

# Features of "smart city" concept in urban paradigm of globalization

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**Abstract.** The paper pointed out that the concept of smart city - is the basis for the development of the area within clearly defined borders. It was found that each of the components of smart cities should be offered to the format of uniform development and structuring of the overall paradigm of development of the region.

## 1 Introduction

Regulatory and methodological base of creating a future model of sustainable development of administrative-territorial formations is laid today in the international standards of intelligent grid building (Smart Systems/IoT) and sustainable development of smart cities and smart communities - SC & C based on integration of a wide range of technological, general technical, design, organizational management and logistics solutions and a future architecture of Internet of Things is formed, where full energy and information interoperability and a new, higher level of control will be provided both at the level of the system of systems, and at the lower levels of system hierarchy - administrative-territorial formations based on open and publicly accessible standards. At the same time, the priority is the standards that define common principles of design and building of smart grids.

Building of a new model of territorial organization of government and administrative-territorial structure and improving social, production, housing and municipal, telecommunications sphere etc., to develop and implement public policies harmonized with the European approach at supranational, national and sub-national levels in Ukraine depends both on common efforts of government and local authorities, business units and the public, and on deepening of horizontal and vertical linkages based on introduction of regulation of technical parameters of network infrastructure as a legal basis for regulating internal market and creating favorable conditions for development of foreign trade of local communities.

## 2 Metods

Among the publications on the analysis of foreign experience of introduction of e-governance at the local level include the collections of essays edited S.Steuer, A.Benabbas, N.Kasrin, D.Nicklas, M.Giatsoglou, D.Chatzakou, V.Gkatziki, A.Vakali, L.Anthopoulos,

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F. A.D'Asaro, M.A. Di Gangi, V.Perticone, M.E.Tabacchi[1-3]. Among domestic researchers of the problems of e-government development at the local level engaged V.M. Drispac, I.S. Cosplay, A.O. Serenokand others.

In recent years, in the context of e-government development at the local level becoming more and more popular the concept of smart city (smart city). Sometimes they substituted the concept of electronic city. Among domestic researchers have not paid attention to the delineation of the essence of these concepts and their application in the context of e-government development at the local level. In the most complete and extensive foreign studies understanding the essence of a smart city (smart cities) can be attributed to the works of G.V. Pereira, M.A. Macadar, E.M. Luciano, M.G. Testa[4], L.Schauer, A.Hirschleb, M.Zaddach[5], G.C.A. Peng, M.B.Nunes, L. Zheng[6] E.Tekin Bilbil[7].

The purpose of the article. The aim of the article is the analysis of the concepts of "smart city" (smart city) and "electronic city" in the context of e-government development at the local level, the consideration of best practices and problems that hinder the introduction of e-governance at the local level in the Russian Federation.

The main material of the study. At the level of central and local executive bodies and local self governments, territory management system depends on the consistency of strategic aims of territories development and principles of use of mechanisms such as: innovation, horizontal-vertical partnership, integration of policies and tools, synchronization of measures, compliance of mechanisms with potential and needs of the region development, concentration of resources, strategic orientation of tactical measures based on the formation of a unified state policy in the field of technical aspects regulation. Strengthening of regulatory and legal cooperation between administrative-territorial formations and regulation in the sphere of technical regulation is mutual interest of Ukraine and the EU in the implementation of key infrastructure projects related to the importance of compliance with market needs when designing a single common European intellectual infrastructure and introduction of open and predictable procedures in order to facilitate and attract investment resources. It is exactly technical regulation and national standardization that act as the primary organizational and technical basis of economic and research and development cooperation of local communities in shaping infrastructure grids of interaction and the effect of objective economic necessity in management of economic and production processes of territories.

Standardization of network infrastructure includes, above all, definition of basic concepts of infrastructure as a scalable and integrated system of unified indicators in order to use common technical parameters and specifications for their measurement and use in different types of communities. The standards are focused on technical aspects of "smart grids" that support the operations and activities of local communities and are crucial for the security of administrative-territorial formations, and the state as a whole, and are considered in terms of productivity related to technologically feasible solutions in accordance with the sustainable development of communities.

It is exactly the energy development that raised the question of a gradual shift from traditional technologies involving the use of mainly large generation and passive energy grids to fundamentally new solutions focused on the widespread use of renewable energy sources and active grids that are able to provide services on transmission and also storage and conversion of electrical energy. Active energy grids that are able to adapt quickly to changing needs of stakeholders - owners, customers, vendors - are now regarded as a key element of the future Smart Grid infrastructure of administrative-territorial formations. Formation of a new intellectual infrastructure of territorial communities is inextricably linked with the development of information infrastructure suitable for solving technical and managerial tasks arising from the need to ensure sustainable, safe, cost-effective operation

and development of Smart Grid, and this integration should be at the state level. In fact, it is about creating a giant intellectual consortium, which uses as a technology platform integrated information and energy grid, a kind of energy internet, energy cloud computing, where scientific and methodical, organizational, technical and legal aspects of its formation are considered in the concept of Smart Grid in power economy. However, in a global sense of intelligent grid - it is not only new energy technologies, but also modern information and communication technologies of billing, e-commerce, access control and administration in grids of all sizes, modeling and data storage, virtualization, computer security, distributed computations, collection, processing and transmission of information in real time. At its core, Smart Grid should be considered not as a separate technology, but as a comprehensive approach and methodology for the creation of large-scale smart communities, which operate on the basis of a new technology platform and provide a range of services using rapidly developing information and energy technologies.

A key role in the coordination, clarification and formation of future innovative model of development of local communities adapted to the functional reference architecture of smart intelligent grid plays organization and performance of works on international, regional and national standardization for products, processes and services, including systems, their compatibility, rules procedures, functions and methods of building. International standards provide support for formation of state policy in practical decisions based on providing confidence in technical specifications and safety requirements, and assistance in ensuring fulfillment of commitments to implement sustainable development aims. The EC reserved a special role in the development of a common technical policy and general technical principles of territorial communities to ensure the processes of unification, interoperability, interchangeability and reliability of utilities, including power economy, water resources, transport, waste management, ICT that are vital for local communities and focused on technical aspects in terms of global responsibility, to cooperation of international organizations such as the International Organization for Standardization - ISO, the International Electro technical Commission - IEC, the International Telecommunication Union - ITU, European organizations for standardization such as the European Committee for Standardization - CEN, the European Committee for Standardization in Electrical Engineering - CENELEC (Comité Européen de Normalisation Électrotechnique) and the European Telecommunications Standards Institute - ETSI, as well as national standards bodies - NSB, technical committees - TC and Standards Development Organizations - SDOs.

The International Organization for Standardization (ISO), aimed at the ratification of standards developed by joint efforts of delegates from different countries through its technical committees for standardization (TC ISO), promotes standardization on a global scale to facilitate international trade and mutual assistance and to expand cooperation in the area of intellectual, scientific, technological and economic activity. There are over 21000 international standards developed in the ISO, which are included in the common catalog of standards and identified both by sectoral signs of the International Classification for Standards - ICS, and using the names of technical committees (TC) and keywords.

As part of the ISO to develop and implement integrated cross-sectoral approaches and adoption of integrated solutions to ensure sustainable development of smart communities in March, 2012 the Technical Committee for Standardization - ISO/TC 268 “Sustainable development in communities” was established, in structure of which operates ISO/TC 268/SC 1 subcommittee Smart Community Infrastructures and working groups - WG 1 Management Systems and WG 2 City Indicators.

To ensure implementation of integrated approaches in ensuring sustainable development of smart communities, ISO TC 268 works closely with other technical and project ISO committees for standardization to develop standards, including: project committee -

ISO/TC 242 Energy Management, technical committees - ISO/TC 224 Service activities relating to drinking water supply systems and wastewater systems – Quality criteria of the service and performance indicators, ISO/TC 204 Intelligent Transport Systems, and others.

Standardization of sustainable development in the communities with ISO/TC 268 provides for development and publication of standards series ISO/PRF 37101 in a form of draft technical reports (e.g., ISO/DTR 37121) as well as new proposals concerning requirements for management systems (ISO/NP 37122) for different types of smart community.

### **3 Results**

Implementation of common technical policy for maintaining proper work of network infrastructure to ensure unification, interoperability, interchangeability and reliability of utility networks requires development and harmonization of necessary standards at the international level that will facilitate interoperability, openness of new markets participants providing security and demonstrating opportunities in the fight against cybercrime and terrorism of smart cities and communities - SC&C.

In recent years, there has been much more active work in international practice on standardization of systems, their compatibility, rules, procedures, functions and methods of building of SC&C, providing organizational and technological measures to establish uniform technical parameters of utility infrastructure that can be used to measure its performance.

Thus, the following work was done:

- at the end of 2013, experts from Japan, China, Germany under the auspices of the International Electro technical Commission - IEC created a group to assess the smart cities - IEC SEG 1 (Systems Evaluation Group - Smart Cities) to study the matters of technical regulation and organizational support for building SC&C;
- September 2013, in the framework of the International Organization for Standardization - ISO, the ISO's Technical Management Board - ISO TMB launched a targeted direction for development of possible model of reference architecture of smart cities, standardization of roadmap and strategic approaches to the development of joint activities in cooperation with a group for assessment of smart cities - IEC/SEG (Systems evaluation group - Smart cities). The next step of TMB ISO on forming the SC&C concepts under the guidance of the CEN/CENELEC/ETSI4 was creation of operational and working groups on formation of SC&C - IEC/SEG15, ITU-T SG56, ISO/IEC JTC1/SG17, by the results of work of which in September 2015 the ISO published a summary report “Responding to difficult situations of urban life formation in the XXI century”;
- February 2013, in the International Telecommunication Union - ITU was created an open platform - FG SSC - (Focus group on smart sustainable cities), experts of which published technical reports and specifications for system solutions to build innovative infrastructure of a smart city - ITS (Innovations as intelligent transport systems) and proposed definition of a smart city as an innovative city that uses ICT, and also other means to improve quality of life, efficiency of operation of urban infrastructure and services, while ensuring the needs of present and future generations, taking into account economic, social, environmental and cultural aspects;
- November 2013, in the ISO upon a proposal of China a joint research team of ISO and IEC technical committees - ISO/IEC JTC 1 (ISO/IEC Joint Technical Committee JTC1) for standardization of heterogeneous integration of complex technologies in information and communication technology (ICT) was created;

- December 2014, in the ISO was established a smart city strategic advisory group - SAG to provide advice and recommendations on TMB ISO on terminology, landscape and most important aspects of joint solution of building a smart city. By the results of research, SAG published a potential standardization infrastructure projects, including the concept of forming smart city system infrastructure as systems of interaction of various components (water and gas supply, power systems, mobility systems, communication, etc.), which requires a cross functional approach and coordination of common positions to develop common standards for the participation of all stakeholders;
- in the framework of the ITU-T Study Group 5 - SG5 on environment and climate change, which is the ICT leading group, climate and electromagnetic phenomena change, recommendations on standards to be developed within SC&C were given. In the recommendation of ITU-T9 were also reflected definitions of the notion of Internet of Things - IoT - as a global information society infrastructure that allows you to expand services by combining both physical and virtual things based on interoperability of information and communication technologies;
- 2015, the ITU-T Study Group 20 Internet of Things and their applications - SG 20, including smart cities and communities continued study of development of the SC&C model, whose activities is focused on development of common approaches to standardization of Internet of Things, smart cities & smart communities.

The system of technical regulation in the EU is the most consistent, efficient and successful example of implementation of European model of SC&C technical infrastructure, which is implemented through standardized basic technical requirements for safety developed and implemented by ISO technical committees (TS ISO) 10.

For integrated and comprehensive evaluation of SC&C sustainable development and to ensure common approaches to their measurement at all levels of administrative-territorial structure, WG 2 ISO/TC 268 working group developed a system of SC&C indicators to track and monitor development of local communities on:

Terminology (ISO/DTR 37102):

- ISO/DTR 37102 Sustainable development and sustainability of communities - Glossary 11.
  - Indicators (ISO 37120, ISO TR 37121):
  - ISO 37120:2014 Sustainable development of communities – Indicators for municipal services and life quality 12. This standard regulates quantitative and qualitative descriptions of standardized infrastructure indicators to confirm consistency and methods of measurement;
  - ISO/DTR 37121 Sustainable development in communities - Inventory and review of existing indicators in sustainable development and sustainability in cities 13. This technical specification defines principles and requirements for indicators of community infrastructure performance.
- Infrastructure (ISO TR 37150, ISO TS 37151 and ISO TR 37152):
- ISO/TR 37150 Intelligent infrastructure of utilities. Review of existing activities related to system of indicators 14;
  - ISO/TS 37151 - Infrastructure of smart community - General principles and requirements for performance indicators 15;
  - ISO/TR 37152 PRF Infrastructure of smart community - General framework for development and operation - Special Group of reports 16.
  - Management system (ISO 37101):
  - ISO 37101 – Sustainable development in communities - Management system for sustainable development - Requirements and guidelines for use 17. This standard aims to preserve the ecology of human settlements.

- Social responsibility (ISO 26000):
- ISO 26000:2010 Guidance on social responsibility 18. The guidance helps organizations to arrange their activities in the field of social responsibility.

Also WG 1 ISO/TC 268 systematized and formed up to 23 types of SC&C, reviewed more than 500 standard references which required changes and updates.

Given the need to systematize existing standards the British Standards Institution - BSI in cooperation with the Imperiale College London in the framework of study of smart city model adopted the world's first standard RAS 181:2014 Smart city framework for the practical planning of cities in the UK, the reason for study of which were over 100 SC&C standards, which are now freely available in the Perinform database at three levels: strategic, technical and process standardizing. Technical standards indicate “what” should be done in terms of implementation and/or operation of Smart Communities model. Process standards are related mainly to activities “how” these processes are associated with actions or steps to be taken and, finally, strategic standards give the answer “why” it is necessary to ensure them.

Such a structured list of standards consists not only of the list of existing ISO, IEC, BSI standards, but also of European national standards bodies, including the German Institute for Standardization DIN - (DeutschesInstitutfürNormung eV), the Dutch Institute of Standards NEN - (NederlandsNormalisatie-instituut), which specializes in the field of standardization of electrical engineering and ICT, institutions such as CEN, CENELEC and ETSI, American standards represented by the ANSI - (American National Standards Institute) and the Institute of electrical and electronics engineers - IEEE, and Russian standards (GOST R), in order to be able to compare standards of SC&C and arrange them in a due context on the basis of keywords to build the strategy underlying a particular model. It should be noted that the largest contribution to the development of strategic SC&C standards was introduced exactly by the BSI. The result of this study were four British demonstration projects of consistent set of standards for smart city (Glasgow, London, Peterborough, Bristol) covering the full range of needs - from terminology to management decisions and interoperability.

The complex of IEEE P2030 standards covers the principles of ensuring interoperability of power and information technologies with elements of power systems, consumer devices. The IEEE P2030.1 documents contain principles of Smart Grid infrastructure management, and the IEEE P2030.2 - principles of interoperability between systems that store energy that are integrated in Smart Grid infrastructure, and the IEEE P2030.3 - test procedure of systems and equipment designed for use in the Smart Grid.

An extremely important role in the infrastructural aspects of technical regulation of SC&C electricity supply system plays the International Electro technical Commission (IEC). The IEC Standardization Council formed more than 100 standards that are mandatory and have significant impact on any decision to build a Smart Grid system and additional interfaces. For the convenience of finding necessary standards, on the website of IEC20 is a roadmap on main areas of standardization for demand management, power distribution, substation automation, power storage, EMC etc.

Today, the international electro technical glossary of terms of smart grids (IEC 60050 standard) contains a variety of standard IEC definitions for Smart Grid and means of electricity measurement regulated in the standards series IEC 62052 (Parts 11, 21 and 31), IEC 62053 (Parts 11, 21 22, 23, 24, 31, 52 and 61), IEC 62054 (parts 11 and 21), IEC 62058 (parts 11, 21 and 31), IEC 62059 and IEC 62056, as well as rules on procedures for connecting smart measurement tools (standards of Australia and New Zealand AS/NZS 3000).

Main areas of standardization are standards developed and promulgated by IEC concerning information model of distribution (IEC 61968) and power management model

(IEC 61970); automation of power supply (IEC 61850); safety (IEC 62351); sharing data for reading meters, tariffs and load control (IEC 62056); functional safety related to electrical/electronic/software systems (IEC 61508).

In addition to basic standards, IEC also offers a number of extremely important Smart Grid standards as technical reports on service oriented reference architecture (IEC/TR 62357)<sup>21</sup>, communications management standards (IEC 60870-6 TaSe2)<sup>22</sup>, distribution automation (IEC/TR 61334 - DLMS)<sup>23</sup>, electric vehicles (IEC/TR 61334 - DLMS)<sup>24</sup>, measuring of Demand Management Side - DMS; distributed energy resources (DER); advanced metering infrastructure (AMI); demand response - DR (IEC 62051-54/58-59)<sup>25</sup> and service-oriented architecture - SOA (IEC/TR 61968, IE/TR C 61970).

Standardization of SC&C service-oriented architecture is primarily in the formation of uniform technical parameters on management systems, distribution systems, operating systems, demand response and measurement (test) and implementation of systemic technical solutions to ensure harmonization, interoperability, interchangeability and reliability of network infrastructure of local communities and are focused on technical aspects.

Functions on overall management of standardization in the IEC, including Smart Grid, are provided by the Standardization Management Board - SMB, which is accountable to TC IEC and SC IEC, and technical advisory committees, strategic groups - MSB (Strategy Market) and CAB (conformity assessment systems).

A group for evaluation of electrical Smart Grid systems was established within the IEC, at IEC's SMB - the IEC SEG (Systems Evaluation Group - Smart Cities), which works closely with TC ISO and other organizations to prepare a reference architecture, building a road map <sup>26</sup>.

Standardization of environmental aspects for development of guidelines, basic and horizontal standards in the field of environmental protection is performed by IEC/TC 111 Environmental standardization for electrical and electronic products and systems in collaboration with the ISO Technical Committee - ISO/TC 207 Environmental Management.

New devices, gadgets, smart homes, electric vehicles also require introduction of relevant standards. To date, there have been developed and published standards for distributed generation (IEC 60904, IEC/TS 62257 and IEC 62446); response of interfaces to electricity demand (ISO series 16484, EN 50090, EN 50428, EN 13321 and EN 50491, AS/NZS 4755); electricity storage (ISO 6469-1, IEC 61982 and IEC 62619); smart automation (ISO series 16484, IEC 14543-3, series EN13321, EN 13757 AS/NZS 4755), including buildings (ISO series 16484 EN50090); electric vehicles (IEC 62196 (parts 1, 2, 3), IEC 61851, AS/NZS 4755.3.4 series AS/ISO 8713, ISO/IEC 15118, IEC 60364-5 (parts 53 and 55), AS/ISO 8713 series) and others.

The European SC&C initiative launched in 2011 at its first phase covered only new buildings with zero energy, as well as existing buildings with minimal energy consumption, energy networks and transport. In 2012, this work was continued under the innovation partnership on energy efficiency, improving transport solutions and intelligent use of ICT. And if in 2013, Smart Grid demonstration projects covered combined and standardized solutions only in three areas (energy, transport and ICT), and which in January 2014 formed the basis for implementing Smart Grid concept of the European innovation partnerships within the Horizon 2020 GRID4EU, then in 2015, the study was focused on standardization of Internet of Things, Smart cities & Smart communities. These studies were conducted by the UN specialized organization in the field of ICT - the ITU Study Group 20 under the Initiative The Global Standards for Internet of Things (IoT-GSI).

Within the framework of the International Telecommunication Union (ITU) a working group operates on sustainable development of smart cities (ITU-T), which forms the legal

basis for the integration of ICT and assesses the need for standardization of IoT, Smart Cities and Smart Communities to create innovation infrastructures in urban areas. The decision on establishment of this group was made by the 5<sup>th</sup> Study Commission on the Environment and Climate Change as a call for urgent action in the context of climate challenges 27. The recommendation of ITU-T-28 defines Internet of Things (IoT) as a global information society infrastructure that makes it possible to expand services by combining both physical and virtual things based on interoperability of information and communication technologies.

Today, ITU-T is an open platform for creating Smart Communities involving municipalities, academic and research institutions, non-governmental organizations and ICT, as well as industry forums and consortia, where stakeholders can share knowledge to develop standardized bases necessary to ensure integration of ICT based services.

## 4 Conclusion

With this purpose, to establish an active dialogue between the government and citizens to further the development of e-where-mocrat, coordination of efforts of public authorities and local governments to develop mechanisms to address identified problems and prevent their occurrence in future.

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