Telecommunications and Internet in the Future Society: Myths and Realities.

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Abstract

The Internet boom has lead to the image of a Global Village, a totally communicated planet where national borders have no meaning and where Internet and the Information Highway have become the path to solve any problem. Technological and scientific research has been conducted in order to exchange information through the telephone lines, which provide a solid platform for the new services related to Internet such as e-mail, electronic commerce and internet telephony.

Non-technical issues should be taken into account to notice that not all the people on earth are aware of the Internet and the new technological society. Many persons are not educated for those new technologies that are out of their reach. Indeed, even if they should be able to access a specific communications network, the new services would not be affordable for them economically and/or intellectually. This article presents indicators that magnify the problem: the gap between the rich and the poor, the educated and non-educated, the Internet literate and illiterate. Reflections on several important issues are presented, and ultimately, the Global Village is questioned as a reality or just a new myth.

1. Introduction: Historical Perspective

In the past decades, telecommunications and other related technologies have had a strong impact on the world's society. Cellular telephones, facsimile transmission and videoconferences are common now while some years ago they would have seemed as part of a science-fiction film. These new systems and services have been made possible due to important inventions and development of new technologies. A revision of history of science and technology, from an engineer's point of view, would surely identify several major milestones that made the new services feasible. The computers and the transistor of the early forties are certainly decisive for modern computing, as the first artificial satellites and the plain old telephone networks of the past are very important for modern telecommunications. There are many other inventions in very diverse fields like material science, crucial for fiber optics and satellite components, abstract mathematics like graph theory, now related with communication networks, or electromagnetic theory, the basis of radio communications. Any attempt of making a complete list would imply the risk of missing some scientific and technological advances that apparently have no relationship with communications or information technology but that turned out to be crucial for them to reach their current status. Thus, the list will be restricted to just two elements: the telephone and the Internet and their impact and importance for the human society.

The telephone has been considered as one of the most important inventions of mankind (see, for example [1,2]). The possibility of being able to communicate with a person a considerable distance away was a mere curiosity in the past century. In 1876, Western Union considered that "This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us."[3]. Nevertheless, the "curiosity" soon turned into an indispensable tool for everyday life. Through 100 years of history, the main service provided by the telephone (basic two directional voice communication) has remained unchanged, and still satisfies the users.

A recent and important milestone is the Internet boom. The Internet, as a communications network, has had a different evolution from the traditional Public Switched Telephone Network (PSTN) [4], however both intend to communicate two human beings in distant geographical places through the use of certain devices: telephones or computer terminals. Indeed, the transmission facilities of the Internet have much relied on the PSTN through the use of leased or switched lines.

New applications and services like electronic shopping through the *Information Highway* have begot a picture of the future society that would not have been imagined even by the most futuristic writers. The *Global*

Village and *Universal Access* are terms that try to define the new vision of the world; a totally communicated planet, where every individual has the possibility of establishing a communication link to virtually any place on earth.

The implicit value of the Internet is the potential opportunity to exchange information and knowledge on a fast, secure and ubiquitous manner. This exchange has been seen as the lifeblood of flourishing information economy and part of the global information society [5]. Different perspectives can be adopted on what is meant by “global”. For some, it refers to a new society beyond borders of countries and continents, for others the term global implies the possibility of being communicated in every spot of the globe. The access to communication has even been recognized as a “basic human right” [6] for every person on earth.

In spite of the good will of these ideas, there are many issues of great importance that must be considered before using terms like *Global* or *Universal*. Internet in many cases is still accessed through traditional telephone lines, so many people would require a telephone in order to participate as an active member of the global society. However, according to Sir Donald Maitland [7], by 1984 more than half of the world population lived in countries where teledensity was below one. Cambodia for example, has a teledensity of 0.07 [8], which means seven telephone lines for every ten thousand inhabitants. It is absurd to include the remaining 9,993 persons as part of that "global" society when a considerable percentage of them ***could have never made a single telephone call*** in their entire life, much less heard of or used the Internet.

The aim of this document is not to propose an answer, but instead to analyze present realities and rise important questions to be considered.

2. The present: state of telecommunications and internet

An objective analysis of the state of telecommunications and Internet should include several elements such as present infrastructure, technological possibilities, future development and applications, economic, legal and regulatory issues, and the social impact on the population. In this article, several indicators and basic statistics will be presented, accepting the implicit risk that presenting statistics involve. One must bear in mind that a given indicator can reflect only a situation on a limited basis.

The telecommunications' infrastructure plays a key role in the services that can be provided by a country to its inhabitants. This infrastructure is composed of different elements that comprise among others, the Public Switched Telephone Networks (PSTN), both, for local and long distance services, Cellular Networks, Cable Television Networks, Wireless Broadcasting Systems, Radio locating and Paging Systems and Private Networks. As these national and international networks become interconnected, the possibility of communicating with another person increases and the intrinsic value of the infrastructure rise.

A common measure of the development of the communications infrastructure is teledensity or the number of main telephone lines per 100 inhabitants. Table 1 [8] groups a number of countries according to their teledensity.

Table 1. International teledensity distribution

Teledensity	Countries	Percent
0-1	43	19.5%
1-5	37	16.8%
5-10	29	13.2%
10-20	28	12.7%
20-30	22	10.0%
30-40	17	7.7%
40-50	19	8.6%
50-100	25	11.4%
	220	100%

The distribution of telephone lines among countries and populations in clearly non-homogeneous. This phenomenon is present also among regions inside countries. Rural areas have normally less attention in the development of telecommunications. Table 2 compares the penetration of lines in some states of Mexico.

Table 2. Mexican teledensity distribution

State	Teledensity	
	1990	1995
Federal District	21.93	23.42
Nuevo Leon	11.99	14.81
Jalisco	8.06	10.62
Chiapas	1.67	2.22
Oaxaca	1.65	2.39
National average	6.59	8.36

Source: Banamex-Accival [9]

In 1990 "Teléfonos de México", the National Telephone Company, was privatized and since then, major changes occurred in order to be prepared to foreign investment and competition both in local and long distance services. As mentioned in [8], the privatization enhanced the access and the national teledensity has risen above 9 in seven years.

A balanced image of the development of a country considers not only teledensity, but also the Gross Domestic Product (GDP), Gross National Product (GNP), or per capita income. This measurement includes the nation's production and not only the telecommunications factors. Figure 1 compares 174 countries in terms of their GDP per capita and teledensity [10]. The well-known trend of the figure is a direct relationship between GDP per capita and teledensity.

Figure 2 presents a similar comparison of GDP per capita against the Internet density of the same 174 countries. The Internet density is measured with the number of Internet hosts connections per every million persons [10]. In this figure, there is not a linear trend similar to the one in the previous figure. The Internet density remains below a very low level for the countries with a GDP per capita lower than a certain threshold. Above this threshold, which is close to US$13,000 p.a., the number of Internet hosts grows considerably but not with a particular trend.

The absence of a linear trend in figure 2 represents the much lesser importance that internet represents as a basic service for most of the countries.

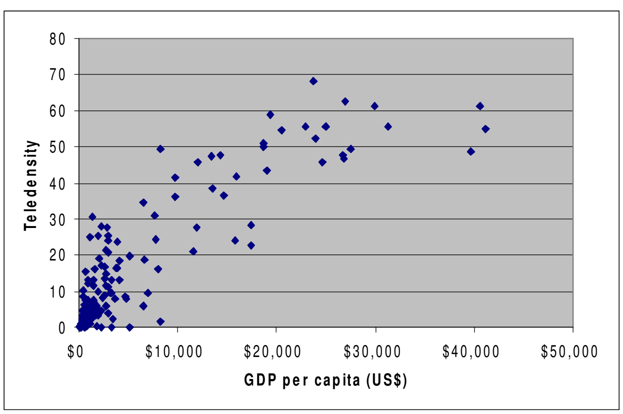

Figure 1. GDP per capita vs. teledensity

GDP or GNP per capita has been criticized as an indicator of the standard of living [11], but economists still consider it as the key indicator of the improvement and correct development of a country. Two important reflections should be observed towards the use of GDP as the measurement of development for a country. First, GDP implies, on the long run, the depletion of many of the earth natural resources. In countries like Mexico where oil is a major player in the GDP, an increase of the barrel production implies that the national reserves will be depleted earlier.

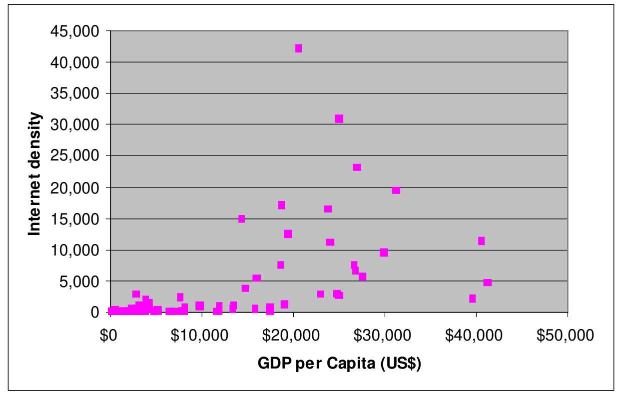

Figure 2. GDP per capita vs. internet density

Second, not all the activities that increase GDP reflect a benefit for mankind. In a country where the society favors the use of the bicycle as transport, like the Netherlands, the GDP related to transportation would be much lower than that of a country where every person requires an automobile (or public transportation). The consumption of gasoline as part of the GDP does not imply a direct benefit for its user.

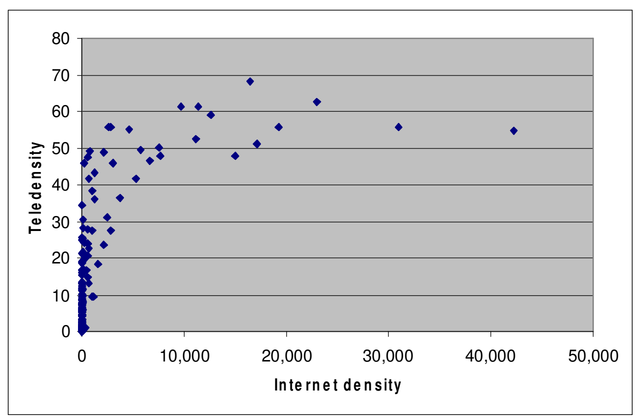

Figure 3. Telephone vs. internet density

Figure 3 relates the telephone and Internet density in several countries regardless of the GDP per capita. The trends in the graph clearly show that internet development without teledensity is hard to find for two reasons: *Internet is not a basic service as telephone is*, and *Internet relies on the established telephone network*. The opposite, a high teledensity without a high Internet penetration, is the actual situation of many countries.

Table 3. Statistical comparison of 45 countries

Country	GDP per capita[1]	Tele density[1]	Internet density[1]	MHDI Rank[2]
Canada	$19,380	59.0	12,595	1
Netherlands	$24,000	52.5	11,110	2
Iceland	$24,950	55.6	31,007	3
Japan	$39,640	48.8	2,151	4
Spain	$13,580	38.5	1,018	5
Sweden	$23,750	68.1	16,405	6
Norway	$31,250	55.8	19,289	7
France	$24,990	55.8	2,604	8
Australia	$18,720	51.0	17,146	9
Switzerland	$40,630	61.3	11,383	10
United States	$26,980	62.6	23,012	11
Finland	$20,580	54.7	42,229	14
Germany	$27,510	49.4	5,794	15
United Kingdom	$18,700	50.2	7,513	16
Luxembourg	$41,210	36.1	4,608	26
Mexico	$ 3,320	9.6	973	45
Turkey	$ 2,780	21.5	85	70
Lithuania	$1,900	25.4	123	72
Jamaica	$1,510	11.6	65	82
Paraguay	$1,690	3.4	0	84
Botswana	$3,020	4.1	0	86
Sri Lanka	$700	1.1	0.3	88
Romania	$1,480	13.1	77	90
China	$620	3.4	1.8	106
Egypt	$790	4.6	10	112
Guatemala	$1,340	2.7	2.5	113
Bolivia	$800	4.7	8.9	114
Morocco	$1,110	4.3	8.6	121
Kenya	$280	0.9	0.6	129
India	$340	1.3	0.9	132
Haiti	$ 250	0.84	0	145
Sudan	$ 800	0.27	0	146
Rwanda	$ 180	0.25	0	152
Bhutan	$ 295	0.63	0	157
Chad	$ 180	0.08	0	161
Burundi	$ 984	0.27	0	163
Mozambique	$80	0.34	0	166
Ethiopia	$100	0.25	0.02	167
Guinea	$550	0.16	0.3	168
Somalia	$500	0.17	0	169
Mali	$250	0.17	0	170
Afghanistan	$ 600	0.14	1	171
Burkina Faso	$230	0.29	0	172
Sierra Leone	$180	0.37	0	173
Niger	$ 220	0.15	0	174

Source: Britannica World Data[1] [10] and Noorbakhsh[2] [11]

The three indicators that have been presented so far; GDP, teledensity and internet density, can be useful to observe a country's industrial development, but they do not reflect the standard of living of its inhabitants.

The United Nations Organization has developed an indicator to measure the standard of living in a country and it includes several factors besides the GDP. This Human Development Index (HDI) [12] considers longevity, education levels, and access to resources in a balanced way.

A modification of this index (MHDI) is presented by Noorbakhsh [11]. He used the results of the 1995 *Human Development Report* for 174 countries to test the index. The data of a sample of countries with very different results in the MHDI was selected and compared with other indicators, namely, GDP per capita, teledensity and Internet density [10]. The information is summarized in table 3.

The table has been grouped in three sections, high, low and medium, according to the MHDI rankings. The average results of the groups are summarized in table 4.

Table 4. Statistical comparison of groups

Group	GDP per capita	Tele density	Internet density
High	$26,391	53.3	13,858
Medium	$1,445	7.4	90
Low	$360	0.3	0.02

The first group includes countries with very high and high level of human development. This comprises the leaders in GDP per capita, teledensity and Internet density, which are Luxembourg, Sweden and Finland respectively. Canada, the Netherlands and Iceland hold the gold, silver and bronze positions in standard of living while their income and some of their densities are even below the average of their group. The United States, who vastly dominates the share of total Internet hosts and telephone lines, falls behind ten other countries in standard of living.

The second group includes countries from high-medium to low human development. It is interesting to compare the average numbers of the first and second groups. GDP per capita of the first group is more than 18 times higher than the second is, while Teledensity is almost 8 times higher. Internet density is more than 153 times higher in the first group. An increase in GDP or Teledensity can represent a much higher increase of Internet density.

On the other hand, the last positions of the MHDI classification are held by several African, Asian and

American countries. The results are alarming, all these countries with poor to extremely poor human development hardly have a dozen Internet hosts, and teledensities below 1% and their annual per capita income is less than 1,000 US dollars.

The figures of table 4 reflect a serious non-homogeneous situation of the world. This uneven distribution poses two different lines of actions for engineers and government agents as problem solvers. First, the responsible persons should consider the provision of basic services, rural telephone, for instance, to all the people that have no access to them. These solutions comprise countries or regions with low teledensity in which a telephone line for every community could be a reasonable goal.

Second, once that basic access has been provided, supplementary services can be part of the development plan. For example, digital cellular telephones are able to receive written messages in the way that pagers do. It is useful to have one and not two communication devices and cover the same services, but if this would not exist, there would not be any human life in danger. These new gadgets are useful and even “cool”, but the people of a country with low teledensity would rather have a telephone line at walking distance.

3. The future: myths of technology or possible reality?

When someone falls into temptation to predict the future or simply interpret the present reality is in risk of foreseeing some unachievable goal, accepting as truth something that eventually will prove to be mistaken, or give a false explanation and conform a *myth*. Some technological myths arose at the beginning of the computer age when those devices were so sophisticated that no one could imagine small personal computers. Thomas Watson, chairman of IBM in 1943 stated that "I think there is a world market for maybe five computers". Still thirty years later, Kenneth Olsen, president, chairman and founder of Digital Equipment Corp. thought "There is no reason for any individuals to have a computer in their home" [3]. Another myth regarding economies was to consider that telecommunications was a natural monopoly, that should be run by the government in order to achieve a maximum social benefit.

A solid forecast of the future must require an objective analysis of the present. If the prediction is concerned with the immediate future, it can be relatively easy to be successful, but as the prediction goes farther in time, the risk of failing increases considerably. Some present realities that we should consider are:

- Not all human beings have a balanced nutrition and are able to eat three meals per day.
- A considerable share of the population does not have a place to dwell and their main concern is to survive.
- Many persons have no access to basic health, education or communication services.
- Globally, information and telecommunication sector is expanding faster than the growth rate of world's economy, except in the "poor" countries with obsolete infrastructure.
- Telecommunications and technology present a potential global access, but most persons are not able to afford the services.
- The share of poor people is increasing while the share of rich people is decreasing.
- The "rich" are concentrating more and more of the world's wealth.

The last two issues deserve some reflection. According to the United Nations [13], the population in developed countries will tend to decrease in the next fifty years while the population in developing countries will double (Table 5).

Table 5. Population projections

Population	1998 (Millions)	2050 (Millions)
Developed Countries	1,180	1,160
Developing Countries	4,750	8,200

This uneven growth will increase the gap between countries and poverty will increase if the basic services, employment and production of each country fall short of the population increase. Regarding income and wealth, the trend has shown that poor people are earning less than rich people are. Figure 4 presents a comparative study of the income of deciles of Mexican population. The comparison is calculated by:

$$\frac{\textit{Income of the decile with highest earnings}}{\textit{Income of the decile with lowest earnings}}$$

The decile represents 10% of the total population of the country [14].

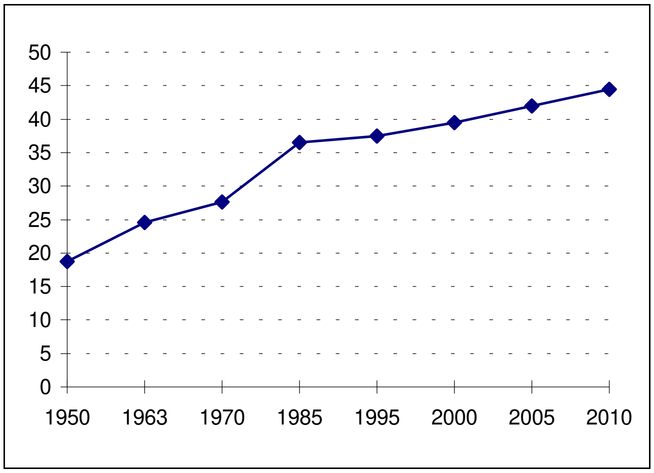

Figure 4. Income distribution of Mexican population

Despite all the differences between countries the industry will continue its development. New services such as *Tele - Medicine, Education, Commuting Shopping, Travel*, will become "global" in the sense that national borders will not influence them, but remain attending only to the richest sector of the population. Already Internet is becoming global, as the domains tend to lose the national codes. The survey of the OECD regarding Internet domains [15] show that more than half of the total domains of the OECD countries are assigned to "country-neutral" top level domains. The most common domains are *.com* for companies, *.org* for organizations, *.net* for networks and *.int* for international for example: *www.itu.int*, or *www.un.org*, the web sites of the International Telecommunications Union and the United Nations respectively.

Table 6. Country neutral domain names distribution

Domain	Total Domains	Percent
COM	34,382,090	53%
ORG	5,099,979	
NET	5,056,226	
Other	39,987,081	47%
Total OECD	84,525,376	100%

Table 6 shows the proportion of three of these domains against the rest in OECD countries.

Facing the risk of being judged in the future, and being wrong, we now present some forecasts.

1. The combination of Information Technologies, Internet and Telecommunications will become one of the world's strongest economies.
2. The gap between rich and poor will be wider unless radical actions are implemented.
3. The "communicated" world will lose its borders and will appear as the Global Village but only to a reduced sector of the population. A real Global Village is not within reach in the foreseeable future.
4. Internet is not the solution to all problems.
5. Telecommunication services will be very different from the present ones.

4. Conclusions: Major concerns

The statement on Universal Access [5] adopts the quest, from the point of view of developed countries, of assisting developing countries in order to reduce the gap that exists nowadays. They are aware of practical hurdles on the way, and unless those hurdles are tackled, the quest will remain only as wishful thinking, and not as a real goal. The following questions should be answered before any other: Who will provide the assistance for the poor countries? How will they provide this assistance? Maybe more important is to think *why* they will assist developing countries? It is imperative to stimulate the economic incentives to develop the economies of both assisted and assisting countries.

Two co-existing scenarios must be refined, one in which the basic communication needs are satisfied solving real problems, and another that will concentrate on developing supplementary goods for developing and developed countries respectively. The first scenario can take basic telephony at affordable prices for the majority of the population as a goal. For the second scenario, more complicated goals can be foreseen: fast and wide band access, Internet telephony, videoconference, tele-jobs through Internet, multimedia communications through a wide band local loop, mobile wide band communications, and mobile Internet are just some examples. These new services must be regulated and economically refined to implicitly assist the first scenario goals. Proper subsidies or funds as proposed in [8] can be considered. Deregulation and privatizing can help the economic development in some countries.

The possibilities are numerous, and remain as a need if we would like to decrease the gap between countries. If we do not take strong actions the world will be divided in two mutually exclusive groups; those who have access to communications, information technologies and Internet, and those who do not; the *information poor* and *information rich*.

5. References

[1] BROOKS, J., *Telephone, The First Hundred Years*, Harper & Row, New York, 1976.

[2] R.L. CONLY, "New Miracles of the Telephone Age", *National Geographic Magazine,* National Geographic Society, Washington D.C., July 1954, pp. 87-120.

[3] The Past Imperfect, *Time*, Time Inc., New York, July 15, 1996, pp. 44.

[4] Internet Traffic Exchange: Developments and Policy DSTI/ICCP/TISP(98)1/FINAL, OECD, pp. 6.

[5] ACC Statement on Universal Access to Basic Communication and Information Services, http://www.itu.int/acc/rtc/acc-rep.htm.

[6] “The Right to Communication: A New Declaration is Born”. *ITU News,* ITU, No. 6/97 1997.

[7] D. MAITLAND, "The Missing Link", Independent Commission for Worldwide Telecommunications Development Report, December 1984.

[8] World Telecommunication Development Report 1998, Universal Access, Executive Summary, ITU, March 1998, pp.3-5,13.

[9] México Social, 1996-1998 Estadísticas Seleccionadas, División de Estudios Económicos y Sociales, Grupo Financiero Banamex-AccivaI, pp.81, pp.154.

[10] Britannica World Data, Yearbook 1998, *Encyclopaedia Britannica*. Encyclopaedia Britannica Inc. Chicago, 1998, pp.784-789, 832-837.

[11] F. NOORBAKHSH, "A Modified Human Development Index", *World Development*, Elsevier Science Ltd. Vol., 26, No. 3, Great Britain 1998, pp. 517-528.

[12] United Nations Development Programme, Human Development Report, Oxford University Press, New York, 1990.

[13] UN Medium Population Projection Cited on *National Geographic Magazine,* National Geographic Society, Washington D.C., October 1998, pp. 42-43.

[14] KULHMANN, F., ALONSO, A., MATEOS, A., *Comunicaciones: Pasado y Futuros*, Fondo de Cultura Económica, SCT México 1989.

[15] Internet Infrastructure Indicators DSTI/ICCP/TISP(98)7/FINAL, OECD, 28 Oct. 1998, pp. 45,54.