European Journal of Sustainable Development (2017), **6**, 1, 71-84 ISSN: 2239-5938
Doi: 10.14207/ejsd.2017.v6n1p71

Smart City Solution for Sustainable Urban Development

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Abstract
The intention of the 21st century we entered a strong global growth in the multitude of comparatively few in number, large cities. Large, dense cities can be highly efficient. It is most desirable that side, by the heads of the green, and the future porticos. Bearing to the influx of the citizens of the new challenges of the rapid advance to command positions. To accumulate the benefits, with a positive, as well as a dense fog, in one state, to measure the informal are the negative aspects of the development of equal, traffic congestion, waste, wealth management approach is wrong. The demand for services is immediate, tribute, and custom, that you might found after them. At the same time in the company the first side of the planet will be in the forms of competition which known to you - a capital for the sake of wealth, and the creative class. These challenges to an approach to the design of new experiments, A finance committee, to the construction of the urban infrastructure and services, which is similar to the operation of the government and the smart cities. Fact this approach to the emerging of the knowledge of the time, technology. This paper is devoted to investigate concepts and principles of Smart City and sustainable urban development, components and urban planners' role.

Keywords: Smart, City, Smart City, Sustainable Development, Urban Development

1. Introduction

While towns and cities offer many opportunities, they also face numerous problems. As a result of the globalization of urban economics, cities increasingly have to compete directly with worldwide and regional economies for international investment to generate employment, revenue and funds for development. There are also cities that cannot compete because of low productivity, economic instability, poverty, inequality and social conflict. They are simply denied access to investment and revenue resources for development, which impinges directly on productivity and quality of life of their citizens. The cities of the future of mankind; in the 18th century global than 5%simply busy the greatest part of men killed, and the people in the city, enough food to generate. Today (UNPD, 2007) more than 50% of the population he lives in the city. It is likely that more than 80% of the population in the end of the world and in other cities. Most of those who are puzzled by this, as it really bring back the mechanization of urbanization and the work of his farm workers moved to the cities to choose agriculture. to seek a better life. And the reason is that in the densification is the process of happy thereby reducing the energy consumption and CO2 is a key man's reason and hence emissions (Owen, 2009).This is a very quick transition because of the many dangers creates urbanized men design, development and operation of the new thinking in the

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cities of the mover, responsible for different professions - architects, urban designers and planners transportation come, utilities, social science, and the counsel of the environmental public knowledge of finance, municipal government, most recently information technology. Information Systems singular so many parts to deal with, not, indeed, in the which he was almost to the wire integration between the communities. In 2010-2011 professional groups, Collaborative Urban Systems (USC, 2011), that is to say, there was formed to develop is to rank among the cooperation. In the last two decades, the concept of "smart" has become more in places of scientific literature of the people, and international organizations. To this the cities are thought to be reason for this is why it is important to recognize the elements future. The reasons for the economic and social life to play a role in the cities of the first worldwide, and how vast is the impact on the environment (Mori and Christodoulou, 2012).According to United Nations Population Fund marked the year 2008More than 50 percent of all the nations, the figure of 3.3 billion in the urban areas70 percent is expected to rise in 2050 (UN, 2008). In Europe, 75 percent To 80 in the number of professionals and the population already lives Proin sit amet2020. The weight percent of the urban areas, as well as a global phenomenon is confirmed diffusion of megacities in Asia, more than 20 million people of Latin America, of Africa (Albino, et al, 2015). As a result, the most important are the power of now, shall be consumed in the cities of the world, contributing to their own economic importance, but and environmental effects and poor. Between the United States consumes 60I feel it, and 80 percent of the industry worldwide are responsible for most of the portion of GHG emissions (UN, 2008). However, the lower urban density, Lorem more electricity is consumed byCO_2 emissions per capita drop to increase the density of urban areas (Hammer et al. 2011).

2. Smart City

Many definitions of smart cities exist. A range of conceptual variants is often obtained by replacing "smart" with alternative adjectives, for example, "intelligent" or "digital". The label "smart city" is a fuzzy concept and is used in ways that are not always consistent. There is neither a single template of framing a smart city, nor a one-size-fits-all definition of it (O'Grady and O'Hare, 2012). Not the new phrase Smart Cities. As to the origins of the Smart Growth (Bollier, 1998)for the movement of the late 1990s and the new urban plan of the author of laborites. Portland, Oregon, seem to be an example of Phaedrus Growth (Caldwell, 2002). The phrase is taken from several companies lorem 2005 (Cisco 2005) (IBM, 2009) application of complex urban infrastructure competition information systems, such an operation is completed structures, none at all, the distribution of electrical, water, and well-being. And when it comes to strives to be no reason for it is near, in the form of innovation, development, and operation states to plug in electric vehicles deployment services(Portland, 2011).But cities bring with them serious challenges. Globally, high urban density seems inevitably to lead to problems including traffic congestion, energy supply and consumption issues, escalation of greenhouse gases emissions(UNEP, 2012), unplanned development, lack of basic services, dramatic increase in waste disposal needs, and increases in crime and antisocial behavior(Edward, Glaeser, 1999). The political and social need to combat these

problems (in particular, the rise of environmental concerns, as climate change worries become ever present), combined with the obvious potential for a lucrative market for technology and telecommunications companies developing digital and networked solutions (Lilian, 2015), has given rise to the buzzword concept of smart cities (Dameri, Cocchia, 2013).This idea has been subsequently eagerly leapt on by national and municipal political leaders, major global tech corporations, and international institutions and organizations alike(Lilian, 2015). When a city of the future is defined as "a community that is run on networked information providing integrated services" (Cisco), it's only part of truth, a small part of the whole truth. We need to tackle a sustainable future community in all the possible complexity and wholeness, timely identifying all sorts of confusion, misrepresentation, misunderstanding, commercial propaganda, empty promises, partialities, or even a new type of "brainwashing": "green washing" or "smart washing". Being a place where the virtual and the real meet, merging into augmented urban reality, a Smart City is emerging a structured organic whole, single urban entity, completeness, totality, and integral unity of is parts, components, constituents as technologically, socially, and economically integrated/connected urban eco systems. Now what is not a smart city, all what is only a part of a true smart city; namely: It is not a conventional city/metropolis/urban center It is not a digital city or wireless city It is not an ecological city or green city or ecologically healthy city or quality urban system It is not an intelligent city or knowledge city or social intelligence city or creative city It is not a network-based smart + connected community It is not a city with a smart community It is not a city with a smart environment It is not a city with a smart economy It is not a city with a smart transportation It is not a city with smart utilities and energy systems It is not a city with smart education It is not a city a smart public safety It is not a city with smart buildings It is not a city smart healthcare It is not a city with smart public administration It is not a city with business parks It is not a city with innovation clusters It is not public administration/authorities that deliver innovation services and infrastructure, based on information and communication technologies It is not a city with a smart economy; smart mobility; a smart environment; smart people; smart living; and, finally, smart governance

It is not a city just with smart Transportation, Utilities, Healthcare, Education, Public Safety, or Building Systems Management. (Abdoullaev, 2011)

So, if the government is striving to advance ecological infrastructure, smart utilities, smart transport, smart buildings, smart economy, smart government, smart environment, smart lifestyle, or smart communities, in the fragmented costly ways, without an integrated, holistic regional/urban planning, it's hardly about a true smart city.

3. Smart City Characteristics

In order to enable this to happen, a number of key characteristics are required:

• The city will be instrumented to allow the collection of increasing amounts of data about city life;

• The data from different sources and city systems will be available to be easily aggregated together to gain far greater insight into what is going on in the city;

• The data will be easily presented in a variety of formats, dependent on the context and the person or technical system needing it, allowing it to be visualized and accessed more easily, thus making it much more useful;
• Detailed, measureable, real-time knowledge about the city will therefore be available at every level, so that it can be easily accessed by whichever person or technical system would be able to use it to help fulfill their role or achieve their goals, within the context of the overall effective functioning of the city;
• In addition, analytics and decision-making systems will be used, so that this knowledge can be used effectively, both by city managers and planners, and by the citizen, to support real time decision making and enable effective actions to be identified that will enable future requirements to be met;
• The city will also be automated, to enable appropriate city functions to be delivered reliably, and effectively, without the need of direct human intervention;
• The city will have a network of collaborative spaces, to enable dynamic communities that will spur innovation and growth and enhance citizen well-being; and
• The continual interaction between the physical and digital worlds enables the decision making processes to be much more open and inclusive, so that citizens, policy makers and businesses can work together effectively to manage the life of the city for the benefit of all.(ISO, 2014)

4. Benefits of Smart City

The application of information technology in Smart Cities can produce various benefits:
• Reducing resource consumption, notably energy and water, hence contributing to reductions in CO2 emissions (NYC, 2007).
• Improving the utilization of existing infrastructure capacity, hence improving quality of life and reducing the need for traditional construction projects (Stockholm, 2006).
• Making new services available to citizens and commuters, such as real-time guidance on how best to exploit multiple transportation modalities.
• Improving commercial enterprises through the publication of real-time data on the operation of city services (Singapore, 2011).
• Revealing how demands for energy, water and transportation peak at a city scale so that city managers can collaborate to smooth these peaks and to improve resilience (Peterborough, 2011).
These approaches have become feasible as a result of recent progress in technology:
• The widespread use of digital sensors and digital control systems for the control and operation of urban infrastructure. These include traffic sensors, building management systems, digital utility meters, and so forth.
• The growing penetration of fixed and wireless networks that allow such sensors and systems to be connected to distributed processing centers and for these centers in turn to exchange information among themselves.
• The development of information management techniques, specifically standardized semantic models, that allow the low-level information to be interpreted by the processing centers and that allow these processing centers to interpret each other's information.

• The development of both computing power and new algorithms that allow these flows of information to be analyzed in near "real-time" in order to provide operational performance improvement and other insights. These developments allow municipal governments to coordinate the operations of their multiple agencies in somewhat the same way that medium and large-scale commercial enterprises have operated since the 1980-90s.

5. A conjuncture of four forces for Smart cities

1- Urban futures

The history of cities has shown that the social, economic and spatial structure of cities reflects their underlying production systems. Although the inertia of physical structures impedes quick transitions within the physical space, it does not hinder utopian visions about the ideal future city from running in a'fast-forward' mode. These visions connect the future of cities with a lavish utopia of a forthcoming mechanized age, inspired by the latest developments in science and industry. The first ones appeared in the late 19th century, (Angelidou, 2015) but they gained popularity from the early 20th century and on The first coherent ideas about the future of society, economy and urban settlements under the effect of the advancing technology appeared in the 1850s. The most well-known one is the vision of a healthy and functional city, as an answer to the acute cities ofthe early industrial revolution, which was illustrated by E. Howardin 1898 in his book 'The Garden Cities of Tomorrow' (Hall, 2002).In essence, technology has ever since the industrial era been a major driver of visions about urban futures. These visions involved cities that would use technology to establish modern and healthy living conditions, where perfect democracy would stem from collective digital spaces and where people's needs would be satisfied instantly and intuitively. Some of today's smart city researchers actually acknowledge that the smart cities movement is predominantly a strategic vision for the future, rather than a reality.(Komninos, Pallot, and chaffers, 2013; Navigant Research, 2011,Schaffers, 2012; Wolfram, 2012).

2- The knowledge and innovation economy

A report from the World Bank (2007) starts out with the ever-lasting importance of knowledge in the history of human civilization and the role that knowledge has always played in local development, from the knowledge produced by the ancient Greek civilization, revolving around sciences such as astronomy, physics, and mathematics, to the Romans who created important engineering techniques, and the Arabs who kept knowledge alive during the Middle Ages, and the thriving knowledge explosion in science, art, and other areas during the Renaissance and later the Industrial Revolution. The report concludes that knowledge is a never-lasting foundation of development throughout the history of humanity. In recent years, moreover, knowledge was recognized as a valuable and manageable asset, capable of accrediting a competitive advantage to an enterprise, organization or city (Angelidou, et al., 2012). The terms 'knowledge economy' and knowledge-based economy' refer to an economy where more knowledge-intensive than labor-intensive activities take place and the share of intangible capital compared to physical capitalist expanding. The knowledge economy is the one that through the course of the first half of the 20th century gradually replaced the post-

industrial economy; the 21st century has been dubbed both as the 'century of knowledge' (Drucker, 1994; Sakaiya, 1991)and as the 'century of learning' (Longworth, 1999).On the whole, the knowledge and innovation economy is an essential driver of the smart city discourse. The technological advancement of the recent decades would not have had such strong impact on cities, if they had not rooted their development in knowledge and innovation (Komninos, 2011a). The knowledge economy played a significant role in the emergence of the idea of smart cities; it is one of the two strands of thinking that formed the current ideas about what a smart city is, how it works, and what it can do.

3- A technology push

The technological advancements of recent years have made feasible the development of a vast array of solutions and products that seek to enable the smart city. These products use ICTs to improve urban function management in areas such as transport, energy, health care, water and waste. As a result, an increasing number of technology vendors and consultancies are looking for a niche in the smart city product market. Other stakeholders in the smart city area occasionally enhance this push, too:

– Global forums and their events (ex. the Smart Cities Summit and the World Intelligent Cities Summit).– Academic research groups that have developed prototypes and solutions for intelligent cities. – Local and global policymaking institutions by means of their policies and funding programs for smart city development (Navigant, 2011).

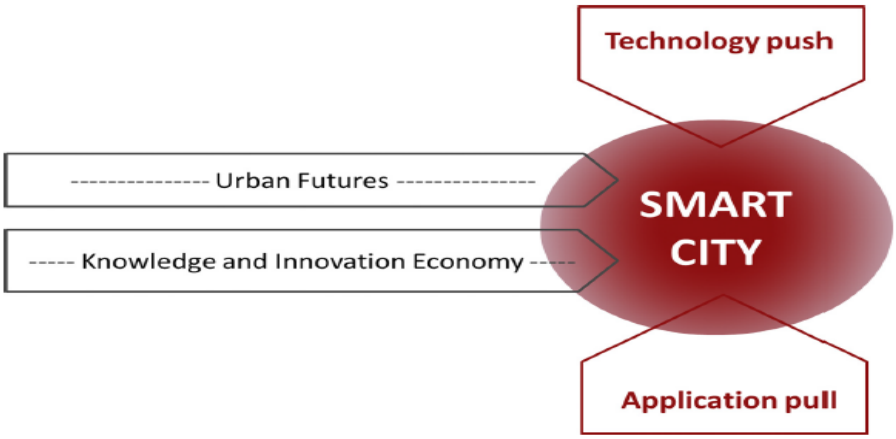
4- Application Pull

During the past twenty years a series of challenges in the cities 'economies and needs have arisen, enforcing the popularization of the smart city idea. The first one is urbanization. Already since2008 the worldwide urban population is higher than the rural one, and estimations predict that this trend will not only continue, but be reinforced, too (UN, 2012). This fact yields tremendous challenges for city economies in terms of resource efficiency and social sustainability. The second one is climate change and natural resource scarcity which is increasingly becoming a topic of concern for cities; city-wide measures for the mitigation of climate change and emergency situations are now omnipresent in strategies for urban development. Furthermore, the recent financial crisis diminished the – already few – financial recourses of city authorities, forcing them to narrow down their spending on urban development. Finally, in the era of global goods, people and information flow, the ever existing competition among cities is becoming more intense. Cities compete to attract highly mobile citizens and skilled workers (Florida, 2002), investors, tourists, and international events. On the whole, governments will have to offer improved and customizable services in order to attract and sustain vital recourses. In this given situation, local government's represent the decisive pull for the smart city discourse (Wolfram, 2012).This phenomenon explains the wide diffusion of the interest on smart cities during recent years, while it also reveals its penetration in the common culture, as well. The stakeholders who enhance this pull even further include: Grassroots movements, forward-looking software developers and technology enthusiasts who engage in developing and using smart city services and applications (Ratti and Townsend, 2011; Roche, Nabian, Kloeckl, and Ratti, 2012; Townsend, 2002; Townsend, Maguire, Liebhold, and Crawford, 2010).

– Public and non-profit organizations participating in the smart city discourse, such as the Intelligent Community Forum and the World Bank. – Informative websites such as

online newspapers (ex. The New York Times) and business magazines (ex. Forbes), or sites about urban development (ex. GlobalUrbanist and Citylab) that engage with the smart city topic on a regular basis.

Fig. 1 . Figure smart cities: a conjuncture of four forces (Angelidou, 2015).



6. Sustainable Development: Definition and Principles

Theory of sustainable urban development requires changes in the political, social, economic and physical backgrounds. Regional development and urban management should be based on the principles of sustainable development and urban planners should consider the damaging effects of modernism and postmodernism in the city and revise their theoretical defeat and allocate a sustainable charter in the cities and their schedules Urban planners and managers of twenty-first century must put aside the comprehensive plans based on the statistical aspects and declare their defeat. They must begin a potential survey to find the appropriate population to the resources, economy and culture in the cities (Ziari, 2001&Khazaei, Razavian, 2013). Although many definitions abound, the most often used definition of sustainable development is that proposed by the Brundtland Commission (Cerin, 2006; Dernbach J. C., 1998; Dernbach J. C., 2003; S toddart, 2011). This broad definition, which will be used in this research, does not limit the scope of sustainability. The explanation does, however, touch on the importance of intergenerational equity. This concept of conserving resources for future generations is one of the major features that distinguish sustainable development policy from traditional environmental policy, which also seeks to internalize the externalities of environmental degradation. The overall goal of sustainable development (SD) is the long term stability of the economy and environment; this is only achievable through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision making process. In the application of this definition of sustainable development, one issue concerns the substitutability of capital. There are several types of capital: social, natural, and manmade. The definition of weak sustainable development explains that only the aggregate level of capital- matters: manmade, or manufactured, capital is an adequate alternative to natural capital. Strong sustainability,

on the other hand, recognizes the unique features of natural resources that cannot be replaced by manufactured capital. Most ecologists and environmentalists are proponents of the strong sustainability definition (Stoddart, 2011). In addition to substitutability, this definition of sustainability is also founded on several other important principles. Contained within the common definition of sustainable development, intergenerational equity recognizes the long term scale of sustainability in order to address the needs of future generations (Dernbach J. C., 1998; Stoddart, 2011). Also, the polluter pays principle states that "governments should require polluting entities to bear the costs of their pollution rather than impose those costs on others or on the environment" (Dernbach J. C., 1998, p. 58). Thus, government policy should ensure that environmental costs are internalized wherever possible; this also serves to minimize externalities. The precautionary principle establishes that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measure to prevent environmental degradation" (United Nations Conference on the Human Environment, 1992). Therefore, the proponent of an activity bears the burden of proving that this action will not cause significant harm. Explicitly stated in the Rio Declaration, the notion of common but differentiated responsibilities recognizes that each nation must play their part on the issue of sustainable development. This principle also acknowledges the different contributions to environmental degradation by developed and developing nations, while appreciating the future development needs of these less developed countries (Brodhag&Taliere, 2006; Dernbach J. C., 1998; United Nations Conference on the Human Environment, 1992). Developed nations, therefore, bear greater responsibility in light of the resources they require and the pressures they exert on the environment. The key principle of sustainable development underlying all others is the integration of environmental, social, and economic concerns into all aspects of decision making. All other principles in the (SD) framework have integrated decision making at their core (Dernbach J. C., 2003; Stoddart, 2011). It is this deeply fixed concept of integration that distinguishes sustainability from other forms of policy. Institutionally, government organizations are typically organized into sectorial ministries and departments. This works fairly well until the system encounters something very comprehensive and highly integrated in nature, such as sustainable development. In practice, sustainable development requires the integration of economic, environmental, and social objectives across sectors, territories, and generations. Therefore, sustainable development requires the elimination of fragmentation; that is, environmental, social, and economic concerns must be integrated throughout decision making processes in order to move towards development that is truly sustainable.

7. Sustainable urban development

Theory of sustainable urban development requires changes in the political, social, economic and physical backgrounds. Regional development and urban management should be based on the principles of sustainable development and urban planners should consider the damaging effects (Khazaei, Razavian, 2013) of modernism and postmodernism in the city and revise their theoretical defeat and allocate a sustainable charter in the cities and their schedules. Urban planners and managers of

twenty-first century must put aside the comprehensive plans based on the statistical aspects and declare their defeat. They must begin a potential survey to find the appropriate population to the resources, economy and culture in the cities. The tax credits for activities consistent with the environment, financial support of these activities, precise programs, laws and educational programs are necessary for the future movements (Ziyari, 2001). Sustainable city is against modern cities which have the following characteristic; large input versus large output. Sustainable city planners should focus on the creation of cities with less energy and materials input and less waste and pollution output (Turner, 1988). Sustainable city is a city with some economic bases which not only have the least adverse impact on the environment but also are effective on the recovery and quality of the city. The sustainable city is a city where the variety be supported and a clear separation among incomes and social groups does not exist, and all individuals and groups have access to basic services and facilities. Thus sustainable city is a city which in terms of sustainable urban development, economic growth, income and employment can fulfill the needs of its citizens. And it pays attention to health status of the people from environmental and health care perspectives and has no problems of urban air pollution, water and green space pollution, leisure time spending and etc. On the other hand sustainable city is a city which acts coordinated and has citizen participation in solving urban problems, and has sustainable development from the bottom to up for planning and management of urban areas. In general it would be a city for all its citizens (Bahreini, 1997).

8. Considerations for Sustainable Urban Development

With regards to the challenges identified from both the FSSD analysis and smart city practitioner interviews around the notion that urban development in smart cities may not occur in a sustainable manner, the FSSD practitioners noted various considerations. Leung(2013) stated that sustainable development in each characteristic of the Smart City Model should always be examined through a lens of the Sustainability Principles. Hauser (2013) answered, that a general definition of sustainability should be applied through the six characteristics in order to avoid confusion amongst planners and to provide opportunity for the city to develop in a sustainable manner. Purkis (2013) answered that smart city practitioners using the smart city concept have to come up with a clear description of succession terms of sustainability in each of the areas highlighted by the six characteristics. He also stated that by having defined success, cities can then develop and apply appropriate metrics to track and measure their performance. James (2013) stated that an SSD approach paired up with sufficient participatory planning and institutionalization can ensure that development in the areas defined by the six characteristics remain sustainable. MacKinnon (2013) stated that in order to ensure sustainable development, it is important to establish a system that allows a city to analyze initiatives and pass decisions through a filter, characterized as the four Sustainability Principles. Duke Castle (2013), Principal of the Castle Group, pointed out that to achieve sustainable development, sustainability and climate change have to be made relevant for people. Further, he added that in order to make sustainability relevant again there is a need for an emotional shift to occur in society.Waldron (2013) stated that he disagrees

with the way the six characteristics of the Smart City Model are structured, because it suggests a hierarchical order between the characteristics and also divides up a whole system into silos. The practitioner suggested combining all characteristics and recognizing them as one living system that is supported by technological (non-living) systems. Further, he suggested that by following this mental model, an overarching strategy should be created with a goal of restoring the living systems. All eight practitioners stated that there is a need for a shared understanding of sustainability, and that it should be defined by the four Principles of Sustainability. Further, Purkis (2013),James (2013), and Pohlmann (2013) responded that having a shared and principled definition of sustainability allows for the communication of complex issues, and enables transformational change. As described by James (2013), "having shared principles where all departments and agencies in a city are using the same principles to guide sustainability in their own issue areas will more likely bring about a systems approach where the results of all those actions complement each other and work towards the same goal rather than conflict with each other."

9. Smart City relationship with sustainable urban development

Human development since the Industrial Revolution has had serious impacts on the environment, and the growth and destructive actions of human society have resulted in negative impacts on the Earth's sub-systems (Steffen et al. 2011). We are therefore facing a systematic sustainability challenge (Ny, etal. 2006), wherein human behavior cannot continue on the same course without having significant negative impacts on future generations' ability to meet their needs (O'Brien 1999). Reaching sustainability will require significant and widespread changes in human behavior. The global urbanization trend is creating an urgency to find smarter ways to manage the accompanying challenges (Nam and Pardo 2011). Sustainable cities have become a highly desired goal for future urban development. For the scope of this thesis, we focus on the concept of smart cities, defined as cities where "investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources,through participatory governance" (Caragliu, Del Bo and Nijkamp 2011, 6). Smart cities highlight important aspects of sustainability, such as the need for responsible resource management, energy efficiency, and citizen engagement. However, the smart city concept can only help a city to reach sustainability if it allows it to function within the natural boundaries of the Earth. Given the present day understanding of the smart city concept, it is unclear whether it holds the necessary characteristics to ensure that sustainable development can occur. Smart cities are highly complex and interdependent, since they are built from large, interconnected systems. Studying them would therefore require an approach that works well in complexity. By studying the smart city concept through a Strategic Sustainable Development (SSD) approach, one is able to examine it from a systems perspective, and evaluate whether sustainability can be reached in a strategic manner.

Conclusion

Today the growth of modern cities is such that it is unprecedented in the history of urbanization. Parallel to the growth the urban environmental problems have also been increased. Unfortunately, there is not much time to modify past failures and improve the status quo, and ensure the protection of the environment. Consequently its important to pay attention to the development of sustainable urban planning and its role in urban management issues is an objective that requires a new approach to urban planning. Global urbanization and the sustainability challenge are putting increasing pressure on urban systems. A new way of thinking, with an emphasis on taking a systems perspective, will be required to address these challenges. The concept of smart cities already holds the potential to address aspects of the sustainability challenge by promoting citizen participation,developing innovative and smart solutions for sustainability, increasing efficiency in city systems, and adopting a transparent and inclusive governance system. Smart Cities are those towns which use information technology to improve both the quality of life and accessibility for their inhabitants, i.e. applying sustainable development in economic, social, and environmental areas. They also keep citizens informed on said development, and thus interacting and adapting to their needs in real time. We hope that this Research contributes to the exciting research within smart cities, and aids in maximizing the potential for the smart city concept to stand as a solution for sustainability in our increasingly urbanized world.

References

UNPD (United Nations Population Division), (2007), World Urbanization Prospects,/ http://esa.un.org/unup/index.asp?panel=1

Owen, D., *Green Metropolis*, Riverhead, London, Paris, (2009), AutoLib', http://www.autolib-paris.fr/spip.php?rubrique1

USC (Urban Systems Collaborative), (2011), urbansystemssymposium.org

Mori Koichiro, Christodoulou Aris, (2012) "Review of Sustainability Indices and Indicators: Towards a New City Sustainability Index (CSI)," Environmental Impact Assessment Review 32: 1, 94–106.

UN, United Nations, (2008), "World Urbanization Prospects: The 2007 Revision Population Database" (2008),http://esa.un.org/unup/.

Albino, Vito,Berardi, Umberto, Dangelico, Rosa Maria, (2015), Smart Cities: Definitions, Dimensions,Performance, and Initiatives, Journal of Urban Technology, 2015, http://dx.doi.org/10.1080/10630732.2014.942092.

Hammer Stephen, Kamal-Chaoui Lamia, Robert Alexis, and Plouin Marissa, (2011), Cities and Green Growth: A Conceptual Framework, OECD Regional Development Working Papers 08, OECD Publishing.

O'GradyMichael, O'HareGregory, (2012), "How Smart Is Your City?" Science 335: 3, 1581–1582,DOI: 10.1126/science.1217637.

Bollier, David, (1998), How Smart Growth Can Stop Sprawl, Essential Books, Washington, DC.

Caldwell, Bob, (2002), Portland, a city of 'smart growth', The Masthead, vol. 54, no. 2.

Cisco, (2005), Dubai: The Smart City, http://www.cisco.com/web/learning/le21/le34/downloads/689/nobel/2005/docs/Abdulhakim_Malik.pdf. - IBM, (2009), Smarter Cities: New York 2009, http://www.ibm.com/smarterplanet/us/en/smarter_cities/article/newyork2009.html.

Portland, (2011), Electric vehicle infrastructure drives Portland's economy and environment,http://www.oregonlive.com/opinion/index.ssf/2011/05/electric_vehicle_infrastruct ur.html.

UNEP (United Nations Environment Programmer), (2012) The Global Initiative for Resource Efficient Cities, http://www.unep.org/resourceefficiency/Policy/ResourceEfficientCities/Activities/GI.REC/tabid/771769/Default.aspx.

Edward L. Glaeser and Bruce Sacerdote, (1999) "Why Is There More Crime in Cities?" Journal of Political Economy, Vol. 107, no. 6, part 2 (December 1999) 225.

Lilian Edwards, (2015), "Privacy, security and data protection in smart cities: a critical EU law perspective ", CREATe Working Paper 2015/11, DOI: 10.5281/zenodo.34501.

R.P. Dameri, A. Cocchia, (2013) *"Smart City and Digital City: Twenty Years of Terminology Evolution"*. ITAIS-Italian Conference of Information Systems (2013), p. 4, available at http://www.cersi.it/itais2013/pdf/119.pdf. The current leading academic non-vendor text is perhaps Townsend, supran X.

AbdoullaevAzamat, (2011), Keynote: "A Smart World: A Development Model for Intelligent Cities", The 11th IEEE International Conference on Computer and Information Technology (CIT-2011),

ISO, (2014), "Smart Cities", ISO/IEC JTC 1, Information technology, Cover photo credit: ISO/CS, 2015, www.iso.org/iso/home/about/iso_ members.htm.

Angelidou Margarita, (2015), "Smart cities: A conjuncture of four forces", Cities, Vol. 47, pp 95-106.

Hall, P. (2002). Cities of tomorrow: An intellectual history of urban planning and design in the twentieth century (3rded.). Wiley-Blackwell.

Komninos, N., Pallot, M., &Schaffers, H. (2013). Open innovation towards smarter cities. Open innovation 2013, pp. 34–41. Luxembourg: European Commission, Directorate-General for Communications Networks Content and Technology.

Navigant Research (2011). Smart cities; intelligent information and communications technology infrastructure in the government, buildings, transport, and utility domains (research report). http://www.navigantresearch.com/research/smartcities Retrieved 09.02.12.

Schaffers, H. (2012). Empowering citizens to realizing smart cities: Results from FIREBALL Smart city case studies (presentation). 2012 future internet assembly (FIA), "smart cities and internet of things", 10–11 May 2012, Aalborg. <http:// www.fi-aalborg.eu/downloads/Session_1.1_Hans_Schaffers.pdf>.

Wolfram, M. (2012). Deconstructing smart cities: An intertextual reading of concepts and practices for integrated urban and ICT development. REAL CORP 2012, 14–16 May 2012, Schwechat. <http://www.corp.at/archive/CORP2012_ 192.pdf>.

World Bank (2007). Building knowledge economies; advanced strategies for development. World Bank Institute Development Studies.

Angelidou, M., Gountaras, N., &Tarani, P. (2012). Engaging digital services for the creation of urban knowledge ecosystems: The case of Thermi, Greece. International Journal of Knowledge-Based Development, 3(4), 331–350.

Drucker, P. (1994). The post-capitalist society. New York: Harper-Collins.

Sakaiya, T. (1991). The knowledge-value revolution or a history of the future. New York: Kondasha.

Longworth, N. (1999). Making lifelong learning work: Learning cities for a learning century. London: Kogan Page.

Komninos, N. (2011a). Intelligent cities: Variable geometries of spatial intelligence. Intelligent Buildings International, 3(3), 172–188. http://dx.doi.org/10.1080/ 17508975.2011.579339.

Ratti, C., & Townsend, A. (2011). Harnessing residents' electronic devices will yield truly smart cities. Scientific American, 16 August 2011. <http//: www.scientificamerican.com/article.cfm?id=the-social-nexus> Retrieved 20.04.12.

Roche, S., Nabian, N., Kloeckl, K., &Ratti, C. (2012). Are 'smart cities' smart enough? Global geospatial conference 2012, spatially enabling government, industry and citizens, 14–17 May 2012, Québec City, Canada. <http://www.gsdi.org/gsdiconf/ gsdi13/papers/182.pdf>.

Townsend, A. (2002). Mobile and wireless technologies: Emerging opportunities for digital government. 2002 annual national conference on digital government research Los Angeles, California.

Townsend, A., Maguire, R., Liebhold, M., & Crawford, M. (2010). The future of cities, information, and inclusion: A planet of civic laboratories. Institute for the Future.

Navigant Research (2011). Smart cities; intelligent information and communications technology infrastructure in the government, buildings, transport, and utility domains (research report). http://www.navigantresearch.com/research/smartcities Retrieved 09.02.12.

United Nations (2012). World urbanization prospects; the 2011 revision. New York: Department of Economic and Social Affairs, United Nations.

Florida, R. (2002). The rise of the creative class. Basic Books.

NYC, (2009), NYC rolling out new technology projects, http://www.crainsnewyork.com/article/20091001/FREE/910019988

Stockholm, (2006), Stockholmforsoket, Facts and Results from the Stockholm Trial, see http://www.stockholmsforsoket.se/upload/Hushall_eng.pdf.

Singapore, (2011), Singapore LiveTraffic, http://www.livetraffic.sg/mobileapp.

Peterborough, (2011), http://www.eweekeurope.co.uk/news/peterborough-aims-to-be-most-sustainable-uk-city-thanks-to-tech-5898, http://www.youtube.com/watch?v=xCrYnLU_EK0.

Steffen, Will, JaquesGrinevald, Paul Critzen and John McNeill. (2011), The Anthropocene: conceptual and historical perpective. Philosophical Transactions of the Royal Society 369: 842 – 867.

Ny, Henrik, Jamie MacDonald, Göran Broman, Ryoichi Yamamoto, and Karl-HenrikRobèrt. 2006. Sustainability constraints as system boundaries. An approach to making life-cycle management strategic. Journal of Industrial Ecology 10, no. 1-2: 61-77.

O'Brien, Christopher. 1999. Sustainable production – a new paradigm for a new millennium. International Journal of Production Economics 60: 1 – 7.

Nam, Taewoo, and Theresa A. Pardo. 2011. Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. Proceedings of the 12th Annual International Conference on Digital Government Research. http://www.ctg.albany.edu/publications/journals/dgo_2011_smartcity/dgo_2011_smartcity.pdf (accessed on January 17, 2013).

Caragliu, Andrea, Chiara Del Bo, Peter Nijkamp. 2011. Smart cities in Europe. Amsterdam: VU University of Amsterdam, 48: 1-12.

Cerin, P. (2006). Bringing economic opportunityinto line with environmental influence: A Discussion on the Coasetheorem and the Porter and van der Linde hypothesis. Ecological Economics, 209- 225.

Dernbach, J. C. (1998). Sustainable development as a framework for national governance.Case Western Reserve Law Review, 1-103.

Dernbach, J. C. (2003). Achieving sustainabledevelopment: The Centrality and multiplefacets of integrated decisionmaking.Indiana Journal of Global Legal Studies, 247- 285.

Stoddart, H. (2011). A Pocket guide to sustainable development governance.Stakeholder Forum.

United Nations Conference on the Human Environment. (1992). Rio Declaration onEnvironment andDevelopment.Rio de Janiero, Brazil: United Nations.

Brodhag, C., andTaliere, S. (2006). Sustainabledevelopment strategies: Tools for policy coherence. Natural Resources Forum, 136- 145.

Ziyari K (2001), Sustainability and responsibility for urban planners in the twenty-first century, Journal of Science and Literature Faculty.

Khazaei M, Razavian M.T, (2013), Sustainable Urban Development (an innovative approach in the development of cities around the world), International Research Journal of Applied and Basic Sciences, Vol, 4 (6): 1543-1547. Science Explorer Publications.

Turner T(1997): The city like a prospect, a view beyond the design super renewal urban planning designs, translated by FarshadNorian, Tehran, processing and urban planning company.

Bahreinish (1997) Urbanization and sustainable development, Policy approach Journal, No. 17, pages 33 to 35.

Leung, Pong. 2013. Skype interview by authors. Vancouver, Canada. April 13, 2013.

Hauser, Regina. 2013. Skype interview by authors. Portland, USA. April 11, 2013.

Purkis, John. 2013. Skype interview by authors. Ottawa, Canada. April 10, 2013.

James, Sarah. 2013. Skype interview by authors. Cambridge, USA. April 13, 2013.

MacKinnon, Lisa. 2013. Skype interview by authors. Madison, WI, USA. April 13, 2013.

Castle, Duke. 2013. Skype interview by authors. Portland, Oregon, USA. April 12, 2013.

Waldron, Dave. 2013. Skype interview by authors. Whistler, BC, Canada. April 12, 2013.
Pohlmann, Monica. 2013. Skype interview by authors. Victoria, BC, Canada. April 12, 2013.