth of 0.25% per year over the next decade [Liikanen, 2000].

Global Internet trade has been forecast to reach USD6.8 trillion in 2004, amounting to 8.6% of the global sales of goods and services. This expansion will be highly concentrated, however, with 12 countries representing nearly 85% of worldwide Internet sales and the United States accounting for half of the total [Forrester, 2000].

Telecommunications and developing countries

As previously noted, the industry is generally less significant in emerging economies, but new technologies have spurred dramatic growth. Telecommunications technology is changing where business can be done, opening opportunities for the developing world. Thanks to modern communications, India has seen its software sector grow by 50% through the 1990s, creating not just valuable exports, but thousands of domestic jobs and a technological talent pool which is drawing international attention from industrialised countries and large multinationals. Costa Rica has also attracted some of the world's largest ICT companies seeking to employ its well-educated workforce, creating jobs and exports and spawning a domestic software industry.

As the key infrastructure of the global economy, this sector is inevitably bound up in the debate about the impact of globalisation. Communications services are essential to the rapid and secure flows of information and money which are at the centre of globalisation.

Wider questions about globalisation are beyond the scope of this report. But it is clear that ICT can make a dramatic contribution to achieving sustainable social and economic development goals, provided the right international governance processes and trading frameworks are in place. By transforming communication and access to information, the industry can create powerful social and economic networks that can underpin sustainable development in emerging economies.

Examples from Africa, South America and Asia demonstrate that telecommunications can help to achieve improved health, better education, employment and empowerment of local communities. One major study [DOI, 2001] as part of the Digital Opportunities Initiative concluded that it is important to see ICT as an

enabler of development rather than as an end in itself, a potential export earner or a purely economic driver. Focusing on using ICT in pursuit of development goals allows countries to achieve a wide range of benefits – both economic and developmental.

On the economic front, ICT has had a variety of beneficial impacts in many countries:

- Higher productivity. *Utilities Afrique Exchange* provides an e-trading platform to utility companies in Africa which helps both sellers and buyers simplify their procurement processes thereby reducing costs;
- The rural economy. In Chile, an Internet network has increased farmers' incomes by providing information about crop status, weather, global market prices and training;
- Access to capital. *Pride Africa's* network provides access to micro-finance for farmers who were previously subject to the rigid requirements of the dominant banks;
- Direct access to markets. *PEOPLink's* global artisans trading exchange helps craft producers in developing countries cut out wholesalers who previously took up to 85% of the selling price;
- Employment opportunities. *TARAhaat* is an Internet portal providing villages in rural India with information about local job opportunities.

Case study: Malaysia

In 1996 Malaysia launched 'Vision 2020' – a plan to build a knowledge-rich Malaysian society by the year 2020, drawing on ICT to increase global competitiveness. The plan included a multimedia super-corridor (MSC), a high-tech infrastructure to attract national and international investors and create spill over effects in the rest of the Malaysian economy. The plan also included specific elements for education, healthcare, government, commerce and manufacturing.

The telephone penetration rate rose from 17% to 23% between 1995 and 1999, and fixed lines in rural areas rose from 5% in 1994 to 11% in 1999. Malaysia is aiming for 250 Internet access points, 250 mobile phones and 500 fixed lines for every 1,000 people within the next five years. This is in addition to the development of other primary physical infrastructure, such as power supply, transportation, airports, office buildings and extended business areas.

The Malaysian economy suffered along with the rest of East Asia in 1998, but bounced back quickly. Foreign direct investment fell from USD6 billion in 1997 to under USD4 billion in 1998, but then increased by 31% in the following year. Gross national product (GNP) rose by 5.4% in 1999, led by manufacturing and particularly ICT-related electronics for export. This sector is now the key driver of growth in the economy. In 1999, the contribution of the ICT sector to GNP (including information technology) was about 37%.

In the wider economy, e-commerce initiatives are helping to provide Malaysian businesses with more efficient access to markets. For example, MyBiz is a platform designed for small and medium-sized enterprises, which helps facilitate collaborative marketing by linking 300 companies in a business network. The same platform can be used to make procurement processes more efficient.

The growing economy has created a demand for skilled knowledge workers and professionals, who are in short supply. The government has created a multimedia university to teach skills such as information and knowledge management, as well as programming applications. A *Computer In Education* programme has provided computer laboratories to 90 secondary schools and 20 primary schools. Between 1996 and 1998, about 1,230 teachers were trained to conduct the course.

Specific social impacts

Companies in the ICT industry have developed numerous partnerships throughout the world to work in health, education and human rights. Many volunteer organisations have been established as a result, and many schools throughout the world have benefited from technology grants, training and Internet programmes.

Most major companies either have in place or are establishing policies on human rights in their workplace, operations and supply chain. They also recognise that the protection and enhancement of human rights around the world involves action as well as policies. Policies are typically based on recognised standards set by international organisations for trade, labour and peace (UN, OECD, International Labour Organisation, International Chamber of Commerce). Some companies have also used the *Caux Round Table* ethical business principles.

Specific examples include:

- BT has launched a supply chain human rights initiative called *Sourcing with Human Dignity*. The company has also examined the human rights impact of its products and services, including intellectual property, freedom of expression and privacy.

- AT&T has teamed up with MentorNet, a Silicon Valley-based e-mail network that links women engineering students with volunteers in the industry, to boost the ranks of African American and Hispanic women in maths, science and engineering. AT&T awarded MentorNet a two-year, USD300,000 grant to support the e-mentoring organisation's outreach to Historically Afro American Colleges and Universities and Hispanic-Serving Institutions.

- The Cable & Wireless *Childnet International Awards Scheme* was launched in June 1997. It highlights and rewards innovative communications projects benefiting children. The company also supports the *Speak Out!* project, which is an Internet initiative for European youth on European citizenship. The initiative will encourage young people in Europe to get online and share their ideas and beliefs about European citizenship. The project is organised by the Institute for Citizenship, a non-profit charity.

- Ericsson has been managing a programme called *Ericsson Response* for several years, developing disaster-preparedness programmes around the world – a faster and more effective response to disasters. *Ericsson Response* is a global initiative aimed at responding to human suffering caused by disasters. The programme is run, in partnership with the United Nations Development Programme (UNDP), the Office for the Co-ordination of Humanitarian Affairs (OCHA) and the International Federation of Red Cross and Red Crescent Societies (IFRC).

- Nortel Networks co-sponsors the John E Anderson School of Business, *Minority Management Development for Entrepreneurs* Programme at University of California at Los Angeles (UCLA). This programme offers minority, women, and service-disabled entrepreneurs the opportunity to gain skills to pursue contracts with utility and telecommunications companies.

- Vodafone has become a core partner in 'e-lab' – a policy laboratory dedicated to creating sustainability solutions in the new economy. This is coordinated by the sustainable development think-tank and charity Forum for the Future, and aims to become an international centre of excellence in analysing the sustainability impacts and opportunities of telecommunications, the Internet and e-business.

Part 3: Digital inclusion

Access to communication networks can help combat social and economic exclusion. The digital revolution offers the potential to spread access to knowledge, information and markets to people who have traditionally been excluded from these crucial aspects of development.

Opportunities for greater collaboration and improved information include:

- Scientific and medical research, for example the human genome project;
- Remote medical consultation. In Gambia nurses in remote villages use digital cameras and transfer images of symptoms to nearby towns for examination by doctors. When an expert opinion is required, doctors in rural towns in Gambia send the images to specialists in the United Kingdom for advice;
- Remote education. The six largest distance-learning universities in the world are located in developing countries;
- Empowerment. A women's group in Mexico City used an e-mail network to do research on the textile factory where they worked. When the women's jobs were threatened, they presented a powerful case to the management based on the information they had gathered.

Three 'Cs' of digital inclusion

The Internet has increased the power of **connectivity** because of the wealth of resources it has made available to those who are connected and have the skills to tap this abundant resource. It can enhance the **capability** of those with access in the fields of education and health, as well as providing new opportunities for economic activity and democratic participation. This is a double-edged opportunity, however. Only those with sufficient capability in the first place can capitalise on these opportunities. Otherwise the technology can add to exclusion by increasing the gaps between those with access and those without.

There are also potential downsides in the **content** of this new abundance. The dominance of the English language in general and American culture in particular threatens to drown local cultures. And the power of electronic networks offers tempting opportunities to authorities around the world to engage in invasions of privacy and censorship of dissonant voices. It is important that the industry and governments work to build the maximum benefit from the digital revolution and minimise the negatives.

Table 1: Telecommunications regional access

Region	Main telephone lines per 100 inhabitants	Cellular mobile subscribers per 1,000 inhabitants	Internet hosts per 10,000 inhabitants	Internet users per 10,000 inhabitants
Africa	2.55	1.47	2.75	52.53
Americas	33.56	21.87	1,029.23	1,503.15
Asia	8.54	6.58	19.57	326.00
Europe	39.16	36.14	157.01	1,250.53
Oceania	40.52	33.69	647.49	2,539.69
World	15.36	12.06	175.66	587.52

(Note: all figures for 2000) Source: International Telecommunication Union

Table 2: Costs as proportion of incomes		
Country	**Cost (USD)**	**% of average income**
Mexico	90	15
United States	25	1
Africa	200	n/a

Source: [BT,2001]

Connectivity

Access to ICT depends on technology being available and useable. This requires appropriate infrastructure and policies to deliver local access, as well as basic literacy among the population. But affordability is likely to be a critical constraint. Telecommunication costs continue to fall, but can still be a barrier to access. The regional distribution of access is highly skewed to the developed world, as Table 1 shows.

Costs tend to be highest in countries with the lowest incomes, and vice-versa (see Table 2). New technological developments will continue to spread access and reduce costs. For example, academics at the Indian Institute of Science and engineers at the Bangalore-based design company Encore Software have designed a handheld Internet appliance for less than USD200, known as the Simputer. It provides Internet and e-mail access in local languages with touch-screen functions and micro-banking applications. Future versions promise speech recognition and text-to-speech software for illiterate users. The intellectual property rights have been transferred for free to a non-profit trust, which is licensing the technology to manufacturers at a nominal fee.

Content

The value of access depends on the relevance and accessibility of the content that becomes available. Inappropriate material will be at best worthless and at worst damaging. It needs to match the users' language and skills, and avoid undermining local cultures.

Up to half of the 6,500 languages now spoken are already endangered. Some experts predict that the world may lose over 90% of the world's languages during this century. English is being used more and more as the language of business, science and popular culture and over 80% of Internet content is in English [BT, 2000]. There is therefore a danger that the Internet could be abetting the decline of the world's linguistic diversity.

At its best, the Internet can be an enabling mechanism. This kind of content consists of information about education, jobs or healthcare and links to government services – all of which could help to attack social exclusion. This area could cover social benefits, for example, as well as social services.

In many parts of the world, language – and the range of languages available – is critical to ensuring that such content is truly accessible. But again, ICT can expand the possibilities compared with paper-based, office-bound systems. For example, Centre Link [www.centrelink.gov.uk] in Australia can deal with 42 languages.

Capability

Users need appropriate skills if they are to capitalise on the potential of ICT. In particular this means education, but also the removal of social barriers as well as any barriers relating to physical disabilities.

Basic literacy is clearly a fundamental requirement for the use of the Internet, although touch-screen technology using

pictorial images can be used for certain basic access. Once a minimum attainment has been achieved, ICT can itself help to develop further skills. Teaching communications technology in schools and as part of further education or company training schemes is important in building education levels.

Modern communications make it feasible to spread learning wider than in the past through vehicles such as 'virtual universities' which reduce the need to travel to education sites and make it possible for students to learn without abandoning their home surroundings and lifestyle.

Combating exclusion

The international divide

The great increase in use of Internet has been concentrated in developed countries. In Hong Kong, Iceland, Norway, Sweden and the United States the Internet has reached more than half the population, and close to one third in other OECD countries [UNDP, 2001]. However, Internet outreach is much smaller in the rest of the world. South Asia, which is home to 23% of the world's people, has less than 1% of the world's Internet users [Wilsdon, 2001]. Even in India, home to a major hub of innovation, only 0.4% of people use the Internet [UNDP, 2001].

Public-private alliances have been formed to help combat the digital divide, at regional and global levels. The Association of South-East Asian Nations (ASEAN) launched the e-ASEAN Task Force in 1999. It is ASEAN's first public-private advisory body and is developing a comprehensive regional action plan for competing in the global information economy. Under this action plan private investment will be focused on creating infrastructure, while public policy will aim to create the best legal and regulatory environment. Policies have been agreed on issues ranging from extending connectivity and building content to creating a seamless regulatory environment and a common e-marketplace.

At the G8 Okinawa Summit, Accenture, the Markle Foundation and the United Nations Development Programme (UNDP) formed a partnership to launch the Digital Opportunity Initiative (DOI). The DOI developed a strategic approach to harnessing the benefits of ICT for sustainable development. In its final report it concluded: 'With the right policies and practical actions, ICT can be a powerful enabler of development.' The report argued strongly for a 'holistic' approach to ICT and development, with the technology seen as an enabler of development rather than an end in itself. It cautioned that different countries would need different strategies, but proposed a framework for action which featured:

- a holistic and multi-dimensional approach, acting in several linked areas;
- co-ordinated actions, strong partnerships and local implementation, with a strong emphasis on the process of strategy development;
- global, national and local linkages, rather than pursuing national strategies in isolation.

The national divide

A divide also exists within countries. Typically the least affluent in the developed world have least access to the Internet and other advanced communications mechanisms. Such lack of access threatens to entrench and exacerbate existing exclusion without specific action by the industry and governments to ensure access. As well as economic factors, usage of the Internet also varies according to:

- **Gender.** Female Internet users are in the minority in both developed and developing countries. The gap is widest in the developing world, (for example men make up 86% of Internet users in Ethiopia, and 70% in China, but only 62% in Latin America). But the gap is narrowing. In Thailand the share of female users jumped

from 35% to 49% between1999 and 2000, and in the United States it has increased from 38% of users in 1996 to 51% in 2000 [UNDP, 2001];

- **Ethnicity.** There are disparities in Internet use between different racial, ethnic and cultural backgrounds. In the United States, for example, Afro Americans and Hispanics lag behind other groups. Asian Americans and Pacific Islanders enjoy the highest levels of access [BT, 2001]. Although, in some countries such as France, it is illegal to collect such statistics;
- **Age.** Younger people are more apt to be online. In Australia 18 to 24 year olds are five times more likely to be Internet users than those above 55. In Chile 74% of users are under 35 and in China that share is 84% [UNDP, 2001];
- **Educational background.** Those that have had tertiary education tend to make up the majority of Internet users. In Chile 89% have had tertiary education, in Sri Lanka 65% and in China 70% [UNDP, 2001];
- **Geographical location.** Examples from very different countries demonstrate the patchy penetration of Internet use. In China the 15 least connected provinces, with 600 million people, have only 4 million Internet users – while Shanghai and Beijing, with 27 million people, have 5 million users. In the Dominican Republic 80% of Internet users live in the capital. In Thailand 90% of users live in urban areas, which contain only 21% of the country's population. Among India's 1.4 million Internet connections, more than 1.3 million are in the five states of Delhi, Karnataka, Maharashtra, Tamil Nadu and Mumbia [UNDP, 2001].

Disability

The digital paradox is, however, that technology can be a vehicle to close rather than deepen existing economic inequalities. Disability is a case in point. Disabled people encounter barriers to technology use. But the technology can also act as an enabler to get over barriers associated with traditional approaches to creating economic and social value. The United Kingdom Employers Forum on Disability sees the potential for ICT to enable people with impairments to become more engaged in all aspects of society, including public policy- making and work opportunities.

ICT companies recognise that including disabled people is integral to business success in a world where 20% of the population has some disability and the same number again are carers or friends of people with disabilities.

Case study: Digital inclusion in India

Until the mid-1990s a telephone was a luxury in India. There was a huge waiting list in most areas. Only 377,000 villages out of more than 600,000 in India had a public phone, and many of them rarely worked. The mobile revolution has changed that.

At the end of 2001, there were about five million mobile phone users in India. And the mobile operators are committed to invest over USD11 billion. The Gartner Group has forecast that there will be 30 million mobile subscribers in India by 2005, while the operators expect to enrol 100 million subscribers by 2008. Their services have made a huge difference to fishermen, farmers and poor villages.

Case study: Benefits to fishing sletts in Kerala, India

BPL Mobile marketed its service as 'connectivity for the common man' and focused on 'communities of interest' such as the fishing fleets in Kerala. Communications lessened the fisherman's dependence on the commission agents at particular landing spots. The fishermen use their phones to find the best prices. A few phone calls while still at sea sets up a deal with an agent at one of the 18 landing spots. The price can be 70% higher than normal, and it is achieved without having to burn extra fuel to check out the prices at all the 18 ports.

One in 15 connections sold by BPL Mobile in Kerala is to a fisherman and BPL Mobile is offering an attractive package scheme to the local fisherman's cooperative which has over 10,000 members.

Case study: Benefits to farmers in West Uttar, Pradesh, India

West Uttar Pradesh grows over 15% of India's wheat production. But most of the farmers are heavily indebted to money lenders and often sell their produce at rock bottom prices to the traders supported by these money lenders. Due to lack of communication facilities, most farmers are not aware of the market prices of their commodities.

Mobile phone provider Escotel offered a telephone connection to each village in the area. Each village head was asked to select a person to own and operate the mobile phone, earning a small commission on the total billings.

The mobile owner goes round the village and the farmlands, allowing farmers to use the phone to contact the commodities market and get information about the latest prices movements. Then they decide their harvest and plucking season to maximise their earnings.
The farmers no longer have to make long trips on their tractors to the nearest town market, some 15km away, just to get the price. The government also benefits by the easy communications access to such remote villages.

Escotel has provided such connections in 450 villages in West Uttar Pradesh and the adjoining state of Haryana. Currently, some 2.25 million people in the region benefit from this unique telephone service.

A similar scheme operates in the northern state of Punjab, but here Spice Telecom offers additional services. It facilitates buying and selling farmers' produce and is offering a special package which will help the servicing and repair of the the farmer-subscribers' tractors. A mobile breakdown service has also been set up.

Case study: Telecentres in rural India

A project to assess the impact of information technology on rural areas of India won the Stockholm Challenge Award in 2001 – the Nobel Prize for the use of ICT to create economic and social change.

The project has established a hub-and-spoke model of data-cum-voice communication in a group of six villages. The telecentre in each village can communicate with each other and to the world through the Internet. A hybrid of technologies is in use. The unreliable power supply to the communication centre is supplemented by electricity generated by solar panels. The connectivity to the dial-up Internet access is available at the village public telephone, but provided by a wireless system.

Since 1998, the network has built up a vast array of content, locally generated, related to cropping patterns, market prices of locally produced crops, schedules of local buses and trains, health centres, availability of vital medicines and services, information about educational centres.

Men, women and children, from all walks of life come to check the local weather, to know the price of rice in the nearest market, to get medical advice from doctors in a far-off hospital, to browse through the latest courses and job vacancies in the cities.

For the fishermen in the village, it is the first stop on their way to their daily fishing expeditions. They check the information about approaching cyclones and likely wave heights from the United States Navy's Oceanographic Laboratory Web site, readily available on a computer.

School students in the villages now download and print their public school exam results and marksheets. Earlier, they had to wait for at least a week for the hard copy of marksheets to reach the village school from the territory headquarters.

Studies reveal that assetless, ultra-poor families are among the major users of the information centres. At least 18% of the users are women. In contrast, just 3% of women use the local public library.

Part 4: Environmental opportunities

Introduction

The ICT sector has made significant progress since 1992 in improving its internal environmental performance in energy-efficiency and product stewardship. But just as importantly, ICT can be an enabler of greater sustainability in other industries. Through the intelligent use of ICT products and services, all sectors of industry, commerce and agriculture (and potentially the domestic sector) can improve the management of their operations, by reducing their use of resources through smart energy management, transport substitution and dematerialisation. The impact of such developments will be much more significant for climate change than the continuing progress which the ICT sector will make to improve its own internal impacts.

This chapter addresses both internal and external environmental impacts. The potential for communications technology as an enabler relates to energy and dematerialisation. These two critical areas are also important within the industry. Together they can have a substantial impact on efforts to combat climate change. The Japanese Telecom ministry estimated in 1997 that the combination of applications described in this section could contribute to 7% of the country's required CO_2 reductions under the Kyoto Protocol, as Table 3 shows.

As well as these important impacts, this chapter also describes the sector's progress on:

- phase-out of ozone depleting substances;
- eco design, take-back, recycling and supply chain management;
- health issues relating to mobile technology;
- impacts on air, water, waste and the physical environment.

Energy and climate change

There have been suggestions that expansion of telecommunications, and especially the growth of Internet usage, will result in increased energy consumption. Studies show, however, that this is not the case. In fact the industry itself continues to make great strides to reduce its own energy use, and there is enormous potential to use telecommunications technology to save energy in other sectors.

A study by the consulting firm Arthur D Little for the United States Department of Energy, published in November 2001, concluded that the electricity consumption of all commercial office and telecommunications equipment in the United States may rise from almost 3% of national electricity use to no more than 4% by 2010. Desktop PCs and monitors are the main

Table 3: Japan - Potential CO_2 reductions from ICT

	Estimated volume reduction of CO_2 (kilotonnes)
Telework	1,290
Intelligent transportation systems	1,200
Paperless information exchange	530
Internet	500
Intelligent building management systems	360
Electronic publishing, and newspapers	250
Remote and home learning	3
Total	4,060

Source: Japanese Telecom Ministry, 1997

consumers of this electricity. The study also forecast that electricity consumption could potentially decrease to less than 2% of national supply if 'green' practices were widely adopted [United States Dept of Energy, 2001].

Within the industry

Most of the industry's big players have well-developed environmental management systems and achieved substantial advances during the 1990s. The performance of smaller companies is less clear and, as yet, there is no global data for the industry as a whole. Some figures are available for Europe.

In 1999, signatories to the Charter of the European Telecommunications Network Operators Association (ETNO) emitted approximately 5.2 million tonnes of CO_2 – 84% from energy and 16% from transport. The size of many companies means that individually they are significant contributors to CO_2 emissions, (for example Deutsche Telekom uses about 2.4 billion kWh, which is 0.5% of the total energy consumption in Germany). The figures in the table below relate to the 23 ETNO Environmental Charter signatories. They show improvements in energy use per unit of revenue.

Powering telecommunications networks is the most significant element of total energy use by telecommunications companies, both for fixed line and mobile operations. In addition, call centres and 'Internet hotels' are significant energy users, especially when the load from cooling systems is taken into account. Important improvements in network energy-

Case study: Deutsche Telekom and climate change

Deutsche Telekom is a partner in an initiative called 'e-mission 55', which supports binding international regulations for atmospheric protection. The biggest environmental impact from Deutsche Telekom's operations is caused by energy consumption (about 2.4 billion kWh), which is 0.5% of the total amount of energy consumption within Germany.

To reduce its environmental impacts, the group has introduced targets for energy reduction as a monetary part of the Management Score-Cards used to assess manager's performance, and has set up a special team responsible for sustainable energy use. The group has also launched a campaign, including training programmes and a paper/electronic catalogue to help staff appreciate the environmental impacts of energy.

Since the energy market in Germany was liberalised, Deutsche Telekom has required its energy supplier to identify a sustainable energy mix. The carbon dioxide (CO_2) emissions per kWh were reduced by 12% during 2000 because of improved energy mix – including increased use of Combined Heat and Power Systems.

Table 4: ETNO Environmental Charter signatories' energy use

Region	Average electricity consumption (MWh/1000€)	Improvement in energy use year on year (%)	Average fuel consumption (litres/1000€)	Improvement in fuel consumption year on year (%)
1997	0.094		2.527	
1998	0.081	14	2.087	17
1999	0.074	9	1.868	10

Source: ETNO

efficiency in many developed countries have been achieved through technological developments. The energy use per average subscriber of a typical Radio Base Station has decreased three times over the last decade. The latest switching equipment now uses about a fifth of the energy consumed in 1998. (source: Ericsson).

For example, BT has achieved a 46% reduction in CO_2 emissions due to energy programmes since 1991 and a 25% reduction due to transport programmes. This is equivalent to an annual saving of almost one million tonnes of CO_2.

In other industries

When used effectively, communications technology can help reduce CO_2 emissions by increasing energy efficiency outside the sector in several ways:

- transport substitution, (notably, telecommuting, videoconferencing, distance learning and e-commerce);
- improved transport efficiency and smart distribution;
- improved energy efficiency in offices and homes.

Transport substitution

Telecommuting. Modern communications and computing have made working from home much more practical than in the past. As well as reducing commuter traffic, this option can also be part of a flexible work scheme which allows employees to use a mix of locations – home, office and clients' premises. This kind of flexible working can be an important element in improving the work/life balance.

Commuting can also be reduced by reorganising monolithic office locations, into a collection of decentralised satellite offices, so that travel-to-work distances are reduced. This trend has already begun in the United States, where some analysts predict that it will become one of the most popular forms of flexible working. There are also examples in Sweden. Telia, for example, has set up a satellite office in Nyköping, where employees from completely different parts of the organisation work side by side. Their common characteristic is that they live in the area in question and therefore have a far shorter journey to work.

'Tele-cottages' are another variant of distance working. This concept is applicable in rural areas, where people would otherwise have long distances to travel to work in towns and cities. Tele-cottages rent space for several companies, whose workers share the common communications and computing facilities.

Tele- and video-conferences are an alternative to routine meetings and can save considerable travel distances. The environmental impact can be substantially lower, especially if the displaced journey would have been by air.

One Swedish study [CIT Ekologik, 1998] examined the environmental impact of substituting travel from Stockholm to a meeting in Gothenburg. Comparing the total environmental effects (including manufacture of the equipment) there were clear benefits over air travel. The CO_2 emissions from video-conferencing could be less than 1% of those from a journey by air, depending on the extent to which such substitution leads to eliminating flights rather than merely reducing the number of passengers on a flight. However, if the video-conferencing facility was used infrequently and left on standby for long periods then travel by train (powered by electricity) was shown to have potential advantages.

Practical examples investigated by Deutsche Telekom show that, based on the cumulative energy input, and assuming a four-hour video-conference 12 times per year, video-conferences have an advantage over business trips:

- by train further than 30km,
- by diesel car further than 10km,
- by petrol car further than 8km.

BT estimates that its 4,000 homeworkers between them save approximately 12.5 million commuter miles per annum – equivalent to a saving of 1,000 tonnes of CO_2 emissions.

Members of the North American Communications Environmental Excellence Initiative (CEEI) estimated that they enabled more than 18,000 video-conferences in 2000 and almost a million teleconferences. The resulting savings in CO_2 were estimated at 540,000 tonnes.

Distance learning can be considered as a variant of remote conferencing which offers similar environmental benefits through travel substitution. In addition to communication and e-mail between teachers and students via personal computers, video-conferences are also being used for 'virtual seminars'.

E-commerce has a double environmental impact – shopping from home and business-to-business transactions replace travel, and there is also an element of dematerialisation in some transactions. Video delivered down a phone line has a twin impact – replacing the physical video cartridge and sales location, plus eliminating a journey to the video store. Electronic banking and similar services have the same dual effect.

Electronic banking, as well as transactions with government agencies, can also be considered as a subset of e-commerce, with similar benefits in travel substitution.

A report (by the Washington-based Centre for Energy and Climate Solutions) suggests that the Internet will create year-on-year reductions of up to 2% in the energy intensity of the United States economy [Romm, 1999].

In the United Kingdom a study has estimated that electronic home shopping will reduce car-based shopping travel by 10% by 2010, offset by a 0.5% increase in delivery traffic [NERA, 2000]. But a Dutch study concluded that home shopping in the Netherlands would increase vehicle mileage, because in urban areas van deliveries will often substitute for cycle trips or walking [TLN, 2000].

The example of Amazon, the leading Internet bookshop, shown in Table 5 below, demonstrates the potential.

However, the method of distribution is still critical as Amazon discovered when it delivered 250,000 overnight first edition copies of the Harry Potter story *The Goblet of Fire* in the United States using 9,000 trucks and 100 planes.

As this example shows, the environmental effects are highly complex, but research [UCL, 1999 and UNDP, 2001] suggests that the purchase of household goods and groceries over the Internet has particularly high potential for reducing energy consumption. The potential is determined by the number of households making purchases by e-mail, the population density of the area and the method of distribution. When the goods are distributed by

Table 5: Energy – Traditional bookshop versus Amazon.com

	Traditional bookshop	Amazon.com
Titles per store (USD)	175,000	2,500,000
Revenue per employee (USD)	100,000	300,000
Sales per square foot (USD)	250	2000
Energy cost per square foot (USD)	1.10	0.56
Energy cost per 100 sales (USD)	0.44	0.03

Source: Centre for Energy and Climate Solutions

Table 6: E-commerce scenarios				
	Direction and scale of impact under each scenario:			
Indicator	Cyberspace	Digital Islands	Cyber-society	Networked communities
Resource-efficient production	++	+	++	XX
Resource-efficient supply chains	++	+	++	X
Dematerialisation	++	+	+	X
Sustainable consumption	XX	X	X	+
Less heavy goods transport	+	+	+	++
Less light goods transport	XX	X	XX	+
Fewer shopping trips	+	X	X	X

Source: Digital Futures, by James Wilsden. (Published by Earthscan, 2001)
Note: + = positive impact X = negative impact

delivery van, the benefits in terms of emissions of hydrocarbons, nitrous oxides and carbon dioxide have been estimated at 5% reduction 10% e-commerce penetration. The scale of emission reductions would grow at a slightly faster pace than e-commerce penetration.

In addition, there would be energy savings by the suppliers, as warehouses used by e-shops require around half as much heated or cooled space as a hypermarket.

In some cases, however, e-shopping may have adverse environmental impacts. Depending on the form of transport and the method of distribution to the consumer, buying consumer durables over the Internet may increase CO_2 emissions. Similarly, buying a book or a CD over the Internet from an American provider such as Amazon would have an adverse impact if the products were to be delivered by air.

The Digital Futures project in the United Kingdom presented four scenarios for the development of e-commerce, and considered the effect of each against seven environmental indicators. The conclusions are shown in the table above. They demonstrate the complexity of the relationships – none of the scenarios produced entirely positive outcomes.

The scenarios are defined as follows:

- **Cyberspace:** consumerist, high-growth, free-market, transport-intensive society, with rapid advances for e-commerce, but continued growth of greenhouse gas emissions;
- **Digital islands:** a consumerist society, but globalised, less vibrant e-commerce, continued high carbon emissions;
- **Cyber-society:** ecological concerns underpin steady economic growth and substantial e-commerce, resulting in environmental gains;
- **Network communities:** fragmented, localised markets, limited e-commerce, low emissions.

The 'rebound effect' is a key issue in assessing the potential of all aspects of travel substitution. If people replace the journeys they have saved with other trips this undermines the direct environmental gains. For example, although telecommunications technologies can reduce work-related transport, such efficiencies could be lost by an increase in leisure travel prompted by individuals having more free time. Similarly, some studies of teleworking have found that while home working has reduced commuter travel, the workers often undertook greater travel than before at weekends. In this way some of the environmental gains of teleworking were reduced.

The extent of such increased travel as a consequence of the changed activity pattern is difficult to predict.

Improved transport and distribution

Better communications, for example combining the GPS satellite navigation system in conjunction with, for example, Mobitex (mobile text communication) will enable load factors to be raised and/or distances reduced for goods transport. Computerised route planning, digital maps and electronic document handling offer a potential 15% improvement in transport efficiency. When the system becomes more dynamic, with information on the quickest route, roadworks, accidents, etc, the improvement could be around 25% [Johnston, 2000]. The GPS system also has applications in the field of railway transport, (for example, in connection with monitoring environmentally hazardous loads), and in passenger transport, (for example, enabling the taxi closest to a customer to be directed to the pick-up point).

Traffic management systems can help to improve traffic flows and therefore reduce emissions by cutting journey times and especially idling times in jams or at traffic lights. This includes control systems such as traffic lights and congestion charging, as well as route guidance information.

The Swedish TOSCA project concluded in 1996 that there could be considerable environmental benefits from road transport information technologies The study suggested that increasing the costs for individual motorists in the most congested areas of a city at the times when the traffic is at its peak, would drastically reduce CO_2 emissions [Johnston, 2000].

The *KomFram* project in Gothenburg is based on the intelligent use of traffic lights, having dynamic control over the relative intervals of green and red lights to deliver a better traffic flow. The project also aims to give public transport priority over private cars, using real-time information on bus or tram arrivals. The project aims to reduce stoppage-time at red lights by 20%, which would save five million litres of fuel per year.

Energy efficiency in buildings

Rapid development can be expected in the next few years on energy saving in homes, commercial premises, and public buildings using more effective, IT-based control systems. The current trend can be described as decentralisation (that is 'intelligence' being brought down to the level of houses and rooms). The potential saving on warm water consumption is 30% to 50% [Johnston, 2000].

IT-based apartment- or room-specific control and regulation systems could provide significant savings on the consumption of energy for heating. The potential saving is estimated to be 10-30% [Johnston, 2000]. Intelligent houses using sensor technology (for example, heat and light sensors, video and optics) could feature lights switching on and off as people enter and exit, and automatic adjustments to the temperature of homes and commercial premises according to the outside temperature.

It has been optimistically predicted [Euroworld, 1999] that by the year 2004 a quarter of households in the OECD countries will be living in 'intelligent houses' with this kind of energy management system.

Ozone depletion

Developing technology has resulted in higher power dissipation from communications equipment and cabinets, requiring greater cooling capacity to maintain the correct operating temperature. The industry is working to ensure that communication equipment is designed to minimise the need for forced cooling (for example, by using fresh air), and that equipment is housed in premises designed to maximise natural cooling, (for example,

using raised floors, ventilated ceilings). New cooling units typically use ozone-friendly refrigerants such as R407C.

Individual companies have developed their own approaches to dealing with this issue. For example, Nortel Networks set up a Refrigeration Group in April 2000 to review the number and types of chillers used in Europe. The review will help to develop a sustainable and economic strategy for the replacement of existing chillers.

This Refrigeration Group is currently investigating ways to improve the efficiency of the refrigerant R22 (currently the most widely used refrigerant in Nortel Networks), with a saving in running costs and a corresponding reduction of CO_2 production at the power source. The company may partner with chiller and compressor manufacturers to determine a better alternative to the current cooling systems.

Resource efficiency

Reductions in material and resource use are a key element of sustainability. ICT can help achieve this objective directly in its own sector, and indirectly through the use of its technology by other sectors.

Within the industry

In common with other sectors, the telecommunications industry has developed systems and equipment with higher capacity but less material content, through miniaturisation and reduction in the weight of components and materials. For example, long distance telecommunication cables have seen material content reduced by approximately a factor of ten per decade over the past century.

Good progress has also been made in switching systems. Equipment manufacturers are using nanotechnology and micro-electromechanical systems, which will provide the same function as existing models but with equipment size reduced by a factor of four.

Substituting a service for a product is a potentially more profound example of dematerialisation, since it removes the need for the physical goods which previously provided the service. For example, answerphone machines have been replaced by network services. Conclusions from a life cycle comparison with Telia's TeleSvar service are shown in Table 7 below.

Similarly, Deutsche Telekom's T-Net-Box has demonstrated that such a virtual answering service within the network requires approximately 4% of the energy for production and operation and generates approximately 1.5% of the waste, compared with a physical answering machine, even assuming capacity utilisation of the T-NetBox system of only 20%.

In other industries

ICT also offers opportunities for dematerialisation to many other sectors. E-mail is a prime example, substituting electronic communication for paper-based letters,

Table 7: Life cycle CO_2 equivalents for telephone answering machines and network services

	Answering machine	TeleSvar service	Factor
Weight, (kg)	1.2	0.06	20
Power consumption, (kWh)	1,308	5.7	230
Greenhouse gas emissions, (g CO_2 equivalent)	140,000	590	240

Source: Telia

reports etc. E-mail has replaced a significant volume of physical mail, although the paper savings are limited by the habit many users have of printing messages. Reduced consumption of paper in industry is estimated to lead to a 0.25% reduction in total industrial energy consumption and emissions of greenhouse gases by 2003, and double that in 2008. But the comparison is complex – a study by Swisscom and Deutsche Telekom compared the environmental impacts of e-mail versus letters. It showed that the physical distance between the sender and recipient, and the amount of data transmitted, determine whether e-mail has a lower environmental impact than conventional mail.

Similar examples include newspaper and magazine Web sites, electronic dictionaries and other reference works, and electronic teaching aids replacing textbooks in education. Digital photography, video-on-demand and downloadable music are other ways in which new technology enables the electronic transmission of previously physical products, and may eliminate the physical version entirely (for example, depending whether the music is stored on computer or saved onto a CD).

In many of these cases the environmental benefits will depend on the extent to which users print material from the screen, thus using electronics merely as a transmission medium rather than replacing the original paper medium. But in general, some telecommunications services are clearly more environmentally-friendly than their energy- and material-intensive alternatives. The more customers use these services, the greater the environmental benefit.

Other aspects of resource efficiency:

Eco design and supply chain management, take back and recycling

The most effective way to improve resource efficiency is to design products and equipment that minimise material and energy use over the entire life cycle, including disposal. The industry has been working on this approach for some time – for example Marconi's eco-design guide, embracing a life cycle approach to product design, was first published in 1997. See also the Lucent Technologies case study later in this section.

While closed loop design must be the ultimate objective, in the meantime special schemes are required to deal with end-of-life equipment. Companies have designed systems to ensure that materials are reused or recycled as much as possible, and disposed of responsibly where that is not possible.

As a major customer, the industry is also aware of its responsibility to encourage its suppliers to improve their environmental performance – including issues such as packaging and product energy efficiency. For example, all members of the Communication Environmental Excellence Initiative (CEEI) acknowledge environmental issues in their procurement processes, as do leading European companies. Environmental criteria are usually included in contract requirements, and in North America suppliers may be preferred if their products carry environmental labels.

ETNO has developed procurement guidelines designed to ensure that the full range of environmental issues is considered when specifications are developed. They cover a product's entire lifetime (design, operation, end-of-life treatment), and address issues such as:

- materials used (use of recycled materials, hazardous materials),
- energy consumption,
- end-of-life options,
- efforts to minimise the environmental impact of future products.

The guidelines also help to assess suppliers' attitudes to environmental issues and the

environmental impact of their activities. A number of suppliers within the European Information and Communications Technology Industry Association (EICTA) are discussing a process known as 'materials disclosure'. These discussions were stimulated by the need to avoid old equipment that contains hazardous materials. The aim is to identify substances that could be banned in the foreseeable future, and to avoid using them in new products and equipment.

In Europe several suppliers have set up take-back systems, sometimes involving co-operation between operators. Deutsche Telekom's 'T-Punkt' shops (sales outlets) will take back, free of charge, pre-paid phonecards, CD-ROMs and batteries. Reuse is the priority and, in 2000, 3.5 million terminals/telephones were returned, of which about 1.2 million were reused, and about 3.2 million kg of material was recycled. (Nearly 100% of plastics and about 75% of other material) are reused. The materials from the devices are separated in a company-owned recycling plant.

Mobiles and health

Electromagnetic fields from mobile handsets and base stations have given rise to health concerns. The industry has co-operated with relevant bodies, and sponsored research to deepen understanding of the risks involved. The current position of independent bodies such as the International Commission on Non Ionising Radiation Protection (ICNIRP) is that current levels of exposure are not likely to cause any harm to human health. The World Health Organisation (WHO) endorses the international guidelines developed by ICNIRP.

WHO is continuing to sponsor research in this area. Its current position is that exposure to RF fields, such as those emitted by mobile phones and their base stations, is unlikely to induce or promote cancers, and that there is no firm evidence of other health risks. The biggest risk from using mobile phones appears to be traffic accidents caused by drivers being distracted while using their phones. WHO reports that it will be another three years before definite conclusions can be reached.

A task force has been established within ETNO and GSM Europe to follow the development of scientific research, and to create a forum for exchanging experience and proposing action. The task force will also collect and evaluate existing research to help communicate existing knowledge and develop understanding of the issues.

Case study: Lucent Technologies

Lucent has an 'Environmental Health and Safety (EH&S) 2000+ Goal' to minimise the EH&S impacts of its products over their full life cycles. It will achieve this by developing tools that assess the life cycle EH&S impacts of current products, and by including EH&S impact considerations in design.

Lucent initiated this programme by conducting life cycle analysis (LCA) on at least one major product from each of its product groups in 2001. The assessments were conducted using an internal LCA methodology that is quicker and clearer than traditional approaches in that it uses a measurement tool that quantifies products' environmental performance and sustainability. For example, a product's energy use can now be evaluated during its operation to look for opportunities for next-generation improvement. The ability to quickly quantify, understand and act on the impacts of additional product features translates into improved environmental performance and reduced total cost of ownership for customers.

Case Study: Vodafone - Monitoring electromagnetic fields

Omnitel Vodafone and the Municipality of Catania, in Sicily, have collaborated to develop a new innovative service for the permanent measurement of electromagnetic fields and the communication of results to the local population.

The Cassiopea project, based at the University of Catania, provides concrete scientific information using data recorded to monitor electromagnetic emissions and make sure that they are in line with legal limits. The system involves the installation of 15 electromagnetic field monitoring stations, located in dense pedestrian traffic areas and inside both public and residential buildings. Data is recorded 24 hours a day, and then transmitted over Omnitel Vodafone's GSM network to a server controlled by the Municipality of Catania which publishes the results via the press and the Internet.

Other municipalities all over Italy are now following the example set by Catania and Omnitel Vodafone is working with the Ministry of Communication and the four other mobile operators in Italy for a nationwide extension of the initiative.

Table 8: Deutsche Telekom total solid waste

Year	Tonnes	% change
1995	129,830	
1996	140,815	+8.4
1997	102,535	-27.2
1998	102,772	+0.3
1999	75,000	-27.0
2000	78,584	+4.8

Source: Deutsche Telekom

Other environmental impacts

Apart from global warming and ozone depletion, which have already been dealt with in previous sections, direct pollution by the industry of air or water is limited. However, many companies are seeking to reduce their water use, for example by detecting and repairing leaks and instituting water-saving devices.

Waste is the most significant other environmental issue, with substantial volumes going to landfill from many companies. Most have programmes in place to reduce the volumes of waste. The data in table 8 from Deutsche Telekom show the progress that has been made, but also demonstrate that specific developments can create interruptions in such progress. The increase between 1999 and 2000 was the result of old analogue technology being replaced by new digital technology.

The visual impact of mobile phone base station masts is also important. This issue will grow with new generation technology, as more masts will be required. As far as possible companies use existing buildings rather than create new structures, which minimises the visual impact. Where new structures are required companies work closely with local authorities and communities to achieve the best possible balance between technical requirements and protection of the local landscape.

Part 5: Management

ICT companies are addressing the need to make sustainable development an integral aspect of management, rather than an isolated policy issue. The industry has adopted various management systems, as described below, to ensure integration and rigour in addressing the challenge.

Co-operation within the industry has grown in recent years to develop common approaches to industry-wide issues and to agree guidelines for sustainability action.

It is important to reach out beyond the industry to engage stakeholders and to work with others to tackle social and environmental issues. This has been done through dialogue and formal reporting, as well as by forging partnerships with government and non-government bodies.

Management systems

Many companies in the industry have adopted formal certification programmes such as ISO 14001, while others have developed their own systems, often based on such standards. A third of the ETNO Charter signatories have developed environmental management systems based mainly on the ISO standard and are currently implementing them. Three companies have so far achieved external certification.

Each of the companies participating the North American Communication Environmental Excellence Initiative (CEEI) has a written environmental policy, and most of them are publicly available. Seven of the ten companies which participated in the group's first environmental report for 2000 have comprehensive, systematic management systems. The remaining three companies are developing them.

Certification has helped companies focus on continuous improvement, not only by reducing the impact of their operations on the environment, but also by continually improving their management systems.

Ericsson has received the first ever worldwide ISO 14001 certification for its environmental management system. This is the first time that a company has received one ISO 14001 certificate encompassing worldwide operations, covering both manufacturing and non-manufacturing.

Some companies are expanding their management systems to include aspects beyond the environment. For example, Motorola has developed an integrated global Environment, Health, and Safety Management System which has obtained ISO14001 registration for its manufacturing operations worldwide.

Accountability

Virtually all the members of GeSI publish reports detailing company efforts, procedures, and performance on environment, health and safety. These reports are usually public and many are published online.

In fact the Internet plays a growing role in how companies disseminate information. The use of the Internet has enabled the industry to reach places and people beyond the reach of traditional media. E-mail has enabled companies to network much more quickly and cheaply on an international level than was possible before, and to build dialogue with stakeholders.

The Web allows reports and news releases to be distributed to millions of people around the world very quickly and free of charge. For a very small input in terms of resources, the industry can send thousands of documents to people worldwide.

The leaders in the ICT industry were some of the earliest companies to report their environmental performance externally, and have led the development of practice in this area. For example Ericsson has produced eight annual environmental reports. For 2001, the report will be expanded to include both social and economic dimensions to make it a full sustainability report. (See also the BT case study)

ETNO has produced environmental reports since 1998, describing the performance of Charter signatories. An internal report is compiled every year, while a public report is released every two years to coincide with the biennial ETNO environmental conference. The public report is published on the ETNO Web site [ETNO, Web site]. A set of both qualitative and quantitative indicators has been developed to enable aggregated reporting, and to help less advanced companies develop their practices. New quantitative indicators are being tested for the next public report to be issued in 2002.

A key point of the ETNO Charter is communication to stakeholders. The level of environmental communication (see case study below) from Charter signatories to the main stakeholder groups, employees, customers, governments, and shareholders, has increased over the past two-year reporting period.

Case study: BT

BT has been producing an annual environmental performance report since 1992. It published a first social report in 1999 and the two were integrated in June 2001. This was published online only and is updated frequently. The BT Web site includes information on both the performance of the company, as well as the impact on society of its products and services.

BT has important relationships with a wide range of different constituencies, including customers, employees and suppliers. BT consults with these constituencies in various ways.

The company regularly surveys its customers, and has set up a number of initiatives to gain a better understanding of customer concerns and the issues that are important to them. BT operates a number of consumer liaison panels, each consisting of 12 to 15 consumers with a broad range of experience and usage of communications technology. Feedback from panel members provides valuable insight into consumer thinking and informs the policy-making process within BT. The company also has two special interest panels: one consists of representatives from small and medium enterprises (SME), and the other comprises young people, (under 24).

BT is also involved with Telecommunications Advisory Committees – groups of local people with an interest in telecommunications, which are recognised by the appropriate government department.

The company also encourages informal communications through a facility on its Web site which enables customers to e-mail comments or to ask questions about products or services. More than 10,000 e-mails a month are received through this facility.

So far as employees are concerned, BT recognises two trade unions representing more than 100,000 staff. BT also has a European Consultative (Works) Council, which provides an annual opportunity for trans-national dialogue with representatives from the United Kingdom and operations in continental Europe.

Partnerships and voluntary initiatives

The companies contributing to this report are involved in a number of voluntary initiatives, which vary between formal agreements and standards or codes of conduct, and informal initiatives to address particular issues.

GeSI is itself a voluntary initiative of the global industry. ETNO, the European trade association for telecommunication network operatorsis one of GeSI's members. In 1996 ETNO launched the Environmental Charter of European telecommunications network operators. With 25 signatories (as of 11 January 2002), companies representing more than 95% of the European telecommunication market have now signed the charter. It commits signatories to continuous improvement in six areas:

- awareness,
- compliance,
- research and development,
- procurement,
- information provision,
- environmental management systems.

The North American Communication Environmental Excellence Initiative (CEEI) has also launched a voluntary charter based on its vision for the industry to be 'a leader in the area of environmental responsibility as well as an innovator of communications technologies and services, bringing creative solutions to bear on society's natural resource issues and ecological concerns'.

Individually, companies participate in a broad range of national and international initiatives or programmes with various organisations, foundations and trade associations. These initiatives cover subjects ranging from environmental sustainability, aspects of globalisation, environmental education and training, elimination of municipal solid waste, wildlife preservation and restoration, industrial hygiene, and fire protection.

Industry members have developed numerous partnerships throughout the world to carry out work in health, education, human rights and to address the 'digital divide'. Many voluntary organisations have been established as a result. Some company examples follow.

AT&T has invested more than USD600 million in cash and kind since 1984 in support of education, representing more than half of its contribution dollars, employee volunteer time and community service activities. The AT&T Learning Network offers comprehensive online resources and support to help teachers use technology effectively. Highlights include:

- *Resources for Teachers,* which provides hundreds of annotated links to education resources to help teachers navigate the World Wide Web to find lesson plans, online discussion groups, technology resources, online project ideas, and funding sources;
- *Virtual Academy,* a centralised resource of online courses designed to help educators integrate technology into their curriculum while updating their professional credentials;
- *Cable in Education resources,* including programmes from the former Tele-Communications Inc. (TCI), to help educators integrate cable services and programming into their classrooms.

Marconi is taking part in the British Prime Minister's *Partnership for Technology in Education* initiative, aimed at improving education in developing countries. As part of the Imfundo[1] team, it will help develop and carry out strategies to provide and improve existing methods of education in rural areas of Africa, using information and communications technologies. Initially, the team will pilot its projects in Rwanda and The Gambia, and possibly in Uganda, South Africa and Senegal, with successful models to be extended worldwide.

(1) Imfundo is a South African word, which means 'the acquisition of knowledge'

Marconi is currently working with the South African Government to enable young South Africans at the country's technical colleges to acquire the information technology and communications skills they need to get jobs in business and industry. Separately, five schools in Coventry in the United Kingdom are to reap the benefits of an international link programme with SMART Schools in Malaysia. The Marconi-financed initiative will allow teachers across the globe to share best practice and work together on joint projects in maths, science, technology, English language and information technology.

Motorola has established a partnership with WWF (formerly known as the World Wildlife Fund) which aims to apply the company's technology to help protect endangered ecosystems. The purpose of the partnership is to use Motorola's two-way communication systems technologies to help conservation programmes. For several years Motorola has donated and installed communications systems in remote conservation areas around the world. These include: Chapada dos Veadeiros, (Brazil), Kanchenjunga, (Nepal), Gamba, (Gabon), and the Kuril Islands in Russia.

Communications and conservation go hand in hand to ensure that some of the most endangered areas for loss of biodiversity are protected from both natural and man-made threats. For example, in 2001, an oil spill in Galapagos, (Equador), threatened the islands' unique ecosystem. Constant communications among the response teams facilitated the recovery. This was made possible by the Motorola Communications Systems.

Part 6: Future goals for the industry

The sector's goals reflect the distinction throughout this report between internal industry issues and the impact of the ICT industry on wider society and economies. To the extent that goals are concerned with issues beyond the industry, achievement of them will not entirely be within the control of the industry. There is therefore some overlap on such issues between industry goals and issues for policy-makers.

Internal industry goals

Coverage

GeSI aims to extend membership to embrace telecommunications operators and manufacturers around the world, and to include smaller companies as well as the global giants. GeSI also aims to deepen the commitment to its principles among existing members at the same time as broadening the membership. Eventually it is intended to widen the membership beyond telecommunications to include the information technology sector, recognising the convergence between communications and information technology.

Achieving these three objectives will strengthen the industry's commitment to sustainable development and embed the principles of continuous improvement throughout the ICT industry. In particular the industry aims to continually improve its own eco-efficiency, especially through the application of its own technologies.

Measurement and reporting

Members will be encouraged to measure and publicly report their environmental and social impacts on a regular basis, as part of management systems which target continuous improvement. To make this easier for smaller companies and to enable comparisons across the industry, the GeSI will develop a set of key indicators in collaboration with the Global Reporting Initiative, and a standard approach to implementing them. This should be facilitated by Web-based reporting systems. Companies will also be encouraged to move towards independent verification of published information.

Product stewardship

GeSI members will strive to reduce the energy consumption during manufacture and use of products, will work to eliminate materials which may be dangerous and cannot easily be reused or recycled, and will work towards waste minimisation. In particular GeSI encourages all ICT companies to set themselves challenging energy minimisation targets.

Stakeholder engagement

Companies will seek to widen and deepen dialogue with stakeholders, especially those representing 'civil society', who have not traditionally been included in routine dialogue. The goal is for the industry to understand better the impact it has on society, and for the industry perspective to be better understood by all stakeholders, especially non-government organisations and communities affected by its operations.

Human rights

The industry needs to develop a clearer understanding of human rights issues associated with ICT - in the supply chain and 'downstream' where issues such as freedom of expression and privacy need to be addressed.

Societal ICT goals

Dematerialisation

ICT has unique attributes which can help to break the link between economic development and resource depletion. The industry aims to be the key tool for decreasing mass flow without sacrificing the standard of living in developed countries; while in

developing economies helping to optimise quality of life with minimal input of material and energy.

Economic development

The ICT sector should be an important part of any country's development plan. It should be seen as an enabler of development rather than an end in itself, with important social spin-offs and potential benefits in limiting environmental impacts, especially through the advantages of e-commerce. E-commerce should also bring significant environmental gains to developed economies.

Social development

The use of ICT should help to spread access to education, health information and democratic participation. The goal must be to extend access as broadly as possible to combat exclusion and aid development. Companies will work with governments and government agencies to overcome the 'digital divide' and avoid sections of society being deprived the benefits of ICT.

Furthermore the role of ICT in emergency management has been clearly demonstrated by recent events: wireless communications, environmental and weather information, and remote alarm systems are just a few examples of the services the industry is making available that aim at protecting human life, habitats, land and properties.

Partnerships for action

Many of these external goals can only be achieved in co-operation with governments or other partners. The industry will be a willing partner, but will be limited in the impact it can have if denied access to markets or constrained by inappropriate regulation. For ICT to be an effective facilitator of sustainable development, it is essential that governments, civil society and the business community co-operate to create the conditions for the sector to help improve the competitive position of developing countries and reduce the environmental impact of developed economies.

The best way of demonstrating and developing the transformational characteristics of ICT technology is by application. Companies and governments all over the world are encouraged to apply ICT technologies to help achieve their sustainability goals. This often requires imaginative cross-departmental working and the establishment of creative partnerships.

Issues for policy-makers

The social and environmental benefits which ICT can bring will be constrained unless policy-makers ensure that markets are open to new technologies and new approaches.

A rapidly-changing industry such as this needs a flexible framework within which to operate. But the framework should ensure as far as possible harmonised standards and reasonable stability over time so that companies have a solid basis on which to invest and avoid unnecessary costs of compliance with different sets of standards.

GeSI believes strongly that global issues such as biodiversity and climate change need global solutions. But national and local governments can also play a part in stimulating the use of ICT to achieve their social and environmental objectives. Governments should ensure they understand the potential benefits of a vibrant ICT industry and should make specific provisions for ICT in sustainable development plans.

Specific incentives should also be considered to speed the pace of desired innovation, such as the spread of ICT to rural communities, the dissemination of advantageous new technologies, substitution of communication for travel and the use of ICT in health and education.

Annexe 1: Bibliography

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Annexe 2: Further information - Web site addresses

Asociación Hispanoamericana de Centros de Investigación y Empresas de Telecomunicaciones (AHCIET) - http://www.ahciet.net/ahciet/english/who_we_are.asp

Digital Europe project - http://www.digitalfutures.org.uk/

Digital Opportunity Initiative (DOI) - http://www.opt-init.org/

e-ASEAN Task Force - http://www.e-aseantf.org/

European Telecommunications Network Operators Association (ETNO) - http://www.etno.belbone.be/

Global e-Sustainability Initiative (GeSI) - http://www.gesi.org/

International Telecommunication Union (ITU) - http://www.itu.int/home/index.html

North American Communications Environmental Excellence Initiative (CEEI) - http://www.ceei.org/about_ceei.html

United Nations Environment Programme (UNEP) - http://www.uneptie.org/

GeSI members:

AT&T - Environment, health and safety Web site - http://www.att.com/ehs/
Telework Web site - http://www.att.com/telework/

Bell Canada - Bell in the Community Web site - http://www.bell.ca/en/about/bic/

British Telecommunications plc - Better World Web site - http://www.groupbt.com/betterworld/index.htm

Cable & Wireless - Corporate Responsibility Web site - http://www.cw.com/th_11.asp?ID=au_corpresp

Deutsche Telekom AG - Environment Web site http://www.telekom.de/dtag/ipl1/cda/level1_a/0,3678,10941,FF.html

Ericsson - Sustainability and Environment Web site - http://www.ericsson.com/sustainability/

European Telecommunications Network Operators Association (ETNO) - http://www.etno.be

Lucent Technologies - Community Web site - http://www.lucent.com/corpinfo/cs.html
Environment, health and safety Web site - http://www.lucent.com/environment/

Marconi - Environment Policy - http://www.marconi.com/html/solutions/environment.htm

Telcordia Technologies - http://www.telcordia.com

Telenor AS - Environment Web site - http://www.telenor.com/environment/
Community Web site - http://www.telenor.com/about/community_involvement/

Telstra Corporation - Sustainability Web site - http://www.telstra.com.au/sustainability/

Vodafone - Corporate Social Responsibility Web site - http://www.vodafone.com/about/responsibility.htm

UNEP contribution to the World Summit on Sustainable Development

The mission of the United Nations Environment Programme (UNEP) is to provide leadership and encourage partnerships in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations. **The UNEP Division of Technology, Industry and Economics (DTIE)** contributes to the UNEP mission by encouraging decision-makers in government, business, and industry develop and adopt policies, strategies and practices that are cleaner and safer, make efficient use of natural resources, ensure adequate management of chemicals, incorporate environmental costs, and reduce pollution and risks for humans and the environment.

This report is part of a series facilitated by UNEP DTIE as a contribution to the World Summit on Sustainable Development. UNEP DTIE provided a report outline based on Agenda 21 to interested industrial sectors and co-ordinated a consultation process with relevant stakeholders. In turn, participating industry sectors committed themselves to producing an honest account of performance against sustainability goals.

The full set of reports is available from UNEP DTIE's web site (http://www.uneptie.org/wssd/), which gives further details on the process and the organisations that made it possible. The following is a list of related outputs from this process, all of which are available from UNEP both in electronic version and hardcopy:

- industry sectoral reports, including
  - accounting
  - advertising
  - aluminium
  - automotive
  - aviation
  - chemicals
  - coal
  - construction
  - consulting engineering
  - electricity
  - fertilizer
  - finance and insurance
  - food and drink
  - information and communications technology
  - iron and steel
  - oil and gas
  - railways
  - refrigeration
  - road transport
  - tourism
  - waste management
  - water management

- a compilation of executive summaries of the industry sectoral reports above;
- an overview report by UNEP DTIE;
- a CD-ROM including all of the above documents.

UNEP DTIE is also contributing the following additional products:
- a joint WBCSD/WRI/UNEP publication entitled *Tomorrow's Markets: Global Trends and Their Implications for Business*, presenting the imperative for sustainable business practices;
- a joint WB/UNEP report on innovative finance for sustainability, which highlights new and effective financial mechanisms to address pressing environmental, social and developmental issues;
- two extraordinary issues of UNEP DTIE's quarterly *Industry and Environment* review, addressing key regional industry issues and the broader sustainable development agenda.

More generally, UNEP will be contributing to the World Summit on Sustainable Development with various other products, including:
- the Global Environmental Outlook 3 (GEO 3), UNEP's third state of the environment assessment report;
- a special issue of UNEP's *Our Planet* magazine for World Environment Day, with a focus on the International Year of Mountains;
- the UNEP photobook *Focus on Your World*, with the best images from the Third International Photographic Competition on the Environment.

Sustainability profile of the Information and Communications Technology industry

- Achievements
  - Telecommunications is at the heart of the global knowledge economy and will continue to play a critical role in economic development in the 21st century.
  - In the last ten years there has been growing awareness of environmental and social issues by the sector. During this period there have been significant reductions in resource consumption per bit of data transmitted.
  - Telecommunications has made a significant contribution to raising standards in health, education, employment and empowerment of local communities.

- Unfinished business
  - Getting the commitment of more ICT companies to actively engage in and promote sustainable development.
  - Extending access to ICT services through extensive partnership between private and public sectors.
  - Better integration of ICT solutions into company and public policies on climate change and economic development.
  - Measuring and publicly reporting environmental and social impacts on a regular basis.
  - Extensive promotion of the use of ICT as a key to environmental and social improvements.

For further information contact:

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