Challenges of Spatial planning in the context of ICT: lessons from actual research projects – new frontiers for spatial planners and cities.

Didier VANCUTSEM, Faculty of Architecture,
Université Libre de Bruxelles (ULB), Belgium

1. Introduction

The emergence of ICT (Information and Communication Technologies) since the 90's modified profoundly our urban environment and the way spatial planning is implemented. This case study aims to explain the importance of the relationship "ICT - Spatial Planning", connected to future frontiers of spatial planning and is based on the results of three projects Plan4all, HLanData and plan4business, where ISOCARP was involved as consortium partner.

2. Role of the ICT in today's Society

In the past 250 years, the World experienced five major technological revolutions and each of these was linked to a specific technological innovation (1771, The First Industrial Revolution in Britain, based on the mechanization of the cotton industry; 1829, The Age of Steam and Railways; 1875, The Age of Steel and Electricity; 1908, The Age of Oil, the Automobile, and Mass Production; and finally 1971, The Age of Information and Telecommunications). Every technical invention and development has resulted in advantages and disadvantages, which have influenced the well-being and prosperity of mankind. But somehow, they have provided the conditions for a long period of sustained economic growth as a process of economic development, which is usually described as a series of waves (Kondratieff waves) (Kondratieff, 1925).

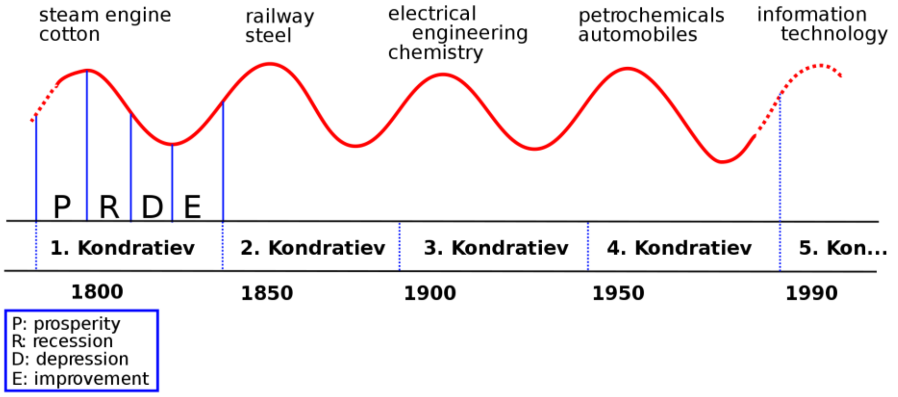

Figure 1: Simplified Kondratieff Wave Pattern (2009), Wikipedia

These technological innovations, characteristic for each periods of technological revolution, had a fundamental influence on the behaviour of man and consequently on society. Such influences can be seen in every level of daily life including living conditions, housing and recreation, and have changed our habits and our culture.

They have also a number of aspects in common. First of all, specific technologies have a wide applicability to a variety of different production processes, generating both process and product innovations. Secondly, because of this feature, they generate a whole series of new applications. Thirdly, because of large and increasing demand for this bundle of innovations, they create and shape new industrial complexes, which can be characterised by a large number of horizontal and forward reaching linkages: **Everything is interlinked**.

Among the five technological revolutions, three are directly linked to the means of transportation and communication: the developments of the steam engine, the combustion engine and the microchip technology in the 60s together represent a shift from the moving of goods, to an increased ease of moving people and exchanging information and ideas.

The integration of digital technology and computers finally resulted in the development of communication technology and the introduction of the term ICT (Information and Communication Technology). Regarding the microelectronic revolution, we are still in the **middle of a learning process**. Considering the on-going developments in cloud computing, multi-touch screens, intelligent systems for houses and communication, broadband and broadcasting, also related to nanotechnologies, it seems evident that the Information and Communication Technology is already dominating and will continue to dominate our way of life in the near future. One aspect is however evident from the past 250 years:
Technological change involves both technical change and organisational change.

It remains difficult to evaluate the effects of ICT on the organisation of society and on spatial and urban planning because the topic is very complex and the microelectronic revolution is still in process. Nevertheless, it is evident that the ICT influence is not direct, but indirect via social and economic trends, which cause changes in the behaviour of each individual in society, the economy and, consequently, in culture.

A rapid transformation is currently taking over advanced industrial cities. Old ideas and assumptions about the development, planning and management of the modern, industrial city seem less and less useful. Accepted notions about the nature of space, time, distance and the processes of urban life are similarly under question. Boundaries separating what is private and what is public within cities are shifting fast. Urban life seems more volatile and speeded up, more uncertain, more fragmented and more bewildering than at any time since the end of the last century.

Related to urban and spatial planning, the use of Information and Communication Technology (ICT) has been under constant development over the last decade and is **becoming a standard today in the worldwide Urban and Spatial Planning context**. Publishing information via the internet, communicating via e-mail, chatting and using interactive, real-time virtual reality to show the results of a planning process is the planners new normal day. Actual development is the “e-planning” philosophy, which refers to the use of electronic processes in delivering planning and development services, such as the online placement and processing of development applications, and the provision of web-based information such as maps, regulations and state and local policies. Such processes are already installed in several administrations around the world and give positive feedback with strong support from government, industry and communities.

Only as an example, the European Union launched in 2010 the Digital Agenda for Europe (DAE), which aims to reboot Europe's economy and help Europe's citizens and businesses to get the most out of digital technologies.

3. Interaction of ICT and spatial planning

Cities and spatial planning are becoming more and more influenced by the use of ICT in the industrial change.

Emerging trends of urban evolution are supported by:
- Digital telecommunication networks such as the Internet and broadband technology;
- "Nomadic" tools facilitating mobile lifestyles, such as mobile phones, wireless, laptops, PDAs, smart phones, pagers, GPS, etc.;
- Decentralised networked intelligence embedded everywhere, in the Internet itself, including also cloud computing; and
- IP services, sensors, smart electrical supply, electronic road pricing and navigation.

Digital telecommunication networks are new types of urban infrastructure, following in the footsteps of water supply and waste disposal, transportation, electrical supply, telegraph and telephone networks. They often replicate the routes and nodes of earlier networks, which both fragment and recombine urban activities and spaces. New networks infrastructures selectively loosen spatial and temporal linkages among activities. Latent demands for adjacency and proximity become reality. This produces simultaneous fragmentation and recombination of urban types and spatial patterns. Some traditional spatial types may disappear, others may transform themselves and new types and patterns emerge.
In the time of information, different combinations of local and remote interactions, together with synchronous and asynchronous modes of communication provide the "glue" that holds communities together. Many options simultaneously exist, with differing costs and advantages. Citizens are able to choose among them within an increasingly complex economy of presence.

The relationship between spatial settlement pattern and modes of communication is illustrated in the table below. The emergence of the information society is demonstrated in a massive shift across the diagonal of the table, from local synchronous interaction to dispersed asynchronous communication. These shifts affect markets and organisations as well as communities, as they produce a new cycle of fragmentation and recombination of familiar spatial types and patterns.

Settlement pattern	**Modes of communication**		
	synchronic	Semi-synchronic	A-synchronic
local	face-to-face agora 9-5 workplace	post-it notes whiteboards	non-circulating libraries old-fashioned databases
partially dispersed	churchbells sirens loudspeakers	pedestrian and bicycle messengers	LANs Intranets
dispersed	telegraph telephone live broadcast teleconference	Mail systems voicemail email	Internet www dot-coms

Figure 2: Adapted from " Information in the Urban Age", ISOCARP Congress 2002. Source: Mitchell, 2002

ICT is a significant factor affecting spatial change and consequences can often be rather surprising. This necessarily provides planners with some challenging problems. Spatial change from the point of view of urban and regional planning is always both an opportunity and a threat. However, current on-going changes offer opportunities to use the new possibilities inherent in ICT to enable regions, cities and rural areas to partake in new types of development. New development trends can also threaten the future of these areas. Therefore planners have to find ways to try to forestall such possible negative effects.

On the other side, decentralisation, multilevel governance, public participation, bottom-up approaches, empowerment, local government, regional approach, environmental policies, strategic planning, participative budgets, council of regions, public private partnerships, administrative links, local agendas 21, low carbon concepts and climate change, vertical and horizontal integration, are some of the actual topics considered today in legal bodies and planning practices.

4. Challenges of spatial planning and ICT

Spatial planning has been around for hundreds of years while the World Wide Web is a relatively fresh arrival that has yet to celebrate its 20th birthday. As a consequence, the predominant practices within spatial planning have evolved out of a non-technological environment.

Spatial planners are concerned about spatial features such as residential, commercial, mixed use and industrial areas, about traffic, transportation, and utilities infrastructure, about community facilities and about all information, which impacts the distribution and suitability of the aforementioned areas. The only way to get an overview of and correlate this type of information is maps. Due to the long traditions of spatial planning, this very often means paper maps.

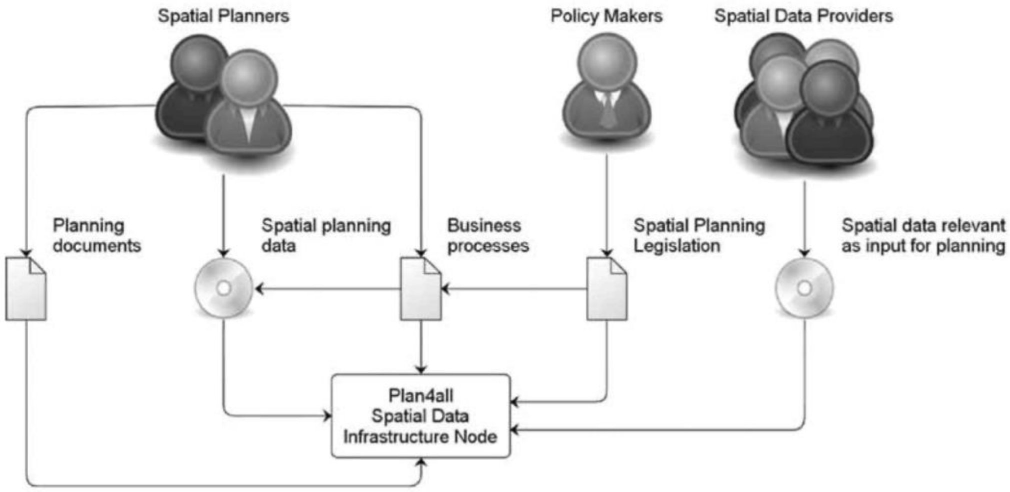

Figure 3: The business of spatial planning is not only a question of maps – spatial planning is about legislation, processes, data, documents and all available information about of a planning area, making spatial planning not only a provider but also a consumer of spatial data. (Plan4all Book, p.126)

Spatial planners like to draw and conceptualize on maps and, as many are not oriented towards abstract concepts of GIS, express their professional capabilities much more effectively using pen on paper than they would work directly in a digital environment.

While from a GIS perspective, information resulting from the spatial planning process is considered data, the spatial planner will often consider the same information as sketches or drawings – and as a result the often rich by-products of the planning process will not be shareable as it does not conform to any standards interpretable by third parties.

The logical next step for a spatial planner who is used to draw on a paper map is to shift into a CAD environment, which effectively replicates the drawing board in a software environment. In CAD scale and micro-accuracy is of great significance, whereas spatial location and orientation often is not observed. The output is also self-contained drawings, which print well – but which often do not conform to any form of standard, which makes it possible to transform the drawing into data – shareable and re-usable in a GIS environment.

The first impediment to publishing of spatial data on the Internet is the fact that in most planning laws, the paper map, including its map scale, cartography and underlying base map is what is adopted as the legal spatial plan. This means that publishing the spatial plan as data will not constitute legal data – and may not be desirable from the perspective of the planning authority as it may cause dissent due to use of the data at larger scales and with different cartography which may render boundaries extended or contracted compared to the legal plan.

The second impediment is that introducing static pre-defined data models, controlled vocabularies and GIS software into the equation of spatial planning is a major paradigm shift for the traditional planner.

It is also a shift, which may consume a disproportional share of the spatial planner's professional resource in resolving technical obstacles – and which may curb her or his ability to produce high quality professional work. It must therefore be assumed that the transition from drawings to data will take a significant amount of time.

Such a transition is however necessary if we want to effectively enable not only the use of spatial data as input to planning processes – but also get spatial data as output from the same.

The big software actors in the CAD domain such as Autodesk are currently enabling more comprehensive data intelligence to be embedded into drawings, gradually bringing the universes of CAD and GIS closer together, whereby facilitating the INSPIRE Directive objectives of enabling and efficient use of spatial data across professional disciplines.

5. Learning from research projects

During the past years, several research projects were developed in the European Union, related to the European Directive of "INSPIRE": the INSPIRE (INfrastructure for SPatial InfoRmation in Europe) Directive aims to establish a European Spatial Data Infrastructure and entered into force in May 2007. The Directive defines SDI (Spatial Data Infrastructure) as "... metadata, spatial data sets, spatial data services; network services and technologies; agreements on sharing, access and use; coordination and monitoring mechanisms, process and procedures, established, operated or made available in accordance with this Directive..." (EC, 2007, art. 3.1).

INSPIRE does not aim to establish new infrastructures, but it is based on infrastructures created by Member States that are made interoperable by common Implementing Rules (IRs) and measures established at the Community level. The purpose is to align national legislation and achieve a joint result within European Member States.

Although the Directive specifically aims to support European environmental policy, INSPIRE is having a great impact on the European GI community. The correct implementation of the INSPIRE Directive could represent a big step towards effective information sharing to support problem solving. INSPIRE represents a solid foundation on which to build wider interoperability of spatial planning in Europe, since it takes into consideration current standards and practices in the field of SDIs, and summarises the point of view of most stakeholders.

The plan4all project was a European project co-funded by the Community programme "eContentplus" between May 2009 and October 2011. Plan4all was a consortium of 24 partners including universities, private companies, international organisations and public administrations, and where ISOCARP contributed to the findings on spatial planning and dissemination. The main objective of the project was to harmonise spatial planning data and related metadata according to the INSPIRE principles. The project focussed on 7 aspects of the INSPIRE directive: Land cover, Land use, Utility and Government services, Production and industrial facilities, Agricultural and aquaculture facilities, Area management / restriction / regulation zones and reporting units, as well as Natural risk zones.

For this purpose, the Plan4all project first promoted Plan4all and INSPIRE in countries, regions and municipalities; designed the spatial planning metadata profile; designed the data model for selected spatial data themes related to spatial planning; designed the networking architecture for sharing data and services in spatial planning; validated the metadata profile, data models and networking architecture on local and regional levels; established a European portal for spatial planning data; and finally deployed spatial planning data and metadata on local and regional level. www.plan4all.eu

The second project (April 2011- April 2013) called “HLanData – Harmonisation of land use and land cover datasets”, was aiming to demonstrate the feasible European level harmonization of the Land Use and Land Cover datasets taking into account both the data categorization and the data models, for any of their possible uses and users, through the development of user oriented value-added services.

Starting point of the project was that there is no valid data harmonization model for the Land Cover and Land Use datasets, taking into account both the data categorization and the data model and the end users’ specificities, which could be valid for all the application areas and at a European level. Therefore, the project HLanData aimed at making a significant step forward in overcoming the aforementioned barrier, fostering the use of the Land Use and Land Cover geographic data at a European level, through the creation of value-added European services. In order to achieve this objective, newly developed web services were used for the implementation of 3 pilot projects in 3 different application areas, used to validate the harmonization proposal made:

- PILOT 1: Land Use- Land Cover Data Analysis System for intermediate-level users
- PILOT 2: Harmonized and Interoperable Land Information Systems
- PILOT 3: Stratification of waste dumps

The conclusions of the HlanData project and the harmonisation methods of the data models were integrated into the INSPIRE geoportal.

The project plan4business (April 2012 - April 2014) is focussing more on the implementation of the Directive and the accessibility of harmonized datasets. In this case, plan4business is developing a platform serving multiple providers and thus offering users a full catalogue of planning data such as transport infrastructure, regional plans, urban plans and zoning plans. Such an aggregation platform will not just offer clients the data itself in integrated, harmonised and thus ready-to-use form, but will also provide rich analysis and visualisation services. Such services can be offered via different interfaces, such as an API and an interactive web frontend (Web GIS).

6. Conclusions

The work of urban and spatial planners has shifted from maps to data.

The most promising feature offered to spatial planners by SDIs is the ability to quickly identify all available spatial data for a planning area. As opposed to the business process changes required to create spatial data, the changes required to efficiently use spatial data as input to the planning process are considerably less.

ISOCARP Knowledge for better Cities

By using and having harmonized spatial datasets, the spatial planner is able to control and develop much wider and integrated solutions, by tacking into account all parameters of spatial development.

It is also to be noted that whereas GIS used to be an expert discipline reserved for domain professionals, the art of digital map making, combining information from a multitude of sources and browsing it on the computer screen is now at the fingertips of any contemporary computer user. This may facilitate a behavioural change whereby less of the map information will have to be printed and more may be accessed directly online from decentralized View and Download services.

Therefore, Spatial Data Infrastructures Networking architectures have a great potential to improve the quality of spatial planning enabling quick overview of and access to all spatial data available for a certain planning area, thus ensuring quality input to the spatial planning process.

It is however necessary to understand that spatial planning is not only maps and spatial data but also planning documents and planning laws, which needs to be available to unambiguously interpret the planning data.

Furthermore, a bridge between the mapping and digital cartography environments of CAD and GIS is needed in order to support the flow of information between homogeneously GIS oriented SDI infrastructures and highly heterogeneous mix of CAD and GIS being used in spatial planning authorities.

In addition to the possibilities offered by the technology, behavioural change is required among the spatial planners to effectively exploit the possibilities of the SDI Networking architectures in their day-to-day operations.

References:

Castells, M., (1996), The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I. Cambridge, MA; Oxford

CEMAT (1983), European Conference of Ministers responsible for Regional Planning

ISOCARP (2009), International Manual of Planning Practice, ISOCARP The Hague

Knaap, G. A. van der and Linge G. J. R. (1987), Technology and industrial Change, London, Croom Helm

Mitchell, W. (1999), e-topia, MIT Press London Cambridge

Mitchell, W. (2002), Planning and design for the information age, ISOCARP The Hague

Mumford, L. (1961), The City in History: Its Origins, Its Transformations, and Its Prospects, Mariner Books, London

Nooteboom, B. (1999), Inter-firm alliances, analysis and design, London, Routledge

Nooteboom, B. (2009) Evolutionaire economie. Economisch Statistische Berichten, 94 (4571), 655, Tilburg University

Rostow, W. W. (1960), The stages of economic growth, London, Cambridge Press

Vancutsem, D. (2010), WP2, European Project Plan4all, www.plan4all.eu, European Commission