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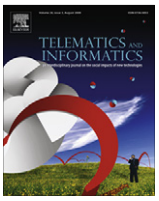

Editorial of the Special Issue on Digital Cities

The research on the use and exploitation of Information and Communication Technologies (ICT), as well as the corresponding practice, initially for a long time were mainly at the firm level. It was aiming at finding new ways of using and exploiting ICT in firms, in order to increase the efficiency of their business processes and their coordination, to support decision making and to enhance interaction with their external environment (e.g. customers, suppliers, partners, etc.), and also at investigating their critical success factors, impacts and business value (e.g. Arvanitis and Loukis, 2009; Loukis et al., 2008; Barua et al., 2004; Melville et al., 2004; Wan et al., 2007). However, in mid 90s' an interest is gradually developed, driven to some extent by the emergence and growing penetration of the Internet and the World Wide Web (WWW), in the use of ICT for improving various aspects of everyday life, mainly through the development of network infrastructures and applications for supporting the communication, collaboration and in general interaction among regional communities. In many cities around the world are constructed network infrastructures offering to public organizations, businesses and houses high speed connectivity, and on top of them are developed applications/e-services aiming at both economic objectives (such as enhanced competitiveness and growth) and social objectives (such as higher quality of life, better services to various groups, social networking and inclusion, environmental protection, etc.). According to Ishida et al. (2002) these initiatives 'shift our view of Internet use from one side (business) to another (everyday life)'.

The 'CONNECT 96–Global Summit on Building Regional Communities' held at the Stanford University, California, USA, in September 1996 provided the opportunity for a first systematic analysis of such initiatives in many cities in quite different cultural and social contexts around the world (USA, Europe and Asia) (Eineman, 1996); in this sense it can be regarded as a starting point of a new research domain aiming to find ways of electronic support of regional communities and investigate their critical success factors, impacts and social value. The main conclusion drawn in this Conference was that among these initiatives there were differences, since they had been 'socially constructed' in quite different cultural and social contexts, but also shared many similarities as well. A variety of objectives of these initiatives were identified, such as provision of infrastructure for citizens' interaction, development of electronic communities for promoting cohesion among different social groups and cultures, support of research and development, promotion of local economic development and coping with structural economic crises, provision of network access to all as a means of democratization and fighting 'digital divide'; also, improvement of training, skills and qualifications mainly of the young citizens, improvement of population access to local government, promotion of cooperation within and between communities, support of environmental protection and regional disasters (e.g. earthquakes) control; some initiatives were aiming at preventing local communities from being cut off from wider trends and creating links to other developed areas. At the same time were identified some obstacles and challenges that these initiatives faced, such as lack of funds and qualified personnel, technical problems (especially with respect to the quality of communication lines), problems in the collaboration among the multiple stakeholders (e.g. private sector firms, universities and research institutions, government agencies, etc.) and difficulties in widening users' base.

Since then these initiatives have been multiplied; in many cities all over the world have been implemented numerous such projects, aiming to build network infrastructures (recently focusing on building municipal broadband networks, e.g. see Bouras et al., 2009; Hudson 2010) and applications, initially for achieving higher administration productivity and interoperability (Charalabidis et al., 2006) and later for facilitating various city functions, such as community activities, local economies and municipal services; a good review of such initiatives is provided by Yasuoka et al. (2010). This gave rise to the development of the 'digital cities', which are extensive information systems (including network infrastructures and applications running on them) that collect and organize the digital information of the corresponding 'physical cities' and provide a public information space for people living in and visiting them (Ishida et al., 2002). Digital cities tend to integrate large quantities of both WWW information and real-time sensor-based data from physical cities using digital maps and geographical information systems (GIS) as front ends. Big numbers of sensors can be embedded in various points of the city, collecting visual information (i.e. photos and videos at various points of the city) automatically, which can be integrated using a digital map; these can be accessible by citizens via various electronic channels (e.g. PCs, mobile phones, handheld electronic de-

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vices, etc.), enabling them to 'feel' and understand better the life and activities of the city and possibly participate in them. Such an advanced 'digital city' will become an essential complement of the 'physical city' - mirroring and at the same time affecting it.

The digital cities developed so far, according to Yasuoka et al. (2010), differ significantly in two basic dimensions, which can be used for categorizing them: the socio-technical and the virtual-physical dimension. On the socio-technical dimension two extreme situations can be defined: technological dominance/direction, where ICT specialists play a central role and focus on finding ways of applying advanced technologies to regional information spaces; and on the contrary social dominance/direction, where the main emphasis is on facilitating citizens' life using appropriate ICT that provide local information and enable local interactions; between them we can have various 'intermediate' situations. On the virtual-physical dimension we can also define two extreme situations: on one hand digital cities closely associated with (or even 'mirroring') the corresponding physical cities and providing functions for accessing regional information and activities; and on the other hand digital cities not directly associated with physical ones, rather resembling virtual worlds like 'Second Life', with appropriate functions for supporting interactions among specific groups of citizens or communities of interest; similarly various 'intermediate' situations exist between these two extreme ones.

Cities have been for long time of critical importance for economy and society, as they bring together (in geographic proximity) many different types of resources and people, and this allows various economic and social activities to take place efficiently. It has been argued by several scholars that the development and penetration of high speed networks would result in 'the end of geography' and therefore in the reduction of the importance of cities; however, this did not happen (Van den Besselaar, 2005). Modern ICT enable us to work, shop, learn and socialize from any location, e.g. through tele-work, e-shopping, e-learning, e-fora and blogs, so it has be predicted that this would reduce the role of proximity in physical space and face-to-face communication, which would gradually be replaced by various forms of tele-presence and virtual organizations. At the same time the emerging 'dematerialization' of production would reinforce this trend. These would reduce the importance of resources and people concentration offered by the cities and finally would result in their decline and 'disurbinization'. However, this has not been realized as many important economic and social activities continue to necessitate some persons and resources to be present at the same geographic location and at the same time; also people spend most of their income for housing, shopping and entertainment near the place where they leave. On the contrary the role of cities as economic, cultural and knowledge centers has increased. This necessitates the electronic support and enhancement of their main functions through the development of appropriate supportive citywide network infrastructures and applications/e-services in the form of 'digital cities', which tend to become of critical importance for attracting and maintaining new high value economic activity and for offering high quality of life to the citizens. It should be noted that in the past several technologies have affected significantly the structure and functions of cities, such as the streetcar (Warner, 1978; Sheller and Urry, 2000) and the telephone (Pool, 1977). So several scholars argue (based mainly on theoretical analyses) that these digital infrastructures might have severe impacts on the structure and functions of cities (e.g. Moss, 1998; Zook et al., 2004).

Therefore much more research is required in this area. It is important to analyze systematically 'digital cities' projects in various national and cultural contexts and gain knowledge from them, which is going to be useful for improving both design and implementation of future attempts, and also for public policy making in this area. In particular, it is important to gain a deeper understanding of the main motivations and objectives of these projects, the main difficulties and challenges they faced, the business models they adopted and the role of government agencies, private sector firms, universities and research institutions, and to assess their social, economic and other city-related impact and value. Also, it is quite interesting to examine to what extent the above theoretical expectations concerning the impacts of these digital infrastructures on the structure and functions of cities will be realized.

The present 'Special Issue on Digital Cities' aims to contribute in these directions. It includes seven papers covering a variety of aspects of digital cities (implementation methodology, network infrastructures, applications, impacts) and also a variety of national and cultural contexts (Brazil, European Union, Jamaica, Korea, USA). The first two papers are dealing with digital cities implementation methodology. The introductory paper titled 'Digital Cities: Towards an integrated decision support methodology' by Emmanouil Ergazakis, Kostas Ergazakis, Dimitrios Askounis and Yannis Charalabidis initially sets the stage presenting the basic concepts of digital cities and the basic benefits they offer and reviewing the strategies of some successful cases. Then it presents a decision support methodology for developing digital cities, which has been constructed as part of the European Union project "A network for rapid and sustainable ICT regional adoption". Its main target group is local authorities interested in developing digital cities infrastructures, and aims to support them so as to select the most appropriate ICT interventions and best practices, integrate them into their strategic approaches and finally adopt and implement them in a rapid and sustainable way. The second paper titled 'Disruptive innovation for social change: how technology innovation can be best managed in social context' by Dong-Hee Shin and Chul-Woo Lee analyses Korea's strategy for the development of the ubiquitous city (u-city) using the Actor–Network Theory. It concludes that the implementation approach adopted by the Korean government did not pay enough attention to the participation of stakeholders in the design of the digital city. Korean case reveals the significance of participatory design in u-city development: the design of such a complex and pervasive intervention should be based on users' needs, and its design decisions should be based on community consensus. This paper has already been published in Volume 28, issue 2 (doi:10.1016/j.tele.2010.10.002).

The third paper titled 'An exploration of user-generated wireless broadband infrastructures in digital cities' by Catherine A. Middleton and Amelia Bryne is dealing with digital cities' network infrastructures. Initially it examines the broadband connectivity options available in digital cities and concludes that existing shortcomings create opportunities for citizens

to share their own broadband connections. Then it explores the approach of Wi-Fi hotspot provider FON to create 'user-generated broadband infrastructure' and outlines some reasons why it has been unable to deliver highly robust broadband infrastructure; also it discusses ways in which users and the public sector can be involved in developing new mobile infrastructures that will meet citizens' needs. The fourth paper titled 'Digital cities of the future: Extending @home assistive technologies for the elderly and the disabled' by Charalampos Doukas, Vangelis Metsis, Eric Becker, Zhengyi Le, Fillia Makedon and Ilias Maglogiannis is dealing with digital cities' applications/e-services. It proposes a framework for extending assistive technologies for the elderly and the disabled from the indoors environment to the outdoors spaces of modern cities, based on sophisticated sensors to be placed in public spaces and mobile communications infrastructures. Sensors will interact with a vast infrastructure put out across an urban environment, especially using cell phones, GIS, GPS, public cameras and other technologies already in place. Subsequently, the data generated and transmitted can be used as input to an intelligent, context-aware infrastructure using software and hardware agents to assist the elderly and the disabled population.

The remaining three papers are dealing with the impacts of digital cities. The first of them titled 'Assessment of digital inclusion via the actor–network theory: The case of the Brazilian municipality of Pirai' by Adonai Teles and Luiz Antonio Joia presents the results of the analysis of a digital city/inclusion program implemented by the Municipality of Pirai in Rio de Janeiro state, Brazil. The Actor–Network Theory was used to investigate the formation of heterogeneous networks of actors during the implementation of the above program. It is concluded that there are different groups derived different levels of benefits: the municipal executive body, students and teachers of the public school system had big benefits, while the general public, including tradespeople and entrepreneurs, are still far from reaping the full benefits of this digital inclusion program. The second paper titled 'The challenge of e-participation in the digital city: Exploring generational influences among community telecentre users' by Arlene Bailey and Ojelanki Ngwenyama analyzes the experiences of four telecenters (=public computer and Internet access centers) in Jamaica and focuses on the role of inter-generational interactions in community telecentres in facilitating low-income, older and technology-challenged citizens to gain access to and use digital city infrastructure. Older telecentre users expand their e-literacy skills by learning from the younger users, and the social ties developed between these two groups in telecentres seem to have positive spillover effects to the wider community. The final paper titled 'A Critical Discourse Analysis of three US municipal wireless network initiatives for enhancing social inclusion' by Andrea H. Tapia, Lynette Kvasny and Julio Angel Ortiz analyzes the municipal wireless broadband Internet initiatives of three USA cities (Philadelphia, San Francisco and Chicago). It concludes that in these initiatives there is extensive use of digital inclusion rhetoric around broadband deployments, which has brought the social inclusion issue to the forefront, pushing the vendors and community-based partners toward a more favorable stance and attracting more political attention to this issue. At the same time this need for social/digital inclusion had to be combined with business realities and objectives.

The findings of the papers of this Special Issue provide interesting and useful insights into significant aspects of digital cities. With respect to digital cities implementation methodology they indicate that the need of incorporating new and sophisticated ICT in digital cities can leads to 'asymmetric' implementation teams, dominated by technological experts and with very low representation of the other stakeholders (e.g. potential users); this can be the source of many problems in the implementation of these projects and the acceptance of their products. Also, since the implementation of digital cities is complex and difficult, some local authorities (e.g. smaller ones) might not have the required capabilities for this, so it is important to systematically select and use the knowledge and experience of other local authorities that have been successful in this area, and appropriate decision support systems can be very useful for this purpose. Concerning digital cities' network infrastructures they suggest technological progress in this area has created many options, but there are still significant shortcomings which create opportunities for citizens/users-generated complementary infrastructures; however this approach has still weaknesses and problems, so improvements are necessary in order to have an efficient large scale application of it. With respect to digital cities' applications, which will be developed and run on these network infrastructures, the findings presented in this Special Issue indicate that beyond the 'classical' applications there can be many highly innovative ones, which can produce high social value, such as the extension of existing applications of assistive technologies for the elderly and the disabled from the indoors home environment to the outdoors public spaces. Finally concerning the impacts of digital cities the findings of the relevant papers indicate that they can significantly contribute to the 'digital inclusion' of various sensitive groups, such as the low-income, the elderly, the technology-challenged, the students and the teachers, in quite different national and cultural contexts. The 'mechanism' for achieving this might differ from case to case, ranging from the integration of digital cities infrastructures in the official educational system (as in the case of Pirai, Brazil) to the inter-generational interactions and influences in the public computer centers (as in the case of Jamaica). However, in some cases a compromise is needed between social/digital inclusion objectives on one hand and profitability objectives of the involved private firms on the other.

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