Dr inż. Colin F. Hales
Wydział Ekonomii
Uniwersytet Rzeszowski

Information and Communication Technologies for Sustainable Development

INTRODUCTION

Many people like to think that mankind is at the dawn of a new era, that of an age of enlightened communication. Visions abound on how breakthroughs in digital technology will change the way we live, work, do business and interact. It is widely believed that the so called information age will bring radical change and improvement, and countries all over the world are busy with constructing the necessary infrastructure, the "information superhighways", in order to meet the challenges of the information society of the 21st century. When considering these roles it is important to keep an open mind about the kinds of ICT's that are likely to be most appropriate for these purposes.

Presently, there is a general agreement that Information and Communication Technologies (ICTs) have great influence on people all over and at different levels of society. ICTs are seen as new instruments for which a wide variety of uses is generated and accordingly this means that such technologies should be in the mainstream of available tools for development. This correlation between ICTs and development has been widely studied and researched and, in general, it is believed that a positive association exists between both variables, so that investment in such technologies is considered as an important dimension for the successful achievement of development projects. In spite of this, there is still a long road ahead before such technologies are included in the development agendas, given the fact that third-world countries do not usually give priority to investment in these areas. This paper considers the role that Information and Communications Technologies (ICTs) can realistically be expected to play in improving the level of living and quality of life of people all over the world.

DEFINING INFORMATION AND COMMUNICATION TECHNOLOGIES

ICT includes a whole range of technologies that facilitate communication and the processing and transmission of information by electronic means from conventional radio and landline to computers, Internet and mobile phones. Information and Communication Technologies are based on digital information and

comprise computer hardware, software and networks but they are not the only technology that deals with information. Others include:

- 'Intermediate' technology, still based largely on analogue information held as electro-magnetic waves such as radio, television and telephone.
- 'Literate' technology, based on information held as the written word such as books and newspapers.
- 'Organic' technology, based solely on the human body such as the brain and sound waves [Heeks, 1999].

There is a tendency at present to centre discussion of information and communications technologies on the Internet and to channel development assistance largely toward facilitating access to it. But modern technologies are not always what people need most. In some cases, Internet use may prove too expensive or too difficult for local people to maintain, and thus be unsustainable. And in others, the Internet is simply not the best medium for supporting local socio-economic and political progress.

In many parts of the world, mobile telephones are transforming people's quality of life. New digital radio stations are reaching a wide public in an interactive way through call-in programmes. Moreover, when reporters are equipped with mobile phones, their minute-by-minute monitoring of local elections reported by radio is making a significant difference in the transparency of electoral processes. Satellite television enormously expands the range of programming available to inhabitants of countries whose governments, until recently, could limit television reception to a few state-run channels. Video cassettes perform a somewhat similar function, providing uncensored news to a network of viewers, at the same time that cassettes allow millions of migrants to stay in touch with their families back home [Hevitt de Alcantara, 2001].

It is important, then, to maintain an open mind about which of the many options contained in the ICT field are more relevant and useful in particular social settings. Certainly, mobile telephones have enjoyed extraordinary success in developing countries during the past few years much more so than the Internet, because they meet immediate communications needs in places where access to fixed telephone installations is not available. Compared to the cost implied in traveling from out-of-the-way places to the nearest stationary telephone, using a mobile telephone can be relatively inexpensive, especially when it is shared among neighbors. And it allows for privacy, which can be at a premium in situations where many people must live in close proximity.

Four main potential roles for Information and Communication Technologies can be identified:

- as an output (computers, components, software, web pages),
- as a production technology (information-based products),
- as an information processing technology (business systems),
- as an information communication technology (receipt and transmission of information).

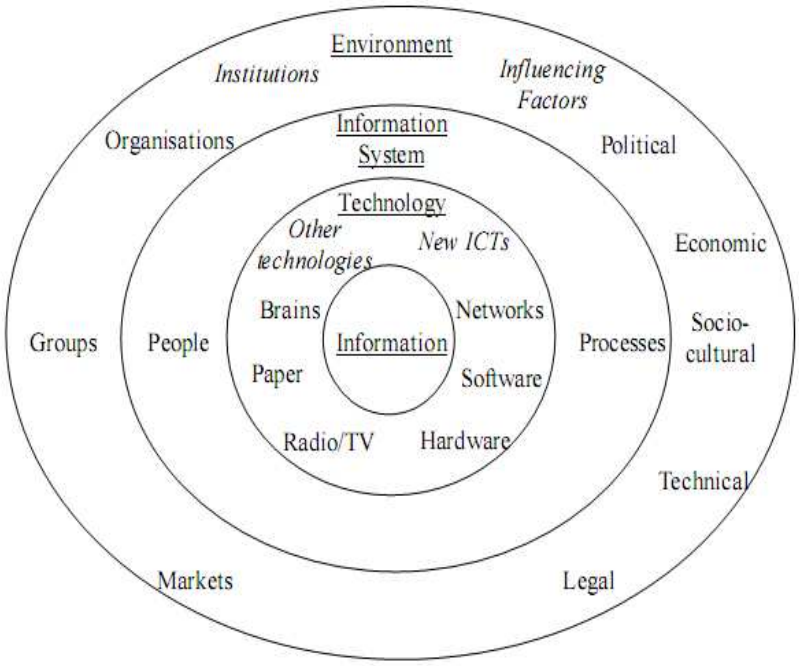

Figure 1. A systematic view of Information and Communication Technologies
Source: [Heeks, 1999].

For several decades, information, knowledge and communication have been core elements of sustainable development efforts. So what has really changed over the last few years due to the dramatic development and spread of information and communication technologies? The following is a list of the major changes with regard to information flows and communication effected by ICT:

- Interactivity: ICT facilitate dialogue. It is much easier and faster to put information for feedback on the Internet, compared to printing a book or writing a letter and asking for written reactions from the reader. Owing to ICT, local radios can be made much more interactive and run more economically than a decade ago.
- Speed: Simultaneous information in writing, sound and picture can be exchanged within fractions of seconds around the clock. Moreover, the Internet allows real time 'many-to-many' interactions.
- Lower costs: Although the cost factor is still a challenge in general, the relative cost of ICT has greatly fallen over the past years and it continues to fall. As a result, innovative uses of ICT can facilitate information flows and

communication much more cheaply compared to traditional means such as books or newspapers. Integration: ICT allow for the integration of different types of media. For instance, the combination of a local radio with the Internet allows access not only to a much wider range of information sources but also the efficient exchange of broadcasting modules, making e.g. censorship more difficult.

These new technological possibilities have had a large impact. They are at the core of the so-called ICT revolution from a development perspective. Interactivity not only concerns the Internet, but also the radio that has become much more of a two-way communication tool over the past decade, especially at the community level. The fact that the Internet allows interactive, fast and low-cost many-to-many interactions between people has given rise to powerful networks at all levels. In addition, these technological innovations have emerged in parallel with multifaceted globalization and increased participation of citizens, of civil society organizations and of the private sector in policy debates, planning and action. Today, there is a clear trend towards a global 'network society'

Taking this into account, there is a strong relationship between information and communication technologies on the one hand, and development and poverty reduction on the other. This emanates especially through three dimensions:

- access to information and knowledge
- stronger voice of the people in democratic processes and decisions affecting their lives
- networking and communication among people and organizations [Weigel, 2004].

Access to well-established technologies such as telephones, radio and television can transform the lives of poor people. Much remains to be done to maximize access to and effective use of these technologies. The vast majority of the world's poor has never made a telephone call, and do not have access to a telephone. Many companies, government ministries and local and regional government offices in developing countries have still not effectively deployed computer technology, despite its potentially vast impact on efficiency and productivity.

When these older technologies have so much untapped potential, do new technologies such as the Internet, which have received so much attention, really offer anything new? The short answer is, when used appropriately, yes. The Internet dramatically reduces the costs of making information available to others and accessing global information and knowledge resources. It facilitates forms of "many-to-many" communication and action that bypass traditional power relations and hierarchies. One important impact of this has been to increase sub-

stantially the ability of civil society groups to network, share information worldwide and form coalitions. However, it is worth noting that for many users, the greatest benefits of Internet access derive from doing things that were already possible in better, quicker or cheaper ways (e.g., e-mailing relatives or obtaining government documents from a website). In developing countries, e-mail remains by far the most common application of Internet access, partly because it is a powerful and convenient communication tool, but also because surfing the web may be very expensive or unreliable because of poor infrastructure. Satellites and other advanced technologies will also make new things possible [Marker at. al., 2002].

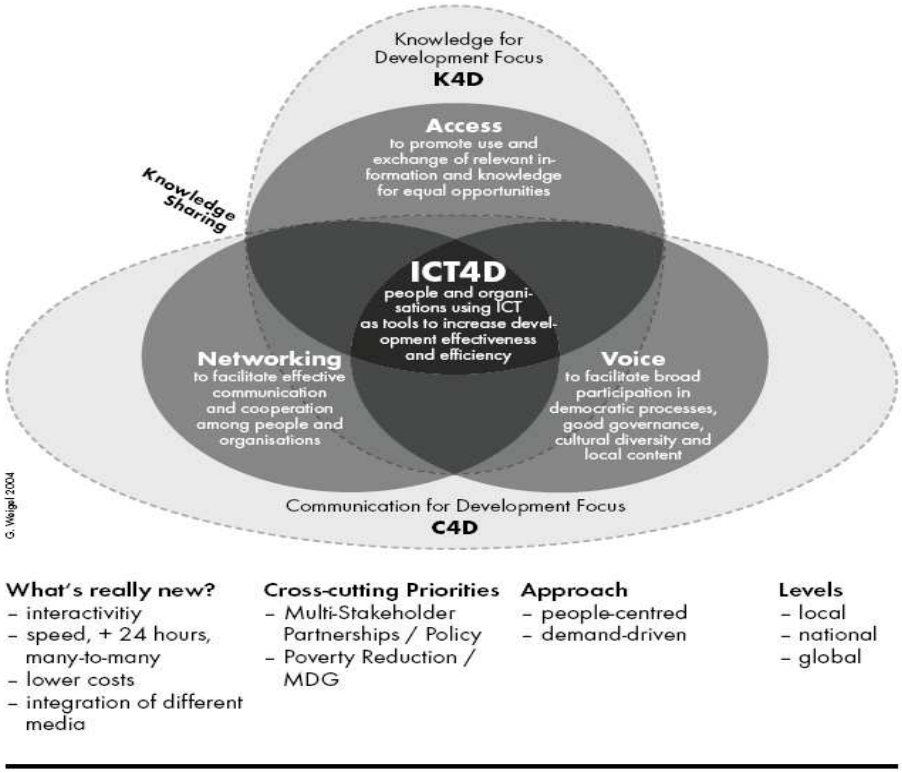

Figure 2. ICT for Development (ICT4D): Key Dimensions and Main Goals
Source: [Weigel, 2004].

Recent innovations in hand-held devices, in mobile telephony, and in satellite communications might lead to new and cutting-edge information and communication tools specifically relevant to the needs of the poor.

INFORMATION AND COMMUNICATION TECHNOLOGIES IN DEVELOPMENT

Perhaps more important in assessing the productivity impact of ICT is to take account of the fact that long adjustment periods are needed for an economy to fully benefit from a revolutionary new technology [De Farranti, 2002].

New growth theorists and economic historians have characterized general purpose technologies (GPT's) by:

i) wide scope for improvement and elaboration;
ii) applicability across a broad range of uses;
iii) potential for use in a wide variety of products and processes;
iv) strong complementarities with existing or potential new technologies.

General Purpose Technologies play the role of "enabling technologies", opening up new opportunities rather than offering complete solutions. They act as catalysts, inducing complementary innovations in other sectors. ICT is the General Purpose Technology of our time. As with earlier GPTs, short term impact to be reflected in economy-wide productivity is likely to be underestimated. However the time needed for ICT to beneficially impact on the whole economy may be shorter than the steam engine which is widely accepted as the GPT of the first industrial revolution and the electric dynamo which is viewed as the GPT for the second industrial revolution.

With these important implications, it is not surprising that the connection between the expansion of information communication technologies and economic development is currently receiving considerable attention by practitioners, policy makers, researchers and funding organizations and there is good reason for this attention. If increased deployment of information communication technologies leads to greater digital opportunities, including economic and human development, ICT can be framed and applied as a potent tool in reducing poverty, extending health services, expanding educational opportunities and generally improving the quality of life for many of the world's disadvantaged [Gillis, Mitchell, 2002].

We all know that information plays a vital role in the proper functioning of markets. If information does not flow properly the result is a shortage of information about rights, services, and opportunities.

Economic growth is severely constrained whenever there is a lack of information, communication and knowledge. Where there is not enough information or where communication is difficult we may discern that investment and innovation are also on a lower level. Generally speaking, shortages of sufficient information, communications infrastructure and needed physical infrastructure inhibit private investment

A further important aspect of the relation between ICTs and economic growth is the fact that ICTs improve the productivity of both workers' and companies thereby making it possible to achieve better output using a set of sparse resources.

There are an increasing number of ICT projects aimed at beneficially impacting economic development although one must define economic development benefits as being much more than economic growth and wealth creation. The United Nations believes that ICT can encourage human development in a variety of areas:

- offer better access to government services,
- reduce fraud and scepticism in elections,
- enhance access and delivery of training programs,
- reduce gender inequalities in access to opportunities,
- improve the delivery of health care services.

A few mutually supporting roles or influences can be proposed for ICT in fostering development:

- The ease and speed of accessing sharing and processing information and knowledge will foster increased learning and innovation. In this respect one can venture to say that ICT may have a profound impact similar to the invention of the printing press.
- ICT's have the ability to transform production systems by increasing the speed at which transactions and decision making can be facilitated. This too can lead to a drop in the costs of production in almost every sector of society. In this sense, ICT may initiate and facilitate changes somewhat similar to those brought about the steam engine, electricity and the railways in transforming production and transportation systems.
- ICTs have been increasingly described as "technologies of freedom" [de Sola Pool, 1983] which suggests that they may have a great role in empowering people through the ability to coordinate, disseminate and share information more freely. Power over information is being decentralized, fostering new types of community and different roles for government.

SUSTAINABLE DEVELOPMENT THROUGH ICT

Sustainable development of a region is based on a variety of factors – Including economic, social and physical. One very important factor for development of a region is its ability to attract investment to the area. Since investment is continually searching for profitable and early returns regions are in constant competition with each other for these scarce resources. Subsequently one can conclude that a region's potential for development is closely related to its ability to pull

and retain resources to the area. This ability can be compounded as the image a region portrays to investors.

What can be the role of ICT's in this respect. One of the theories considered states that the attractiveness of a region is largely influenced by its proximity to centers of influence, closeness to markets and of course to resources – both physical and social. This factor is called the "location multiplier" – an expression of the accessibility of the region and its image in the view of prospective investors [Gaki at. al., 2007]. Subsequently it can be argued that an improvement in the location multiplier should enhance the development potential of a given region.

Albeit such improvement is not easily possible, especially in areas which are physically located in remote regions or those which are "culturally" distant. A possible solution to the problems facing outlying areas is to develop indigenous industries which do not rely heavily on transportation needs. Another feasible way out would be undertaking activities for which this remoteness is not a problem or may even be considered an asset e.g. tourism [Koufodontis at. al., 2007].

One possible solution to the problem of remoteness is the development of alternative communications networks which should alleviate the problem of accessibility to such areas. It can be argued that ICT do provide a possible solution in this respect – outlying regions now become more accessible in this way thereby improving the location multiplier which theoretically should make them more attractive for investors. For those activities which do not need the transportation of physical inputs or finished goods e.g. call centres, this method of regional development should be more feasible. Indeed investors could be more interested in locating core activities in such areas taking into consideration also that in most cases the cost of employing workers if much lower than in congested central area. These arguments combined with the fact that land prices are often much lower and "quality" of living conditions can be much better.

A large number of "less developed regions have taken advantage of this concept of action achievable though ICT investment. Examples of regions that have benefited for this are direction of action can be found in Cambridge, Milton Keynes and Crawley in the UK, Grenoble, Montpellier in France, Lombardy and Tuscany in Italy and Southern Bavaria in Germany [Komninos, 2002]. These regions have been able to attract businesses and employees in part through the use of ICT, which reduced the dependence of work on the place of work.

The development of the Information Society in peripheral regions can be said to offer certain benefits, among them the closer access to markets in the central regions – the so-called "death of distance" phenomenon. Since the communica-

tions network is a two-way medium one must realize however, that at the same time this also opens up regional markets to the influence of the generally stronger centralized markets. One aspect of this access is seen in the access regional businesses have to services (products) in the centralized markets which in a way allow such enterprises to obtain resources from a more competitive and often cheaper source. The disadvantages of this situation as mentioned before are seen to be the undermining of local suppliers of such services.

It would be too simplistic to assume that ICT investment alone can attract businesses and workers to a region. There must be additional factors in place which taken together create a more enticing package in the eyes of potential movers to the region these can collectively be called the social and cultural characteristics of the region. Among the above-mentioned attributes we can identify health service, educational opportunities and cultural infrastructure.

Nevertheless the result of improving the ICT attractiveness of a region does not have to depend on inward movement of investors or workers. After all indigenous development can also take place wherein inhabitants of a given region are better poised to take advantage of their access to ICT to develop local businesses which foster economic and social development. The region is also more able to compete for services offered through the ongoing outsourcing trend observed in the business sector. However it must be admitted that the majority of work obtained through this outsourcing potential is normally lower grade information work where the bargaining power of the region is usually on a price basis which can be a fragile base for future projection and planning.

The interaction ICTs-development takes a new approach as of the adoption by the UN of the so called "Millennium Development Goals" (MDGs) in the year 2000, within the framework of the Millennium Summit. One of the issues included in these goals is precisely referred to ensuring that the benefits provided by new technologies, particularly ICTs, are made available to all people. Here are the development targets for 2015 emerging out of WSIS; these primarily deal with ICT infrastructure:

1. to connect villages with ICTs and establish community access points;
2. to connect universities, colleges, secondary schools and primary schools with ICTs;
3. to connect scientific and research centers with ICTs;
4. to connect public libraries, cultural centers, museums, post offices and archives with ICTs;
5. to connect health centers and hospitals with ICTs;
6. to connect all local and central government departments and establish websites and email addresses;
7. to adapt all primary and secondary school curricula to meet the challenges of the Information Society, taking into account national circumstances;

8. to ensure that all of the world's population have access to television and radio services;
9. to encourage the development of content and to put in place technical conditions in order to facilitate the presence and use of all world languages on the Internet;
10. to ensure that more than half the world's inhabitants have access to ICTs within their reach [Tongia, 2004].

There is now growing evidence of the role that ICT can play in enhancing development. In recognition of this, the UN Millennium Declaration outlines a focus on partnerships with the private sector to "ensure that the benefits of new technologies, especially information and communication technologies ... are available to all." In spite of this enabling potential and role, ICT is yet to be widely mainstreamed to assist developing countries in addressing traditional development problems with innovative solutions and approaches that are both effective and more easily scalable and replicable.

Table 1: How ICTs can help the MDGs

Goal/Target	Role of ICTs
1. Eradicate extreme poverty and hunger Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day Halve, between 1990 and 2015, the proportion of people who suffer from hunger.	Increase access to market information and reduce transaction costs for poor farmers and traders. Increase efficiency, competitiveness and market access of developing country firms. Enhance ability of developing countries to participate in global economy and to exploit comparative advantage in factor costs (particularly skilled labor).
2. Achieve universal primary education Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Increase supply of trained teachers through ICT-enhanced and distance training of teachers and networks that link teachers to their colleagues. Improve the efficiency and effectiveness of education ministries and related bodies through strategic application of technologies and ICT-enabled skill development. Broaden availability of quality educational materials/resources through ICTs.
3. Promote gender equality and empower women	Deliver educational and literacy programs specifically targeted to poor girls and women using appropriate technologies. Influence public opinion on gender equality through information or communication programs using a range of ICTs.

4. Reduce child mortality 5. Improve maternal health 6. Combat HIV/AIDS, malaria, and other diseases Reduce infant and child mortality rates by two-thirds between 1990 and 2015 Reduce maternal mortality rates by three-quarters between 1990 and 2015 Provide access to all who need reproductive health services by 2015	Enhance delivery of basic and in-service training for health workers. Increase monitoring and information-sharing on disease and famine. Increase access of rural caregivers to specialist support and remote diagnosis. Increase access to reproductive health information, including information on AIDS prevention, through locally appropriate content in local languages.
7. Ensure environmental sustainability Implement national strategies for sustainable development by 2005 so as to reverse the loss of environmental resources by 2015 Halve, by 2015, the proportion of people without sustainable access to safe drinking water. Have achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers.	Remote sensing technologies and communications networks permit more effective monitoring, resource management, mitigation of environmental risks. Increase access to/awareness of sustainable development strategies, in areas such as agriculture, sanitation and water management, mining, etc. Greater transparency and monitoring of environmental abuses/enforcement of environmental regulations. Facilitate knowledge exchange and networking among policymakers, practitioners and advocacy groups.

Source: [*World Telecommunication* ..., 2003]

CONCLUSION

As such there exists an acute interest in trying to comprehend the link between ICT and economic development which means that one must consider results beyond traditional measures such as GDP, employment and enterprise creation. The use of ICT to provide a wider range of public goods including improved health care, literacy and equal access to economic opportunity creates social capital essential for stimulating economic development which can be achieved through the use these new technologies. It would be a great misunderstanding and misjudgement not to take into account the critical role of social capital formation in creating economic development.

Partially because of its complexity, empirically defining the relationship between ICT and economic development is proving to be significantly difficult.

This discussion suggests that ICT has the potential, if conceived as a means and not an end in itself, to be a powerful enabler of development. However, the fact that ICT can, in theory, assist development efforts does not mean that it will necessarily do so. In order for ICT to positively foster development goals, it must be employed effectively.

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Summary

Presently, it is generally agreed on that Information and Communication Technologies (ICTs) are playing a significant role in the lives of people and society. ICTs are seen as mechanisms which provide the basis for the proper functioning of many aspects of modern-day societies and as such these technologies may be considered to be the bearers of economic and social development. The ultimate relationship between ICTs and development is believed to be positive and investment in such technologies should be considered as an important factor for the successful achievement of sustainable development especially at the regional level.

Technologie informacyjno-komunikacyjne dla zrównoważonego rozwoju

Streszczenie

Obserwuje się na całym świecie postępującą transformację do gospodarki elektronicznej, do gospodarki opartej na wiedzy oraz do społeczeństwa informacyjnego. Szczególne znaczenie w tym procesie odgrywają technologie informacyjno-komunikacyjne (ICT), w szczególności w kontekście ich potencjału do wspierania rozwoju społeczno-gospodarczego. Uważa się, że technologie informacyjno-komunikacyjne (ICT) mają potencjał stać się siłą napędową rozwoju, służąc jako środek do osiągnięcia celu, a nie cel sam w sobie. Opracowanie to poświęcono dyskusji nad znaczeniem, rolą oraz możliwościami wykorzystania ICT w celu wspierania oraz usprawniania działań w zakresie rozwoju zrównoważonego.