SMART CULTURAL HERITAGE IN DIGITAL CITIES

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Konstantina Siountri
Adjunct Lecturer, University of Piraeus
ksiountri@unipi.gr

Dimitrios D. Vergados
Associate Professor, University of Piraeus
vergados@unipi.gr

Abstract

The expansion of Information and Communication Technologies (ICT) has been proved to transform urban life, enabling people to improve their quality of life within the city environment. As a direct result of the digital revolution, current urban plans are transforming the vision of sustainable cities, which must meet not only economic and environmental indicators' requirements, but also make current technological developments easy to use and accessible to their residents. At the same time, while technology continues to change city infrastructure, without considering in some cases the cultural characteristics of different sites and communities; however cultural heritage, both tangible and intangible, remains crucial to the shaping of future societies. This paper examines how Smart Cities will benefit by the introduction of "smart cultural heritage", in order to support various cultural services and to promote and preserve the cultural heritage, through smart applications and participatory processes.

Keywords*: Smart Cities, Smart Cultural Heritage, Digital Cities, Sustainable Development*

Introduction

According to the United Nations[1] research, 54% of the world's population currently lives in urban areas. This figure is expected to increase to 66% by 2050. Forecasts suggest that urbanization combined with the global growth of the world population could add an additional 2.5 billion people in urban areas (mainly in Asia and Africa) over the next thirty years, while by 2030, the number of Megacities will reach 41 worldwide, with more than 10 million inhabitants each.

In addition, statistics indicate that in the next 12 years more than 5 billion people will live in urban environments[2] and that by 2020, the Philippines and Thailand may have "middle classes" as large as the population in the United Kingdom, France or Italy. Regarding the global middle-class community, it is estimated that it now stands at 3 billion people, who account for two-thirds of the global consumer spending, demanding public services and resources such as water and energy.

[1] United Nations - World Urbanization Prospects - 2014
[2] https://www.un.org/sustainabledevelopment/cities/

In order to manage the population growth, the increased population density and the growing middle class, the optimization of service provision and better management of available resources are imperative. In all the above, technology advancements will be the critical factor for the transition of existing cities into the urban environments of the future. The implementation of "smart solutions", which will allow the use and management of "information" to improve infrastructure and services and thus the quality of life, is summarized in the term "smart cities" in recent years.

There is not a globally accepted definition of a "smart city". It means different things to different people. So Smart City's idea varies depending on the level of development, the willingness to change and reform, the resources and the expectations of the local communities.

The European Union defines a smart city[3] as a "*place, where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business*".

However, it is becoming more and more perceptible that the smart city model cannot ignore the history and culture of a place. Smart Cities' goal is to promote economic growth and improve people's quality of life by enabling the development of the local area by tapping technology. Any attempt to change the quality of life should address cultural needs along with the economic and social expectations of the inhabitants of a city. Therefore, if a city is on the way to become "smart", ways of managing its heritage should not remain static, but they should follow the advancements in the ICT field.

Fig.1: The UN Agenda for Sustainable Development for 2030.
Source: https://unhabitat.org/un-habitat-for-the-sustainable-development-goals/

Sustainable cities' development - Indicators of sustainable and smart cities

Although sustainable development is a global challenge, the initiatives to achieve urban sustainability remain considerably local. Therefore, the strategies differ in application and content from country to country and region to region.

[3] https://ec.europa.eu/info/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

Among the international observatories for the sustainable development of cities is the United Nations Organization with the Sustainable Development Goals 2030 Agenda with the Strategic Goal No 11[4] (Figure 1). In addition, there are relevant international working groups that have been set up for developing Smart Cities Sustainability Management Systems (e.g. International Telecommunication Union - ITU[5], Figure 2). Also, international standards are being introduced and adopted e.g. the ISO 37100[6] series for performance benchmarks and terminology.

According to the above guidelines, sustainable cities must have the following characteristics:

a. Openness. Cities are designed in order to offer services to all citizens without discrimination (open cities / inclusive cities).
b. Smartness. Data are gathered and exploited in order to implement innovative solutions, new technologies and smart infrastructures (smart cities).
c. Security and quality of services for citizens, visitors, businesses and investors.
d. Resilience. The ability to recover to a satisfactory level of operation following a disruptive event, natural disaster or crisis (resilient cities).
e. Coexistence of urban environment with peri-urban ecosystems and protection of the terrestrial and aquatic environments.

The design of the transformation measures must take into account a) the current use and the efficiency, b) the future needs for exploitation and c) the predicted disposal conditions of resources.

In addition, it is proven necessary to define indicators that will help cities to measure their performance, service management and quality of life over time, share good practice and allow for evaluation, comparison and international statistics. Indicators can be used to document the city's viability reporting status and to monitor the progress of its performance after the implementation of transformation measures.

The Hellenic Organization for Standardization on 12/07/2018 announced the draft of the Greek ELOT Standard 1457[7] "Sustainable Growth in Cities - Sustainability Performance Indicators" in order to "*propose indicators on 15 thematic, four pillars of sustainability: Economy, Environment, Society and Governance / Culture / Policies"* and *"help municipalities and city partners choose actions and priorities to serve Sustainable Development Goals*".

ELOT already afforded the Greek versions of the international standards ELOT ISO 37101, "Sustainable Cities - Urban Sustainability Management Systems - Requirements and Implementation Guidelines" and ELOT ISO 37100, "Sustainable Cities - Terms and Definitions of Concepts" in support of the national strategy and the initiatives of Greek cities to respond to international obligations and to meet the objectives of Sustainable Development.

[4] https://www.un.org/sustainabledevelopment/cities/
[5] https://www.itu.int/en/ITU-T/ssc/Pages/default.aspx
[6] https://www.iso.org/standard/71914.html
[7] http://www.elot.gr/1427_ELL_HTML.aspx

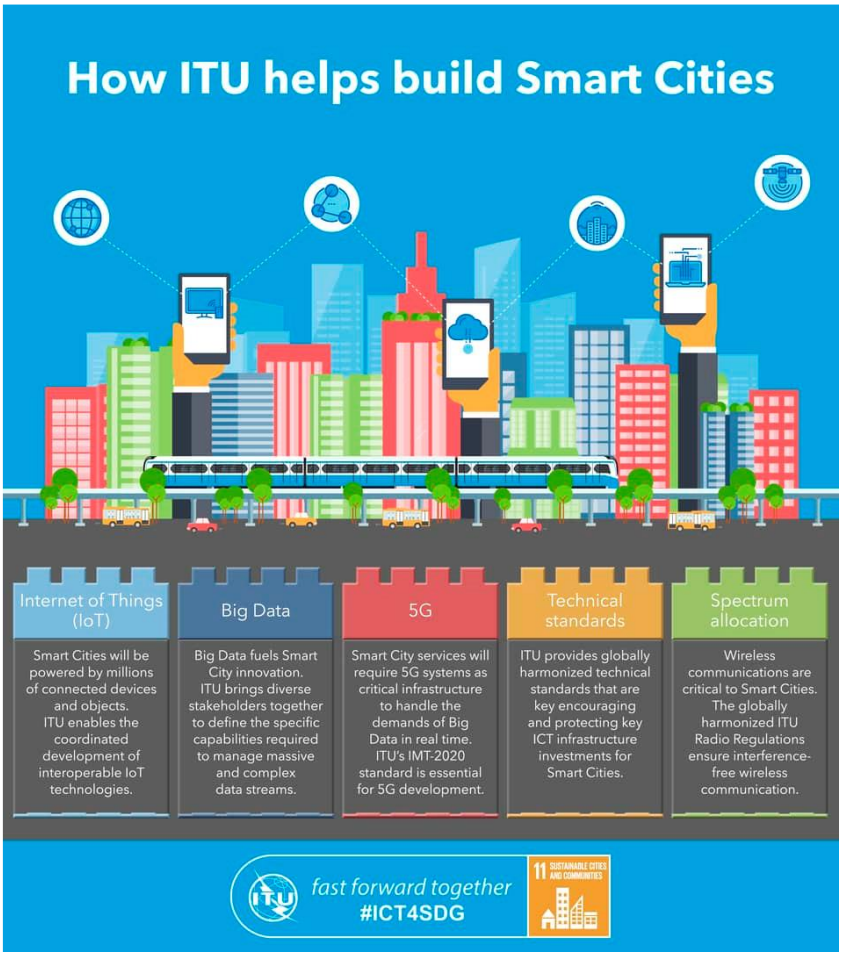

Fig.2: How ITU helps build Smart Cities.
Source: https://news.itu.int/how-itu-supports-smart-sustainable-cities-and-the-achievement-of-sdg-11

Smart Cities and the Internet of Things (IOT)

Technological companies such as Google, IBM, Cisco, and Intel had launched from the early beginning smart initiatives or city platforms designed to gather, process, and understand the data produced by municipal devices and physical factories. This is justified by the fact that Smart Cities are considered a huge global market, which is expected to reach $ 2.57 trillion by 2025[8].

Since 1975, Singapore has introduced an electronic road traffic management program, which has significantly reduced traffic volume, collisions and emissions from cars. Since then, hundreds of initiatives have been announced to create smart cities, which raising concerns whether city planning has passed from the hands of urban planners and architects into the hands of technocrats. A typical example is the expansion of Toronto to its untapped coastal front, whose design was assigned to Google[9], or the design of a neighboring area of the Denver airport in the United States from Panasonic[10].

[8] https://www.grandviewresearch.com/press-release/global-smart-cities-market
[9] http://theconversation.com/can-a-tech-company-build-a-city-ask-google-86402
[10] https://www.businessinsider.com/panasonic-smart-city-project-denver-2018-1

However, similar initiatives take place not only in the Western world, but also in developing countries such as India, where the National Ministry of Urban Development grants the Mission of the 100 Cities transformation to Smart Cities[11]. The aim of this program is to promote cities that provide basic infrastructure and provide a decent quality of life for their citizens, a clean and sustainable environment and the implementation of "smart" solutions.

Until now companies that are designing smart city applications are investing in:

- Management of traffic congestion.
- Management of transit and transport procedures, e.g. the provision of safe, on time and reliable transit, alternative public transport.
- Improved water management.
- Infrastructure and operational monitoring of the power grid, including computing resources, cyberspace protection, safety and security.
- Adaptive timing for light signals to minimize congestion and optimize flow depending on conditions, e.g. morning, evening, bank holidays, business days.
- Monitoring and data collection for high local air quality.
- Addressing to natural disasters.

Internet of Things (IoT), i.e. " *the communication network for a variety of devices, home appliances, cars, and any other object incorporating electronic means, software, sensors and network connectivity to allow connection and exchange of data*" [12] is the basis for the ultimate achievement of the goals of smart cities.

Regarding environmental impacts, critics argue that multiplying the Internet of Things (IoT) devices will increase energy requirements, although the overwhelming view is that smart cities will have more benefits through better resource management such as energy, water, reduced emissions.

Especially for locations such as airports, seaports and shopping centers, IoT technology can reduce energy costs, spatial management and maintenance of buildings by up to 30%. Singapore for example has made significant reductions in carbon dioxide and particulate emissions through congestion management (reduced congestion is leading to lower emissions). While Gartner[13] predicted that Smart City and IoT technologies would halve the international urban environmental footprint by 2030.

Nevertheless, the greatest danger of using the Internet of Things seems to be the lack of human privacy. The continuous data recording regarding human behavior, movement, trade transactions and even information about daily life, e.g. through Google Assistant digital assistants, Amazon Alexa, Apple Siri, Samsung Bixby and others may be the beginning of an Orwellian era[14].

It is logical that the changes in the lives of citizens that will happen either consensually[15] or will be imposed (our era is characterized as the era of the 4th Industrial Revolution), the

[11] https://en.wikipedia.org/wiki/Smart_Cities_Mission

[12] https://en.wikipedia.org/wiki/Internet_of_things

[13] https://www.gartner.com/smarterwithgartner/the-future-city-in-a-smart-world/

[14] https://el.wikipedia.org/wiki/1984

[15] James Bridle "New Aesthetic" - "*In making these connections invisible and silent, the status quo is hard-wired into place, consent is bypassed, and alternatives are deleted. This is, if you will, the New Anaesthetic*". https://jamesbridle.com/works/the-new-aesthetic

adoption of new technologies will have both negative[16] and positive consequences. The shifting of powers to the benefit of large companies and the mechanisms that control collect of data, requires constant social engagement, information and participation.

Smart Cultural Heritage

The perception, which prevails in the most conservative communities, is that there is a contrast between technology and culture. This view is mainly since mechanization replaces traditional craftsmanship, directly threatening the intangible cultural heritage.

At the same time, the Smart City model, as shown in infographics, social networks, corporate and company advertising campaigns, researcher presentations, appears as a "homogenized" hybrid environment that can grow with the same success, either we are talking about Arizona in the USA, either Shanghai in China or Trikala or Ermoupolis in Greece.

The advent of the Smart City, as an idea and as a set of practices that can be implemented, runs the risk of influencing the physiognomy of urban landscapes (e.g. the vertical development of skyscrapers in order to limit the spreading of the urban area due to the increasing density of the population).

However, the fact that cultural heritage must be preserved and protected in any context of Smart Cities is not negotiable. A city needs an appreciation of its past before moving to a "digital" future. The questions that arise are immediate. What are the parameters of the cultural heritage of the Smart City? How does Heritage become "smart"? These are some issues that require urgent and full attention from decision-makers, policymakers, urban planners, smart city counselors, heritage professionals and stakeholders.

There are over 120 city service indicators across 20 theme areas that include: education, energy, finance, recreation, fire emergency, response, governance, health, safety, solid waste, transportation, urban planning, wastes and water. But Smart Cultural Heritage indicators are not included, and this must change. The cultural metrics of tangible and intangible heritage should be considered as key elements for the community infrastructure. Those elements shape the physiognomy of a city, not only in terms of its image, but also its social composition through its customs and social morals. Smart cities must meet not only social, economic and environmental indicators, but also combine the current technological developments with the cultural wealth (Siountri et al. 2018).

The Smart Cultural Heritage City Indicators should be standardized, consistent, and comparable over time and across cities, enhancing the ability of cities to observe trends and to facilitate comparisons with other cities, but at the same time to preserve or enhance their own special cultural characteristics. The evolvement of the local society and the local stakeholders and the constant evaluation of the system are necessary, to assure the preservation of diversity and protection, monitoring and enhancement of the local cultural heritage.

[16] https://theconversation.com/the-internet-of-things-is-sending-us-back-to-the-middle-ages-81435

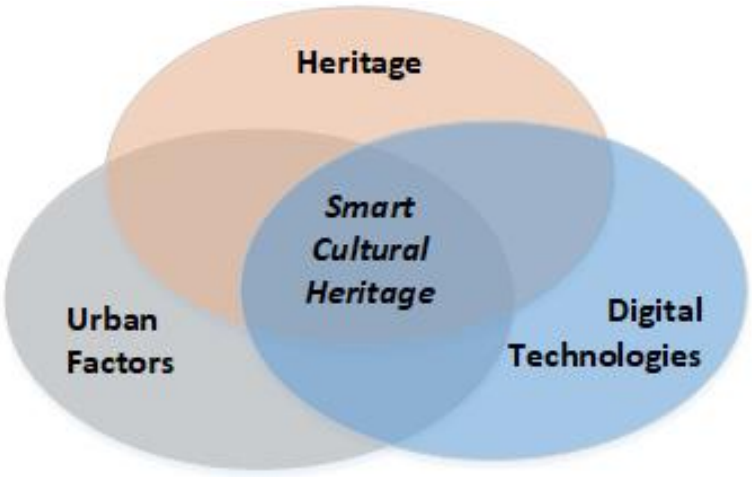

Fig.3: The smart cultural heritage concept combines all the urban Factors (a), the novel digital technologies (b) with tangible and intangible heritage of the city (c).

Smart Cultural Heritage (Figure 3) can indeed serve the preservation of identity (tangible and intangible) of sites and communities using smart technologies. This need is particularly evident in Greece, where cultural resources represent a significant possible source for the local economy and enhancement.

Technological advancements have already led to the achievement of the following:

- Digital networking of institutes, associations and organizations, visitors and cultural objects.
- Crowdsourcing information, related to gastronomy, wine, monuments, trails, customs, anthropogeography etc. by creating databases and "digital paths" etc.
- Access to cultural objects and e-learning (a) production of virtual and mixed reality applications, documentation, videos, 3D models, hiking trails, b) production of audiovisual material and 3D movies, and c) visit to "virtual museums".
- Digitizing material and developing tools for analyzing and searching for information found in cultural heritage institutions (e.g. libraries, museums, etc.), creating large data repositories that allow access to preservation of cultural heritage.
- Extended research of the past, as new technologies can reveal hidden information and properties of the evidence, to bring to light hidden collections or to unite antiquities which are spatially remote.
- Education, as digital applications have a significant impact on youth.

But as technology is constantly changing, the imperative need is to develop local Smart Cultural Heritage strategies and tools to enhance and preserve cultural and environmental resources, which will be integrated with the local Smart City plans (Skondras et al. 2018).

By aiming to promote and further understand Smart Cities in the contemporary cultural environment, we can understand their interdisciplinary and dynamic nature through three main pillars:

- Research on the nature, role and functionality of Smart Cities in modern socio-political development through the creative use of advanced digital technologies.

- The education of future citizens, through multidisciplinary collaborations, in the support and management of digital cities as an integral part of their cultural environment.
- Reconstruction of thought, as well as, the development of a sustainable model of development, protection and management of the urban environment as a mean of future coexistence.

These action lines will share a common technological platform to create an ecosystem in which businesses, public administrations, organizations, citizens and visitors will be involved and reported. All local projects can participate in a national open platform for smart services for the culture sector.

Conclusions

In conclusion, the key aspect of the Smart Cultural Heritage approach will be to preserve and promote the cultural heritage as a key component of Smart City plans. This will inevitably require a change in the design of transformation measures and the definition of smart metering and performance indicators at international and national level. Smart Cultural Heritage strategies will have conceptual, administrative and operational implications for the integration of cultural heritage within the framework of smart cities.

Culture experts should work with Information and Communication Technology (ICT) specialists on "different" and "customized" preservation, management, interpretation and experience of the heritage, as appropriate, and the region. This will lead to unique and innovative solutions for any Smart City.

References

- ITU (2015), *Master plan for smart sustainable cities*, Focus Group Technical Report.
- ISO (2014), *Smart community infrastructures – Review of existing activities relevant to metrics*, Technical Report, ISO/TR37150.
- ELOT (2017), *Sustainable development in communities – Management system for sustainable development - Requirements with guidance for use*, ELOT ISO-37101.
- ELOT (2018), *Sustainable Development of Communities – Reporting and Indicators of sustainability performance*, ELOT 1457.
- E. Skondras, K. Siountri A. Michalas and D.D. Vergados (2018), "*A Route Selection Scheme for supporting Virtual Tours in Sites with Cultural Interest using Drones*", The 9th International Conference on Information, Intelligence, Systems, Applications (IISA 2018), Zakynthos, Greece.
- K. Siountri, E. Skondras, D.D. Vergados (2018), "*A Delivery Model for Cultural Heritage Services in Smart Cities Environments*", International Conference on Digital Heritage - EuroMed 2018, Nicosia, Cyprus.