ICT: PRESENT AND EXPECTED SCENARIO

ICT as a function of national economic situation

Synopsis. The paper deals with the expansion of ICT in the world over the last 5 years. New commodities, especially those based on digital technology, have gradually been affecting business and social activities by introducing new references, new facilities, new ways of communicate. The study of correlation between growth of ICT services and the improvement of national economic situation (independent variable GDP/capita) gave sufficient confidence only in case of traditional commodities (telephone); for the new services it seems too early to get significant relationship with the same representative variable. That is due, mainly, to the insufficient statistics available, to the little experience of new market preferences, to the vague knowledge users have of ICT benefits, to the technical limitation of network and to the hesitation of market to rank new priorities face to their actual needs and to the price of services. The qualitative results obtained have been used to imagine the evolution of ICT services at level of World Regions. Developing areas, where fixed telephone network is still the dominant tool to use waiting for modernisation of the existing network, show an increasing expansion of fixed telephone while developed countries already reversed such a trend.
At international level many Organisms (ITU and Others) have been studying, systematically, this scenario since 2004: the aim is to measure the "information economy" through "Opportunity Index" that mainly account for national economic situation. The results obtained so far encourage further detailed tests as to develop new models or create new ones.

1. ICT start and growing

Information and Communication Technology integrated and expanded the traditional Telecommunication Sector as it includes a set of traditional commodities (fixed and mobile Telephone), and a number of new services based on digital technology. In particular:

- Telecommunication services: fixed and mobile telephony, data and image transmission.
- Telecom equipment: public network equipment, private systems, software services.
- Computer software/services, data processing, computer hardware, PC and peripherals.
- Media services: TV, video, cinema, consumer electronics, audio and video equipment.

It is commonly accepted to fix the start of ICT evolution at the year 1991, when fixed telephony commodity was used at 78% followed by PC connections (19%), mobile telephone (2%) and Internet access (1%). Over time, as pointed out by table below (figures in million), market preference (**Source itu.int/ITU-D/ict/statistics**) and technical expansion of network produced a slow down of fixed telephone demand (6,43% per year), a reasonable increase of Personal Computers (14,18% per year) and significant increases of mobile telephone (38,96% per year) and Internet access demand (40,67% per year).

ICT commodities	1995	2000	2004
Fixed telephony	689	983	1207
Mobile telephony	91	740	1758
Personal Computer	235	500	775
Internet access	40	399	863

Sources: ITU-D

The introduction of broadband (from 5/10 Mb/sec over) got, as well, its role in changing not only the communication systems but also in shaping the whole productive sectors and transforming social and economic activity through the way individuals, businesses and other part of the society work, communicate and interact. Different Firm-level studies seem confirming high potential of ICT to raise productivity but, in the same time, emphasise that the benefit of ICT depends on a number of other factors worthy to be explored.

2. Objectives

The main objective of ICT would be to provide telecommunication and high-speed access to Internet for all population, possibly over the whole territory where they live: the supporters of this concept believe that this could take a country in the Internet era and help national economic systems to recover competitiveness by improving the efficiency of its working processes.

So far the implementation of network and the offer of services was carried out in profitable areas (Cities and great Centres) with high concentration of people and consequent great de-

mand. If the trend is to move towards the coverage of the whole territory in a country Providers would expect to satisfy greater demand under the condition of getting back adequate economic return. But the fact that great part of population may potentially access ICT commodities does not exclude little utilisation of new services. The strategy, then, might involve significant costs (about 800/900 Euro/capita according to available estimate in Europe) to produce inadequate economic return: the process, in fact, is more complex than perceived as it depends, in general, by national economic activity and, in particular, by the behaviour of demand.

America's global approach. The US seek to provide all US citizens the access to the information society, through a series of federal network and computer supply programmes. On practical ground, in 2004, were implemented application programmes among which, one in the area of healthcare and, another, in the area of innovation and economic security.

South Korea's co-operative model. ICT development policy is the result of a planned economy, combining government incentives and industry involvement. Vast infrastructure programs were launched in the 1990s allowing expansion of fixed and mobile broadband access.

Europe. In Europe even those countries which have had success in terms of ICT industry development (Ireland and Finland) have themselves taken a variety of paths. It can be said that only some countries are working to co-ordinate their initiatives with European mechanism (Programme for Research and Technological Development).

3. The network

Despite having lost a significant share in the telephone market, dominant carriers still enjoy massive control over local loop access. Although broadband internet access is still based essentially on fixed lines and cable networks, the low level of main line equipment has proven a major obstacle to the web's take-up in developing countries. Broadband wireless access solutions, such as WiMax could provide these countries with a real alternative, and save them from having to deploy fixed infrastructures.

In view of growing demand for bandwidth applications, operators are, now, turning to fixed very high-speed (VHS) technologies deploying optical fibres in access networks either directly to subscribers or concentrating in nodes or cabinets close to last mile connection. Satellite is the most highly digitised network while the situation on cable networks varies a great deal, and terrestrial TV is still largely analogue.

Technologies envisaged for the introduction of ICT include DSL, Wi-Fi, Wi-Max, optical fibre and satellite. Each of these technologies will have its own role as a function of services demanded. Most of services used to day seem sufficient to meet demand, nevertheless market is evolving and new services are requested. The use of copper wire might offer services such as videoconference and television on IP. But the problem created by this evolution will raise

the difficulty of being able of providing band when a connection is accessed simultaneously by several uses.
The copper wire will allow speed like 20 or 30 Mb/sec but because of multiple users optical fibre would be introduced to assure TV high definition, video-surveillance, professional training, education. A possible choice, in the attempt to reduce costs, may be that of using many existing supports (gas, water, electricity).

4. Expansion of ICT over time

The decline in the number of fixed telephone lines, which began in 2000, involved the majority of industrialised countries; the trend was largely compensated by the growth of mobile service which is the natural substitute of fixed telephone. As well, either Internet access and broadband demand had a significant expansion which contributed to change the communication scenario. With reference to the main commodities included in ICT the following considerations can be expressed.

During the period 2000-2004 **fixed telephone lines,** over the world, had an annual increase of 3,95% **(Annex 1.1 – Source ITU)**. The details available show that this is a combination of a decrease (-1,50%) of fixed telephone lines in developed countries and of a corresponding increase (+9,82%) of fixed telephone lines in developing countries; the two trends partially compensated so far. At the year 2008, estimate world density moves up to 20,11% (annual increase of 4,09%) and represents the weighted average between the density of 43,46% in developed countries and the density of 17,79% in developing countries.

In the same period (2000-2004) , still on a world basis, **mobile telephone lines** reached a density of 27,4% (**Annex 1.2 – Source ITU**). Developing countries, starting from a density of 5,40% reached, in 2004, a density of 18,80% (36,60% increase per year); developed countries, moving from a density of 49,60%, arrived to a density of 76,80% (11,55% increase per year). At the year 2008 world density is expected to reach 49,89%: it is the weighted average of a density of 120,41% in developed countries and of 37,71% in developing countries.

Access to **Internet** had, as well, a rapid expansion (**Annex 1.3 – Source ITU**) over time: the world relevant density was 13,80% at the year 2004 (20,71% annual increase from 2000). In particular, developed countries moved from a density of 30,70% in 2000 to a density of 53,80% in 2004 (15,06% increase per year), while developing countries, starting from a density of 2,10% in 2000, grew up to a density of 6,70% (33,65% increase per year). At the year 2008 number of users, on a world basis, are expected to be 24,81 per 100 population: it is the weighted average between the density in developed countries (84,65%) and the density in developing countries (14,38%).

Asia/Pacific Region was, during 2002-2005, leading **broadband access** market, accounting for about 42% of total subscribers world wide (**See table below**) and is expected (2009) to maintain its leadership even if, recently, Western Europe and North America went ahead.

Region of World	2002	2003	2004	2005	2009
Western Europe	13	24	39	56	107
North America	22	31	42	54	92
Asia/Pacific	27	44	66	90	204
Rest of the world	2	5	8	12	40
Total	**64**	**104**	**155**	**212**	**443**

Source: IDATE Foundation

Users concentrated in populated Capitals or Great Cities can easily enjoy high rate of digitisation: the coverage (and the use) may reach level of 90%. Full coverage of a country depends on a number of constraints (especially evident in developing countries) such as: territory to serve, density of potential users, delays into the expansion of the network (lack of investment), insufficient knowledge of potential benefit provided by new services, economic structure still to grow up and, above all, the predictable return.

Once again this aim looks like the engagement to provide the "universal service" which was felt as an obligation at the time when only fixed telephone service was existing. Whether there is strong willing to go ahead, the process will take time to implement.

Market situation is continuously changing. Mobile telephone is significantly growing so as to produce a relative stagnation of fixed telephone. Such decline is "compensated" by the increasing number of commodities and services (electronics, computer equipment). Market demand is moving restless from one facility to the others often creating niches or small groups asking for specific services.

Providers operating in the market found interesting enter into alliances to reduce competition both at the infrastructure level and for mobile handset production. Such agreements range from the simple purchase of non-exclusive content for programme distribution to far more ambitious strategies of exclusive rights of acquisitions. Alliances are also being formed between complementary operators seeking to offer complete quadruple play bundles (TV, Internet access, fixed and mobile telephony) to their customers.

5. ICT as a function of national economic situation

As a general approach the ICT contribution to total GDP, on a world basis, has been of about 7,5% per year during 2003-2006 as it is shown in the following table:

commodity	2003	2004	2005	2006
Telecom equipment	0,50%	0,60%	0,60%	0,60%
Telecom services	3,00%	2,90%	2,90%	2,90%
IT equipment	0,90%	0,90%	0,80%	0,90%

IT services & software	1,90%	1,70%	1,70%	1,80%
TV service	0,70%	0,70%	0,70%	0,70%
Consumers electronic	0,60%	0,70%	0,70%	0,70%
Total	**7,60%**	**7,50%**	**7,40%**	**7,60%**

Source: IDATE Foundation

The traditional approach used to estimate the inter-dependence between telephone penetration and national economic situation was to relate two of the most significant indicators: telephone density and Gross National Product per capita.
The introduction of ICT commodities completely changed the old scenario and created new behaviour. Still national economic situation is involved but the old model works only in the case of fixed and mobile telephone commodities.

The main relevant data to which the present paper makes reference are those, widely used, released officially from the World Bank and other international agencies. Data available (2000-2004-part of 2005), separate by Region, are: Population, GDP produced (Sectors of Agriculture, Industry, Services), penetration of fixed and mobile telephones, internet users.
Even with little number of data, the approach used was to check, by evaluating the correlation between variables, the following working hypothesis:

- the economic size of agriculture sector affects the expansion of ICT services
- the expansion of ICT services is linked with national economic activity

Results are given in **Annex 1.4**. The correlation between (fixed and mobile) telephone density (dependent variable) and the contribution (in %) of Agriculture to Gross Domestic Product (independent variable) shows a confidence of 88,62%. The shape of correlation function seems to confirm the hypothesis that the lower is the contribution of Agriculture to total GDP, the higher is the (fixed and mobile) telephone density which concentrates into Industrial and Service Sectors. Further, (fixed and mobile) telephone density may be associated to the GDP/ capita with a confidence of 85,89%; the greater is the GDP per capita the greater is the (fixed and mobile) telephone density.

The density of Internet commodity, as dependent variable, was studied, in **Annex 1.5**, either as a function of Agriculture contribution to GDP (independent variable) and as a function of GDP/capita (independent variable). In this case, Internet density shows poor correlation with Agriculture contribution to GDP (70%) and with the GDP/capita (72,57%). The shape of functions seems verify the above hypothesis: Internet access is decreasing as Agriculture contribution to GDP increases and increase as GDP/capita increases. But the conclusion is not supported by a significant test: it can be accepted only as a qualitative evidence.

6. The ICT Opportunity Indexes

The use of Information and Communication Technology products drove, at international level, to the definition of the new scenario as "information economy". To provide a measure of the "information economy" the International Telecommunication Union (ITU), into partnership with a number of international partners **([1]),** has published the ICT "Opportunity Index" whose conceptual framework introduces the notion of a country's "info-density" and "info-use". Info-density refers to a part of a country's overall capital and labour stocks indicative of productive capacity; info-use refers to the consumption flows of ICT at any level. Interesting is he fact that it is possible to aggregate the two and arrive to a degree of a country's "info-state". The "Digital Divide" is then defined as the relative difference in the level of information economy among countries.
Digital Opportunity means:

- the whole population have easy access to ICT at affordable prices.
- All homes are equipped with ICT devices
- All citizens have mobile ICT devices
- Everyone is using broadband

The methodology used links index to national and regional policies, regulatory changes and economic context in a way that they highlight relative economy of countries and show which countries are making progress and how fast. Statistical information further helps governments identify targets and adopt relevant strategies accordingly. Index is used, as well, in everyday life to track changes in familiar variables (prices, wages, pensions, stock market and complex concepts inflation of a basket goods, cost of living, human development, quality of life).
A number of reference data have:

- to achieve a common set of core ICT indicators to be agreed upon internationally
- to enhance the capacities of national statistical offices in developing countries
- to develop a global database on ICT indicators and to make it available on Internet

Relevant significant activities occurred so far to study the problem are:

- A firs set of core ICT indicators, comparable at the international level, was adopted at the WSIS Thematic Meeting in Geneva (7-9 February 2005). A detailed methodological report on the core indicators was published at WSIS in Tunis (15 November 2005).
- A global stocktaking was carried out to collect information from all countries regarding their statistical measurement of ICT.A comprehensive report highlighting relevant results was released at WSIS in Tunis.
- Regional workshops have occurred in Addis Ababa, Beirut, Gaborone and Santiago de Chile in order to prepare for capacity building in developing countries.

[1] OECD, UNCTAD, UNESCO institute for Statistics, UN Regional Commissions, the UN ICT Task Force, the World Bank, the World Summit on the Information Society WSIS.

7. ICT empowerment Network ([2])

At the ITU Telecom World Opening Ceremony (3.12.2006), the International Telecommunication Union and the Grameen Bank got an agreement for a collective global effort to combine the power of ICTs with micro-credit financing to help the poor to earn sustainable incomes. The ICT empowerment project consists of numerous independent self-financed groups of partners that collaborate either in physical centres or virtually.

The objective is to implement devices, connectivity and access solutions at low cost. It has the aim of expanding the existing GSM networks into some of the poorest, most remote, rural areas using very low cost VHF radio. That will support "low-band" data services such as SMS and e-mail and short range voice capability to non-served villages: local users would be enabled to access micro-finance programmes for small business purposes. This will speed roll-out world wide, ensure interoperability and allow companies to explore demand in new markets without great expenses or risk.

A minimum of economic activity will be supported in the selected areas. ITU, Grameen and other partners will launch their own ICT-related businesses such as computer repair shops, internet or mobile phone service providers, community tele-centres etc. as to lead and sustain successful local ICT business.

The empowerment Network reflects the successful concept of Village Phone and represents. the extension of the Village Phone model in Indonesia, whose program was to create micro-entrepreneur operating telecommunications businesses serving rural communities with access to wireless voice telephony and data services. The core concept is simple: a local small business person purchases a cellular phone and service plan with a micro-loan and then retails the "minutes" to friends and neighbours. The programme is shaped on a model that has proved successful in Bangladesh, in Uganda and, most recently, in Rwanda.

8. Overall benefits

Firms that have been focusing for several years on cost-cutting and short term profitability, have been investing in ICT. Great part of projects implemented are aimed at reducing telephone expenses by pooling traffic on broadband networks, concentrating phone traffic onto several major sites and by eliminating a portion of telephone accesses.

Firms with a large proportion of mobile employees, and whose business is structured around large-scale projects (aeronautics, automobile, engineering, etc) or based on call centres, invested in VoIP projects to increase both services for employees and their productivity level.

In 2005 employee's mobile telephone equipment was comparable to that of previous year, but laptop PC equipment levels rose substantially. Remote access to e-mail and the company intranet also grew significantly, and the majority of contracts signed by business were for this type of service.

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[2] http://www.itu.int/prtners/telecom2006/empowerment.html

Lack of IT security continues to be a primary area of concern for business. A number of risks are involved here: lack of network availability, interrupted access to e-mail, intrusion, viruses, worms etc. Firms are giving greater attention to access control (firewall, intrusion detection, anti-spying, implementation of application servers…) supervising users behaviour and often modifying their IT department's organisation. The prime beneficiaries of these expenditures are Firms which offer managed security services. Seeking to optimise their production processes, businesses are making increasing use of specialised software that help them to manage internal (products, personnel, finance) and external (suppliers, clients) resources.

9. Conclusions

The exercises produced in this paper show that the relationship between ICT and national economic situation may give significant information as to orient choices and strategies about the expansion of new commodities and about the advantages they can take to social and economic activities. The paper represents a starting point from which it is worth to develop additional analysis to understand the best way to expand digital communication.