Smart Cities: From Theory to Reality - The Athens Case

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Abstract

The term "smart city" has been used in many circumstances, mainly to determine the added value of the "smartness" of a city. The cities must be viable for their citizens, "green", with "empty" spaces, without traffic problems, good infrastructures etc. In addition, a city must be "smart", means providing smart data, smart infrastructures and "smart" applications to their citizens. Many academic papers and real projects have exhaustively analysed and concretised the above issues. Nevertheless, from a practical point of view, there is not a short list of factors extracted from a combination of a) theoretical definitions, b) indexing systems measuring a city's "smartness" c) the citizens experiential needs and desires for smart applications and d) factors coming from the applications/data provided by local, national and international institutions/governments and private companies. A such integrated list may give a valuable practical level of the "smartness" degree of a city. This article is based on the extraction of the above factors which determine the level of "smartness" of a city. All those factors were applied in the city of Athens in order to determine the level of city's "smartness".

1. Introduction

The terms of smart data and smart cities have been used in many circumstances, in scientific, thematic and professional frames, mainly to determine the added value of the "smartness" of a city. The cities must be viable for their citizens, "green", with "empty" spaces, without traffic problems and traffic jams, with good infrastructures, health services and security. Citizens must also have easy access to all levels of education. In addition, a city must be "smart", providing smart data, smart infrastructures and "smart" applications to their citizens. Many academic papers have exhaustively analysed and real projects have concretised the above issues. Nevertheless, from a practical point of view, there is not a short list of factors extracted from a combination of:

1. a number of definitions of smart cities,
2. an integrated index system of smart cities (based on the most indexing systems of smart cities),
3. the experiences/desires/demands of citizens concerning the smart applications and data that would expect from their city and
4. factors coming from the applications/data provided by local, national and international institutions/governments and private companies.

It is confirmed (but not mentioned in the literature) that smart data and applications coming from international private companies or international institutions, surely add into the "smartness" of a city, e.g. Google Maps, Open Street Map, Tripadvisor. This article is based on the extraction of the above factors which determine the level of a smart city. A such list of factors could be used as a city's smartness guide for citizens and tourists. All those factors were applied in the city of Athens in order to determine the level of city's "smartness". Last section concerns the conclusions of this project.

2. Smart Data – Smart cities: Definitions

Over the years, many definitions of smart cities have been mainly given by the scientific community. The term "smart city" is in many cases related with the existence of smart data. Based on a literature review of this term we have chosen a number of representative theoretical definitions. From those definitions we extracted a number of practical factors which determine according to our study a general level of "smartness" of a city. The extracted factors are classified in the following categories: traffic/mobility, health, government, education, recreation/tourism/culture, infrastructure, environment, security (Figure 1).

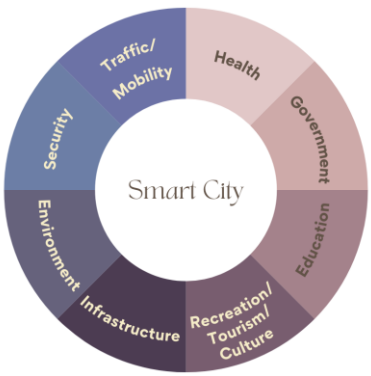

Figure 1. Categories of the factors which determine the "smartness" of a city.

Several definitions are presented from various sources as well as from the lists of Lombardi (2012) and Albino (2015). An attempt has been made to select definitions presenting different perspectives of the "smart city" meaning. Some definitions are considered very general. For this reason, we didn't use them in order to extract city's "smartness" factors, e.g. (Schöch, 2013), (Komninos, 2011), (Kourtit and Nijkamp, 2012), (Thite, 2011), (Thuzar, 2011), (Zygiaris, 2012).

- Smart city as a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality. (Bakici et al., 2012) - **Factors**: e-shops in the city, augmented and virtual reality applications in city places, good internet quality signal
- Being a smart city means using all available technology and resources in an intelligent and coordinated manner to develop urban centres that are at once integrated, habitable, and

sustainable. (Barrionuevo et al., 2012) – **Factors:** too general, no factors

- A city is smart when 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 et al., 2011). - **Factors:** Public Participation Geographic Information System (PPGIS)
- Smart cities will take advantage of communications and sensor capabilities sewn into the cities' infrastructures to optimize electrical, transportation, and other logistical operations supporting daily life, thereby improving the quality of life for everyone (Chen, 2010). **Factors:** digital management of infrastructures, digital application for transport/telegeomatics/telematics, government, digital application for public documents procurement
- Two main streams of research ideas: 1) smart cities should do everything related to governance and economy using new thinking paradigms and 2) smart cities are all about networks of sensors, smart devices, real-time data, and ICT integration in every aspect of human life. (Cretu, 2012) **Factors:** telematics, telegeomatics, e-government
- Smart community – a community which makes a conscious decision to aggressively deploy technology as a catalyst to solving its social and business needs – will undoubtedly focus on building its high-speed broadband infrastructures (Eger, 2009). **Factors:** ubiquitous Internet
- A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens. (Giffinger et al., 2007) - **Factors:** e-government, transport applications
- A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens (Hall, 2000). – **Factors:** Digital infrastructure management, smart security e.g. traffic cameras, security cameras
- A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city. (Harrison et al., 2010) - **Factors:** Digital infrastructure management
- A community of average technology size, interconnected and sustainable, comfortable, attractive and secure (Lazaroiu and Roscia, 2012). **Factors:** digital management of security matters
- A smart city infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions, deploy resources effectively, and share data to enable collaboration across entities and domains (Nam and Pardo, 2011). - **Factors:** collection and analysis of data for the environment, traffic, health, digital smart management of infrastructure
- The use of Smart Computing technologies to make the critical infrastructure components and services of a city—which include city administration, education, healthcare, public safety, real estate, transportation, and utilities—more intelligent, interconnected, and efficient. (Washburn et al., 2010) - **Factors:** e-government, transportation applications, health digital applications, distance learning
- Smart Cities initiatives try to improve urban performance by using data, information and information technologies (IT) to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration among different economic actors, and to encourage innovative business models in both the private and public sectors. (Marsal-Llacuna et al., 2014) - **Factors:** Data collection, analysis and process, digital smart management of infrastructures
- Smart cities are emerging as the future of urban areas. Smart cities are defined as promising communities that use intelligent technologies to connect people through internet devices to improve their quality of lives (Hollands, 2020). - **Factors:** people's connection (e.g. via applications)
- Dembski et al. (2020) mention as fundamental parameters of a smart city the use of virtual and augmented reality, to facilitate collaborative and participatory processes of urban planning, design, and decision support. - **Factors:** Digital representations of the city (2D, 3D, DTM, Digital twins, etc.), virtual and augmented reality applications for/in city places
- Based on multiple relative sources, Verhulsdonck (2021) formulate the following definition: […] smart cities are often described as "urban operating systems," e.g., as "data cities," "intelligent cities," "wired cities," "digital cities," "information cities," and "city data landscapes". Such terms give the impression that IT integration at a city level is necessary to innovate various social and human dimensions in a smart city. - **Factors:** available data sharing with the citizens, IT applications for the city functions in different levels and thematic / professional areas (health, education, public bureaucracy, etc.)
- Through the use of ubiquitous wireless networks, smart devices, the Internet of Things (IoT), and data sharing, smart cities thus create a technology-enabled vision of how embedded digital sensing infrastructure can facilitate various interactions for smart city inhabitants (Gustav Verhulsdonck, 2021). **Factors:** existence of ubiquitous wireless networks
- Qureshi et al. (2020) argues that cybersecurity is a necessary component to smart cities. **Factors**: Cyber security, data sharing
- In smart cities, governments have started to use IT, popularly known as e-government, to enhance citizen access to city government and services (Grant & Chau, 2005). **Factors:** e-government
- Another fundamental technology, IoT, is turning physical devices and objects into active smart "things", which connect the physical and the digital world together (Huber et al., 2019). The IoT can become ubiquitous and evolve into the Internet of Services and Internet of People, which promise to be broadly utilized in applications ranging in all domains of life encompassing effective social, economic, and technical IoT services for people (Nicolescu et al., 2018). Chatterjee et al. (2018) argues that there is a large utilization for the elderly population who have difficulties in various settings, including their homes, residential settings, or institutional settings. IoT devices can support the elderly in monitoring daily living activities and changing user behaviour. In addition, Hussain et al. (2015) claims that healthcare platforms for people with disabilities need the IoT and wireless body sensor network as fundamental technologies, to monitor the health of the elderly and people with disabilities as well as provide them with emergency services when required. **Factors:** Internet of Things (IoT), healthcare platforms, e-governmnet

- The Republic of Korea has developed a plan to pursue efficient urban operations. Since 2003, U-City has been a long-term project to develop cities by incorporating ubiquity. Today, in the information society, smart cities, which include a network linking the entire city, are emerging through an infrastructure represented by information and communications technologies (ICT) for telecommunication activation. […] These smart city infrastructures have also begun to affect the tourism behavior […]. Some cities in Korea are also introducing smart tourism as a strategy to revitalize tourism (Taehyee Um & Namho Chung, 2021**). Factors:** ubiquitous network, smart tourism

The above extracted factors from the definitions are classified in the following categories.

Category: Traffic/Mobility - **Factors:** digital application for transport/telegeomatics/telematics
Category: Health - **Factors:** collection and analysis of data for health, health digital applications/healthcare platforms
Category: Government - **Factors:** e-government (online government services), IT applications for the city's bureaucracy
Category: Education - **Factors:** distance learning/e-learning
Category: Recreation/Tourism/Culture - **Factors:** Augmented and virtual reality applications in city places, e-shops in the city, good internet quality signal, digital representations of the city (2D, 3D, DTM, Digital twins, etc.), other IT applications for recreation/tourism/culture
Category: Infrastructure - **Factors:** digital management of infrastructures, ubiquitous wireless networks, people's connection, available data sharing with the citizens, IoT, PPGIS
Category: Environment - **Factors:** collection and analysis of data for the environment, IT applications for the city's environment
Category: Security - **Factors:** Cyber security

3. Factors resulting from the smart cities index systems

A large number of indexes sets with factors for smart cities has been presented in the literature. They are published either by states and their organizations, or by companies, and other independent groups such as: the ranking of smart cities by VUT (Vienna University of Technology) (VUT, 2007), the city index by Ericsson (Ericsson 2014), the smart city indices by ISO (International Standards Organisation) (ISO 2015), ITU (International Telecommunication Union): the ICT index (ITU 2015), the UN (United Nation) prosperity index (UN 2016).
The ITU and their SSC (Smart Sustainable Cities) focus group presented in 2015 a comparative analysis of nineteen sets of factors (ITU 2015). The U4SSC (United for Smart Sustainable Cities) project (ITU 2017) KPIs (Key Performance Indicator) have been developed as an expansion of the above set to provide cities with a consistent and standardised method of data collection and a method to measure their performance & progress towards a smarter city. In the UN proposed scheme, each factor and indicator describe the overall city performance in three dimensions: Economy, Environment and Society/ Culture. Each dimension contains sub-dimensions that focus on specific areas of performance and progress. Sub-dimensions are further divided in categories with groups of indicators to provide more in-depth view on each domain. All factors are also subdivided into Core or Advanced factors. Core factors are reported on by all cities, while advanced factors are reported or implemented by a city with more advanced initiatives (ITU 2017).

The list of factors contained in the KPI wheel published by (Moussas et al. 2019) & (Pantazis et al., 2018), was based on the aforementioned works and is in accordance with the guidelines of the UN initiative.
The proposed KPI wheel is shown in Figure 2, contains 5 main categories of factors that correspond to the 3 UN main directions, namely: Economy to Economy ICT & Infrastructure, Environment to Resources and Society & Culture to Quality of Life & Society.

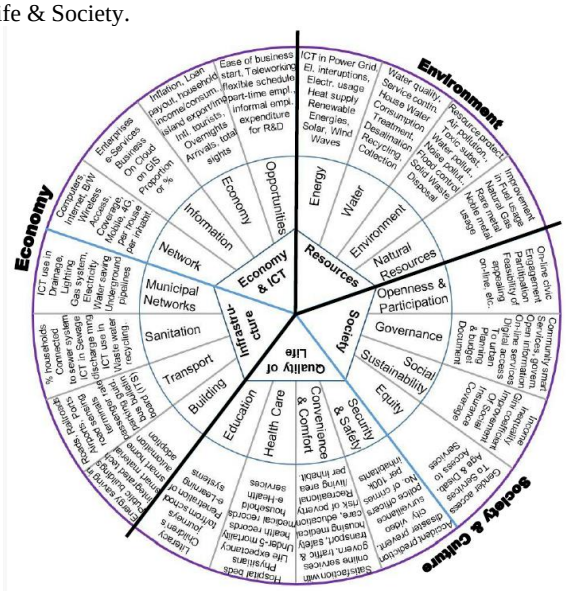

Figure 2. The KPI Wheel with the smart city factors divided in dimensions and sub-dimensions (Moussas et al.,2019).

In more detail, the KPI wheel contains a large number of indices & factors and the corresponding metrics. The above factors can be also classified in the categories which have been presented in section two. Those categories are a mixture from different levels of the KPI wheel.

Category: Traffic/Mobility - **Factors**: Road infrastructure in km per 100k population, airports and ports infrastructure in passenger rate, number & frequency of connections (Air/Sea/Coastal), coverage of road sensing, coverage of parking guidance, coverage of electric bus, satisfaction and convenience of transport quality and traffic information/administration
Category: Health - **Factors:** Number of hospital beds/100k., number of physicians/100k., life expectancy improvement, under-5 mortality rate, % of electronic health records archiving and usage rate, coverage rate of household e-Health services, convenience of medical care
Category: Government - **Factors:**
Information Facilities: % of e-service enterprises, proportion of Cloud based business
Innovation & Opportunities: Ease of starting a business (days) - Teleworking penetration (%) - Work Scheduling flexibility (%) % of part-time employment - Formal/informal employment ratio - % of R&D expenditure
Economy & Production: Inflation (%), Loan payout rate, % of e-Commerce transaction amount, household income/consumption ratio, island export/import of goods ratio, importance as tourist location (total sights, overnights), overnights/year/resident - International tourists (arrivals/resid.), Sustainability of resources
Openness & public participation: On-line citizens engagement/participation %, feasibility of appealing on-line

Social sustain. & equity: Gini coefficient of income inequality, gender ratio, age and disab. ratios of access to services, social insurance coverage
Governance sustainability: Appliance of smart community services, penetration rate of government on-line services, penetration rate of government open information, digital access to urban planning & budget document, convenience of government services, proof against risk of poverty
Category: Education **Factors**: Literacy enrolment, children's journeys to school, penetration of e-Learning system, convenience of education access
Category: Recreation/Tourism/Culture **Factors:** Satisfaction with online services, satisfaction with food and drug safety monitoring, satisfaction with housing conditions, recreational area/100k.
Category: Infrastructure **Factors:**
Network Facilities: Fixed broadband subscribers/100, wireless/Mob/5G subscribers/100, Intl. B/W per user (bps), % of Households with Internet, % of households with computer, coverage rate of next-G networks
Building: Application level of energy saving technologies in public buildings, % of public buildings with integrated technologies, proportion of smart home automation adoption, proportion of smart materials used, average living area/inhabitant
Sanitation: % households connected to sewer system, ICT use in Sewage discharge management, ICT use in waste water recycling
Municipal networks: ICT use in: Drainage system management, lighting system management, gas system management, electricity supply system management, water saving smart metering, underground pipelines improved administration
Category: Environment **Factors:**
Energy: ICT use in power grid resilience, average length of electric interruptions (hr/day) - Civilian electricity usage improvement, Industrial electricity usage improvement, heat supply systems usage improvement, % of Renewable energy sources on total consumption
Water: Water quality %, continuity of water service (hr/day), % households connected to water service, water treatment proc/level improvement, % of Water desalination, % of Water recycling, % of population served by water collection, domestic water consumption (lt/day), industrial water usage improvement, years of positive water balance
Environment Monitoring: Percentage % of ICT means used for: water resource protection, flood control monitoring, water pollution control, air pollution/CO_2 monitoring, noise pollution monitoring, toxic substances monitoring, solid waste disposal
Natural Resources: Fuel usage improvement, natural gas usage improvement, rare/noble metal usage improvement
Category: Security **Factors:** Accident prediction ratio, ICT use for disaster prevention, penetration of city video surveillance, No. of police officers/100k., No. of crimes/100k., satisfaction with crime prevention, security, and disaster countermeasures

4. Factors resulting from experiencing

The experimental factors of the "smartness" of a city come out based on the desires and wishes of the citizens. We have classified them on the same categories. Their gathering is based on informal discussions with a large number of different people, personal experiences, and informal questions/discussions with students' groups. Despite the fact we are focusing in city of Athens the results concern the majority of big cities in Europe (>1.000.000 population). For each category we identified a number of factors as following:

Category: Traffic/Mobility **Factors:** maps showing the best itinerary, the closest place X, the traffic jam/alternatives paths, shorter itineraries, the parking localization, the number of free parking places, the public bus/subway stop positions, their itinerary and the time needed to arrive to the next stop, "how can I go somewhere" applications, digital application for transport/telegeomatics/telematics, AR applications for navigation in the city
Category: Health **Factors:** possibility of finding the closer hospital, remote health platforms, remote medical care, digital medical appointment, app to find the closest open pharmacy
Category: Government **Factors:** possibility to extract/request official documents form digital platforms without physical presence, digital demands and complains, digital banking, e-government, digital retirement process, digital urban planning, digital cadaster, digital demands and complains
Category: Education **Factors**: Remote education (distance learning), for all levels of education (private & public)
Category: Recreation/Tourism/Culture **Factors:** location of museums/opening hours, cultural events information, parks' location, cinema locations and films schedule, bars and restaurant location and opening hours, digital ticketing systems
Category: Infrastructure **Factors:** Digital process for complains, reparations request, digital management of the infrastructure, charge Spot/ Application of easy Localization of charge spots
Category: Environment **Factors:** Sensors for air/ water/ soil pollution measurement, digital diffusion of the information in a daily basis (public available environmental data), digital weather forecasting in daily/weekly/monthly basis
Category: Security **Factors:** Digital cameras, digital surveillance systems (e.g. in the football match etc.), smart allocation of police officers, drones patrol, digital security cameras

5. Smart Cities: A multifactor System

Our days the "smartness" of a city depends of a multi-parameters multi-layers hierarchical open system. The system contains smart data and applications and other components from various and independent, dependent or semi-dependent sources, from local, national and international levels from public and private domains (Figure 3).

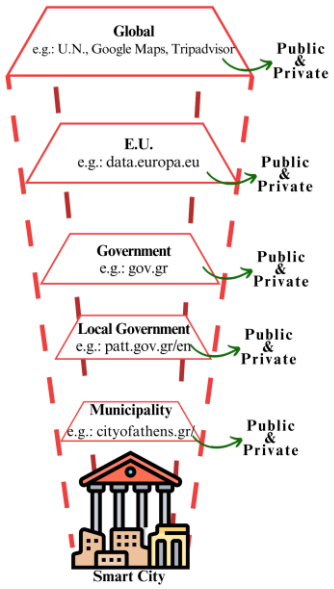

Figure 3. Local, national and international levels, public or private, that provide smart data and applications for a smart city.

How can we measure the "smartness" of a city? As already mentioned, the index systems give a solution. In the frame of our research, we are trying to create a list less complicated, more practical and useful for citizens and tourists. Our problems were: first to determine a short list of categories and factors that could give an idea of the level of the "smartness" of the city. Second to find out how those factors can be measured. Third is to determine how international and national companies contribute to a "smartness" of a city. At an international (global) level this "smartness" depends from a) the smart data and applications concerning the entire country of Greece, e.g. Data and applications from UN, Google, Microsoft, Greek private companies etc. which can be used at city level b) the smart data and applications concerning the EU which can be used at the city level c) the smart data and applications coming from European companies. At a national level this "smartness" depends from d) the smart data and applications coming from the government e) the smart data and applications coming from the local government f) the smart data and applications coming from the municipality g) smart data and applications coming from private local companies. The Table 1 gives the answers to the above questions.

Category: All categories. **Factors:** All factors

6. Case Study: Athens

Following the factors that we have extract from three different sources (definitions, index systems, experiences/desires) and the methodological tools of analysis and classification of data and applications, (coming from different levels presented in section five), we have created the cross – check Table 1 for the city of Athens:

Category	Factor	Athens
Traffic/Mobility	Maps showing the best itinerary, the closest place X, the traffic jam/alternatives paths, shorter itineraries, the parking localization, the number of free parking places, the public bus stop positions, their itinerary and the time needed to arrive to the next stop, how can I go somewhere apps	https://www.google.com/maps
		https://www.bing.com/maps?cp=37.975056%7E23.737335&lvl=11.0
	Digital application for transport/telegeomatics/telematics	https://www.oasa.gr/telematics/
		apps: OASA, Moovit etc.
	Coverage of parking guidance systems	-
	Coverage of electric bus bulletin board	-
Health	Possibility of finding the closest hospital	https://www.google.com/maps
	Remote health platforms, Digital medical appointment	https://www.finddoctors.gov.gr/p-appointment/#/patients/patients-login
	Closest open pharmacy	(https://www.google.com/maps)
		https://fsa-efimeries.gr/
	Remote medical care	e.g.: https://www.drtsoukalas.com/agogi_kai_parakolouthisi_eks_apostaseos-su-298.html
	Collection and analysis of data for health	https://www.moh.gov.gr/
	Health digital applications/Healthcare platforms	https://www.eopyy.gov.gr
		https://www.idika.gr
Government	Possibility to request official documents form digital platforms without physical presence	https://aitiseis-kep.services.gov.gr/
		https://www.cityofathens.gr/services/
	Digital demands and complains	https://aitiseis-kep.services.gov.gr/
	Digital banking	All Greek banks offer digital banking
	Digital platform for the necessary applications for retirement	https://www.efka.gov.gr/el/elektronikes-yperesies/elektronikes-yperesies-gia-syntaxioychoys
	Digital cadastre	Ktimatologio.gr
	E-government (online government services),	Gov.gr
		https://www.gov.gr/ipiresies/polites-kai-kathemerinoteta/ex-apostaseos-exuperetese-politon
	IT applications for the city's bureaucracy	http://gis.epoleodomia.gov.gr/v11/#/
Education	Remote education (distance learning), for all levels of education	https://www.eap.gr/en/
		https://iepx.iep.edu.gr/courses/course-v1:edX+DemoX+Demo_Course/about
		https://www.minedu.gov.gr/grafeio-typoy/298-uncategorised/44467-21-03-2020-odigies-gia-tin-eks-apostaseos-ekpaidefsi-3
		websites: e-class
		https://athena.net.gr

Recreation/Tourism/Culture	Location of museums/opening hours, cultural events information, parks' location, cinema locations and films schedule, bars and restaurant location and opening hours	https://www.tripadvisor.com/
		+ internet pages coming from public from private domains
	Augmented and virtual reality applications in city places	https://www.cosmote.gr/cs/cosmote/en/cosmote-chronos-akropoli-virtual-tour.html
		https://www.fhw.gr/cosmos/index.php?lg=_en
		Google Maps Live View
	E-shops in the city	Apps: Wolt, e-food etc.
		Skroutz.gr: Shop confidently and with ease in Greece & Europe!
	Good internet quality signal	https://www.cosmote.gr/cs/cosmote/en/map.html
		https://www.vodafone.gr/elegxos-taxythtas-internet-diktyou-kinitis
		https://nova.gr/kiniti-tilefonia/diktio-kinitis-tilefonias/diktyo-prosbashs-kinhths/xartis-taxititon-speedmap
	Digital representations of the city (2D, 3D, DTM, Digital twins, etc.)	https://earth.google.com
		https://www.bing.com/maps?cp=37.975056%7E23.737335&lvl=11.0
		https://www.openstreetmap.org/#map=6/38.359/23.810
	IT applications for Recreation/Tourism/ Culture	https://www.snfcc.org/en
		https://www.nationalgallery.gr/en/
		https://www.emst.gr/en
		https://www.namuseum.gr/en/
	Digital ticketing system	https://www.more.com/en/
Infrastructure	Digital process for complains, reparations demand, digital management of the infrastructure	https://www.eydap.gr/en/DealWithIssue/LeaksUpdate dei.gr
	Adaptive streets highway lightning	https://tvilight.com/case-study/ai-powered-adaptive-street-lighting-at-greeces-most-strategic-motorway/
	Automatic toll system	https://www.neaodos.gr/μηχανήματα-αυτόματης-πληρωμής/
		https://www.aodos.gr/diodia-e-pass/thelo-na-apoktiso-e-pass/h-syskeui/
		https://www.fastpass.gr/index.php/home-2/
		App: Myodos
	Charge Spot/Application of easy Localization of charge spots	https://chargemap.com/cities/athens-GR
	Digital management of infrastructures	https://www.dei.gr/en/
		https://www.eydap.gr/en/DealWithIssue/LeaksUpdate
		cosmote +gis cosmote
		https://www.astynomia.gr/kykloforia-stous-dromous/deltio-kykloforias-attiki/
	Internet access easy and fast/existence of ubiquitous wireless networks	https://www.wifimap.io/map/1301-athens?wifiHotspot=57161bde-095b-483f-9ce4-2b3da1efb80d,
	People's connection	-
	Available data sharing with the citizens	Many websites and apps, private and public
		https://giscityofathens.readthedocs.io/el/latest/
		https://www.statistics.gr/en/home/
	PPGIS	Small, only for particular cases
	Smart home	Small %
Environment	Sensors for air/ water/ soil pollution measurement, digital diffusion of the information in a daily basis	http://www.emy.gr/emy/el/climatology/climatology_city
		and many more apps
	IT applications for the city's environment	https://www.blueflag.gr/
	Digital weather forecasting in daily /weekly/monthly basis	https://www.meteo.gr/index-en.cfm
	Digital cameras, digital surveillance systems (e.g. in the football match etc.)	https://www.skylinewebcams.com/el/webcam/ellada/atiki/athina/ermou-street-syntagma-square.html
Security	Cyber security	https://www.astynomia.gr/hellenic-police/special-services/cyber-crime-division/?lang=en
	Smart allocation of police officers	-
	Drones patrol	-

Table 1. Factors for the city of Athens

7. Conclusions

The "smartness" of a city depends on many factors, data and applications. City "smartness" does not only depend of the city efforts or the city's infrastructures. It is related and depends from international organizations and companies, national and local governments/companies (see section 5). Sometimes the use of Internet alone gets a city "smart" without so much effort from the municipality (except for Internet infrastructure).

Most of the definitions of smart cities concern the same things and the same fundamental factors. We underline the fact that the city "smartness" depends on many apps and data coming from outside of the city's environment and independently of the city's efforts. Amongst our results is the concretization with real and existent applications of what a smart city could be.

Based on our factors, Table 1 shows that Athens' city's "smartness" is high. Nevertheless, there is always room for improvement. Particularly on the domains of Traffic/Mobility, Government, Infrastructure, Environment, Security.

Last but not least, our approach shows that there are also disadvantages living in a smart city. Those disadvantages concern privacy, unequal opportunities for access to technology, and the necessity for collaboration between private and public domains.

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