Igor Yu. Matyushenko,
V.N. Karazin Kharkiv National University, Department of Foreign Economic Relations and Touristic Business
app. 380, 6 Svobody Sq., 61022 Kharkiv, Ukraine, imatyushenko@karazin.ua

Anna M. Pozdniakova,
Research Centre of Industrial Problems of Development of NAS of Ukraine
5 Svobody Sq., Derzhprom, 7 port., 61002 Kharkiv, Ukraine, mira37cle@gmail.com

SMART CITIES IN UKRAINE - THE EVOLUTION, STATE AND CHALLENGES OF SMART SOLUTIONS IN THE AREA OF GOVERNANCE

Abstract
Comparatively new in the field of urban development, the concept of "Smart city" is considered to be a crucial tool to overcome urban challenges faced by the citizens in XXI century. The article discusses the basics of the concept, analyzing its key dimensions. An overview of digital market in Ukraine and its positions in the world rankings are provided along with the evolution of e-governance in Ukraine, as one of the components in "Smart city" concept.
We have outlined the most interesting smart solutions presented in Ukrainian cities and built a comparative table for those among 4 cities. Based on the analysis conducted we have created a list of challenges faced by Ukraine on its way to "smartization".

Key words
Smart city, e-governance, ICTs, urban development, digital society.

Introduction
Cities have always been crossroads of culture, and today urban areas are the driving forces of development and globalization [1]. During the last years of the twentieth century two important interrelated processes have greatly intensified, namely, urbanization and active development of information and communication technologies (ICTs). According to the United Nations Population Fund, 2008 was the year when more than 50% of the population (3.3 million) were living in urban areas. It is expected that by 2050 this figure will increase to 70% [2].

Cities grow and, as a result, most resources are consumed today in cities. This emphasizes economic, social and environmental importance of the last. Around 75% of world energy reserves are consumed in cities and around 80% of greenhouse gas emissions are produced by cities [3].

People move to cities looking for new opportunities, hoping to get a better job, more profound education and as a result to improve their standards of living. But along with opportunities, urbanization brings a number of challenges (congestion, increasing demand for scarce resources, pollution, etc.). This raises a crucial question of whether it is possible to make cities more sustainable and what are the tools. "Smart city" concept holds an enormous promise here.

Related work
The concept is being studied and developed by academics, civil servants and private sector representatives, which makes it truly unique, allows to consider it comprehensively and to study all the aspects from different points of view. The first academic work on the topic of "Smart cities" was published in 1992 [4]. While the label "Smart city" itself got its popularity starting from 2005, thanks to a number of technology companies like Cisco [5], Microsoft [6], IBM [7], Siemens [8]. The term was applied to complex information systems integrated into the urban infrastructure (transport, water supply, security, etc.).

In 2010 IBM launched the Smart Cities Challenge programme [9], deploying top IBM experts to 100 cities around the globe to help them to address their most critical challenges. During the 18th annual session of the United Nations Commission on Science and Technology for Development (CSTD), Smart Cities and Infrastructure, was selected as one of the priority themes for the 2015-16 period [10]. The topic was actively studied and developed by many prominent academics Cohen B. [11], Giffinger R.[12], Lombardi P.[13], Schaffers H.[14], Murray A., Minevich M. and Abdoullaev A. [15] and others. Many renown organizations have contributed to the topic, for example, The United Nations Educational, Scientific and Cultural Organization (UNESCO) [16], The European Innovation Partnership on Smart Cities and Communities (EIP) [17]; European Parliament [18]; National Intelligence Council [19]; World Bank [20]; Intentional Communication Union (ICU) [21], etc.

Objective and method

The objective of this article is to give an overview of "Smart city" concept and to reveal the evolution of smart solutions applied in Ukraine, particularly in the area of governance. We have started with a short review of the "Smart city" concept components, discussed digital market in Ukraine and finally outlined the latest trends in e-government process along with the key challenges presented in Ukraine.

We have used a method of theoretical, logical and systemic analysis of literature (scientific papers, policy documents, media channels and statistical sources) to study various views on "Smart city" concept and outline recent trends in Ukraine. Also methods of comparative analysis (to compare various ICTs indexes for selected countries) along with descriptive and structural analysis were applied in the article.

"Smart city" concept

There are many sources that aim to describe the concept, but till now there is no standardized, commonly accepted set of terminologies that would help to work with a "Smart city" concept. So first we have to deal with numerous different definitions, indicators and indices [21].

Academics use many terms that connect ICTs with different economic, political and social changes. Among the most widespread are "Digital city", "Smart city", "Intelligent city", "Creative city", "Sustainable city" etc. According to Pardo and Nam "Smart city concept" can be reviewed within 3 dimensions: Technology, Human and Institutional dimensions [22]:

Firstly, technology dimension. It focuses on mobile and smart technologies, physical infrastructure and digital networks. The dimension presupposes commercial application of smart products and solutions. For example, smart houses that are filled with sensors, mobile terminals, smart grids etc. The target is to build a high-tech intensive city that successfully connects and maintains the links between people, information and city elements. Corresponding concepts: digital city, information city, ubiquitous city.

Secondly, human dimension. Concepts where this component dominates assume that creativity and creative class [23] are key elements for the urban development. Since all the innovative/smart solutions are generated by the creative class, the main target for cities is to attract and "grow" this creative class as well as exploit human potential to the fullest. Corresponding concepts: creative city, knowledge city, learning city.

Thirdly, institutional dimension. Under it we understand smart governance and policy to build a smart community where each actor (government, business, citizens) understands the potential of ICTs and is willing to use them to make the environment around a better place for living and developing. Basically institutional preparations and smart governance are crucial to building a smart community. The concept assumes that the interests of peripheral and less developed districts also should be taken into account, with inclusion and equality being the important ingredients. The city strives to improve the quality and efficiency of city services, promoting transparency and accountability [24]. Corresponding concepts: smart community, sustainable city, good governance.

The International Telecommunication Union (ITU) has analyzed approximately 116 definitions of smart cities in 2014. They were obtained from a variety of sources including: academical/research communities, government initiatives, international organizations, corporate/company profiles etc. And in result has identified 8 categories

that are believed to be crucial for smart sustainable city: (1) quality of life and lifestyle, (2) infrastructure and services, (3) ICT, communications, intelligence and information, (4) people, citizen and society, (5) environment and sustainability, (6) governance, management and administration, (7) economy and Finance, and (8) mobility. Among these six key factors for further analysis were chosen:

- smart living,
- smart people,
- smart environment and sustainability,
- smart governance,
- smart mobility and smart economy [21].

Based on the performed analysis ITU suggested the following definition for a smart sustainable city: "A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects" [21].

We support the necessity and importance of including "sustainability" component into the concept of "Smart city", since it shifts the main accent from ICTs, showing that technology is just a tool, while the final goal itself is sustainability.

Digitalization of Ukraine

Nowadays "Smart city" concept gains a huge popularity in Ukraine. This happens due to the number of reasons: urgent need in positive changes on the local levels, intensification of decentralization processes and profound amount of specialists coming to power, people that are willing to promote positive changes on the local levels. Unfortunately, right now the concept does not have the required support at the national level. Its elements are developed and implemented by individual cities and results spread rather slowly and in the limited areas. Obviously, a comprehensive "Smart city" concept cannot be implemented in a "non-digital" country. So right now, at best, we can consider only establishment and development of individual "smart clusters" [25]. We think it is important to give a brief overview of the ICTs sector of Ukraine, since ICTs is one of the key components to promote "Smart cities" concept.

Major Ukrainian cities (Kharkiv, Kyiv etc.) have around 4,000 IT companies operating in offshore development centers. They involve around 100,000 programmers, managers and consultants in total. Around 30,000 students graduate every year from the country's 20 education institutions specializing in IT. Moreover, a significant number of Ukrainian specialists possess international education or job experience abroad [26].

According to ITU, there are 144 mobile-cellular telephone subscriptions per 100 inhabitants in Ukraine and the number keeps growing. But only 43.40% of individuals are using Internet [27]. Comparing to the European countries, Ukraine has a small Internet market, which, however, under certain favorable conditions may offer great opportunities for growth (see Fig.1). But this also means that many people in Ukraine do not have regular access to Internet. Most of them are residents of small villages and thus lack both technical equipment and needed skills.
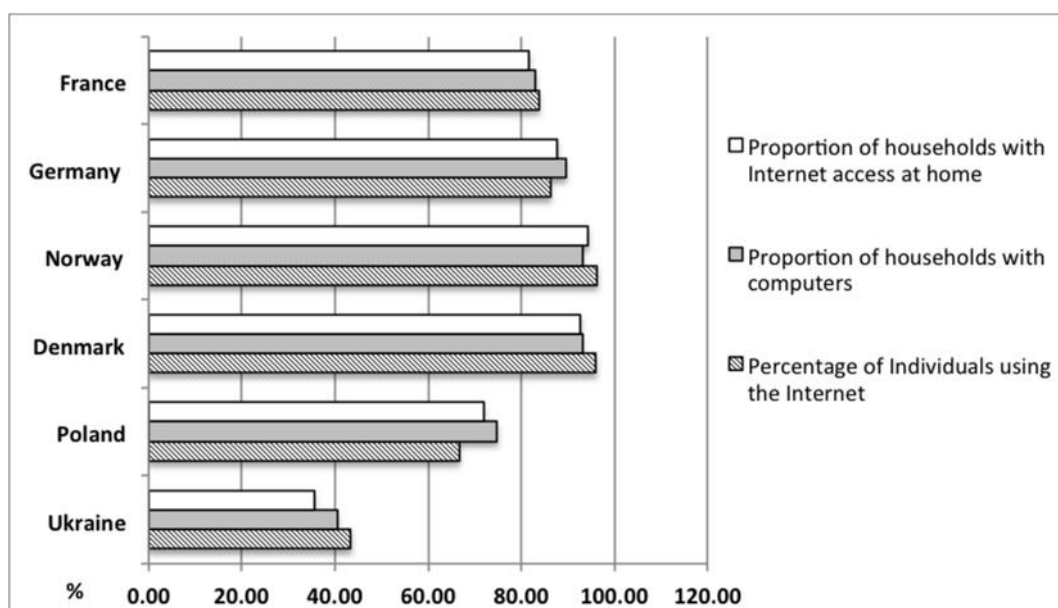
Fig. 1. Availability of ICTs across a number of European countries (2014)
Source: [27]

ITU annually (starting from 2009) publishes reports that feature key ICT data and benchmarking tools to measure the information society, including the ICT Development Index (IDI). The latest report compares the progress within 167 economies worldwide [27]. IDI includes 3 sub-indexes:

First, ICT access (weight in index - 40%)
  Fixed-telephone subscriptions per 100 inhabitants;
  Mobile-cellular telephone subscriptions per 100 inhabitants;
  International Internet bandwidth (bit/s) per internet user;
  Percentage of households with a computer;
  Percentage of households with Internet access.
Second, ICT use (weight in index - 40%)
  Percentage of Individuals using the Internet;
  Fixed-broadband subscriptions per 100 inhabitants;
  Active mobile-broadband subscriptions per 100 inhabitants.
Third, ICT skills (weight in index - 20%)
  Adult literacy rate 100;
  Secondary gross enrolment ratio;
  Tertiary gross enrolment ratio [27].

According to the data (see Table 1.), it is obvious that Ukraine has good positions in terms of human capital readiness but level of networked infrastructure and access to ICTs along with the level of ICTs usage in society leave much to be desired.

Table 1. ICT Development Index and its compounds for selected countries 2010 vs 2015

	2010				2015			
	ICT access	ICT use	ICT skills	**Overall**	ICT access	ICT use	ICT skills	**Overall**
Ukraine	5.23	1.27	9.06	**4.41**	6.27	2.17	9.25	**5.23**
Poland	6.85	4.6	9.02	**6.38**	7.15	5.62	9.02	**6.91**
Denmark	8.7	7.2	9.09	**8.18**	8.72	8.83	9.29	**8.88**
Norway	8.33	7.55	9.06	**8.16**	8.24	8.43	9.1	**8.49**
Germany	8.77	5.34	8.17	**7.28**	9.22	6.98	8.69	**8.22**
France	8.15	5.66	8.5	**7.22**	8.77	7.23	8.58	**8.12**

Source: Author's based on [27]

E-government development Index (EGDI) is another interesting index worth studying. According to the report "United Nations E-Government Survey-2014. E-Government For The Future We Want" Ukraine ranked 87 among the 193 member countries of the United Nations in EGDI index and 77 of 193 in e-participation index [28, 29].

EGDI Index includes 3 dimensions:
- Scope and quality of online services (Online Service Index);
- Development status of telecommunication infrastructure (Telecommunication Infrastructure Index);
- Inherent human capital (Human Capital Index).

E-participation Index includes:
- E-information: Enabling participation by providing citizens with public information and access to information without or upon demand;
- E-consultation: Engaging citizens in contributions to and deliberation on public policies and services;
- E-decision-making: Empowering citizens through co-design of policy option and co-production of service components and delivery modalities [29].

Ukrainian positions are rather poor in everything except Human Capital Index (see Table 2). Poland does a little better than Ukraine but is still far from the leading European states.

Table 2. EGDI and E-participation Index for selected countries, 2014

	E-government development Index				E-participation Index
	Online Service Index	Telecommunication Infrastructure Index	Human Capital Index	Overall	
Ukraine	0.27	0.38	0.86	0.50	0.43
Poland	0.54	0.56	0.83	0.65	0.49
Denmark	0.66	0.87	0.91	0.82	0.55
Norway	0.76	0.81	0.94	0.84	0.68
Germany	0.67	0.8	0.89	0.79	0.70
France	1	0.8	0.88	0.89	0.96

Source: Author's based on [28, 29]

Results prove that developing and providing online services along with supplying the needed infrastructure is the main challenge for Ukraine right now. The study also reveals especially insufficient development of online services for disadvantaged groups and people with disabilities in Ukraine, so "digital inequality" takes place. Digitalization process in Ukraine can be also characterized by the irregular level of development within the regions of Ukraine [30].

E-governance in Ukraine
The scope of the article does not allow us to cover all smart solutions and practices that are applied in our country. So we have decided to focus on governance area only. According to Ukrainian 2020 strategy of the President of Ukraine, eGovernment and the increase of eServices is on top of the agenda [31].

Fig.2 captures the most important events of the recent years that contribute to the development of e-governance in Ukraine. One of the distinctive features in Ukraine is a great contribution of so called "creative class". Active volunteers are the main moving force of the concept in Ukraine. The active stage of development and implementation took place only starting from 2015, when civil society started to take active part in the process.

A major role belongs to ICT Competence Center founded in 2015. It is a non-governmental organization (NGO) that brings together representatives of government, business and individuals with expertise in IT to implement elements of e-governance in Ukraine [32].

The group iGov unites IT volunteers throughout Ukraine. Their major task is conversion of state services into electronic form and maintenance of portal iGov.org.ua. iGov is an open-source project, its code is available on GitHub, so any individual can contribute to the development. It is also a great example of cooperation between government and citizens. Currently 338 administrative services are already available online, while the development of another 723 is being underway [33].

In February 2015 an electronic public procurement system ProZorro was launched in a pilot mode. It allows selling online to government. The platform aims to boost competition and decrease the corruption level in public procurements. Any company can register, find an auction, and apply for it. The tenders are anonymous, only prices and competitors' terms are available. After the winner is chosen based on the results of the tender, the company`s name is revealed. Any user can check on the website what was purchased by the state-owned enterprise and at what price. Participants are required to pay 175 UAH (around $7) for participation but only in cases when the amount of the planned procurement exceeds 35 thousand UAH (around $1410) [34].

Over 20 million dollars have been saved already thanks to the platform, with only 2% of all public tenders being held using ProZorro. All large suppliers, such as ministries, departments and the largest state-owned enterprises should switch to ProZorro on a mandatory basis starting from the 1st of April 2016 [35].

Starting from August 2015 E-petition service has been launched in Ukraine. The main target of this tool is to launch the debates on the issues that are extremely important to people and to reach out to higher authorities. E-petitions tool functions on two levels:

First, state level. The focus is on the issues of the national importance. For example, e-petition to the President of Ukraine is considered in case it gained 25,000 signs within 3 months from the moment the petition was posted [36].

Second, local level. Deals with the issues that are committed to the discretion of local communities. The Unified Local Petitions System (e-dem.in.ua) was developed under the E-governance for Accountability and Participation (EGAP) program, which is funded by the Swiss Confederation. Right now 22 cities are already engaged in the project. Targeted regions of the program are Vinnytsia, Volyn, Dnipropetrovsk and Odessa. However, many more are to join [37].
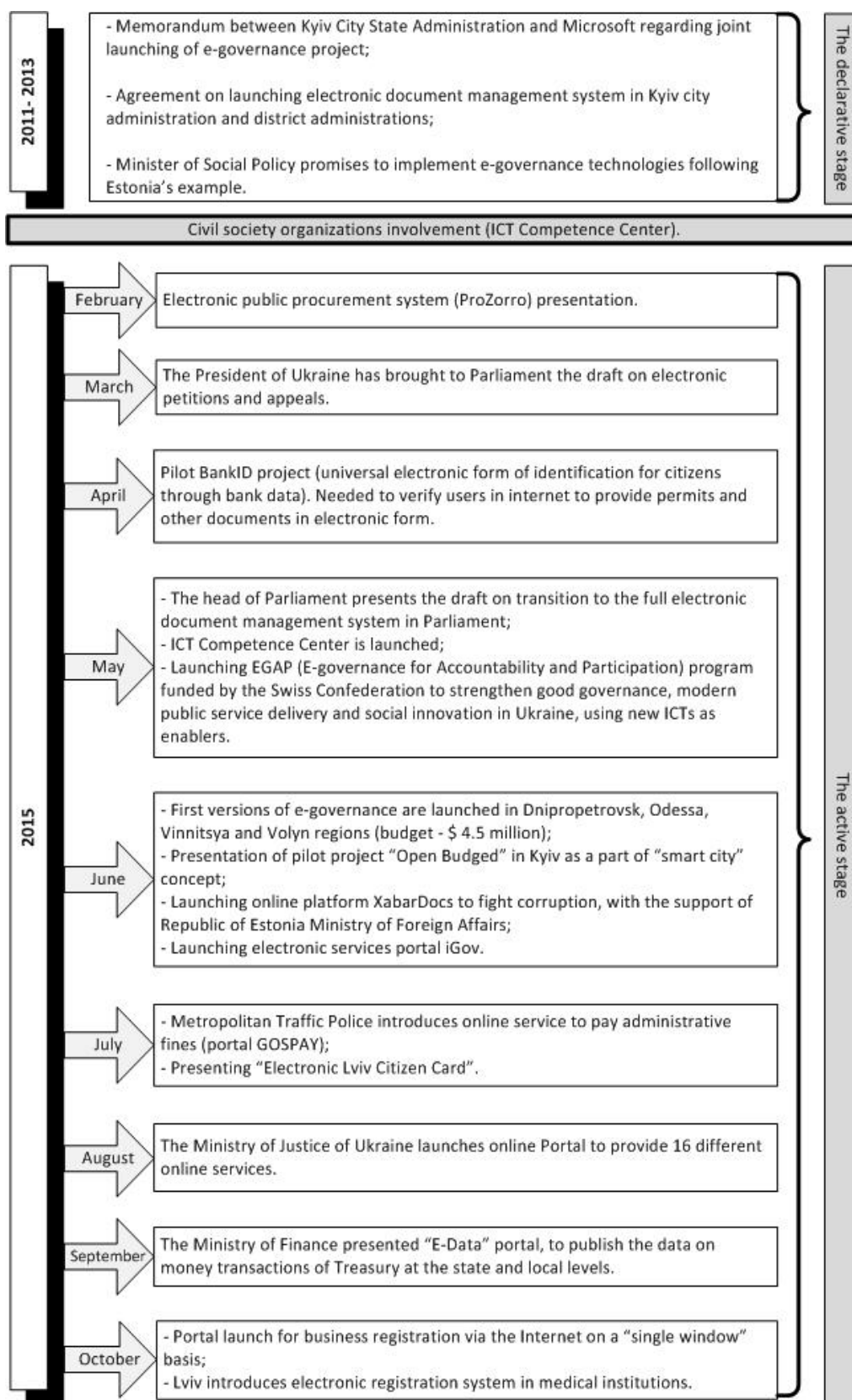
2011- 2013 — *The declarative stage*

- Memorandum between Kyiv City State Administration and Microsoft regarding joint launching of e-governance project;

- Agreement on launching electronic document management system in Kyiv city administration and district administrations;

- Minister of Social Policy promises to implement e-governance technologies following Estonia's example.

Civil society organizations involvement (ICT Competence Center).

2015 — *The active stage*

February — Electronic public procurement system (ProZorro) presentation.

March — The President of Ukraine has brought to Parliament the draft on electronic petitions and appeals.

April — Pilot BankID project (universal electronic form of identification for citizens through bank data). Needed to verify users in internet to provide permits and other documents in electronic form.

May
- The head of Parliament presents the draft on transition to the full electronic document management system in Parliament;
- ICT Competence Center is launched;
- Launching EGAP (E-governance for Accountability and Participation) program funded by the Swiss Confederation to strengthen good governance, modern public service delivery and social innovation in Ukraine, using new ICTs as enablers.

June
- First versions of e-governance are launched in Dnipropetrovsk, Odessa, Vinnitsya and Volyn regions (budget - $ 4.5 million);
- Presentation of pilot project "Open Budged" in Kyiv as a part of "smart city" concept;
- Launching online platform XabarDocs to fight corruption, with the support of Republic of Estonia Ministry of Foreign Affairs;
- Launching electronic services portal iGov.

July
- Metropolitan Traffic Police introduces online service to pay administrative fines (portal GOSPAY);
- Presenting "Electronic Lviv Citizen Card".

August — The Ministry of Justice of Ukraine launches online Portal to provide 16 different online services.

September — The Ministry of Finance presented "E-Data" portal, to publish the data on money transactions of Treasury at the state and local levels.

October
- Portal launch for business registration via the Internet on a "single window" basis;
- Lviv introduces electronic registration system in medical institutions.

Fig.2 Evolution of e-governance processes in Ukraine
Source: [38, 39]

Among the recent developments, the team of IT volunteer will work on establishment of e-government portal "E-progress". It will represent a platform for e-governance best practices exchange among local authorities, businesses and society. The United States of America will provide a grant for this project [40].

The analysis of "Smart city" initiatives in Ukraine reveals that there are many different smart solutions implemented by Ukrainian cities, aimed at improving quality of life, city management, cost reduction and promotion of sustainable development.

We have built a comparison table (see Table 3) among 4 cities: Vinnytsia, Ternopil, Kyiv, Kharkiv and described below the most successful initiatives presented in Ukrainian cities.

Table 3. Smart solutions comparison among 4 Smart Cities of Ukraine

Services	Vinnytsia	Ternopil	Kyiv	Kharkiv
Open Budget	+	+	+	+
Mobile transport schedule	+			
E-petition	+	+	+	+
Map of emergency works	+		+	+
Electronic queue and registration to kindergarten	+	+	+	+
WiFi in public transport	+	+	+	+/-
WiFi in city parks		+	+	+
Remote payment for utility services	+	+	+	+
Electronic citizen card			+	
Video surveillance system		+		+/-
E-procurement system	+	+	+	+
"Open city" platform		+	+	

Source: [41, 42]

"Open Budget" established to promote transparency and free public access to information concerning the planning and execution city budgets [43]. The initiative was implemented in 25 cities already;

Single Public Transport E-Ticket for all public transportation options. The introduction of a single electronic ticket will automate fare collection, increasing revenues by 20-30%, and significantly reduces the costs of public transport services providers (Kyiv) [44];

Mobile applications that allow users to notify local authorities about the ongoing issues (e.g. lack of water, electricity, wastage problem etc.). Citizens are also welcome to share propositions and questions they might have. Service works 24/7. The user gets its number and can check online the status of application. The web site also includes the interactive map of the current repair works (Kyiv, Kharkiv) [42, 44].

Electronic Citizen Card — multifunctional electronic ID Card, which includes user's personal data and supports various applications relating to the provision of social welfare benefits, city services and many other functional options (Lviv, Kyiv) [44];

Medical Portal in Kyiv. It allows citizens to see the availability of particular medicines through the interactive map in different hospitals [45];

Online police portal in Kharkiv that allows to claim the crime, has interactive map of crimes and allows to order certificate of no criminal record [46];

"Open city" platform for effective dialogue with the authorities that was implemented in 27 cities already. It includes 3 sections:
- "Problems and solution", allows to post the problem which will be forwarded to the corresponding

organization;

- "Official information", which includes information about official repair works, the user can also sign up for the updates to be sent to his/her email.
- "Useful facilities", map where users can add hospitals, schools, WiFi free zones, and battery collection zones [47].

Challenges on the way
Local attempts to develop and implement smart initiatives in particular cities allowed us to outline a number of socio-political, economical and executive challenges for Ukraine (see Fig.3).
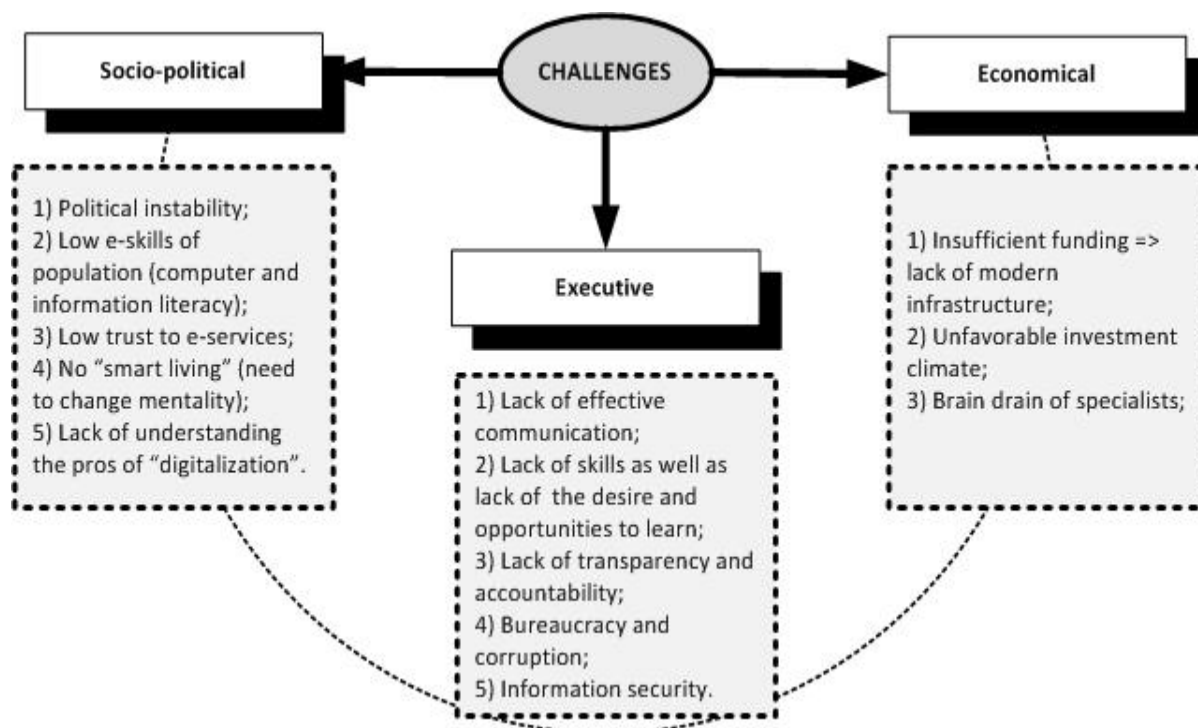

Fig.3 Challenges for Ukraine on the way of implementing "Smart city" concept
Source: Author's

These challenges prove the necessity of the comprehensive government policy and support in the matter. In particular the policy should include:

- Government support for the regional initiatives, aimed at elimination of the "digital gap";
- Steps to increase the quality of the services provided in ICTs sector, their correspondence to the national standards, that are prior to this should be harmonized with international standards;
- Programs and initiatives to increase computer and information literacy of the population;
- Information campaigns to ensure population awareness of the numerous possibilities available, their pros and cons;
- Encouragement of the effective exchange on the national (between the regions) and international levels.

Conclusions
Nowadays reality demands shifting towards a higher and more effective way of ICTs usage for governance improvement, administrative services provision, social support of residents etc. A truly smart and sustainable city needs to possess a "body, mind, and soul". The "body" is the infrastructure, the "mind" is a smart software and the "soul" is the human element making it all work together to meet the needs of present and future generations with respect to economic, social and environmental aspects [48].

In this paper, we have presented a general overview of "Smart city" concept and considered its evolution along with implementation in Ukraine, particularly in the sector of governance. The concept can be considered within three dimensions: Technology, Human and Institutional. But we believe that only systematic integration of these approaches will result in establishment of a truly smart, sustainable and citizens-friendly city. Underdeveloped digital infrastructure (proved by low positions of Ukraine in corresponding international rankings) considered to be the main challenge for Ukraine today. It causes a serious "digital gap" within the country and hampers country's "smartization" process in general.

All the initiatives that are currently developed in Ukraine have a rather bottom-up approach and do not receive a required level of governmental support. While innovations and progress in e-governance are especially valuable for our country, taking into consideration Ukrainian problems with corruption, transparency and accountability in governmental bodies.

Finally, we have considered a list of key challenges (socio-political, economical and executive) on the way to "smartization" along with the possible solutions that hopefully will help to overcome those. And we strongly believe that our first and outmost aim should be not for smart cities themselves but rather for encouragement and development of intelligent behavior and smart citizens that will be able to implement and develop this concept in future. Along with encouragement and support of the active dialogue between government, business and civil society.

References

[1]   World entering "Urban Millennium", Secretary-General tells opening meeting of Habitat special session, General Assembly Press release, 6 June 2001. http://www.un.org /press/en/2001/GA9867.doc.htm

[2]   World Urbanization Prospects, 2014. 32 p. https://esa.un.org/unpd/wup/Publications/Files/WUP2014-Highlights.pdf

[3]   G. Lazaroiu, M. Roscia, Definition methodology for the smart cities model. Energy Volume 47, Issue 1, November 2012, 326–332 p.

[4]   D. V. Gibson, G. Kozmetsky, and R. W. Smilor (eds), The technopolis phenomenon — smart cities, fast systems, global networks. 1992, 264 p.

[5]   Cisco, Smart cities. http://www.cisco.com/c/en/us/solutions/industries/smart-connected-communities.html

[6]   Microsoft CityNext. https://enterprise.microsoft.com/en-us/industries/citynext/

[7]   IBM, Smarter Cities. http://www.ibm.com/smarterplanet/us/en/smarter_cities/overview/

[8]   Siemens, Transforming Cities for the Better through Sustainable Technology. https://w3.siemens.com/topics/global/en/sustainable-cities/Documents/Transforming_Cities_en.pdf

[9]   IBM, Smarter Cities Challenge. https://smartercitieschallenge.org

[10]   Issues paper on Smart Cities and Infrastructure, UNCTAD, January 2016. http://unctad.org/meetings/en/SessionalDocuments/CSTD_2015_Issuespaper_Theme1_SmartCitiesandInfra_en.pdf

[11]   B. Cohen, The Top 10 Smart Cities On The Planet, Fast Company, 11 Jan. 2011. http://www.fastcoexist.com/1679127/the-top-10-smart-cities-on-the-planet.

[12]   R. Giffinger, et al. Smart Cities Ranking of European Medium-sized Cities. Centre of Regional Science, Vienna UT, Oct. 2007. 28 p. http://www.smart-cities.eu/download/smart_cities_final_report.pdf

[13]   P. Lombardi, New Challenges in the Evaluation of Smart Cities, Network Industries Quarterly, Vol. 13, 2011. http://newsletter.epfl.ch/mir/index.php?module=epflfiles&func=getFile&fid=241&inline=1

[14]   H. Schaffers, N. Komninos, P. Tsarchopoulos, M. Pallot, B. Trousse, et al., Landscape and Roadmap of Future Internet and Smart Cities, 2012, 222 pp.

[15]   Art Murray, Mark Minevich and Azamat Abdoullaev. The Future of the Future: Being smart about smart cities, 2011. http://www.kmworld.com/Articles/Column/The-Future-of-the-Future/The-Future-of-the-Future-Being-smart-about-smart-cities-77848.aspx

[16]   UNESCO, Creative cities network. http://en.unesco.org/creative-cities/home

[17]   European Innovation Partnership on Smart Cities and Communities – Strategic Implementation Plan, 2013. http://ec.europa.eu/eip/smartcities/files/sip_final_en.pdf

[18]   Mapping   Smart   cities   in   the   EU,   2014. http://www.europarl.europa.eu/RegData/etudes/etudes/join/2014/507480/IPOL-ITRE_ET(2014)507480_EN.pdf

[19]   Global Trends 2030: Alternative Worlds, National Intelligence Council, December (2012). http://globaltrends2030.files.wordpress.com/2012/11/global-trends-2030-november2012.pdf.

[20]   Building smarter cities, World Bank. http://blogs.worldbank.org/ic4d/building-smarter-cities

[21]   Smart sustainable cities: An analysis of definitions. ITU-T Focus Group on Smart Sustainable Cities. 2014, 71 p. http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx

[22]   T. Nam, T. A. Pardo, Conceptualizing Smart Sustainable City with Dimensions of Technology, People, and Institutions, The Proceedings of the 12th Annual International Conference on Digital Government Research, 2011. http://www.ctg.albany.edu/publications/journals/dgo_2011_smartcity/dgo_2011_smartcity.pdf

[23]   R. Florida, The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday life. New York: Basic Books. (2002): 424 p.

[24]   M. Kehoe, M. Cosgrove et al., Smarter Cities Series: A Foundation for Understanding IBM Smarter Cities. 2011, 30 p. http://www.redbooks.ibm.com/redpapers/pdfs/redp4733.pdf

[25]   V. Omelchenko: "Smart cities" and "digital nations" are created by businesses and "creative classes" not by bureaucrats. / Golos.ua, 2015 http://ru.golos.ua/ekonomika/valeriy_omelchenko_umnyie_goroda_i _tsifrovyie_natsii_sozdayut_ne_chinovniki_a_biznes

[26]   Ukraine ICT environment, innovation policies & international cooperation. EECA Cluster. http://eeca-ict.eu/images/uploads/pdf/eeca_counires_reports_new/ict-env_inno-policies_and_intercoop_report_ukraine.pdf

[27]   Measuring the Information Society Report 2015. International Telecommunication Union. Geneva, 2015, 233p. http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf

[28]   United Nations E-Government Survey-2014. E-Government For The Future We Want. United Nations, 2014,   264p.   https://publicadministration.un.org/egovkb/portals/egovkb/documents/un/2014-survey/egov_complete_ survey -2014.pdf

[29]   E-Participation   Index.   https://publicadministration.un.org/egovkb/en-us/About/Overview/E-Participation

[30]   Report on state informatization and information society in Ukraine 2014. State Agency for E-Governance in Ukraine. Kyiv, 2014, 137p. http://dknii.gov.ua/content/shchorichna-dopovid-pro-rozvytok-informaciynogo-suspilstva.

[31]   Ukrainian 2020 strategy of the President of Ukraine. http://zakon3.rada.gov.ua/laws/show/5/2015

[32]   ICT Competence Center. http://www.ict.org.ua/#section-02

[33]   Web-site for the online State Services (iGov platform). https://igov.org.ua

[34]   Web-site for the electronic procurement system ProZorro. http://prozorro.org/

[35]   Introduction of ProZorro public procurement system will save UAH 5 bln in 2016. / Interfax-Ukraine, 2016. http://en.interfax.com.ua/news/economic/318152.html

[36]   President   signed   Law   on   electronic   application   and   electronic   petition,   24   July   2015. http://www.president.gov.ua/en/news/prezident-pidpisav-zakon-pro-elektronne-zvernennya-ta-elektr-35709

[37]   The E-governance for accountability and participation (EGAP) program. East Europe Foundation. http://eef.org.ua/en/governance-and-civil-society/410-the-e-governance-for-accountability-and-participation-egap-program.html

[38]   A. Melnikh, E-governance in Ukraine – the story of creation, 2015. http://www.imena.ua/blog/e-government-longread/

[39]   Habardocs. https://www.xabardocs.org

[40]   IT volunteers will create a unified e-government portal. http://en.reporter-ua.ru/it-volunteers-will-create-a-unified-e-government-portal.html

[41]   M. Cherkashin, Smart cities of Ukraine: Kyiv, Ternopil, Vinnytsia. / Korrespondent, 2015.

http://blogs.korrespondent.net/blog/events/3583073/

[42]   E-governance in Kharkiv. http://eu.infocity.kharkov.ua/?page_id=889

[43]   "Open Budget" portal. http://www.openbudget.in.ua

[44]   Kyiv Smart city concept. 2015, 25p. http://kscf.in.ua/Smart_City_ENG_prev.pdf

[45]   Medical Portal in Kyiv. http://health.kiev.ua

[46]   Kharkiv police web-site. https://police.kh.ua

[47]   Open city platform. http://opencity.in.ua/

[48]   Expanding Participation and Boosting Growth: The Infrastructure Needs of the Digital Economy. World
Economic Forum 2015, p.32. http://www3.weforum.org/docs/WEFUSA_DigitalInfrastructure_Report2015.pdf