

THE CONCEPT OF 'SMART CITIES'. TOWARDS COMMUNITY DEVELOPMENT?

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Abstract – *The value of ICTs in support of a variety of functions in urban environments, serving people, businesses and governmental institutions is nowadays greatly acknowledged. The concept of 'smart' cities has emerged, where local innovation systems, largely supported by digital networks and their applications, are contributing to the: diffusion of knowledge and information, knowledgeable decision making, network cooperation, efficient interaction among various actors and intelligence gathering. The aim of the paper is to indulge in the concept of 'smart' cities for inclusive community development. The first part elaborates on the concept of 'smart' city, by exploring its various meanings, key dimensions, and potential for community development. In the second part, the Greek experience is presented, by means of a prominent example of a Greek 'smart' city, developing city-specific ICTs applications for inclusive community development. Finally, in the last part, some conclusions and future prospects of the concept of 'smart' cities for community development in Greece are drawn.*

Key-words – *ICTs, 'smart' city, community development, sustainable urban development, urban planning, participation*

Résumé – *L'utilité des TIC en appui d'une variété de fonctions, que ce soit en milieu urbain, au service du public, des entreprises ou des institutions gouvernementales est aujourd'hui largement reconnue. Le concept des « villes intelligentes » est apparu là où les systèmes locaux d'innovation, largement soutenus par des réseaux numériques et par leurs applications, ont favorisé : la diffusion de connaissances et du savoir, la prise de décisions éclairée, la coopération en réseau, l'interaction efficace entre différents acteurs, et la collecte de renseignements. Cet article se propose d'interroger le concept des « villes intelligentes » pour un développement communautaire inclusif. La première partie aborde le concept de « villes intelligentes » en examinant ses diverses significations, les avantages clés de ces villes et leurs potentiels de développement local. Dans la deuxième partie, l'expérience grecque est présentée à travers l'exemple remarquable d'une « ville intelligente » ayant développé des applications spécifiques utilisant les TIC en vue d'un développement local inclusif. Enfin, on livre dans la dernière partie, des*

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éléments de débat et des perspectives sur le concept de villes intelligentes pour le développement communautaire.

Mots clés – TIC, Villes intelligentes, développement communautaire, développement urbain durable, planification urbaine, participation

Digital broadband capability and its potential to support intra- and inter-community interaction are considered of crucial importance for increasing competitiveness, local prosperity and social inclusion in the urban context. Moreover, it can support the creation of a communication platform for information exchange, local cooperation and intelligence-gathering that may result in more active and informed citizens, thus enhancing community development potential (Albert et al. 2009). Its power to transform existing communication and interaction patterns as well as to increase efficiency in economic, social and environmental urban processes has motivated many urban environments worldwide to make efforts in placing a sufficient level of digital infrastructure development at the service of local stakeholders and citizens. ‘Wired communities’ or ‘networked communities’ or ‘smart communities’ or ‘intelligent communities’ are emerging in this respect.

This note elaborates on the context of ‘smart’ cities (definitions, critical success factors, digital dimensions,) and their potential to support community development purposes.

DEFINING ‘SMART’ CITIES

Broadband network developments (DSL, cable, satellite and wireless communication) are greatly affecting the interaction potential of various actors (e.g. individuals, small businesses, institutions and local governments,) by providing access to both worldwide knowledge and information (re)sources as well as a broad range of tools to connect both locally and globally. Based on the challenging new network opportunities, and on steering competitiveness gains and community development efforts, the concept of ‘*smart communities/cities*’ has appeared. Searching the literature available, however, a clear-cut definition of ‘smart’ communities/cities does not exist. Furthermore, a number of terms similar to ‘smart’ communities have appeared: ‘wired’ communities, ‘broadband’ communities, ‘digital’ communities, ‘networked’ communities, ‘smart community network’ and ‘community informatics’, ‘intelligent’ communities; these seem to be used interchangeably by the various researchers, but all imply communities that are making ‘*a conscious effort to understand and engage in a world that is increasingly connected*’ (Albert et al. 2009:8). Although there are certain differences in the way the above terms are used by the various researchers, all definitions have three key aspects in common, namely: the *communication mean* (network infrastructure – technology – ICTs); the *process* (networking of various actors); and the *goal* pursued (public involvement or other).

'Smart' communities are defined by the Canadian Federal Government (CFG) (2002) as those communities in which local leaders and stakeholders, by use of electronic networks and the Internet, are forming alliances and partnerships in order to innovate and extract new economic and social value. In this definition, emphasis is placed on the network deployment (transport and ICTs), but also on investments in human and social capital in support of sustainable community objectives and quality of life, by means of engaging social participation as well as user-specific technologies and community-building applications. The idea of a 'wired' city as the main development model and of 'connectivity' as a source of growth is brought to the forefront for increasing local prosperity and competitiveness (Komninos 2009). A broader definition, provided at the Smart Cities Workshop (2009), defines a 'smart' city as '... a city that makes conscious effort to innovatively employ ICTs in support of a more inclusive, diverse and sustainable urban environment', a definition that is also adopted by the California Institute for Smart Communities (2001). An alternative approach for defining 'smart' communities' is to place placing emphasis on the importance of *social and environmental capital* in urban development. This implies communities whose citizens are taught to learn, adapt and innovate. It has a strong *focus* on social inclusion and on participation in community affairs and decision-making processes in order to reach social and environmental objectives (Coe et al. 2001).

The terms '*community informatics*'², '*virtual community*'³, '*digital community*'⁴, and '*smart community network*', used by various researchers, seem to have very close meanings to the CFG definition (Albert et al. 2009). '*Networked communities*', on the other hand, relates to communities that have deployed digital broadband capability and make maximum use of it on behalf of their citizens, targeting economic development, organizational performance and high quality of living (Albert et al. 2009). '*Community networks*' are defined as publicly controlled networks, at the service of the community, namely: individuals who use the network for communicating with friends, playing games, acquiring information, obtaining training etc.; and organizations running a variety of work tasks through the network (Albert et al. 2009). An '*intelligent community*', on the other hand, is a community that perceives broadband communication services as a vital new collaborative opportunity for economic growth and social welfare (ICF 2007). The distinctive attribute of such communities is the view of local users of

² The term '*community informatics*' places *more* emphasis on the ways that ICTs are used to support communities in achieving economic, social, cultural and political objectives (Keenan and Trotter 1999).

³ The term '*virtual community*' mainly refers to completing tasks in an on-line environment, thus eliminating barriers of place and time, while reinforcing cooperation potential among people, who are physically separated.

⁴ A 'connected' community, which integrates broadband communications infrastructure with innovative services in support of the needs of governments, businesses and their employees, as well as citizens (Intel 2007). e.Republic's Center for Digital Government and Digital Communities Program defines as 'digital communities' those local municipalities that successfully incorporate ICTs into operations to better serve constituents and businesses (<http://www.digitalcommunities.com/survey/cities/>).

ICT networks not as simple customers and consumers, but also as *'producers and creators of content, products and services'* (Albert et al. 2009:9).

At least five different descriptions can be encountered for 'intelligent cities', as follows:

- Intelligent cities are meant as virtual reconstructions of cities or virtual cities (Droege 1997). The term has been broadly used as an equivalent to 'digital city', 'information city', 'wired city', 'telecity', 'knowledge-based city', 'electronic communities', 'electronic community spaces', 'flexicity', 'teletopia', 'cyberville', covering a wide range of electronic and digital applications relating to digital spaces of communities and cities⁵.
- World Foundation for 'smart' communities defines 'intelligent' cities as 'smart' cities which, based on the adoption and use of ICTs, are paving a 'smart' development. This implies a conscious effort to use ICTs to transform life and work within a certain region (California Institute for Smart Communities 2001).
- 'Intelligent' cities were also defined as intelligent environments with embedded ICTs, targeting the creation of interactive spaces that bring computation into the physical world. From this perspective, 'intelligent' cities (or more generally 'intelligent' spaces) refer to physical environments in which ICTs and sensor systems disappear as they become embedded into physical objects and the surroundings in which we live, travel, and work (Steventon and Wright 2006; Bakis 2010).
- Along the same lines, 'intelligent' cities (communities, clusters, regions) were defined as multi-layer territorial systems of innovation that bring together knowledge-intensive activities, institutions for cooperation in learning and innovation, and digital spaces for communication and interaction, in order to maximize the *problem-solving capability* of the city. The distinctive characteristic, in this respect, is highly innovative performance, as innovation and solving new problems are the main features of intelligence (Komninos 2002; 2006).

The goal behind 'smart' city development is the provision of qualitative and innovative services to the public, to the economic activities, and also to the visitors of a city, together with the production of a safe, pleasant and inclusive urban environment. To this end, the development of a 'smart city' presupposes the proper *integration* of three layers (Komninos 2006; 2009):

- *Physical layer*, incorporating human capabilities and knowledge-intensive activities;
- *Institutional layer* that incorporates proper institutional mechanisms for social cooperation towards knowledge and innovation development. (More specifically it involves institutions and mechanisms for information diffusion, transfer of technology, cooperative new product development, etc.);
- *Digital infrastructure layer* that incorporates a range of ICT infrastructure, tools, applications and content in support of both individual and collective action.

⁵ MIMOS - Malaysian Institute of Microelectronic Systems.

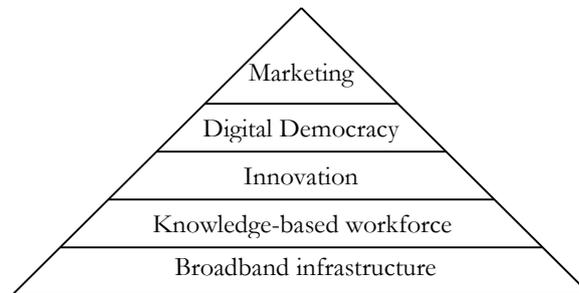
The concepts of ‘smart’ and ‘intelligent’ cities are treated in the available literature as being quite relative. However, in ‘smart’ cities, the emphasis is placed more on embedded systems, sensors and interactive media that support knowledge diffusion and interaction. ‘Intelligent’ cities, on the other hand, seem to rely more on collective /collaborative intelligence, innovation systems and web-based collaborative spaces. In both cases, the focus is on the integration of the three dimensions of urban space i.e. the physical, institutional and digital dimension.

GOING ‘SMART’: CRITICAL FACTORS

In its effort to explore the best practices amongst the world's Intelligent Communities adapting to the demands of the Broadband Economy, The Intelligent Community Forum (ICF), a think tank that studies the economic and social developments of 21st Century communities, defines five *critical success factors* for the creation of ‘smart/intelligent communities’, which are also used as evaluation criteria for assessing and rewarding the efforts undertaken by various cities towards ‘going smart’. These are as follows (Figure 1) (ICF 2008; Bell et al. 2008; Passerini and Wu 2008; Komninos 2009):

- Deployment of *broadband communication infrastructure*, used for the evaluation of the local capacity for digital communication. It should be noted that connectivity choices made by a ‘smart’ city need to be evaluated through both the prism of that city’s local vision, and the affordability of costs incurred for the users (Passerini and Wu 2008).
- Effective *education and training* of local labour force, strengthening high rates of adoption/use of ICT infrastructure. This results in increasing the capacity of this workforce to perform knowledge-intensive activities, while transforming ‘individuals’ into ‘citizens’, and enhancing the potential of participation in knowledge creation processes.
- Policies and programs that promote ‘*digital democracy*’ by bridging the digital divide among different groups of society, ensuring that everyone will reap the benefits of the broadband revolution (i.e. digital inclusion);
- *Innovation capacity*, assessing the level of creation of an innovation-friendly environment that attracts highly creative people and businesses.
- *Marketing* of ‘smart’ communities as advantageous places for living, working and running a business, which leverages the community’s potential to attract talented employment and investments.

Figure 1: Critical success factors for cities 'going smart'



Source: Adapted from ICF website, also in Passerini and Wu 2008.

It should be noted that although technology forms the basis for community interaction, it is in fact the last factor that worries leaders of smart communities, as it constitutes a success factor that changes rather quickly. As experience from world pioneer smart cities shows, of critical importance are the rest of the factors presented in Fig. 1, as well as effective policies to challenge local people to use broadband. The key issue, in this respect, is not 'what' type of technology is available, but how 'effectively' this technology is used (Bell et al. 2008).

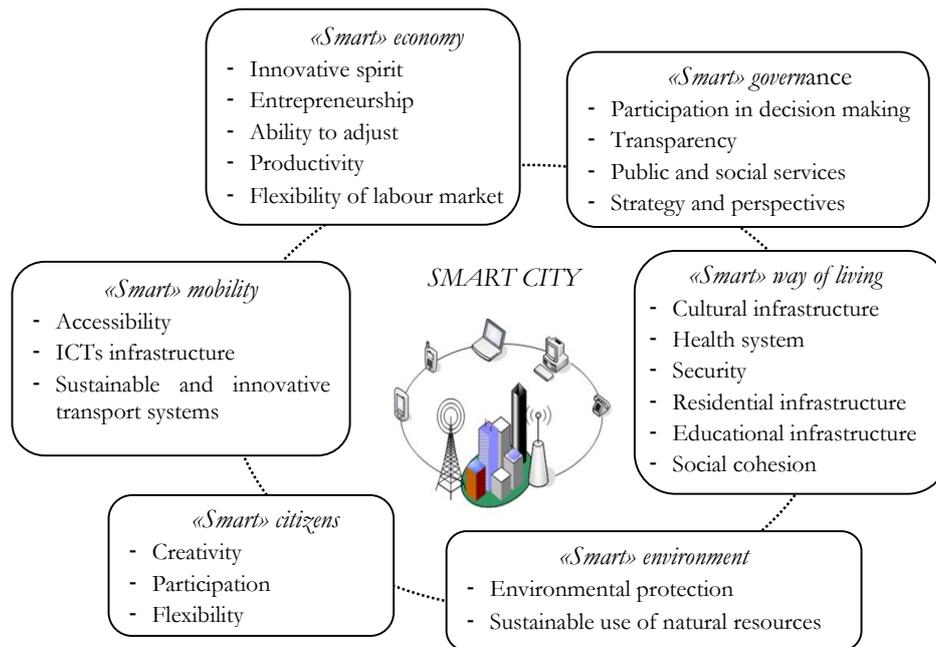
DIGITAL DIMENSIONS OF 'SMART CITIES'

The 'smart' city can offer local citizens and businesses a range of tools and ICT applications that can steer innovative behaviour. These applications create virtual environments, supporting both individual choices and group communication-collaboration options (Korninos 2006). The whole range of applications can be classified in the following groups:

- *e-Information*: refers to the provision of various types of information to a wide range of audiences, e.g. citizens, visitors, businesses, institutions;
- *e-Business*: refers to the potential offered to businesses for the exploitation of e-business opportunities, adoption of business-to-business (B2B) and business-to-client (B2C) interaction models, adoption of new innovative strategies for e-marketing their products etc.;
- *e-Marketing*: supports a range of e-marketing possibilities for a city / municipality in the promotion of the city's image (products, archaeological sites, cultural assets etc.);
- *e-Government*: refers to the provision, in a more effective way, of services to citizens, businesses, and governmental institutions (G2C, G2B and G2G interaction);
- *e-Innovation*: refers to the potential for e-cooperation and on-line development of new products;

- *e-Participation*: refers to the increasing potential for e-inclusion of citizens, thus strengthening active participation in the decision-making processes (e-Democracy).

Figure 2: Dimensions of smart city development



Source: Adapted by Tsarchopoulos (2006)

Based on a search of 'smart cities' literature, it is evident that this term does not carry a holistic meaning gained by the integration of certain city attributes/functions. Instead, it is used to describe innovative aspects available to a city that are based on the adoption/use of ICTs. These aspects can be associated with the economy, local population, governance, citizens' participation etc. With regard to the economy, a 'smart' city can be a city hosting a 'smart' industry (i.e. an industry that is either a producer or a heavy user of innovative ICTs,) or a city which develops highly ICT-based business parks in its territory. It is also used to describe a city with 'smart' inhabitants (i.e. highly educated local human resources - [Giffinger et al. 2007],) or a city where G2C (government to citizen) interaction is heavily based on ICTs (e-governance); or a city exhibiting a strong, ICT-enabled, public participation in local decision-making processes (e-democracy). Moreover, it may refer to a city which makes use of modern ICTs in urban processes in order to improve the quality of life for its inhabitants (e.g. 'smart' transport systems in support of urban traffic management). Finally, the term is used to describe a city that makes use of ICTs to improve services in several fields, e.g. security/safety, health, 'green' urban development, or sustainable energy consumption.

In the European Smart Cities Project (Vienna University of Technology), six *dimensions of 'smartness'* were identified, referring to the economy, local citizens, governance, mobility, environment and way of life. These are shown in Figure 2, together with a range of indicative issues raised within each category (Giffinger et al. 2007).

'SMART CITIES' AND COMMUNITY DEVELOPMENT

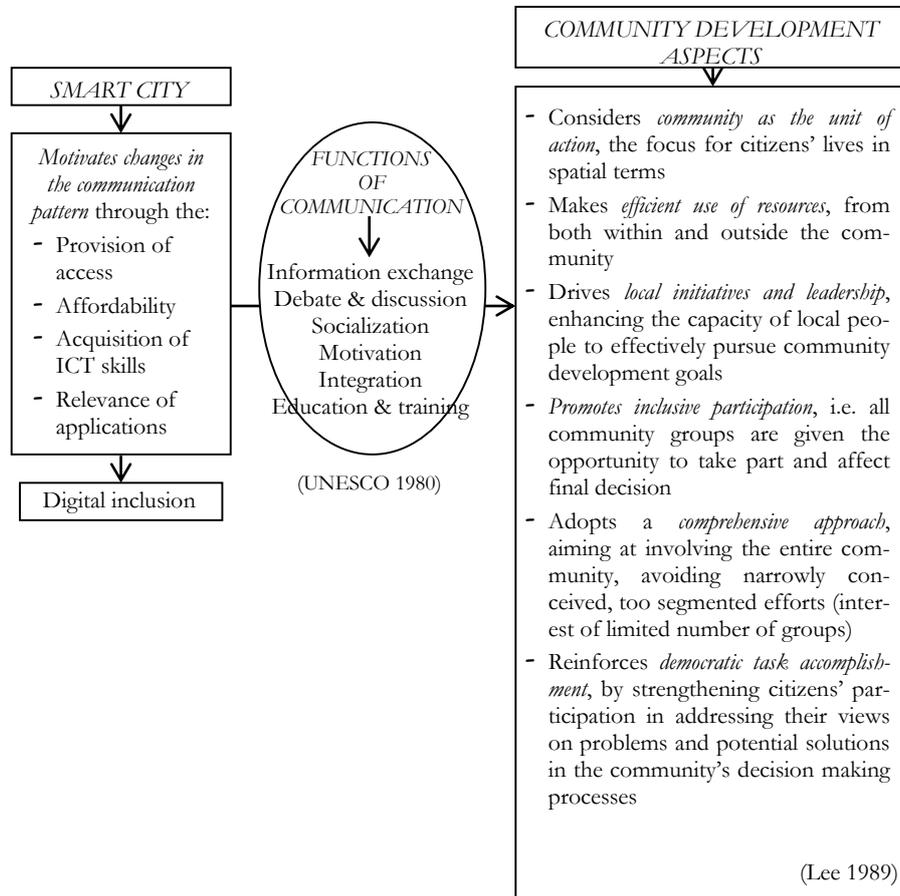
Getting access to effective and affordable ICT systems is crucial for reaping the benefits of communication and driving *community development processes* in the broadband economy context. This places new challenges in front of planners and regional policy-makers regarding the bridging of the '*digital divide*' at community level, and coping with *ICT illiteracy*. The UNESCO Report (1980) entitled 'Many voices one world', stresses the need for a '*democratization of information flow*', implying more equal access to information for larger groups of society, together with the need for policy action towards this end, dealing with the development of high-quality broadband connectivity. It also articulates and legitimizes the idea of '*the basic human right to communicate*' and be informed about whatever might affect daily life in order to support autonomous decision-making. Moreover, emphasis is placed on the role of citizens and stakeholder groups as *carriers of change* at the community level, based on participation and access to information.

Today the scope of citizens' and stakeholders' right to information has been considerably broadened, in alignment with the huge development of ICTs and their applications that has given rise to a further increase in interaction and networking potential both between and among different groups of society, thus contributing to a more *equitable share* of knowledge and information, and a relative shift of *power relationships* affecting decision-making processes at the community level.

A crucial *objective* of the 'smart' cities' perspective relates to *community development*, seeking to empower local individuals and groups by providing them with the necessary skills and information to affect changes in their own communities. As Lee (1989) states, community development represents a *process of change*, where *participation and collective action* is of crucial importance. It implies a community where individuals are assisted to acquire skills and competences and to develop their own views and attitudes, a requirement for their democratic participation in a wide range of community problems (Mezirow 1963). Community development creates the foundation for building communities that are based on justice, equality, mutual respect and cooperation; it also forms the cornerstone for the creation of *relationships and networking*, thus strengthening bonds and understanding among local citizens, as well as the creative exploitation of local knowledge and experience. Moreover, it is considered as a step for influencing power relationships and their role on policy decisions, by changing the position of ordinary people and their potential to affect local decision making.

The key aspects of community development, according to Lee (1989), are presented in Figure 3, where the role that 'smart cities' can play towards this end is also shown.

Figure 3: Smart cities for community development



'SMART CITIES' IN GREECE - A CASE STUDY

This section briefly presents a successful example of a 'smart city' in the context of Greece, namely the city of Trikala (Figure 4). It is worth noting that this city is the first 'smart' city in Greece, rewarded by ICF for three consecutive years (in 2009, 2010 and 2011 it was among the top 21 'smart' cities of the world)⁶.

⁶ The city of Trikala is a small peripheral urban settlement in central Greece (80,900 inhabitants in 2011), capital of the respective nomos (administrative unit as the NUTS 3 level) of Trikala. The city was traditionally one of the most isolated urban settlements in the Greek territory, mainly due to the rough morphology, the inadequate access to transport and communication and the low skills profile of the local population. The city had, for many years, experienced economic stagnation, a decrease in population due to migration, and a lack of employment opportunities, especially for younger groups, low-income families etc.

The city's efforts towards going 'smart' started quite recently⁷. The objective of these efforts was to establish effective interactions among citizens, businesses and the local government (G2C, G2B and B2C interactions,) serving sustainable urban development objectives. Towards this end, efforts were concentrated on the following 'smart' dimensions: a) *smart living*, aiming at the improvement of the quality of life in the city; b) *smart economy*, in support of business interaction / development; c) *safety of citizens*, aiming at the protection of disabled citizens; d) *social care*, aiming at the provision of e-Health services to the local population (in-house and mobile services); and e) *e-Participation/e-Democracy*, encouraging the active participation of citizens in the community's decision-making processes.

Figure 4: The city of Trikala, Greece



Source: Google Earth

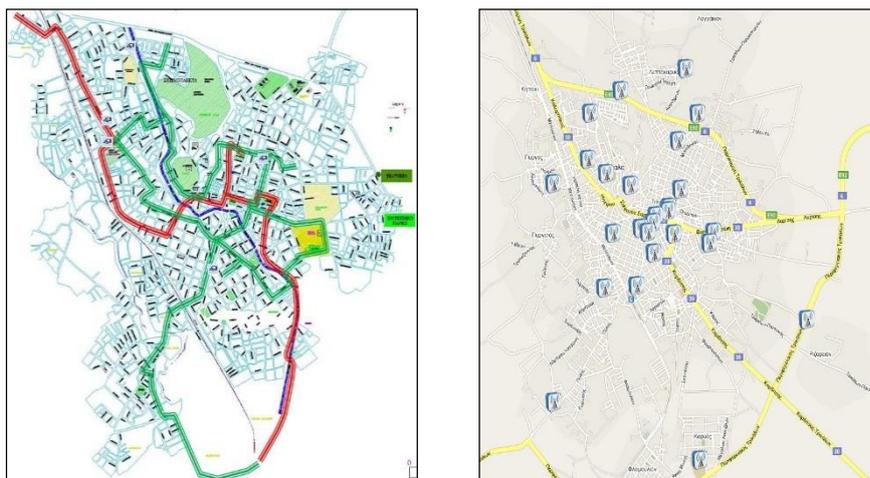
More specifically the following *e-initiatives* were undertaken:

- *Smart health care*: provision of health services to elderly, disabled and chronically ill citizens (about 300 citizens), based on the city's wireless broadband network and portable devices, via which these citizens are steadily monitored, and by which they are offered health care services whenever necessary.
- *Smart safety*: the city is involved in a pilot EU project that aims at creating a 'Smart House' for elderly people with Alzheimer's, by means of deploying

⁷ In 2008, the 'e-Trikalla A.E' was established, run almost exclusively by the Municipality of Trikala (99%) in cooperation with Trikala's Chamber of Commerce (1%).

- fire/water sensors, house surveillance equipment, reminder/help equipment, GPS equipment, etc.
- *DEMOSTHeNES - Citizens' Complaints Service System*: a platform whereby citizens can place complaints about various aspects of everyday life (e.g. litter collection, pavement problems, parking spaces), which are properly addressed to municipality services for further handling.
 - *Smart Park System*: aims at coping with the severe parking problems of the city. Citizens can, by SMS, pay for municipality parking places, extend the duration of parking, and pre-reserve a parking place in the city.
 - *Smart Transport*: development of a system that aims to offer reliable and effective public transport services in the city. By means of this system, the municipality can monitor and manage the municipality fleet, monitor the public transport fleet, and monitor congestion in the city. It also offers e-ticketing services and location-based information on bus transportation.
 - *GIS – Location-based information to citizens*: providing information on a range of the city's services, such as medical services, entertainment etc.
 - *Tourist Portal*: aimed at providing tourist information on the region's assets, and the downloading of this information by PDAs, connected to free municipal Wi-Fi.
 - *e-Participation / e-Democracy*: the highest priority issue is public participation in the decision-making process. The municipality has strongly promoted e-interaction with citizens and local businesses, who can not only set the agenda of the municipal council (local priorities), but also express their opinions on the issues discussed by the council, then e-vote and finally e-interact with the city council to affect the final outcome. In such a context, e-Democracy and e-Participation are enhanced, as is the effectiveness of the various policies, as they relate to a well-informed and strongly-engaged public.

Figure 5: Network infrastructure of the city of Trikala



Going 'smart' largely reflects the effort of the city of Trikala to address new sustainable development perspectives, taking advantage of the potential offered by ICTs for removing isolation. By exploiting available resources both at the national and the European level, and with the support of liberal local leadership, the city has been, in a quite short time period, transformed into a pioneer at the national level and a prominent example at the international level (being recognised for three consecutive years -2009, 2010 and 2011- by the ICF). The main emphasis of the city's effort is on the creation of: firstly a vision, inspiring and motivating local citizens and businesses to participate in local affairs; and thereafter an innovative urban environment that provides e-services affecting people's lives and opportunities. This is largely supported by the deployment of ICT infrastructure (a 30km fiber optic network and 21 free access nodes – Figure 5) and city-specific ICT applications.

As to the *benefits* reaped by the city of Trikala by 'going smart', some primary positive conclusions can be drawn regarding: the restraining of urban population decrease; the lessening of the city's vulnerability in the economic crisis (ICF, 2011); the active participation in a range of national, European and international activities in the field of 'smart' city development; the participation in a range of EU Research Projects, focusing on the development of specific e-applications; the networking of the city, establishing links with other pioneers in the 'smart' city development field (member of the International Network of e-Communities, Pan-European e-Participation Network PeP-NET, DigitalCities etc.); the strong interaction established between the city and universities at the national level; the dynamic development of the e-trikalla A.E. (from one employee to 22 technology specialists within 5 years); the leading role in the first digital community in Greece (CitiesNet), comprising eleven peripheral small-scale urban settlements; the high penetration of Internet-use in the local population (almost 30% in the first year), etc.

DISCUSSION

The role of ICTs in pursuing sustainable urban development objectives is nowadays widely acknowledged. 'Smart cities' appear to be a promising means towards this end.

In studying the efforts made not only in the case of Trikala but also by a number of small-scale peripheral Greek cities in 'going smart', certain conclusions can be drawn: the concept of 'smart' cities is *gaining ground* in Greece, as a means of dealing with the challenges of sustainable urban development in the broadband economy context; *isolation* is a key motive for many of the urban settlements 'entering the game' in the Greek context; *key issues* for 'going smart' efforts are e-democracy and e-government, as well the creation of innovative urban environments for attracting high-skilled labor and innovative investments; creation of a *new participatory culture* in the decision-making processes helps support community development objectives. Moreover, successful efforts seem to be the outcome of visionary leadership, good planning, as well as strong commitment. Also crucial is the identification of communi-

ty needs and expectations, (based on local traditions, culture, etc.) in order to make decisions on the correct ICT infrastructure and relating that to user-oriented city-specific e-applications. The latter is critical since customer profiling or, even more, the co-designing of services with the citizens can lead to more sustainable and effective e-services, providing higher level of citizens' satisfaction and thus higher rates of 'log-in' potential (Smart Cities Project Guide 2009). This implies that although new e-services are often technology-initiated, 'smart' cities' development should stress the importance of user-oriented city-specific applications and identify appropriate channels for successful service delivery in order to further strengthen community development potential.

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