A Critical Outlook to Remourban Project of Eskisehir Tepebasi Municipality as a Smart Settlement

Pınar Demirel Etli and Sevin Aksoylu
Faculty of Architecture and Design, Department of Architecture, Anadolu University, Eskisehir, Turkey

Keywords: Smart City, Regeneration, Remourban Project.

Abstract: In recent years strategies for urban regeneration have been developed due to the interurban competition and growing awareness of the cities' role as an impetus for innovation and regional economic growth. One of the goal of these strategies is to implement initiatives to improve the quality of the environment operating in a wide sense towards a smart growth. In Turkey, some municipalities also got off the ground the smart settlement principles for the regeneration of the residential areas. This paper deals with a regeneration model called as "Remourban- " project to accelerate the smart urban transformation of Life Village Site of Tepebasi Municipality in Eskisehir. The first part of the study contains definitions and content of urban regeneration and smart city in the literature. In the second part, the approaches and objectives of the Remourban project are given and evaluation of smart city attributes tested along with objective data of Remourban Project. Although, the project has many criteria which are overlap the definition of smart cities, it is not expected to classify in the same scope. Therefore, in order to be characterized as a smart city improvement in the concluding section, opportunities and recommendations have been presented.

1 INTRODUCTION

In recent years, many cities in the world have been working on urban space in order to transform cities into sustainable cities (Panuccio et al, 2015). In general, urban regeneration is used for cities to improve their competitiveness, productivity and liveability. New concepts - such as liveable cities, sustainable cities and smart cities have created a wealth of opportunities for economic and social growth. Planning offers the possibility to develop and transform a city into a modern and attractive city. Urban planning considers the smart growth cities as the system of opportunities (Russo et al, 2014). Despite the fact that lots of articles and researches have attempted to clarify the smart city, it is still unclear in literature. Different approaches and descriptions can be summarized as follows.

The terms "smart" and "intelligent" have become part of the language of urbanization policy, referring to the clever use of IT to improve the productivity of a city's essential infrastructure and services and to reduce energy inputs and CO_2 outputs in response to global climate change (Hodgkinson, 2011).

Smart cities represent a conceptual urban development model based on the utilization of human, collective and technological capital for the enhancement of development and prosperity in urban agglomeration. Smart cities are all urban settlements that make a conscious effort to capitalize on the new Information and Communications Technology (ICT) landscape in a strategic way, seeking to achieve prosperity, effectiveness and competitiveness on multiple socio-economic levels (Angelidou, 2014).

Smart Cities Workshop (2009), defines smart city as a city that makes conscious effort to innovatively employ ICTs in support of a more inclusive, diverse and sustainable urban environment (Stratigea, 2012).

A smart city as a high-tech intensive and advanced city that connects people, information and city elements using new technologies such as ICT systems, in order to create a sustainable greener city, a competitive and innovative commerce and an increase in the quality of life with a straightforward administration and maintenance system of the city (Schaffers et al, 2012).

The aim of 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

Etli, P. and Aksoylu, S.
A Critical Outlook to Remourban Project of Eskisehir Tepebasi Municipality as a Smart Settlement.
In *Proceedings of the 5th International Conference on Smart Cities and Green ICT Systems (SMARTGREENS 2016)*, pages 86-93
ISBN: 978-989-758-184-7

safe, pleasant and inclusive urban environment (Komninos, 2006).

Smart cities emerge not just as an innovative modus operandi for future urban living but as a key strategy to tackle poverty and inequality, unemployment and energy management (Manville et al, 2013).

While some papers discuss smart city in a specific part, such as: smart transportation, mobility, ICT, smart food or other, this paper deals with a case study of 'Smart city concept' on a pilot settlement of Eskisehir- Tepebasi District in a general approach. These analyses are based on a hypothesis, as urban regeneration can be used to provide an urban quality and the establishment of the smart settlements .In this scope, the purpose of this paper to suggest new outlook for the Life Village Project as a smart settlement.

2 URBAN REGENERATION PROCESS AS A TOOL OF SMART SETTLEMENT

The city, from a place of social life, has become a space to be used to take advantage of the infrastructure and services. This mentality has generated degradation, disorder, waste, lack of resources, poor services. In recent times, to solve these issues strategies for urban regeneration have been developed. The concept of urban regeneration can be evaluated in a different ways depending on the development levels of the countries (Aksoylu, 2012). In the most developed economies, the goal is to promote a "return to the city", revitalise the city centre, restore activity in a fiercely competitive international context, and implement initiatives to improve the quality of the environment operating in a wide sense towards a smart growth. In course of time, urban regeneration has developed from the renovation or rehabilitation of built environment to rebuilding of the urban fabric, the renewal of the city image or the urban economy and equity, public participation and their professional and social integration into a multi- functional context (UNEP, 2004).

By the 1980s, social concerns were replaced by economic concerns and regeneration projects started preparing the city for a new century (Gotham, 2001). Urban regeneration can be described as, "a comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change" (Roberts, 2000). As Gibson & Kocabas (2001) states, urban regeneration is a holistic, comprehensive and integrated approach that embraces the three aims (the three e's- economy, equity and environment); maintaining economic competitiveness, reducing inequality and protecting and embracing the environment and that suggests a new generation of partnerships for policy development and delivery that includes innovative configurations of public, private and NGO sectors in more equal relationships.

Today, urban regeneration aims to address issues that are associated with change in the economy and employment, economic competitiveness, social exclusion, community issues, vacant and deteriorated sites in cities, new land and property requirements, environmental quality and sustainable development (Turok, 2004, Keles, 2003, Roberts, 2000). Depending on this, it is resulted in improving the infrastructure of the urban areas which is a prerequisite in the creative sector's choice of location. Regeneration projects can also introduce new infrastructure such as new lines of transportation, and digital infrastructure. As a result, smart city is started to discuss in the cities.

3 CHARACTERISTICS OF A SMART CITY

In association with economy or jobs smart city is used to describe a city with a "smart" industry. That implies especially industries in the fields of information and communication technologies (ICT) as well as other industries implying ICT in their production processes. The term smart city is also used regarding the education and qualification of its inhabitants. A smart city has therefore smart inhabitants in terms of their educational grade. In other literature the term smart city is referred to the relation between the city government administration and its citizen. Smart city is furthermore used to discuss the use of modern technology and cloud systems in everyday urban life. This includes not only ICT but also, and especially, modern transport technologies. Logistics as well as new transport systems as "smart" systems, which improve the urban traffic and the inhabitants' mobility. Moreover various other aspects referring to life in a city are mentioned in connection to the term Smart City like safety, green, efficient & sustainable, energy etc (Giffinger et al, 2007).

A smart city is a city well performing in a forward-looking way in the six characteristics (smart economy, smart people, smart governance, smart mobility, smart environment, smart living) built on the smart combination of endowments and activities of self-decisive, independent and aware citizens (Chourabi et al, 2012).

Smart City can describe with relationship between several fields of activity such; technology, industry, education, participation, energy and environment. Using information and communication integrated infrastructures transforms cities in significant ways. IT infrastructure and applications are keystones of the smart cities. However, the ICT systems are necessary but not enough to make a smart city. All technological systems need collaboration and cooperation between local governments, public and private actors and citizens.

4 CHARACTERISTICS OF ESKISEHIR

In the scope of smart city actions, smart urban regeneration projects aim to improve the quality of urban life via upgrading of urban utilities. Eskisehir Tepebasi Municipality The Life Village Project is one of the few smart urban regeneration projects in Turkey.

Eskisehir is a medium-sized city with a population of 685.135 inhabitants in Turkey. It is located in Central Anatolia between Capital Ankara and Istanbul. Eskisehir city centre is divided into two municipalities by Porsuk river. On the one side there is the Odunpazari district and on the north-west side there is the Tepebasi district. Since Tepebasi district is at the centre of the city, it represents nearly 40 % of the city' population with an approximately 320.000 inhabitants. Eskisehir is among the provinces having the highest level of urban and life quality. According to social and economic development index which was prepared based on the basic indicators of demographics, urbanization, health, education and employment, Eskisehir occupies 2nd and 3rd place within 81 provinces.

Density of Tepebasi district is 400-600 people per hectare. In general, main environmental problems of the Tepebasi district have been identified as noise pollution, water pollution and problems caused by the waste pollution.

Eskisehir is influenced by the continental climate changes with very hot summers and very cold winters. The temperature difference between day and night also could be major. So it can be needed much more energy for heating and cooling for the buildings.

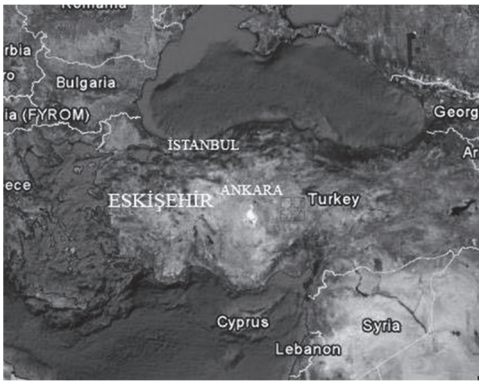

Figure 1: Location of Eskisehir.

Figure 2: Boundary of Tepebasi Municipality.

In recent years, depending on the globalization wind and neo-liberal policies that enriched the new elites who have new life styles, the housing capital focused on these groups in 1990's in Turkey. After 1999 earthquake in the country, the fear of possible earthquake has also changed the housing preference as from the high-rise apartment buildings to the lower detached houses (Aksoylu, 2015). Eskisehir is not exempt from this situation, many low rise houses have been constructed on the gated communities and on the Mass Housing Areas on Tepebasi District.

Additional to this, Energy Efficiency Law inurement in 2007, the existing buildings and industrial establishments have been started to be revised and transformed to fulfil energy efficient compact buildings (Law: Official Gazette, 2007). After 2017 all buildings will mandatorily take an Energy Identification Certificate. According to this legislative regulation, new buildings that are constructed since 2011 are taken Energy ID Certificate in Turkey and also in Eskisehir.

Figure 3: Eskisehir Porsuk River, Tepebasi.

Nowadays, a residential building restoration in a common European city is not a profitable business itself. It is clear that if any energy renovation is tackled modifying the building enveloping, it will be necessary about 30 years to return the initial investments through the energy savings reached. For this reason, a business model based on building energy renovation is not an attractive business (Proposal of Remourban, 2014).

5 SPATIAL CHARACTERISTICS OF LIFE VILLAGE OF TEPEBASI DISTRICT

Life Village is a district of approximately 30,000 m^2 with a built area of just under 10,000 m^2 in the North-West of the city of Eskisehir within the jurisdiction of Tepebasi Municipality of Eskisehir.

There are 57 same type two storey dwellings, 386 inhabitants and a 560 m^2 social facility building in the Area. The buildings were constructed for residential use in 2007 however after ownership of the buildings changes to Tepebasi Municipality, they were transformed into Alzheimer patients and elderly cares. Each dwelling has 174 m² conditioned area consisting 3 bedrooms, 1 living room, kitchen, bathroom, wc, storage etc. parking space and garden.

Some of the buildings were recently renovated to satisfy the needs of the Alzheimer patients. The ground floors are used as common areas like dining room, activity room, recreation and TV rooms Bedrooms and bathrooms are located on the upper floors. Also there are clinic and rehabilitation rooms in buildings. Health centre and administrative office have office functions. The special workshop for disabled citizens serves various purposes and houses, offices as well. The rehabilitation centre is home to social activities, workshops and conference centre in 560 m^2 conditioned area in one storey building.

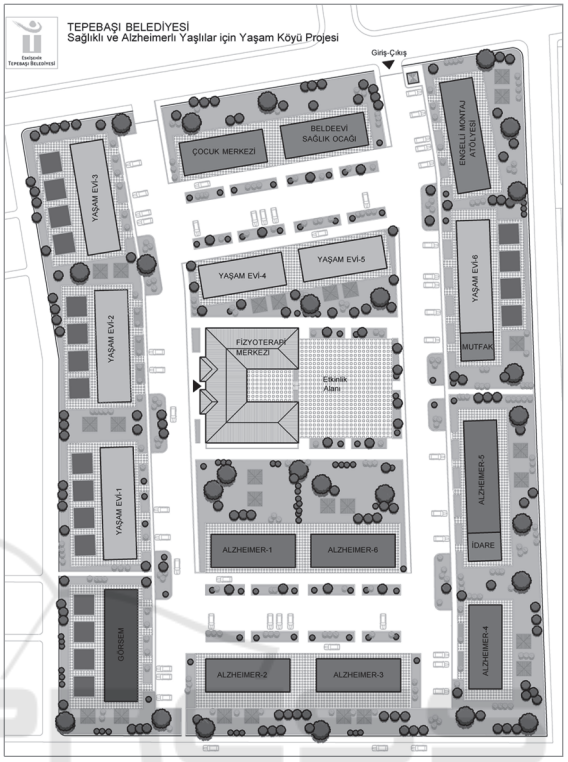

Figure 4: Layout Plan of Life Village.

6 OBJECTIVE OF REMOURBAN PROJECT FOR LIFE VILLAGE

RemoUrban (REgeneration MOdel for accelerating the smart URBAN transformation) is a large scale demonstration project, which aims to accelerate the urban transformation towards the smart city concept taking into account all aspects of sustainability, and pretends that Valladolid, Nottingham and Eskisehir will be a reference in Europe (and World Wide) with respect to social progress, urban planning and environmental regeneration. For achieve it, public authorities and several industrial partners have assumed the commitment to support and co-finance the necessary actions that allow to validate a powerful urban regeneration model for accelerating the city transformation in a more sustainable urban environment (Proposal of Remourban, 2014).

Remourban will address an intense activity focused on searching applicable solutions for city transformations. Some of the business models are a good example of how the economies of scale can be

applied, increasing the intervention impact and with the aim to make the investments more attractive than these usually are. There are many examples of interesting business models for heating systems, specially at district level, where apart from using renewable energy sources as biomass. These models go towards energy services business model with investment returns period less than 5 or 6 years (Proposal of Remourban, 2014).

Remourban has set the objective of building a "Sustainable Urban Regeneration Model" that aims to transform existing cities into more sustainable and smarter places to live and work. The urban renovation strategy is focused on the citizens, because the people live in the city is the most affected by the improvements and alterations.

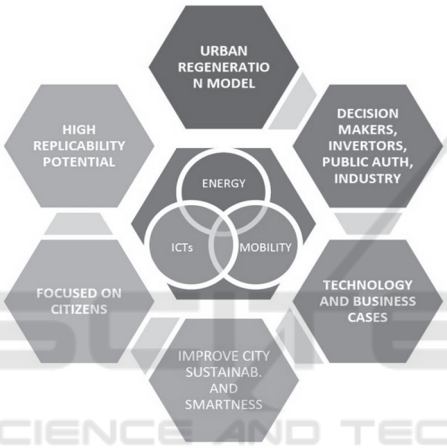

Figure 5: REMOURBAN main concept (Proposal of Remourban, 2014).

The point is improving the current conditions of a city in order to achieve energy efficient neighbourhood and more sustainable urban transport. Remourban, thus, will have as major challenges those that enhance the key indicators of environment, reduction of emissions, transport efficiency, access to the city information and citizen engagement. It is commonly avowed that for achieving it, it is necessary combining improvement strategies in the energy, mobility and ICT sectors.

The model is designed to propose holistic integrated approaches, jointly in the energy and mobility sectors with the ICT potentiality. The project vision aims to achieve higher economic, social and environmental benefits for cities to improve sustainability where it is possible to get better results (Proposal of Remourban, 2014).

According to the Report of audits in the Tepebasi demo site, the initial task aims to develop a baseline in the fields of buildings and district energy supply,

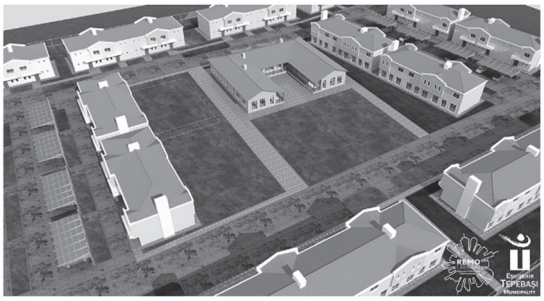

Figure 6: Buildings modelling in demo site.

city transportation, suitable urban infrastructure, existing urban plans for promoting low energy districts and sustainable mobility, public procurement procedures, regulations and normative approaches and existing actions for citizens' engagement as well as recommendations for further improvement (Demir et al, 2015).

6.1 Efficient Energy Use

In order to analyse energy use, thermal comfort and health&well-being in the buildings, measurement equipments were installed in selected buildings. These equipments measure outside temperature, outside humidity, inside temperature, inside humidity, indoor air quality, temperature of boiler distribution lines (outgoing-return). Thus, the improvement of energy use will be developed for all buildings in demo site.

The demonstration aims at the reduction of 85% in the energy consumption per capita, and a 79% of the CO^2 emissions. The dwellings will be retrofitted in order to achieve a reduction in the building consumption higher than 53%. A district heating/cooling facility based on biomass and water sourced heat pump will be installed for the targeted district, together with solar thermal facilities for DHW, with a reduction of CO^2 emissions of 79% PV facility of 100 kWp will be deployed on the roof of the central social building as BIPV and also a 50 kWp tracker PV installation, with a total electricity production of 25 kWh/m^2yr.

Each dwelling was designed with individual gas fired boiler with 24 kW capacity to provide heating and DHW (Domestic Hot Water) for the users. The buildings were planned and built for residential use however after ownership of the buildings changes to Tepebasi Municipality. Major changes were done to turn these buildings into Alzheimer patients and elderly cares. Due to the different purpose of use expected in the buildings, it is necessary to improve energy systems to manage different energy demand

Table 1: Smart energy solutions in demo site.

	Success Factors	Action Description	Tepebasi Applications
Smart Energy& Environment	Attractivity of Natural Conditions	District scale retrofitting	9.110 m^2 district retrofitting 57 dwellings 400 residents %60 energy savings
	Pollution	Air quality/Weather/Noise/Waste management and Encourage to using of EV for low carbon emission	Air quality and waste management system. EV using for public transport and encourage for e-bike
	Environmental Protection	Transforming the energy chain Use of cleaner vehicle Use of electric or hybrid technologies for clean transport	Micro grid: renewables, storage, demand side management. Integrated bike rental system & Free parking EV, 50 e-bikes, 4 e-Buses & minibuses, 7 EHV
	Sustainable Resource Management	Electricity distributed generation Renewable heating and cooling Greenhouse gas emissions reduction Shift to a new and more sustainable energy scenario.	PV panel on roofs (100 kWp) & Energy monitoring and control. Water sourced heat pump for H&C and Biomass heating plant. Solar thermal for Domestic Hot Water. Thermal and photovoltaic solar energy using

profiles and meter and control individual dwellings to avoid energy inefficiencies.

Figure 7: Buildings and car parks in demo site.

Figure 8: Buildings and car parks in demo site.

Although relatively newly built, the district building stock consists of inefficiently constructed buildings in energy consumption terms. Also the comfort conditions are extremely low and the heating costs are quite high zone. Energy performance of buildings in the district are energy-inefficient and poorly insulated type mass housing, typical of TOKI construction, highly inconsiderate of the climactic.

6.2 Smart Mobility Solutions

City on Cloud ICT city management platform will be developed that will put together all energy and mobility data and more than 3.000 variables will be gathered and stored. The study is an integrated transport system consisting of buses, trams, minibuses, cycling and walking networks. 4 buses and 7 hybrid cars will be utilized in the project in addition to a 50 e-bike rental system. The study area covered 72 planning zones and a conventional four-step transportation model was calibrated with the travel data collected from 7,000 households. Transportation model intended to improve pedestrian system continuity in the existing central business district of the city, and extended the system into new streets. The bikeway elements of the transportation master plan consisted of an enhancement of the bicycle paths within the city. The intent of the plan was to improve the continuity of the bikeway system throughout the city, linking.

All of the technologies purpose is accelerating the transformation of the city in urban areas into smarter places of advanced social progress and environmental regeneration.

Table 2: Smart mobility solutions in demo site.

	Success Factors	Action Description	Tepebasi Applications
Smart Mobility	Local Accessibility	Pedestrian and bicycle network Connecting transport modes, nodes and mobility services Multi-modal travel Logistics supply chain inside the city	8 km bicycle route with pedestrian road Ticketing, Smartcard, Smart Debit Card
	ICT Infrastructure	Charging infrastructure for electric and hybrid vehicles Open data alliances Responsive and integrated mobility services Monitoring Tools for Energy Computer-based systems to automatically monitor and control the main facilities, devices and services Mobile ITS* (location-based route / travel information + traffic light systems) ICT integrated waste management and lighting systems and sensors	5 e-bike & 2EV charging stations Smart Phone App. Mobility: info. interface to bike system Advanced monitoring and energy performance viewing ICT platform Energy monitoring and control system (automatic control, occupancy control, CO2 sensors, comfort controllers)
	Sustainable, Innovative and Safe Transport System	Collective transport, clean logistics, sharing of goods vehicles and distribution infrastructure	Integrated bike rental system Free parking EV Travel info kiosks

It is planned to connect the life village demo site to internet by using point-to-point wireless connection. Also there is a fiber optical connection project in life village to connect 16 places to each other.

7 CONCLUSIONS

In the twenty-first century, the challenges faced by cities and their residents will be unlike any we have faced even before. Technology is becoming more powerful and offers newfound assurance for the future of cities such as; more efficient resource usage, greater connectivity between people and city, and more comprehensive opportunity for all. By this way the cities transform more quickly. Remourban project guides as a smart city initiative and set a course to overcome some of those challenges by the actions given the study.

This paper presents a regeneration model to accelerate the smart urban transformation of Life Village Site in Eskisehir. Remourban project focuses on these three main areas; mobility, district and other urban infrastructures. Also Remourban demonstration evaluates the cities with a schematic vision about the scope by these indicators:

- Sustainable mobility: green transport shift, city logistics and urban transport.
- Low energy districts: district energy auditing, retrofitting and renewable integration.
- Integrated infrastructures: information platforms and smart grid.
- Non-technical actions: citizen engagement, communication, urban planning, etc.

Even if as a regional smart urban regeneration project the “Remourban” meets the expectations for local improvements, it is not expected to fulfil each single component of smart city initiatives. Additional to targets that have been achieved in the presented project, below items can be assessed as “open to improve” in the scope of smart settlement.

- For smarter governance; project may embrace citizen participation in planning, decision making and organisation, encourage people to participate the information portal and give feedback for the decisions by government.
- For smarter people; project may focus on enhance the level of qualification by improve the opportunity of having access to education and training.
- For smarter living; project may focus to increase the capacity of cultural facilities, enhance the health conditions and individual safety, improve education facilities and support the cultural activities etc.

Recently, smart cities have become a major factor for economic activities and inviting governments to embark on new long-term vision and ideologies for sustainable development based on renewable energy and technology. Therefore, the municipalities need to set goals to accelerate smart transformations of the cities for their future sustainability, the establishment of a transport system that favours people over automobile and a lively city through its environmentally friendly approach.

REFERENCES

Angelidou, M., 2014, Smart city policies: A spatial approach. *CITIES,* 41, pp. 3-11.
http://dx.doi.org/10.1016/j.cities.2014.06.007.

Aksoylu, S., 2012, City Marketing and Urban Branding through Urban Regeneration and Image Making as a Case of Eskisehir-Turkey, *The IUP Journal of Architecture,* Vol. IV, No. 1, India, pp. 64-82.

Aksoylu,S. 2015, Development of the Urban Periphery and Issues Related to Urban Landscape Due to Gated Communities, *Journalism And Mass Communication,* Vol. 5. pp. 415-427.

Chourabi, Hafedh, Nam, Taewoo, Walker, Shawn, Gil-Gracia, Ramon J., Mellouli, Sehl, Nahon, Karine, Prado, Theresa A., and Scholl, Hans Jochen, 2012, Understanding Smart Cities: An Integrative Framework, *Hawaii International Conference on System Sciences*.

Demir, E., Demir C., Kuban B., Sevincli, H., Erden, U., Ersan, B., Atalay, S., Karabatur, M., Öztürk, B., Yörükoğlu, E., Yazici, B., 2015, *"D3:3: Report Of The Audits In The Tepebasi Demo Site"*

Gibson, M., and Kocabas, A., 2001, "London: Sustainable Regeneration- Challenge and Response". Paper presented to the *Rendez-vous Istanbul:* 1. International Urban Design Meeting, Mimar Sinan University, Istanbul, Turkey.

Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. 2007, Smart Cities: Ranking of European Medium-Sized Cities. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology.
http://www.smart-cities.eu/download/smart_cities_final_report.pdf.

Gotham, K., F., 2001, Urban Redevelopment, Past And Present. In Critical Perspectives On Urban Redevelopment, K F Gotham (ed.). Elsevier Science Ltd, Oxford.

Hodgkinson, S. 2011, Is your city smart enough? Digitally enabled cities and societies will enhance economic, social, and environmental sustainability in the urban century, *OVUM report.* pp. 2-11.

Keles, R. 2003, "Urban Regeneration in Istanbul". Paper presented to Priority Action Programme, Regional Activity Center, Split, May.

Komnisos, N. 2006, "The Architecture of Intelligent Cities", *Conference Proceedings Intelligent Environments 06*, Institution of Engineering and Technology, pp. 13-20.

Law: Official Gazzete, 2007.
http://www.resmigazete.gov.tr/eskiler/2007/05/20070502-2.htm.

Manville C., Cochrane, G., Millard, J., Pederson, K., J., Thaarup, K., R., Liebe, An, Wissner, M., Massink, R., Kotterink, B., 2013, *Mapping Smart Cities in the EU.*

P. Panuccio, L. Amo deo, P. D'Agostino, D. Lamari & T. Scattarreggia, 2015, Urban Regeneration And Smart City According To EU Strategies: An Urban Distribution Center In City Logistics, *WIT Transactions on The Built Environment,* Vol 146, pp. 313-324.

Proposal of REMOURBAN, 2014, Horizon 2020 Proposal number: SEP-210170312.

Roberts, P. 2000, "The evolution, definition and purpose of urban regeneration". In P. Roberts and H. Skyes (eds.), *Urban Regeneration A Handbook,* London: Sage Publications, pp. 9-36.

Russo F., Rindone C., Panuccio P. 2014, The process of smart city definition at EU level, WIT Transactions on Ecology and the Environment, Vol. 191, WIT Press, Southampton, UK, pp. 979–991.

Schaffers, Hans, Komninos, Nicos, et al. 2012, Landscape and Roadmap of Future Internet and Smart Cities.
http://hal.inria.fr/docs/00/76/97/15/PDF/FIREBALL_D2.1_M24.pdf.

Stratigea, A. 2012, The Concept of 'Smart' Cities – Towards Community Development?, *Networks and Communication Studies,* NETCOM, Vol. 26, pp. 375-388.

TUIK, 2015, Turkey Statistical Institute.
http://www.turkstat.gov.tr/PreTablo.do?alt_id=1068.

Turok, I. 2004, "Urban Regeneration: what can be done and what should be avoided?". Paper presented to *International Urban Regeneration Implementations Symposium,* Lütfi Kirdar Exhibition Centre, Istanbul.

UNEP, 2004, Guidelines for Urban Regeneration in the Mediterranean Region, Priority Actions Programme Regional Activity Centre Split.