Intelligent Cities

Nicos Komninos
Aristotle University, Greece

INTRODUCTION

In the dawn of the 21st century, information and communication technologies have radically altered the construction of our physical environment. Instead of constructing spaces that intermediate between nature and man's physical condition, a new orientation is emerging attempting to create spaces that increase man's intellectual capacity and improve the ways in which we use the environment in order to learn, innovate, and reach new frontiers. Intelligent cities belong to this new orientation; they are part of an ongoing research project for creating environments that improve our cognitive skills, our ability to learn and innovate, to foresee and prevent.

Intelligent cities combine two fundamental dimensions of our era: information technologies and innovation systems.

...We use the term 'intelligent city' to characterize areas (communities, neighborhoods, districts, cities, regions) which have the ability to support learning, technological development, and innovation procedures on the one hand, with digital spaces and information processing, knowledge transfer and technology tools on the other hand. ....There are three basic components of an intelligent city: (1) the island of innovation formed by a community of people, production, exchange and other activities, (2) the virtual innovation system, which includes knowledge management tools and information technologies for online provision of information and innovation services, and (3) the connection between the physical and virtual innovation systems, in other words, the use of the latter by the island's community. (Komninos, 2002, p. 198, 201).

To date, many territories have adopted "intelligent city" strategies. Public authorities in Singapore, Taipei (Taiwan), Spokane (U.S.), Seoul and Songdo (Korea), and Cyberjaya and Putrajaya (Malaysia) have implemented plans to make their cities more "intelligent." But, the most elaborated illustration of intelligent cities is to be found in the awards of the Intelligent Community Forum (ICF), which assesses communities, cities, and regions with respect to five criteria of innovation performance and digital government. During the last five years, about 20 territories from all over the world were selected by the ICF as top intelligent cities (http://www.intelligentcommunity.org).

BACKGROUND

The concept of "intelligent city" is ambiguous. At least four different descriptions of what is an intelligent city (IC) can be found in the literature:

- ICs have been frequently defined as *virtual representations* of cities, as virtual cities; the term has been used interchangeably as an equivalent of the "digital city" and "cyber city." Nonetheless, it is certain that communication capabilities offered by a digital platform or a virtual representation of a city do not suffice for an urban system to be characterized as "intelligent."
- A second approach is derived from various electronic and digital applications involved in the *management of city operations and functions*, which make very frequent use of terms such as "information city," "wired city," "telicity," "knowledge-based city," "virtual city," "electronic communities," "electronic spaces," "flexicity," "teletopia," "cyberville," etc., (Droege, 1997).
- Thirdly, ICs are conceived as environments with *embedded information and communication technologies* (ICTs) creating interactive spaces that bring computation into the physical world. From this point of view, intelligent cities (or intelligent spaces more generally) refer to physical environments in which information and communication technologies and sensor systems disappear as they become embedded into physical objects and into the surroundings in which we live, travel, and work. (Steventon & Wright, 2006). The "Intelligent Room" is a good miniature illustration of such environment; it is laboratory room which supports computer vision, speech recognition, and movement tracking, based on about fifty distinct intercommunication software agents that run on interconnected computers (Cohen 1997).

- Fourth, intelligent cities are conceived as territories that bring *innovation systems and ICTs* within the same locality, combining the creativity of talented individuals that make up the population of the city, institutions that enhance learning and innovation, and virtual innovation spaces facilitating innovation and knowledge management (Komninos 2002, ICF, op.cit).

This diversity in the understanding of intelligent cities is due to the multiple scientific and technology disciples and social movements that take part in their creation, namely the movements towards "cybercities," "smart communities," "intelligent communities," and "intelligent innovation environments."

CYBERSPACE AND CYBER CITIES

The term "cyberspace" was introduced by Gibson (1984) in his science fiction novel Neuromancer to describe a dystopian future based on virtual reality, artificial intelligence, and high-tech implants. With the explosion of the Internet, the meaning of the term changed radically and actually cyberspace came to describe an emerging universe of virtual spaces existing within the worldwide computer network, the Internet, and the World Wide Web. Cyber cities are virtual entities related to the physical and social environment of cities in two ways: first, by representing this environment with the help of maps, plans, two-and-three dimensional images, and text; and second, by managing this environment through the representation, communication and governance of functions and processes that take place within cities. This second aspect of cyber cities is more compatible with the origin of the term, which comes from "cybernetics," a theory of communication and control which places emphasis on the functional relations between the different parts of a system, and in particular, the transfer of information, feedback mechanisms, and self-organization. Cyberspace and cyber cities have some unique spatial features which make them extremely valuable for managing the physical and social environment of cities: (a) physical distance is not valid and accessibility is just few "clicks" away depending on topological linkages only (Shiode, 1997); (b) cyber spaces can be easily modified; (c) digital representations are not limited by the characteristics of physical space; (d) the production of digital space is extremely low-cost compared to physical space; and (e) digital communication enhances person-to-person communication and contact in local communities. Using these features, city planners may create digital constructs, which complement activities in the daily life of cities and facilitate the solution of urban problems.

SMART COMMUNITIES

The initiative for smart communities was the first systematic effort to promote the link between cities and information and communication technologies. The World Foundation for Smart Communities launched it in 1997 in close cooperation with the California Institute at San Diego State University, which drafted the *Smart Communities Guide*. "A Smart Community is a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental, rather than incremental, ways" (http://www.smartcommunities.org). Put more plainly, a smart community is a community ranging in size from a neighborhood to a multi-county region in which public administration, enterprises and residents have understood the capabilities offered by IT and attempt to use those technologies to improve their everyday life and work in a significant, efficient manner. Smart communities in the U.S. and Canada are inspired to a large extent by local principles. Local development and prosperity depend less on decisions taken by the central-national government and more on initiatives and guidelines chosen by local leaders. Increased local responsibility is on the rise again in an age when information about markets and growth/development is becoming increasingly globalized. Globalization transfers responsibilities for decision-making at lower level, and smart communities offer some tools to deal with the new challenges (Eger, 1997).

INTELLIGENT COMMUNITIES

Intelligent communities is a parallel, but more advanced effort. It is an initiative of the Intelligent Community Forum (ICF)/World Teleport Association seeking to promote the use of information and communication technologies for economic development, in large or small communities, in developed or developing countries.

Intelligent Community is ICF's term for what others have called the wired city, smart community, or e-city. It is the community—whether a town, city, county, or region—that views communications bandwidth as the new essential utility, as vital to economic growth and public welfare as clean water and dependable electricity. (ICF, 2006).

ICF's major achievement is the annual "Intelligent Community" award. Each year the Forum selects seven communities from around the world, which excel in one or more criteria concerning information and communication technologies, knowledge and innovation. These critertia