

## **ICT infrastructures as a new challenge for the urban planning profession**

In an article written in 1991, Manuel Castells (1992) asked urban planners “*The world has changed: can planning change?*” Indeed, most of the processes political-economy that are affecting our present world were already in motion during the early 1990s. However, if before 1992 technological changes were basically occurring in the work sphere, dramatic advances in the field of telecommunications after that period have made computers and electronic devices widely present at both home and work spheres.

Indeed, the use of Internet -- introduced to the public after 1994 -- and related digital technologies have affected almost every important sphere of urban life in modern societies. Information and communication technologies (ICTs) have become pervasive in developed countries and increasingly present in cities of developing world, while each year thousands of new digital devices and applications are brought into the market and into the hands of millions of people. Digital technologies have changed the way we inform, entertain and educate ourselves, as well as our ways of working, carrying out research, doing business, and keeping in contact with each other.

Describing the main transformations in the previously mentioned article, Castells (1992) mentioned *political* changes (the end of centrally planned economies and the rise of neo-liberal policies), *economic* changes (the emergence of a new global economy and the shift from mass production to flexible specialisation), *technological* changes (the central role of information technologies), *cultural and social* change (the rise of feminist culture and the environment movement) and *spatial* changes (the emergence of the space of flows). If these transformations were already enough to declare a ‘new world’ in 1991, the continuous technological advances (in ICTs and bio-technology), unforeseen political changes (the war on international terrorism), deeper socio-cultural transformations (the polarization and fragmentation within and between societies), have further complicated city development and urban life since then. The tasks and roles of urban and spatial planners have expanded and become more complex.

It is clear that the city of the 21<sup>st</sup> century is no longer the city of the industrial era. Different spatial and temporal organizational principles, communication cultures, modes of economic organization and ways of life coexist in the current city. For urban and spatial planners the ICT-related changes pose huge challenges, in the first place because the spatial reach of daily home and work activities and contacts has expanded from the local to the global scale. The consequences of this new spatial reach in the way of organization of the economy, business activities and everyday life have been enormous.

On the other hand, the digital technologies that are the material support of the ‘wired new world’ are very dependent on conventional telecommunication infrastructures. These urban networks, deployed within and between cities, are still an understudied field. With very few exceptions the ICT infrastructures have been growing with little or no supervision or even awareness from local authorities. The lack of public authority and responsibility in the telecommunications sector and the discomfort of urban planners and local authorities regarding the technicalities of ICT infrastructures have played a role in the present disregard.

In their seminal work "*Telecommunications and the city*", Graham and Marvin (1996) denounced the neglect to telecommunications issues in urban studies and planning, relating it to the invisibility and intangibility of ICT infrastructures, the conceptual challenge regarding the increasing space-time complexity that digital technologies bring, and the conservatism of the urban and regional planning disciplines, still focused on the industrial city concepts and models. More recently, Priemus (2004) has claimed that the lack of government involvement in the deployment of ICT infrastructural networks, and the little awareness of the spatial implications of these networks explain why government authorities and planners show so little interest in the topic.

ICT infrastructures are a difficult subject to deal with by planners. The wireless and invisible character of most of them makes people unaware of their territoriality. However, to be digitally connected is today as important as to have adequate transportation means. If traffic networks have traditionally deserved great deal of attention in planning circles, why this is not happening with telecommunication networks?

The purpose of this paper is to illustrate the challenges that the recent infrastructural developments in telecommunications represent for the urban planning profession. To do this, the first section describes the context of the telecommunications sector, which is currently in charge of deploying and operating the digital infrastructures. The second section is focused on the main technical features of the global Internet infrastructure, while the third tackles the current global Internet geography. The last section points out some new issues and challenges for urban professionals.

## **1. Main transformations in the telecommunications sector**

The telecommunications sector has undergone huge transformations, turning from an industry in itself, to become a vital enabler of all other industrial sectors. Considering economic aspects, the telecommunications sector is now both the core (major economic activities are mostly information processing and transmitting or depend critically on it) and the infrastructure of the new information economy (World Bank, 2000). The main transformations of the sector refer to its technical (the networks have turned from local and analogue to global and digital networks) and political aspects (from a public and regulated utility into a private and highly competitive business run by large corporations, mostly of global scale).

### *a) Technical changes*

Enormous technical advances have led to the convergence of informatics and telecommunications (digitisation). Digital text, images and sounds can now be easily produced, reproduced and exchanged at global level. This has demanded the expansion and adaptation of the existing telecommunication infrastructures to the new technical requirements. Powerful optic-fibre backbones have been deployed between continents while the traditional telephone networks have been transformed into digital networks with a global reach. The expansion, computerization and modernization of the networks has demanded high investments, and at the same time it has made the telecommunications business much more complex and diversified than before, multiplying greatly the number of services provided to final customers.

Before digitisation, most long-distance calls were delivered over wireless lines -- by satellite -- but started and finished in landlines. With the completion of the powerful intercontinental fibre-optics submarine cables that surround the globe, the very logic of the infrastructure system has

radically changed: “Radio is now being increasingly used to provide access networks, while wired networks provide the long-distance component” (ITU, 2002a: 4).

New technical advances may bring new drastic changes in the sector. There is still no clarity or consensus among experts about an eventual complete convergence of voice and data transmission with digital TV, or the specialization of voice and data networks, or the consequences of the introduction of WiFi, WiMax (WiFi for up to 50 km reach) or other new technologies. It is very difficult to predict the behaviour of consumers, a situation that brings many uncertainties to the sector, which has to invest in advance. For example, despite the great enthusiasm of large firms towards the full convergence between Internet and mobile telephony, the users have been very cautious and have not fulfilled the investors’ expectations. On the other hand, users have embraced technologies as text messaging, which were not considered interesting by the experts.

#### *b) Political changes*

The legal status and entrepreneurial logic of telecommunication firms have rapidly changed with the world-wide introduction of market principles in the telecommunications sector. In the new model, few large US American and European firms now dominate the telecommunication scene of entire regions of the world, expanding their worldwide networks according to their corporate strategies. Cities and locations are not any more the central object of local telecommunication policies, but merely a point in the map of the world. As such, cities can become nodes of the network or they can be by-passed according to the firms’ objectives, evidently linked to the firms’ profitability.

The introduction of the commercial Internet triggered massive investments and huge expansions among telecommunication firms. There was the notion that only large companies would survive in the new global context, which led to mergers and strategic alliances to gain a global foothold in all markets. To finance this explosive expansion the telecommunications sector used money from the world stock markets and easily-granted bank loans.

The collapse of the stock market in the early 2001, as well as the huge miscalculations, moves and risks taken by the telecommunications companies in their expansion fever to become the largest, have heavily affected the telecommunications sector and led some large firms into bankruptcy. An example is the bankruptcy of WorldCom -- whose assets previous to its liquidation was of 103.9 billion -- which has been the biggest ever in the history (Standage, 2003).

The international bandwidth market was caught in a deflationary spiral that has caused huge price reductions of international bandwidth. At present, there still exists a huge over-capacity in the telecommunications networks, which has made long-distance traffic prices drop greatly. Only 14% of the trans-oceanic submarine cables was in use in 2003 (Telegeography, 2003), the rest is still dark fibre (which is still not lit up to let the digital packets travel). The financial problems have gradually increased the instability of the sector and finally produced the crisis in which it is currently immersed. The confidence which investors had in the telecommunications business decreased greatly. However, there are recent signs of recovery in the sector.

Graham and Marvin (1996) have illustrated how these trends in the telecommunications sector are contributing to an unequal development of cities and regions: large telecommunications firms now compete to provide telecommunications service and infrastructures to the most profitable business and residential markets, in a process of ‘cherry picking’. On the other hand, the less favoured areas are left aside without (good) connection, in a process of ‘social dumping’. This, in turn, contributes to processes of social and spatial polarization in cities and regions.

## 2. Main features of the global Internet infrastructure

The Internet is generally experienced as a seamless network serving and delivering digital flows from terminal to terminal. But when it comes down to its physicality, the Internet is composed of an enormous number of private networks of different sizes that interconnect at certain points and which depend on a structured hierarchy and a different protocol to operate them (Gorman, 1998).

The thousands of networks are structured in a hierarchical way, which can be disaggregated into five different functional levels. NAPs constitute then the first level of the Internet infrastructure. The second level consists of the largest global backbone providers, which operate high-capacity long-distance transmission facilities and are interconnected with each other. In level three we find the regional networks, the 'local backbones'. The fourth level is the one of the ISPs (Internet Service Providers), which provides access to end-users, while the lower level refers to the internal networks of the institutional and residential users (Gorman, 1998). In this way, a small network (ISP) sends data packets from one of its customers to the large network that the ISP uses for backbone services, which in turn sends the data to another backbone network, which then delivers it to the ISP serving the end user to whom the data is addressed.

Networks – as persons -- follow an evolutionary process characterized by their birth, growth, decline and, eventually, death. To understand the growth (or decline) of a network, it is necessary to be aware of the different logics that guide the behaviour of the operators. The operators of the backbone networks function according to four main principles, which are explained by Dupuy (2004): (a) market principles, (b) proximity, (c) connectivity and (d) reliability.

- a) **Market principles:** Infrastructure development is firstly driven by the demands of the market. New networks are deployed according to the expectations of a future market. The concentration of population and of economic activities of a certain city or region are considered as good predictors of a future market.
- b) **Proximity:** Although Internet is generally related to 'the death of distance', the deployment of optic-fibre networks is very expensive. Since connecting two nodes on the network requires extensive resources and time investment, network designers prefer to connect to the closest node with sufficient bandwidth, what clearly favours shorter links (Barabási, 2002).
- c) **Connectivity:** Good connectivity requires enough bandwidth and multiplicity of links. For that reason, operators need to connect to nodes with sufficient bandwidth and to deploy their network in such a way to have the maximal number of links between the nodes of their network and the nodes of external networks.
- d) **Reliability:** To avoid congestion and ensure a good reliability, global operators tend to diversify and distribute the links and nodes of their network. Redundancy of links is therefore good for both reliability and connectivity.

Barabási (2002) has shown that the Internet is not a random network but a 'scale-free' type of network, characterized by an uneven distribution of connectedness. This means that there are many nodes with few links, while there are few nodes that have a huge number of links. This means that links on webpages follow a 'power law' degree distribution. Power law distributions are "*the patent signature of self-organization of complex systems.*" (Barabási, 2002:77).

This situation occurs because in a network that expands through the addition of new nodes to an existing network, as the Internet, the new nodes prefer to attach to already well-connected nodes, a network behaviour that is called 'preferential attachment'. Tracings of data routes along

the Internet networks made by Lucent Technologies and TeleGeography in 1999, seen in Figure 1, show how this hubs and spokes configuration with short links operates.



Figure 1. ICT networks' hubs and spokes configuration down to earth  
(From TeleGeography and Lucent Technologies)

The Internet backbone network is then a large, complex, global, self-organized, hierarchical and unevenly distributed system. Its complexity makes possible that data packets can travel from one node to the other through countless possible routes. The unevenness of its distribution and capacity comes from the principles that guide the operators' logic: the application of the principle of the market and the principle of connectivity, which are translated into preferential attachment behaviour.

Regarding the main components of the Internet infrastructure, Townsend (2003) has made a useful analogy for urban planners, comparing the role of the components of system that supports the new informational economy to important elements of the system that supports the industrial economy: ports, highways, warehouses and factories (see Table 1).

<b>Industrial economy</b>	<b>Informational economy</b>	<b>Referring to:</b>
Highways	Information <i>highways</i>	The backbones: those transcontinental and undersea optic fibre lines which move data at light speed from city to city
Ports	Information <i>ports</i>	Network Access Points (NAPs): the sites where telecommunications carriers interconnect their systems into a single, global network
Warehouses	Information <i>warehouses</i>	Data centres: the secure structures which house rows of telecommunications equipment, such as Internet servers and switches.
Factories	Information <i>factories</i>	The wired businesses and homes that produce (and consume) information products

Table 1. The four main components of the global Internet infrastructure (Source: Townsend, 2003).

### 3. The geography of the global Internet infrastructure

To trace the Internet backbone infrastructure and to measure its transmission capacity is a very difficult endeavour. There is no central source of information about the Internet backbone and its capacity. The private character of the networks, the existence of thousands of networks and the continuous evolution of the Internet conspire against an accurate image of its morphology. Telecommunications firms and ISPs do not easily share information about their networks in this highly competitive sector.

As Gorman (1998) claims, the best level to analyse the Internet network geography is level two, the level of regional backbone providers, which are the best indicators of the geographic location and agglomeration of the Internet. The main operators are large telecommunication firms of European or US origin who work at global scale. The top ten international carriers are: AT&T, MCI, Deutsche Telecom, Sprint, France Telecom, BT, IDT Corporation, Cable and Wireless, Telecom Italia and Telefónica, in that order (Telegeography, 2005).

Internet backbones began to expand from the US territory outwards, and for that reason they are still dominated by US centrality. Their main nodes are located in the U.S. and a good portion of international Internet traffic still flows along the backbones that traverse the U.S. territory. As a result, every region and nearly every country has a direct Internet connection to the U.S., while direct connections between cities of different regions are not so frequent. The U.S. functions as a central switching facility for inter-regional data traffic, being used as a transit point for data packets travelling from one major region to another (Townsend, 2001). US-centeredness is steadily diminishing but is unlikely to disappear, since the US is both geographically and culturally well located between Europe, Asia Australia and Latin America.

During the initial years, Internet development was still mainly concentrated within and between developed countries and major urban agglomerations. However, the expansion of the global Internet backbone has been remarkable since the late 1990s, after the huge deployment of trans-oceanic, satellite and terrestrial optic-fibre networks, which, with the emergence of new Internet exchange points (NAPs), have led to a more diffused distribution of the Internet, diminishing US-centeredness. Gradually, Western Europe has emerged as another important Internet hub: there is presently more bandwidth linking European cities with each other than to the U.S. Additionally, intra-Asian network links are also growing at a very fast rate (Telegeography, 2005). However, a simple look at the distribution of Internet backbones in 2004 illustrates how the ICT backbone network still passes over most part of the developing world. Figure 2 shows the position of the different world regions and cities.

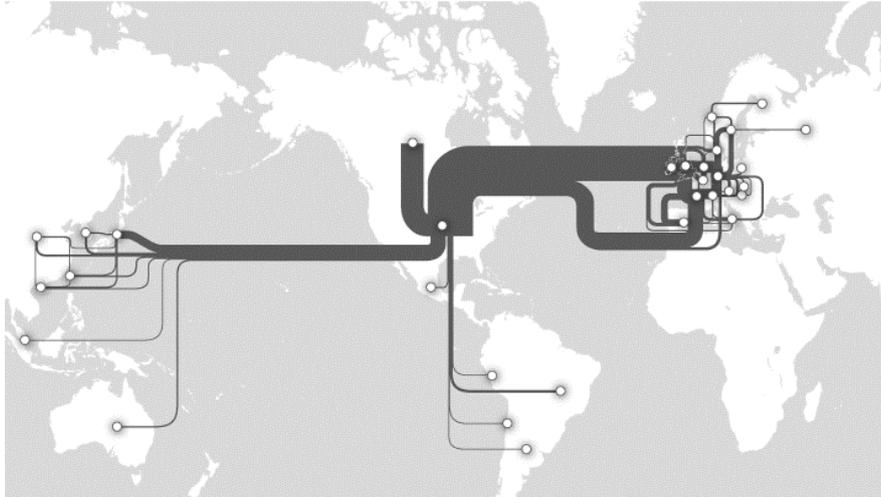


Figure 2. Map of major international Internet routes in 2004 (Source: Telegeography, 2005)

Looking at the geography of Internet, we observe that it mainly connects the largest agglomerations, which become the hubs in this decentralized network structure. Anthony Townsend, whose dissertation has chronicled the development of the ICT networks during the 1990s and early 2000s, explains this: *“Instead of trailblazing into the wilderness, opening a path to new settlements, digital networks have been built to reinforce existing connections between centres of power and influence in the world greatest cities and metropolitan areas.”* (2003:16). Castells states shortly that the Internet is basically a *“network of metropolitan nodes”* (Castells, 2001: 228).

Metropolises are at clear advantage since due to preferential attachment law; they have high capacity and many more redundant links, whereas peripheral cities have lower capacity and therefore less redundant links. However, each region has different characteristics. The historic origins of the Internet have determined the geography of its core backbones, and make the US American networks topology different from the ones of other world regions. When the NSF (National Science Foundation) privatised the initial Internet network in 1995, it was decided to place network access centres (NAPs) in the four existing nodes of the existing network connecting university computing centres: San Francisco, Washington, D.C., Chicago and New York. The Internet developed then outwards. Three years after there were already 11 major peer interconnecting points connecting the most important cities in the US (Gorman, 1998).

Sean Gorman continued mapping the physical infrastructure of the Internet in the US in detail for his doctoral dissertation. But after the events of September 11, the spreading of the information he collected became a security threat in the eyes of government officials and corporate executives, since critical points and vulnerable areas could be easily traced. For that reason, this information is not available for the public. This situation has been widely covered by the press, after an article titled *Dissertation Could Be Security Threat* appeared in ‘The Washington Post’ on July 2003 (For more information see <http://www.washingtonpost.com/ac2/wp-dyn/A23689-2003Jul7>)

On the other hand, Townsend’s examination of the ICT backbones in 2003 have shown that it’s not New York but Washington D.C. the leading hub for backbone networks in the US, followed close by San Francisco, a fact that defy the common ideas of the role and definition of global cities (Townsend, 2003).

Unlike the US American backbone system, the European backbone relies on “a minimum of 12-15 cities to deliver high bandwidth networks and services across Europe” (Rutherford et al, 2004: 29), even if the two largest metropolises (London and Paris) concentrate a significant number of networks and bandwidth capacity. This suggests that the spatial distribution of the Internet networks in Europe has a close relationship with the features of the urban system.

The correlation of ICT backbones and the distribution of population in the world territory is more clearly seen in the developing world, where the networks are less diffused. For example in the case of the Latin American backbones, the largest nodes correspond to the largest metropolises of the region: Mexico City, Sao Paulo, Buenos Aires, Lima and Santiago. Their dependence upon the US backbone networks is, however, manifest: the main regional hub is not located inside the Latin American territory but in Miami (Fernández-Maldonado, 2004).

#### 4. The new challenge: Connectivity as an element of sustainability

In this ‘wired new world’, digital connectivity becomes essential to achieve social and economic sustainability in cities of both the developed and developing world. The new challenge for urban planners in the present circumstances is, therefore, to promote a good level of connectivity to all locations, business and residential. The attention should be focussed on two main issues: to guarantee access to digital connectivity to all people (for social cohesion goals), and to guarantee a good level of telecommunications services for the local urban economy (for economic cohesion goals).

##### a) Digital connectivity for social cohesion

The previous sections, describing the main features of the global infrastructure that provides Internet connectivity, have illustrated their related agglomeration trends. ICTs are indeed powerful technologies for decentralising and dispersing activities in space, but the drive towards deconcentration that they can bring is challenged by ICT-related agglomeration trends. Section one has shown how political trends have led to the domination of market practices in the telecommunication sector, and how these are contributing to social and spatial polarization within and between cities and regions, as illustrated in Figure 3.

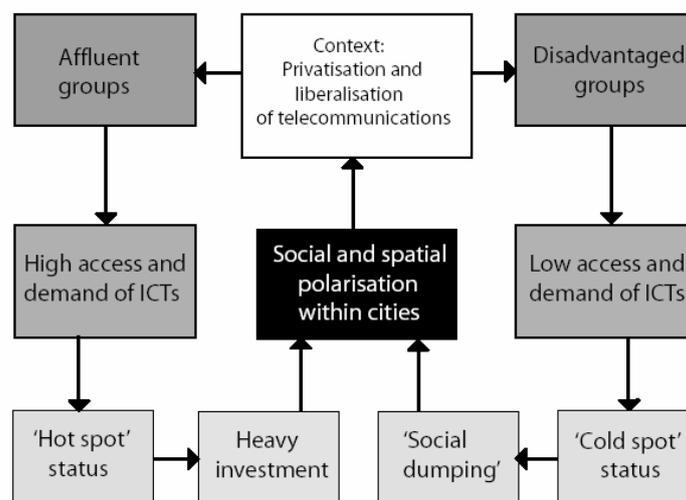


Figure 3. The trends in the telecommunication sector are contributing to an unequal development of cities and regions (adapted from: Graham and Marvin, 1996).

Section two has described from a technical point of view, how the expansion principles of the Internet infrastructures tend to favour situations where the largest nodes get the most links. The forces towards concentration at important nodes are twofold, and mutually reinforcing. While on the one hand, bandwidth deployment is located according to existing and potential markets, on the other hand, empirical studies have established that access to high-speed networks is an important location factor for knowledge intensive and information handling firms and institutions.

In conclusion, privatisation processes and the increased importance of ICTs in work and daily life have given large telecommunications operators a strategic importance in urban life. These global firms, however, make decisions regarding prices, expansion and location of investments outside the local context, and based merely on economic profitability. This fact has several consequences: at macro level the decision about where to place the nodes is reinforcing the urban primacy of large metropolises in detriment of smaller cities; at local level, the prices policies are excluding groups of people from access to the services. The expansion policies are favouring places of high demand and discarding those which are not enough profitable.

The resulting uneven distribution of Internet infrastructure is obviously detrimental to the objectives of sustainable development, since it bypasses entire neighbourhoods, cities and regions. The main problem for urban planners is that cities have absolutely no jurisdiction in the telecommunications policies.

#### ***b) Digital connectivity for economic cohesion***

A good connection to telecommunications infrastructure of strategic importance for the future of the city, indispensable for achieving global competitiveness and the promotion of the more 'advanced' sectors of the economy. Section three showed that the best-served locations in are large metropolises that cluster educational, governmental and financial activities. At the same time, they attract the main offices of global firms and advanced producer services (APS) — those highly specialised and sophisticated industries that provide the tailor-made services to large, globally operating corporations and act as one of the 'main connectors' between global cities (Rocco, 2005).

Therefore, if a city wants to attract foreign firms and foreign investments, and have a smooth link between its local urban economy and the global economy, then it has to be well connected to the global backbones. For those places that are doing fine in terms of the economy, their future is not problematic, since the private sector has already been active. Townsend (2003) showed that in the central business districts of major metropolitan areas of the U.S. there is a duplication of network infrastructure 10, 20, or even 30 times within and between them.

The implementation of the national telecommunications policy does have an influence on the local economy and urban functioning. One of the main conclusions of Townsend' dissertation was that "*national telecommunications policies became de facto urban policy during the 1990s for the first time in history.*" (2003:137). At the same time, he convincingly argued that the digital network infrastructure did not produce the expected dispersion of economic activity out of cities, but it was certainly a crucial aspect of economic competitiveness between urban regions. Local politicians and urban planners, however, know very little about these policies, or the digital infrastructures or the features of the telecommunications sector and, consequently, they are not properly aware of the power acquired by telecommunications firms, or the significance of their private policies for local urban development.

If the private sector fails to invest, how can cities help people’s digital connectivity and/or give a boost to the local economy? In his doctoral dissertation, Van Winden (2003) examined several cases of European cities (Groningen, Eindhoven, Manchester, Rotterdam and Stockholm) with an active broadband infrastructure policy, concluding that the Stockholm case – where a public company was established to deploy the networks and provide digital connectivity to businesses and citizens -- is the most successful one. Table 2 shows the different types of infrastructure policies they found in the studied cities.

<b>Type of policy</b>	<b>Objective of the policy</b>	<b>Rationale for intervention</b>
Community networks (Groningen)	Reduce government’s telecom costs, Improve local broadband infrastructure and service provision	Private sector fails to invest. Bundling public telecom demand creates critical mass for broadband infrastructure
Generic supply policies (Stockholm)	Attract businesses and citizens by improving local infrastructure	Private sector fails to invest. Public company can do a better job, and will evoke more competition on service level
Supply policies in newly built / redevelopment areas (Rotterdam)	Increase the attractiveness of these areas for inhabitants and businesses	Putting fibre in the ground is relatively easy and cheap in newly built areas. It will evoke strong service competition
Group-oriented supply policies (Manchester)	Offer deprived groups / areas broadband access at affordable prices to stimulate social & economic development	Market fails to bring broadband to deprived groups, with negative societal consequences.
Demand policies (Eindhoven)	Improve the provision of broadband infrastructure and services, with positive impact on quality of life and attracting innovative (ICT) companies to the region	Demand subsidies can resolve “chicken and egg” deadlock that keeps companies from investing in new infrastructures

Table 2. Typology of local broadband policies (Source: Van Winden, 2003:78)

These cases, however, are coming from cities of developed countries of Western Europe. The real challenge is how to promote digital connectivity in cities of developing countries. How can urban planners help bypassed or less-connected locations? Several authors (Townsend, 2001; Graham, 2000) have plead for public subsidy to connect or improve connections of cities to international backbones, arguing that backbone connection costs are insignificant compared to what is generally spent on the constructions of roads. The problem is that it is precisely in those bypassed locations where the public resources are scarcer. Local authorities in developing cities prefer to channel resources to ‘more productive’ ends, or to solve urban problems considered more urgent. If one of the reasons for selling out the national monopolies was that the developing countries’ national states were unable to fund the necessary modernisation and expansion of the networks, to ask for public intervention in telecommunications seems now too optimistic.

Most academics from the telecommunications field consider that the public sector should stay away from the telecommunications infrastructure development and the forces of the market will eventually take care of infrastructure deployment to all locations, as it has been the case with

electricity lines. This is also the view held by the International Telecommunications Union (ITU), World Bank, International Monetary Fund and most other international organisations.

In the same line of thought, it is argued that competition between telecommunication firms will eventually make prices decrease until the achievement of universal access. Indeed, there is plenty of room for price decrease in the telecommunications business. Telecommunications is one of the most profitable businesses that exists. In 1996, the top-ten telecommunications firms earned more than the 25 largest banks in the world (Alaedini and Marcotulio, 2002). It is estimated that its gross operations margins are of 40% (Nellist and Gilbert, 1999). According to the ITU, the revenues of the total industry have reached \$1.37 trillion in 2003, while at the same time consumer spending on communications has grown faster than any other household spending (Standage, 2003). Figure 4 shows the huge growth of (fixed and mobile) telephone and Internet markets, as well as the revenues of telecommunications firms in the 1991-2003 period.

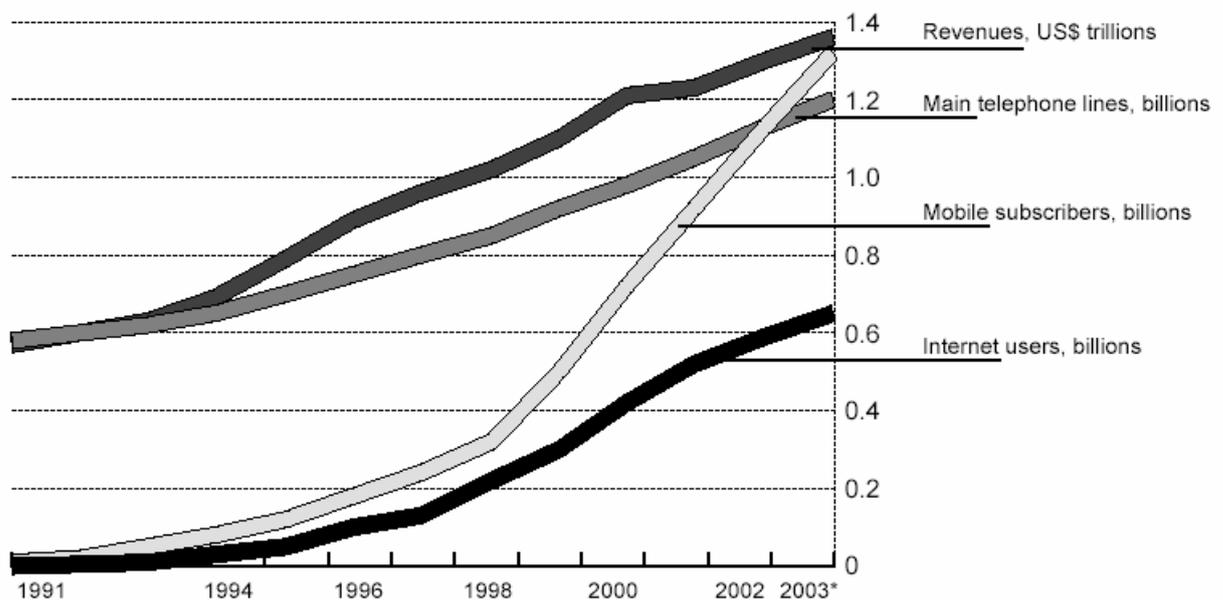


Figure 4. Telecommunications global market and revenues 1991-2003  
(Source: Standage, 2003, with data from ITU)

Telecommunications scholars position are focused in the regulation of telecommunication policies, especially in developing countries, which is seen as the way to achieve a future of universal digital connectivity. There is a growing literature on this topic – with frequent congresses and scientific journals addressing this issue -- which is almost ignored by urban professionals, who do not feel at ease with telecommunications issues. If telecommunication policies are a substantial factor of economic competitiveness and growth, urban planners must consider telecommunications-related issues in their policies.

The fact that the telecommunications sector is completely out of the hands of local authorities limits direct actions towards the tackling of these issues. The emerging role for the planner should be then as mediator and negotiator to make a bridge between telecommunications and urban policies. Urban policies should not neglect the material basis for digital connectivity, despite the great difficulties encountered in this field of action due to the private character of the

networks. Local governments should exercise pressure to have a proper level of knowledge of the situation regarding the ICT infrastructure, and to exert some influence to promote the expansion of networks to all locations to avoid 'cherry picking' and 'social dumping' processes in the less favoured areas of the city. Among the many tasks that the city demands, a fundamental assignment for a more sustainable and democratic future is to find effective ways to deal with the increasingly relevant ICT-related issues.

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