The Use of ICT in Planning Practice: Contributions to an Effective Link between Real and Virtual Cities and Territories

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Chapter 2

The Use of ICT in Planning Practice: Contributions to an Effective Link between Real and Virtual Cities and Territories

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ABSTRACT

The use of information and communication technologies (ICT) in spatial planning is contemporary of the development of computers, and has benefited from the possibilities that ICT brought in terms of data processing and visualisation, with the development of geographical information systems (GIS) being the most successful and widespread example of this relationship. Today, there is a myriad of new ICT being developed based on the existence of a large and affordable computational capacity and on the seemingly infinite data made available. And yet, there is still (and there is scientific evidence of) a large gap between the research and development of ICT and their effective use in the professional practice in planning. In this chapter, the authors discuss the main roots of this gap and present some of the main challenges that researchers and practitioners will face to take advantage of the resources available to effectively reduce that gap.

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INTRODUCTION

Virtual cities and territories¹, the main theme of this book, is a concept that is long embedded in the planning theory and practice. The very concept of urban and spatial planning (from now on referred to as spatial planning) implies the conceptualization of desired futures that are not materialised beforehand, implying a virtualisation through a series of visualisation elements that allow planners, decision-makers and citizens to better understand what planning options and processes are at stake. This virtualisation was made in the past by using maps, sketches, artist visualisations and many other drawing-based elements, all of which using paper or other tangible material. It is made nowadays using the very same elements in their digital form, produced by increasingly powerful computational resources. Still today, the use of paper-based graphical elements to create those virtualisations is very popular, among architects, to give just an example.

Cities and their surrounding territories, agricultural and natural spaces, in a broader sense natural/human landscapes in their various scales, are very complex systems that are, no doubt about this, the evolutionary convergence between nature and civilisation. Even the most planned and designed cities and landscapes are the result of some kind of planning process that is aimed to create a more or less liveable human habitat.

These systems were perceived in many different ways throughout spatial planning history. From a more design oriented spatial planning (or, many times, merely urban design) of cities and territories as it was the practice in the 19th century with many of the industrial cities (and even prior to that with the colonial cities), to new attempts to understand them as the result of more complex interactions, as Ildefonso Cerda's Eixample in Barcelona (Puig & Cerdá, 1999) or Ebenezer Howard's garden cities in the United Kingdom (Howard, 2001), spatial planning evolved from the

necessity of expanding (and also building new) cities to accommodate urban expansion towards the necessity of controlling that expansion, especially after the great world wars.

At the same time, there was an emerging interest in cities and territories from social sciences with an emphasis on urban economics, as it is the case of the Central Place Theory by Christaller (Christaller, 1933; Christaller & Baskin, 1966) or Alonso's land rent theory (Alonso, 1964). This new perspective on how cities and territories work as socioeconomic constructions brought a whole new scope to spatial planning. Virtualisation of cities and territories was from then on not only focusing on the physical spatial design, but also aiming to represent the underlying phenomena that rule socioeconomic evolution of cities and territories.

Form – the physical space – and function – the socioeconomic dynamics that take place in that space – were combined and new ways of representing both were used.

Planning approaches also evolved during the early- to mid-20th century from static perspectives of cities and territories, possibly a consequence of both decades of design-based planning and lack of resources to analyse significantly large datasets (that were already becoming more available and scaling), to the incorporation of dynamics, the inclusion of time as a main pillar of spatial evolution. This brought new possibilities and needs for virtualising cities and territories, and their spatial and temporal dynamics.

As spatial planning was becoming an increasingly more multidisciplinary area of both knowledge and practice, computational science and technology was developed.

Very briefly, computational theory was developed in the 1930s with the work of Alan Turing (Turing, 1937) and modern computers were invented in the 1940s, with the famous Colossus used by the British government to decode the German Enigma code and its counterpart ENIAC built at

the University of Pennsylvania, and the “BABY,” the first electronic computer with memory storage capable of running a simple program built at the Victorian University of Manchester. Computational science and computers went on a fast development pace, with an increasingly higher number of new machines developed and used in high profile research from the 1950s to the 1970s. The next big breakthrough was the development of personal computers in the 1980s, which became a widespread standard working tool in the 1990s across all human activities, spatial planning included (see O’Regan (2012) for further reading on computer history).

What can be considered a surprise for many, research in spatial planning was in the front run of the use of computers as tools to deal with increasingly more complex problems and technical approaches. Since the 1950s, in the very early stages of modern computation, spatial planning is making use of computational applications to try to deal with increasingly larger datasets, to develop and implement new modelling approaches to spatial phenomena, and to create and use increasingly more sophisticated forms of visualisation, from mapping to CAD to virtual environments based on 3D imagery.

This long contemporary period of development of both spatial planning and computation brought us to an era in which computers play a key role as the standard working tool for both research and development, and practice, a consequence of the combined use of computational capacities, database technology and visualisation techniques.

Currently, the immense computational capacity given by cell phones and the endless types of sensors that are almost (or in its way to be) universally distributed has opened a brand new and bright world of possibilities for developing and applying new approaches to spatial planning

based on big data, on real time decision-making and on a more representative participation of citizens in planning processes.

However, after more than one hundred years of spatial planning science and seventy years of modern computational science, after countless attempts to bring both areas of knowledge together, and despite of the also countless successful cases in doing it (of which GIS is the most obvious one), there is a general perception among both researches and practitioners that spatial planning practice and the use of ICT are too far apart one from another.

This is what is many times referenced in the literature as the “implementation gap,” or just the “gap” and that has been dealt with from many theoretical perspectives (Briassoulis, 2008; Brömmelstroet & Schrijnen, 2010; Brömmelstroet, 2012; Couclelis, 2005).

The importance of this gap in the practice is a key topic in the current spatial planning agenda, and it could not be absent from a book dedicated to ICT in planning. The sheer title of the book, “Virtual Cities and Territories,” encompasses a possible dual reading from the two main sides of this coin: ICT enthusiasts (both researchers and practitioners) may see it as a good concept that fosters the integration of ICT in spatial planning; ICT sceptics may stress that cities and territories cannot be deemed ‘virtual’ as they are tangible constructions of humans and nature.

This chapter intends to give a contribution to the discussion based on an ongoing critical analysis about the three main pillars of this issue: the research and development of ICT for planning uses, the relationship between research on ICT and the planning practice and the inclusion of ICT teaching and training in spatial planning programmes. This discussion is part of a new agenda for promoting the use of ICT among planning practitioners that

is being developed within the European Council of Spatial Planners (ECTP), the European association of institutes of professional planners.

THE GAP, A CRITICAL ISSUE IN SPATIAL PLANNING

Traditional planning practice is much more focused on the social and economic aspects of problems and practitioners many times give low credit to more technologically intensive approaches. This separation is not new and has many times been in the front line of the scientific and professional discussions, as can be illustrated, for example, by some issues of the *Journal of the American Planning Association* from 1973, in which Lee published his famous "Requiem for large-scale models" (Lee, 1973), and 1994, with the special issue about the same subject with Batty's paper about the role of scientific planning (Batty, 1994), or later in 2005 with Klosterman and Petit's discussion about the topic (Klosterman & Petit, 2005), or Couclelis' seminal paper on the requirements for useful and representative decision support tools in planning (Couclelis, 2005). This problem has been addressed in more detail from the learning perspective by a group of researchers based in The Netherlands, which has a long tradition in spatial planning (Brömmelstroet & Schrijnen, 2010; Vonk, Geertman, & Schot, 2005).

This gap is still a very important issue that is clearly observed in many, if not all, of the countries in Europe, where the professional practice, especially at the local level, still have some difficulties to incorporate new approaches based on ICT. Very few studies addressed the problem, mainly by assessing the usability and the acceptability of the use of ICT in practice. Vonk and colleagues produce an extensive inquiry to a large sample of practitioners (but also academics) around the world and identify several aspects of what they call the bottlenecks blocking the use of planning support systems (Vonc et al., 2005; Vonk, Geertman, &

Schot, 2007). Brömmelstroet produces a similar analysis based on a survey on the reasons to (and not to) use land use and transport models among a wide variety of practitioners in the Netherlands (Brömmelstroet, 2010), a country with long tradition in planning as mentioned before. The question was recently generalized on a special issue of *Transport Reviews* dedicated to the use of models with several illustrative cases in Europe presented by some of the leading researchers in modelling (Brömmelstroet & Bertolini, 2011). Van Lammaren and colleagues also tried to shed some light on the use of 3D as a means to involve stakeholders in participatory processes in the Netherlands (van Lammaren, Houtkamp, Colijn, Hilferink, & Bouwman, 2010).

This gap often occurs due to the lack of technical skills, which leads to a lack of interest, and/or proper financial resources on the planning agencies side, which in turn leads to the lack of access to ICT, especially at the local level. This situation started to change with the mass use of affordable computation and database management in the 1980s, which lead to dissemination of GIS in the 1990s, and in the last decade with the use of 3D technologies to envision future planning and design options, and of complex modelling tools to create increasingly powerful simulators that give more support to the planning processes.

Nonetheless, it is generally accepted among both ICT researchers and developers, and planning practitioners (from both groups of ICT enthusiasts and ICT sceptics) that the use of ICT in planning is still far from its intrinsic potential, which has originated many but still insufficient studies to understand the reasons for this gap.

THE THREE PILLARS OF THE GAP

This gap between the creation of knowledge and its use in practice in the field of ICT use in spatial planning is rooted in three main pillars: (1) the research and development of ICT; (2) the lack of

use of ICT in practice; (3) and an absence of ICT in the syllabus of a large majority of planning programmes.

Pillar One: ICT in Spatial Planning Research and Development

The research and development of new ICT-based approaches as a means to support planning in general is not new, being in fact contemporary of the development of computers themselves. The investment in research on urban models was very intense in the 1950s and 1960s, with some important models being formulated and applied for the first time to real world case studies, for example the Lowry model (Lowry, 1964). These large scale, aggregated models were aimed not only to research but also to help some highly capacitated public agencies to start understanding urban and regional areas as systems that could be controlled as machines, a period dominated by systems planning. Nonetheless, the weak computational capacities, the lack of technology to effectively deal with large datasets, and the extreme high costs to fund this research made very difficult for the large majority of planning agencies to even think about using them. During the 1970s, computers became more accessible (despite still remaining under the academic arena) and the novel database technology based on Chen's relational model (Chen, 1976) and on the development of SQL database language opened new and bright perspectives both on the development of models but also on their use on planning. Nonetheless, due to a shift on the scale of planning, from the large scale systems to local scale, neighbourhood and community planning, and to the slow pace of development of modelling tools that could be attractive to the practice, practitioners become less and less available to use them, a movement influenced by Lee's paper on the serious problems that models comprised by then (Lee, 1973). The 1980s brought to the research three instrumental features that were decisive for rebounding the interest of

planners on new tools, that from then on were starting to be named as ICT: (1) microcomputers, which made the use of powerful computational and visualisation resources cheap and available to everyone; (2) more capable database technology, allowing the use of larger and better datasets; and (3) the development of GIS as the first powerful tool to deal with data and cartography, in an explicit visual manner. The 1990s and the 2000s were the coming to age decades of the development of new ICT in planning. After a rapidly diffusion of the use of GIS among all levels of planning agencies, researchers understood that they could take the next step towards exploring new tools and new approaches that would not only make use of GIS but also benefit from their popularity to interest the practitioners. A wide set of new tools and decision support systems based on many different concepts coming from all areas of knowledge, from physics to mathematics, from life sciences to economic theory. At the same time, computation becomes increasingly more visual, and brand new technology was used to create the first feasible virtual environments.

During these years, spatial and urban systems became to be regarded as complex ones; new disciplines were summoned, with researchers from all backgrounds becoming involved in the study of urban matters, bringing an entire new perspective to the field. Complexity became a central perspective in urban research, spanning from the more perceivable social, institutional and governance perspectives (closer to planning practitioners) to the mathematical and geographical perspectives (closer to researchers). This brand new research gave birth to a wide set of ICT tools that are currently available for planning and policy design. They range from the use of advanced GIS, with new and more sophisticated methods of spatial analysis to the enhanced capacity of providing valuable visualisation (e Silva, Faria de Deus, & Tenedório, 2012; Simão, Densham, & Haklay, 2009), to the development of new modelling tools based on several approaches, from cellular

automata (Pinto & Antunes, 2010) and agent-based simulation (Wise & Crooks, 2012), to discrete choice based models (Kakaraparthi & Kockelman, 2011), to simulations based on optimization (Koomen, Hilferink, & Borsboom-van Beurden, 2011). The development of 3D environments is also experiencing a significant increase based on the LIDAR technology (Yu, Liu, Wu, Hu, & Zhang, 2010) but mainly driven by the industry, from which many platforms emerged allowing the creation of highly realistic virtual environments (for example the ESRI CityEngine and the widely used Google Earth).

However, all these continuous research and development of ICT, which happened within universities and industry R&D centres around the world, was not sufficient to promote the effective and widespread knowledge transfer towards the practice. Despite a new common understanding that spatial and urban systems are complex entities that need to be addressed with an arsenal of different approaches and tools, the underlying complexity of problems has a two folded influence over planning: on the one hand there are brand new concepts and ICT tools to deal with it, opening new possibilities to the planning practice; on the other hand, the difficulty to demonstrate a robust theoretical background to all this ICT-based approaches (which already exists to a great extent, but is many times poorly demonstrated by researchers) helps to maintain some degree of suspicion from the practitioners side.

Pillar Two: The Use of ICT in the Planning Practice

The gap is particularly well identified by Helen Couclelis:

Models are based on science; planning is about policy. Models are much better (...) at dealing with natural science problems; planning is mired in difficulties most often due to issues in the purview of social sciences. Models are usually developed

from within particular disciplinary perspectives; planning must integrate across all domains. Models are about information and facts; planning is about interpretation and values. (...) Models codify uncertain knowledge; planning must lead to certain action. (...). (Couclelis, 2005, p. 1359)

It was always clear that the interaction between planners and researchers is instrumental for giving credit to a “science of ICT” applied to the planning practice. But this interaction was and still is far from being satisfactory to both sides of the problem. Vonk and colleagues have identified three main categories of constraints to the use of planning support systems (PSS) in planning, which can be easily generalised to ICT in a broader scope: (1) the lack of awareness of practitioners about ICT tools; (2) the lack of experience in using ICT; and (3) a low intention of using ICT-based approaches in their practice (Vonk et al., 2005). Brömmelstroet identifies the notion practitioners have that ICT developers should find a balance between the scientific drive of their research and the needs of their planning subjects, meeting the state-of-the-art with the state-of-the-practice (Brömmelstroet, 2010). Van Lammeren shows that the use of simple 3D elements allows a more pleasant visualisation process that was able to engage more an already significant number of users with a simple 3D engine tool built on top of Google Earth (van Lammeren et al., 2010).

Planners seek to find feasible, robust, and perceivable tools that can help their task of developing informed solutions that can be used by a wide group of more or less capacitated agents. These agents, from elected officials to their constituents, from other planning officers (such as transport planners or economists, for example) to the social and economic agents, have their own social and technical discourses. Planners have then the hard (many times too hard) task of coming up with a cross-cutting discourse that can meet all those specific demands. ICT researchers and developers, on the other hand, are many times focusing on

their own outputs, rather than in their outcomes. All ICT tools imply some degree of conceptualisation of reality, a compromise between what is observed, how detailed this observation is, and what is feasible and even possible to be represented by the ICT tools. This level of conceptualisation and even abstraction is many times the first barrier that needs to be crossed. Although planners may be seen as clients that want to have a certain problem solved by the use of these tools, they can easily become dissatisfied once they realise that conceptualising the problems implies too much simplification, especially when social issues are at stake. It is also clear that decision-makers and the general public are very keen on participating in planning processes based on outputs generated by ICT tools. Public participation and technical discussion over planning options using open workshops or focus groups usually benefit from the use of support tools based on indicators, maps or scenario stories that often are outputs from ICT tools.

Another decisive factor relates to the financial and technical capacities of planning agencies to acquire and use in effective ways these tools. The creation of virtual environments or the development of complex modelling tools are, despite all the advances, still expensive. This cost comes from the high degree of expertise that is involved, both in the academic and in the consultancy arenas. Nonetheless, there is already a series of technologies and methods, both on the hardware and on the software sides, that provide affordable or even free solutions that can be easily become available as feasible and accessible tools that can be used in a wide set of institutional and technical contexts.

Nevertheless, there are already many good examples of the use of these ICT tools to assist planning in many different contexts. The European Commission has been using models to assist the evaluation of land use in Europe, in order to assist future policy design and environmental monitoring for transnational planning processes (Petrov, Lavallo, & Kasanko, 2009). The Urbansim

platform is also in use in some North American regions to model land use and transport planning and to assist planning (Waddell & Ulfarsson, 2004). The Toronto metropolitan authority has a very complex land use and transport model in use to support policy design and analysis (Miller, Douglas Hunt, Abraham, & Salvini, 2004). One of the most striking examples comes recently from Belgium, where the biodiversity policy of the Flemish regional government was designed with the help of a complex planning process that involved a wide set of stakeholders supported by the Flemish Technology Institute VITO, being designed, modelled, discussed and transformed into legally binding regulation in less than one year, in 2013 (Poelmans, Uljee, Hens, Verhaeghe, Goethal & Engelen, 2013). Many other examples could be pointed out illustrating the potential of the use of these ICT-based approaches.

Pillar Three: Teaching ICT in Spatial Planning Programmes

Providing future practitioners (and also researchers) with a set of learning contents that will promote the understanding of new ICT as effective tools to support spatial planning is instrumental to bridge this gap.

Apart from the already traditional teaching of GIS in the majority (if not totality) of spatial planning programs, it is very difficult to find in their syllabuses modules dedicated to the use of more advanced ICT solutions. And even the most common contents of GIS courses are only focusing on mapping and on simple spatial analysis, without exploring in greater detail the very high potential that the majority of GIS packages (both proprietary and open source) already offer.

This is a very important factor that clearly helps to explain part of the lack of motivation that practitioners have to use new ICT tools. If they are not exposed to these tools and their use in the free learning context provided by their undergraduate and postgraduate courses, where they can easily

test the tools, and understand them or even fail to do so, they will not be comfortable to start using them in a professional context. They will not be trained to use ICT tools, and they will not be able to decide, as professionals with the responsibility of informing decision-makers and other agents, whether they should hire external consultancy to use them or not, as they do not have enough information and experience.

If spatial planning students become familiar with planning processes based on ICT tools, they will be more aware, as practitioners, of the immense potential of their use, and of the increasingly more critical issue of using not only proprietary software but also the wide scope of emerging open source tools being developed, opening new opportunities to qualify the practice of planning, a key issue especially for the developing countries and regions around the world.

CONTRIBUTIONS TO BRIDGE THE GAP

The use of ICT in spatial planning and in policy design and evaluation at all scales encloses an immense potential that is becoming extensively acknowledged by all the agents involved, from decision-makers to practitioners to the general public. Nonetheless, the gap between the development and the application of ICT tools and methods is perceived by both sides of the discussion and has contributed to the misuse of new and more capable tools to assist everyday processes. It is clear that developers and users must intensify their joint effort to bring their common interests in qualifying decision-making in planning and policy design and evaluation by working together in the design, test, implementation and dissemination of new ICT tools and methods.

The emergence of the new concepts such as 'smart cities', and the existence of several research

funds dedicated to the research of the interactions between developers of ICT and their users (an example could be the COST Action TU1002 about the use of accessibility instruments in the planning practice (COST, 2010)) are good examples of the shift of mentalities. There are also good examples of a new level of acceptability of ICT. At the European level, the use of spatial analysis heavily supported by data processing and visualization, of which ESPON is one of the most proficient agencies (ESPON, 2012), along with the application of simulation tools to forecast holistic scenarios of future Europe (see the work of the Institute for Environment and Sustainability of EU's Joint Research Centre) are good examples of how the gap is being reduced. At the national/regional level, some examples can also be pointed out, as the recent case of the biodiversity policy design process in Flanders (Poelmans, Uljee, Hens, Verhaeghe, Goethal & Engelen, 2013). And at the local level, there are already many planning bodies that are making use of extensive databases and advanced GIS to implement some of their local policies, as well as to interact with their citizens in participatory processes.

New theoretical concepts and the subsequent development of new ICT applications are also digging their ways to become possible and feasible tools to support spatial planning practice.

Some of the main areas of research and application of new ICT to create increasingly more realistic and useful virtual cities and territories are detailed here.

GIS, Web-Based GIS, Accessible Mapping

GIS has experienced a massive development in the last decade. After a period of consolidation in which the number of users and developers of GIS increased significantly, which allowed a complete generalisation of its use in all agencies and com-

panies everywhere in the world, GIS experienced new developments that increased their potential as effective tools for spatial planning.

The spatial analysis modules offer now a wide range of solutions; new mapping techniques that benefit from the immense number of open source map databases such as Google Maps or Open Street Maps are now widely used; the coupling of GIS with 3D techniques made possible and usable the new concept of 3D GIS; and the use of online GIS systems, many times based on the above mentioned map databases, allowed the development of easy-to-use tools that are very welcomed by a wider range of users, particularly citizens, for example in participatory processes (Kingston, 2007; White, Kingston, & Barker, 2010).

GIS will probably continue to be the flagship of ICT tools applied to spatial planning. The concept is now also benefiting from the explosion of new smartphones and of new applications that are based on maps for these portable devices. An increasingly higher number of people already use smartphone GIS applications in a very natural way, on a daily basis, a fact that will certainly help to consolidate new applications of Web-based GIS to a wider set of spatial problems.

Big Data

Data was also the key issue in the use of ICT-based approaches in spatial planning. Datasets have historically enlarged and, broadly speaking, they are now getting larger at an unthinkable scale. It is already very common to have datasets with billions of entries as it can be found in many cases in transport or social network data.

This “big data,” a new concept that is now in the front line of the research in urban studies (see for example Townsend, 2013), offers unlimited possibilities to researchers and developers of ICT to devise new and more realistic ways of representing and simulating virtual cities and territories. These datasets have a great potential for explaining a wide variety of spatial phenomena

that are key to spatial planning, and new ICT tools will certainly benefit from this highly detailed information on everything.

However, this large datasets are still too large for our capacity to devise what information is relevant for our purposes in spatial planning. A new and very dynamic stream of research is bursting on this big data issue, with some papers already published on urban traffic modelling and management (Hasan, Schneider, Ukkusuri, & Gonzalez, 2013; Kloeckl, Senn, & Ratti, 2012; Nabian, Offenhuber, Vanky, & Ratti, 2013), and it is expectable that within a mid-term future some usable applications will have a more effective use in practice.

COMPLEXITY THEORY AND MODELLING

Complexity theory has been introduced to spatial planning in the past two decades, with many authors giving solid contributions, as it is the case of (Batty, 2005; Portugali, 2006, 2011). It is now acknowledged that different contributions from natural sciences disciplines as physics and mathematics can be quite useful providing new tools to understand the complexity of form and dynamics in cities and territories. But complexity was also already introduced by authors that come from the social sciences side of spatial planning science, trying to understand from a qualitative and critical perspective how the complex socioeconomic interactions occur (Healey, 2006). Nonetheless, both approaches are somehow wide apart, a distance that helps to create some confusion (that evolves to inertia) from the practice side to acquire and apply many of these new concepts and methods. There are already many applications of simulation models that are being in use based on concepts that come from complexity theory (Becu, Neef, Schreinemachers, & Sangkapitux, 2008; Crooks, 2010; Ligmann-Zielinska & Jankowski, 2007; Ligtenberg, van Lammeren, Bregt, & Beulens,

2010; Saarloos, Arentze, Borgers, & Timmermans, 2008; Wise & Crooks, 2012). These and other models are already in a very advanced stage of use, allowing planners and decision-makers to make a more effective use of their intrinsic capacity to capture the complexity of many urban phenomena and of policy contexts.

The Concept of Smart Cities

Smart cities are currently the big hype in the urban agenda, with almost a million entries on a Google search of the term. Many important publications are also addressing the theory behind the concept (see Townsend (2013)), providing critical analysis about the many times loose discussion over the topic. It can be argued (as it is indeed among the researchers community) that this flashy new concept was only possible because of the significant development experienced by all the ICT approaches in spatial planning already in place. Benefiting from a new recognition that cities and territories are complex systems that have a great potential to incorporate new technologies (GIS, the complexity based approaches and smartphones) using the huge flow of data (the big data) that is now available from the infinite network of computers, smartphones and sensors of all sorts capturing all sorts of data, the concept of smart cities is gaining increasingly more interest on research but especially on the ICT industry side and on the policy design side.

European policy on both funding urban research and structural funding for new local infrastructures is stressing the need for developing smart approaches based on ICT. Big technological companies, developing both hardware (computers and sensors) and software (both server based systems and smartphone apps) are putting a significant financial effort to support ICT research focusing on urban systems.

This is the acknowledgement that the complexity of spatial planning problems can only be addressed making use of the immense ICT toolkit that is already available, and there is a common feeling in the research and practice community that this is a brand new era in the field.

However, there is a significant lack of conceptual definition of what does smart cities mean in terms of their theoretical framework, and the risk of transforming this new framework approach into a technology driven way of solving urban problems is very high.

Both researchers and practitioners are aware that many times the purely technological approach brings a reduction of planning and a fragmentation of systems, with a consequent lost for the integrated perspective that drives spatial planning. The big influence that the technology companies currently have in this discussion may constitute a risk.

Despite having all this ICT firepower, all the smart approaches are still focusing only on the more obvious and easy-to-deal-with parts of the system, as the e-government, the traffic management or the energy efficiency agenda, just to give some examples. A highly technocratic perspective of cities and territories may lead to the reduction of the capacity of participatory processes to take the lead on the decision-making processes, and many times decision-makers are very keen of moving to these high-tech solutions backed up by the historic players in the ICT business.

There is a clear need to study further the conceptual framework of what do we want to define as smart cities, and how can we use the immense toolkit of ICT already available to promote smarter spatial planning, creating better virtual cities and territories that will help us to plan and manage better the real ones.

There is a significant risk of a misuse of the concept of smart cities to a point in which it will contribute more to deepening the gap between ICT promoters and sceptics.

CONCLUSION

The aim of our analysis is to make an initial reflection that will support an initiative to promote the use of new ICT in planning within the practitioners' communities in Europe and in the developing countries. We are creating a new working group in the European Council of Town Planners that will support research on the development and on disseminating its results among practitioners. The relationship between researchers on ICT and practitioners has always been stained by this gap that is founded, to some extent, on the mistrust that both sides have on the other side needs and goals. Closing this gap by fostering a closer interaction is crucial and must be based on two premises: (1) there is a common goal of developing the science of planning by exploring the capacity to effectively understand the underlying complexity of this field, making use of the ICT tools already available; and (2) there is an immense and increasing potential on the two-way knowledge transfer, as a significant part of the professional and technical discourses are now showing good signs of overlapping and convergence to a common agenda.

We believe that a long way was already done and that never as today the two sides of the gap were so close and share so many common interests and goals. In fact, the advent of the so called information society is a common mind-set for both sides to envision new theories, new methods, and new ways to apply the huge knowledge acquired in an increasingly more integrated way, opening new possibilities one both the research and on the al world application sides.

However, there is still a significant effort to be done both by ICT developers (in academia but also in the industry side) and by practitioners to promote an effective use of ICT as common tools to support decision-making in planning and policy design and evaluation at all levels, without being trapped on flashy concepts that can easily be left apart one day by policy makers. And one must keep in mind that, if this is clear in the context of

developed countries where the planning practice is using ICT already for two decades (the case of GIS), it is critical in developing countries which lack a structured planning system and intrinsic capacities to develop one, especially taking into consideration their complex challenges due to fast demographic and urbanisation growths.

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KEY TERMS AND DEFINITIONS

ICT: Information and communications technologies, a comprehensive concept that includes the hardware, the software and the networks that currently support all human activities.

Implementation Gap: The gap generated by the set of different perceptions between ICT-enthusiasts and ICT-sceptics on how ICT-based planning approaches could benefit the professional practice of planning.

Knowledge Transfer: The process of transmitting knowledge from the stage of solid scientific research to its use in the professional practice.

Planning Practice: The professional practice of spatial planning in general, including landscape, urban or transport planning, among other areas of the built and the natural environments.

Smart Cities: The new, fuzzy concept that, in general terms, defines the way cities in general are adopting ICT-based solutions to provide new tools to urban, transport and services planning and management, and to deliver innovative ICT-based services to citizens; the concept also includes the smart networks that emerge for society and from the economy, mixing what is many times called the hardware – the city and its systems – with what is called the software – citizens and other agents in general.

Spatial Planning: “The making of and orderly sequence of action that will lead to the achievement of a stated goal or goals” as defined by Peter Hall, applied to the built and natural environments, and to societies that use that environment.

Tension in Spatial Planning: (Relates to the “implementation gap”) a general concept of the tension that is clearly identified in the scientific and practice literature between the development of new planning theories and their application to the professional practice; in the present case, this tension relates to the development and use of ICT-based approaches to planning.

ENDNOTES

- ¹ We define cities and territories as broader concepts that include not only their physical spaces but also their inhabitants, the complex socioeconomic relationships of all sorts and all scales created by them and the natural ecosystems that encompass those human habitats.