

**THE MINISTRY FOR DEVELOPMENT OF INFORMATION  
TECHNOLOGIES AND COMMUNICATIONS OF THE REPUBLIC OF  
UZBEKISTAN  
TASHKENT UNIVERSITY OF INFORMATION TECHNOLOGIES  
NAMED AFTER MUHAMMAD AL- KHWARIZMI**

**Allowed to defence**

Head of department

« \_\_\_\_ » \_\_\_\_\_ 2018 year.

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**THE PATH OF THE ICT DEVELOPMENT OF THE  
“SMART CITY” IN UZBEKISTAN**

**Final qualifying work**

**On a competition of the bachelor degree**

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Tashkent – 2018

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Chairman of the department

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« \_\_\_\_ » \_\_\_\_\_ 2018 y.

**THE TASK**

**For final qualifying work of student Rakhmonkulov Golibbek Fakhridin oqli on theme “the path of ICT development of the “smart city” in Uzbekistan in example of e-government”.**

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3. **The initial data to work:** The first president of the Republic of Uzbekistan I.A. Karimov's publishings and proceedings, the head of our country Sh. M. Mirziyayev's initiatives decrees and speeches, the specialized literature, annual reports of UNDP, Orders and other documents of “Electronic Government” system development center under the Ministry for development of information technologies and communications of the Republic of Uzbekistan.
4. **The maintenance is settlement-explanatory note** (the list of subjects to working out of questions) Introduction; Theoretical and practical issues of smart city; Analyzing current state of smart things in Uzbekistan; The way of development of “smart city” in Uzbekistan; Life safety at the enterprise; Conclusion; The list of used literature.
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Supervisor \_\_\_\_\_

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The section name	Advisor	Signature, date	
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Accomplished by \_\_\_\_\_

« » \_\_\_\_\_ 2018 y.

Supervisor \_\_\_\_\_

« » \_\_\_\_\_ 2018 y.

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## INTRODUCTION

**Actuality of the topic of final qualifying work.** The rapid development of information and communication technologies (ICT) in the world and the introduction of smart cities based on them, is one of the global processes of the present, and the formation of the information infrastructure and the modernization of public administration are among the priorities of the state. At this stage of development of our country it is important to take our place in the global information space. The development of the sector of information and communication technologies and "e-government" can increase the competitiveness of the economy on the world market, and will also help to bring the country to a new level of development characterized by intensive structural shifts in favor of a high-tech information sector.

As was noted by the Decree of the President of the Republic of Uzbekistan Mirziyoyev Sh.M.<sup>1</sup>, "...introduction and development of modern intellectual management systems for urban and regional infrastructure, including housing and communal services, transport logistics, emergency services, with subsequent integration and integration into single complex "smart" and "safe" city", "at the moment, 51.6% (as of 2017) of the population live in urban areas worldwide. For the 2050 year, a figure of 66.4% is already forecast"<sup>2</sup>. This is another fact about raising the demand for urbanization to modern cities.

Agglomeration advantages, such as primarily the chance for work, as well as social, cultural and infrastructural possibilities, draw the population to a large extent in the metropolises or living spaces of the future. Urbanization is the megatrend of our time and is therefore the focus of international attention. Our cities are the engines of the economy, places of networking and communication, creativity and innovation, as well as places of freedom, independence, wealth and happiness.

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<sup>1</sup> Decree of the President of the Republic of Uzbekistan from 19.02.2018 №DP-5349 "On measures for the further improvement of the sphere of information technologies and communications"

<sup>2</sup> United Nations World Population Prospect, <https://esa.un.org/unpd/wup/>

However, every medal also has a downside. The changing demographic factors, the predicted climate change as well as the decreasing availability of resources make it clear: “we have lived beyond our means for too long”. In particular, the cities are and will be moved due to the high population concentration in the focus of the problems. The cities of the future are currently facing a crisis due to ecological, economic, geographical, political and cultural transformation processes. This situation is exacerbated by demographic change, which in addition increases both migration flows and the degree of urbanization.

As a result, this leads to an overload of infrastructure and urban housing. Public transport, the transport, energy and water supply networks as well as the service sector are no longer able to cope with the rising number of citizens. The traffic volume causes congestion, noise and an enormous environmental and health burden. According to Asian Environment Agency (AEA) data, our cities are consumers of up to 70% of Asian energy<sup>3</sup>.

The relevance of the chosen topic is conditioned by the fact that in recent years modern technologies in the field of “e-government” and intellectual public services have been consistently implemented in Uzbekistan and this in a timely manner raises the level of intellectuality in territorial regions.

**The aim of the research.** The aim of the research is to develop recommendations and introduce “Smart Cities” in the Republic of Uzbekistan through the introduction of information and communication technologies. To achieve the aim, **the following tasks are formulated:**

- Studying the theoretical basis of “Smart City”;
- Analyzing infrastructure, planning and management of the “Smart City”;
- To find the main criteria to develop index of smartness using ICT;
- Analyzing e-government as a critical success factor for any countries’ “Smart City”

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<sup>3</sup> <https://www.aecen.org/node/2574>

- Recommendations on the formation of “e-government” to increase the activity of “Smart City” in Uzbekistan

**The object and subject of the research.** The object of the research is the Republic of Uzbekistan in whole and the “Electronic Government” system development Center under The Ministry for development of information technologies and communications of the Republic of Uzbekistan.

The methods and approaches of accomplishing efficiency and growth between citizens and government in all areas through ICT.

**The structure of the research.** The diploma work consists of introduction, four chapters, conclusion, list of used literature and appendix. The total value is 92 pages.

In the initial chapter of this work, the concept of "Smart City", the basic background information about them, the structure of their creation.

The second chapter of the work emphasizes the current situation in the Republic of Uzbekistan, its analysis and research results and different predictions about the development of e-government. Visual figures present information in a concise and clear form in this work.

The third chapter is written based on recommendations, methods that offer some correct solutions to problems that increase the efficiency of “Smart City” in the future.

# **I. THEORETICAL BASIS OF SMART CITY**

## **1.1 Smart cities today**

Humanity is facing major changes and global challenges, and no one knows where the trends of the future will take us. What challenges does the future pose for us and which problems can be solved for us.

The smart city or intelligent city is the way of our cities today into a sustainable, efficient and livable future. Smart city is not a universal definition, but an overriding goal. Technological or non-technical developments and innovations as well as structural planning should be used in order to be able to guarantee the city dwellers a lasting life on a constant or rising level.

In all fields of action, it is essential to recognize the specific strengths of each city and to consider them. Expertise has to be transferred and individual interests maintained, only in this way can the whole potential of a city and the commitment of the citizens be made available in their entirety. The residents must be involved in the transformation to the smart city. A city only has a future if its inhabitants can identify with their problem. Horizontal and vertical cooperation and cooperation at regional, national and Central Asian level strengthens development.

Modern and innovative communication and information technology forms the basis of action strategies. Research and development institutions put on public and private page the necessary competence for innovations. The economy is responsible for corresponding business models, regional and international support measures for the monetary component. In addition to a clear formulation and joint development of a vision of the future, the success factors include a comprehensive steering committee and a suitable monitoring system. The generated strategies and measures of vision, which integrate the opinions and wishes of all stakeholders, must be coordinated and monitored in the interest of all in order to ensure a steady progress of success.

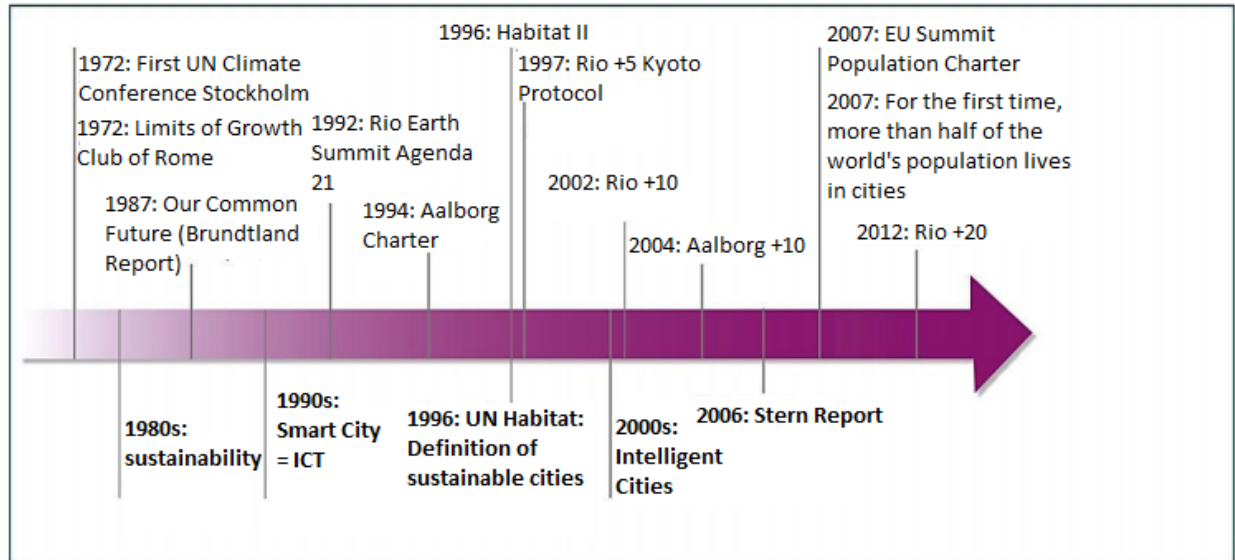


### **1.1.1 Terminology Smart City**

Even if there is no clear definition for the term “smart”, the word future-proof forms a good basis. A city must become sustainable in order to be able to offer its residents a life with a high standard of living or a high quality of life and a steady increase in prosperity in the future as well. The cities of today are experiencing problems which, without a drastic change of behavior of the inhabitants as well as enormous technological advances, will deny our future generations a life in the same qualitative conditions as we have. Smart cities are thus cities that address their main problems, deal with them and try to change them.

The term smart city is often equated with the terms modern city, green city or even innovative city. All of these terms allow a great deal of latitude in the definition and no generality. They all leave room for individual wishes and ideas. However, in the context of the problems of our cities, all publications and studies quickly reveal that they define all cities that are sustainable, efficient and liveable, thereby demonstrating intelligence.

Sustainability generally means satisfying the needs of the present generation so that future generations are not constrained but have the same options. It is therefore about developing a lifestyle and a living environment that can be lived in the long term. Economic, ecological and social compatibility are the pillars of sustainability. Figure 1 graphically depicts the historical development of the subject of smart cities and the term sustainability.



**Figure 1<sup>4</sup>.** Illustration of the historical development of the term smart

Sustainability is always closely related to efficiency, both the efficient use of resources and the availability of efficient structures. On an economic basis, efficiency means being productive and fast, with the least possible use of resources and no loss of quality. The development of the best cost-benefit ratio as well as a rational and intelligent handling of the predicted scarce resources are a prerequisite for this. In the energy sector, energy efficiency, the realization of greater efficiency in energy conversion, the reduction of power losses, and intelligent energy management, both in energy production, as well as in end devices or energy consumers.

The goal of a smart city is to develop a green city, while at the same time achieving greater energy and resource efficiency, and striving for continuous improvements in the quality of life by intelligently networking and integrating urban infrastructure. All components must work together as a whole network and must no longer appear as isolated parts. In this context, in a city not only the objects

<sup>4</sup> Source: De Meo, P., Quattrone, G., Terracina, G., Ursino, D. 2014. A multi-agent system for the management of e-government services. In Proceedings of the IEEE/WIC/ACM Intl. Conference on Intelligent Agent Technology, pp. 718–724.

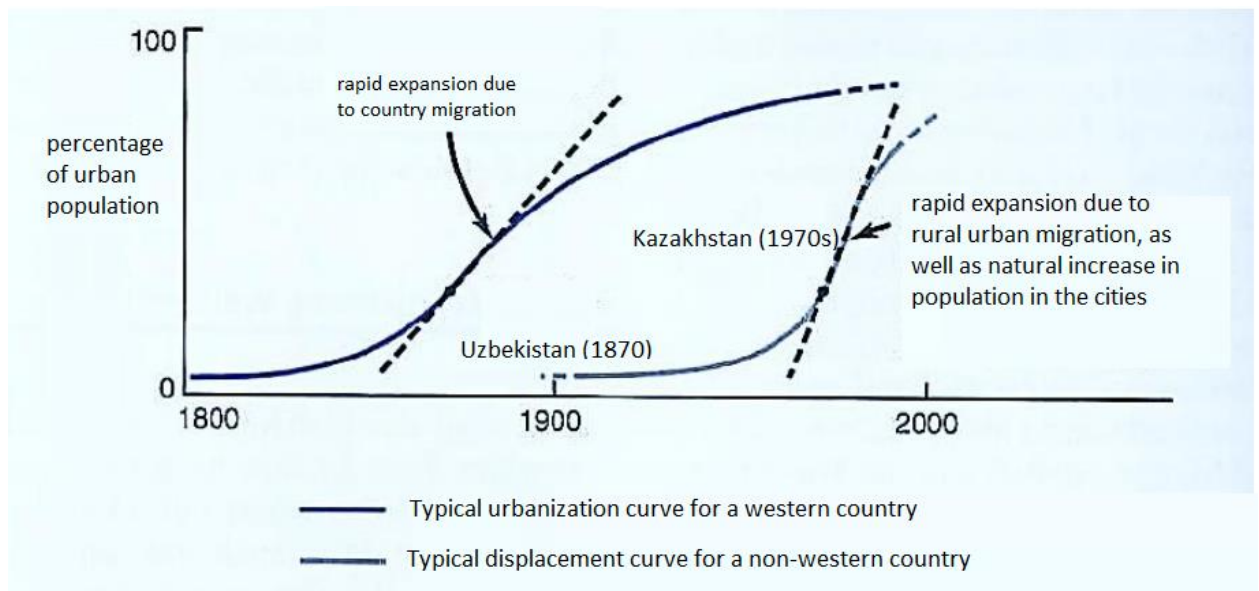
are to be considered, but also the factors. It is not just about participatory access, but rather about the active and constructive involvement of citizens in the smart development of their city. Citizens need to be able to and want to identify with their city, the events in it and their future.

In 2011, Wiener Stadtwerke Holding defined a smart city as follows: “smart city” is the name given to a city in which systematic information and communication technologies and resource-saving technologies are used to pave the way for a post-fossil society reduce the quality of life of citizens and the competitiveness of the local economy on a lasting basis, and thus improve the sustainability of the city.

At least the areas of energy, mobility, urban planning and governance are taken into account. An elementary feature of smart city is the integration and networking of these areas in order to realize the ecological and social improvement potential that can be achieved in this way. What is essential here is a comprehensive integration of social aspects of urban society as well as participatory access.

### 1.1.2 Urbanization to modern cities of the world

No matter what threshold or definition is used for the cityscape, the fact remains that the proportion of city dwellers is increasing worldwide. Taking the threshold of the United Nations of 20,000 inhabitants, measurements until the year 1800, only about 2.5% urban population in the total population. By 1980, the figure had risen to more than 25% and increased to more than 50% by the year 2000. However, as with the city definition, the degree of urbanization depends enormously on the region on our planet. A general pattern for urbanization in the different countries can be seen in Figure 2.



**Figure 2<sup>5</sup>.** Graphic representation of the urbanization (curve) with reference to time

Decisive for the enormous urban growth in western countries is the mid-19th century land-urban migration. The developing country curve differs from that of the industrialized countries on the one hand in the onset and speed of city growth, due to the industrialization process that begins later, and on the other hand, the high birth rate in the cities is more decisive than the rural-urban migration itself a spatial pattern, which was limited at the beginning of the enormous urban growth,

<sup>5</sup> <https://www.statista.com/statistics/455954/urbanization-in-uzbekistan/>

almost exclusively to the middle geographical latitudes (cities such as Tashkent, Samarkand, Bukhara).

Responsible for the rural-urban migration are push-factors such as the agricultural technology revolution, which has pushed the need for peasant work more and more into the background. The rural exodus was further strengthened by the fact that the birth rate in the countryside was increasing, the labor force in agriculture declining, and the price of agricultural products that could not be reliably estimated. Responsible but are also pull factors of the cities. These include first and foremost the opportunity for work, but also social and cultural opportunities that cities provide and the existence of a functioning infrastructure. Equally important is the call of freedom that cities still convey today. Openness, equal opportunity and the prospect of self-determination, freedom, quality of life and, above all, a future worth living.

The earliest urban cultures or historical preforms of our present-day cities already arose during the Neolithic Revolutions in the Neolithic Age, mainly found in Asia Minor and Mesopotamia. It was dominated mainly by castle settlements. At the time of the Roman occupation, the settlement area expanded under a first strong increase in population. Settlements were built here mainly as military sites (castles), with some urban functions and trading venues, as bourgeois cities, as bathing towns or as agricultural single settlements (manor). The first decline came with the time of the migration, which was characterized by enormous processes of de-urbanization and a redistribution of the European settlement area. A rebuilding and real city start boom experienced Europe in the early Middle Ages. Through the introduction, improved agricultural equipment, a renewed increase in population and the extensive development of the market, cities emerged based on lordly ecclesiastical roots such as imperial or episcopal seats, castles and monasteries, but also based on commercial-civic roots such as the market, merchant and mining settlements.

Famines, abandonment processes, a high mortality and epidemics shook the European country. Shortly thereafter, during the late medieval desolation period of the 14th century, led various civil wars and the Thirty Years War, to stop the urban

pugilism. Absolutism was characterized by the expansion of existing cities around sumptuous residences, castles or fortresses, partly according to the ideal city model.

In the course of the industrial revolution, not only shipping, railways and mining were expanded and led to new economic developments, but also improved the medical situation and thus led to rapid population growth. The freedom of establishment and trade, the use of machinery and the chance for work promoted an extreme rural exodus and the run on the cities. The urban revolution changed the cityscape dramatically. The well-defined city-country dichotomy of the pre-industrial city gives way to a city-country continuum.

New commercial and industrial areas are founded and require work colonies and villa settlements for employers and employees. Due to the stored industrial area between the living space a reckless sprawl of the landscape takes place. Urban elements, such as services or new infrastructure, have also spread to rural settlement areas street lighting or sidewalks, and since then lead to the demarcation problem of the term city.

## **1.2 Concept of smart city**

Entire industries are redefining themselves and shaping the future. For the fact is that our society as it lives today cannot continue to live in the same conditions in the future. Demographic change, the coming climate change and limited resource availability in the short term force us to act. As centers of economy, society, commerce and life, awareness is growing that our cities play a fundamental role in development and on the path to a worthwhile future. Concepts for an intelligent city or smart city are the path of today's cities into a sustainable, efficient and livable future.

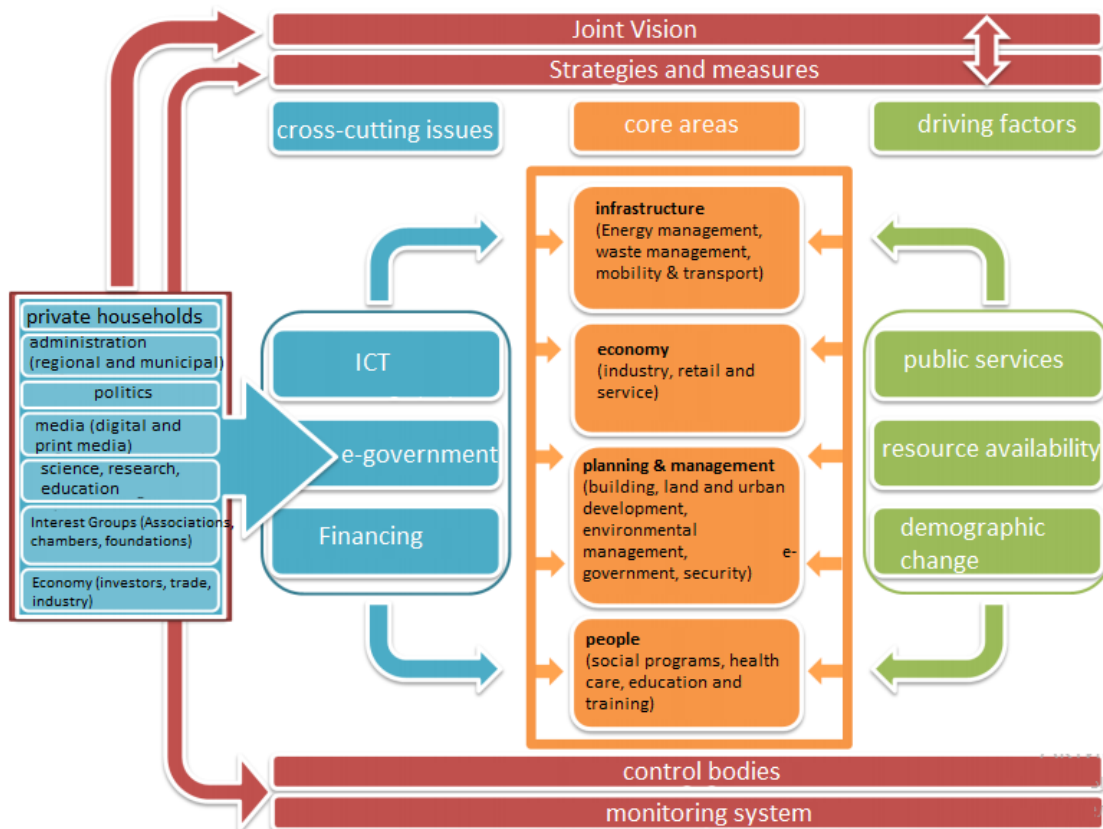
As already mentioned, there is no truly universal definition for the term “smart city”. However, the overall goals are the same in almost every city. Technological and non-technical developments or innovations as well as structural planning are to be used in order guarantee the city dwellers a lasting life on a constant or rising level.

For this purpose, the city must not only strive for energy and resource efficiency, but also turn green to develop feel-good character and quality of life. The urban infrastructure as well as the actors have to be intelligently networked and integrated. The individual components may no longer be used in isolation, but must work together as a holistic network.

The last paragraphs have not only briefly outlined the historical evolution of Asian cities, but also highlight their current lives and the associated stress factors and problems that have arisen during their development. For years, institutes, politics, the media, science, the economy and the most diverse interest groups, including private households, have been tackling problem-solving approaches.

### **1.2.1 Vision of smart City**

The following graphic is intended to graphically present the concept smart city. It was developed in the course of extensive literature research and is intended to cover all relevant topics. The key or core areas for action strategies in a smart city include the infrastructure, the economy, planning and management, as well as the people themselves. These core areas largely comprise the most important fields of action. So-called cross-sectional topics also form the framework of the core areas. They represent the basic requirements or requirements that are necessary to be able to implement the action strategies. They include information and communication technology (ICT), whose basic prerequisite is continuous development, as well as the actors and financial instruments, without which the development of ideas and their implementation are not possible. As driving factors the today's basic problems of our earth and thus also the cities are seen. They can be seen as problem-causing influencing factors and, so to speak, challenge the core issues. These include public services, resource availability and demographic change.



**Figure 3<sup>6</sup>.** Concept of smart city

The structure of the arrows makes it clear that interaction, integration and networking need to emerge not only among the core areas themselves, but also under the inclusion of cross-cutting issues and the driving factors. The smart city concept can therefore be seen as a holistic concept in which all components must be taken into account.

There is no universally valid presentation for the smart city concept as well as a general definition of the term so far. There are no prototypes of cities whose development can be repeated one to one. Each city is individual and differs on the basis of different location factors, the local needs, the actors but also in the visions of the future to the rest. Accordingly, the concept smart city cannot be transferred one to one to every city. For each cityscape, ideas of the future and visions as well as the way to it have to be developed together. There are three key success factors for this. The implementation of an intelligent city can only come about through the

<sup>6</sup> Source: <https://www.smartnation.sg/happenings/events/SNI-Week-opening-symposium>



actors themselves. Among them, networking is just as crucial as with the rest of the system. A society is complex and based on a wide variety of knowledge, ideas, experiences and visions of the future. Communication is their key element in getting the most out of development. Equally important is a steering committee. The interests and activities along the entire process must be managed and coordinated from a central location or position to achieve a successful outcome. The third point is the monitoring system. This serves to measure success and to monitor progress while reviewing and evaluating the strategies and measures.

There is no shortage of ideas and concepts in this day and age. In contrast, the implementation of many of these dream concepts is often problematic. Not only financially and structurally, but also because of data protection. There are many innovations that require more network management, as well as access to sensitive administrative data for companies and private organizations. In our time and with the still existing large security gaps of today's data systems, this is nearly impossible.

Nevertheless, there are a number of ideas, innovations and applications that have already been successfully implemented by the cities and their inhabitants. The city of the future will be smart and social and climate neutral.

### **1.2.2 Fields of action (available technologies)**

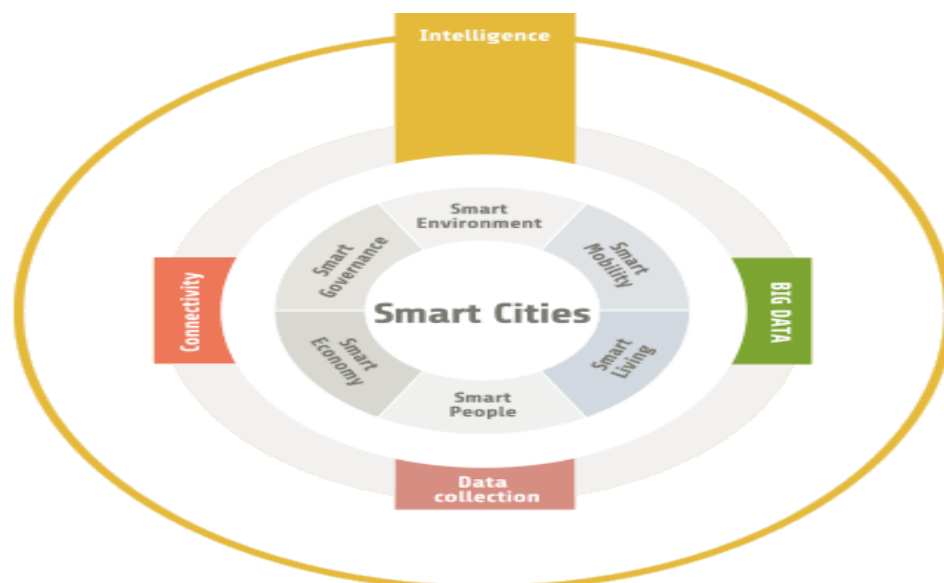
For every city there are general fields of action, but also those that are designed for a specific problem. The development of the transport network is only necessary in some cities, while an energy efficiency strategy is relevant for all cities. The fields of action range from smaller planning measures, such as the creation of parks, to the implementation of very complex technological innovations. From relatively short-term goals, to strategies that pursue plans until the year 2050. Also, one can differentiate primary and secondary solutions. Measures that build on the existing and make use of what is already available or solutions that mean a complete

re-implementation and a new construction. As a result, the development of the fields of action for a city always depends on the framework conditions.

It is therefore particularly important that the fields of action with which cities work are always coordinated with the respective urban problem and interest situation. Likewise, the solution approaches should basically arise from existing competence, build on this and be specifically promoted. By cooperating societal, economic and political know-how, action strategies based on generally accepted guiding principles can be developed. An unreflect takeover from the outside is not the best way.

The topics of smart solutions have an enormous bandwidth overall. As difficult as the precise definition of smart city or the creation of concept, is also the preparation of a collection of general action strategies, because in the current literature, there is no generally accepted scheme. Various institutions have each developed their own schemata, in which they represent the usual fields of action, sometimes in quite different ways.

Based on the extensive literature research, the following figure has emerged, which, in my opinion, combines all-important fields of action and presents them graphically.



**Figure 4<sup>7</sup>.** Smart fields of action

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<sup>7</sup> Source: <http://www.gaia.es/smartcities/en/home/>

In the following, an insight into the individual fields of action of smart applications will be given below. Selected examples, already implemented or future planned topics should also illustrate these.

### **1.2.3 Infrastructure**

Infrastructure not only includes the transport infrastructure but also the energy, water and disposal infrastructure. In the following chapters, the individual components will be discussed in more detail.

A functioning and well-developed infrastructure makes a city attractive and livable, as does the transport infrastructure. Mobility in cities is a key issue and the engine of growth and progress. Mobility means freedom for people to move to other places. Living, working, taking care of, leisure or education, all these are basic functions, which are often, separated by great distances. The activities of daily life should be done quickly, safely, comfortably and environmentally friendly. They must not be a matter of age either. Thus, the increasing proportion of older people now plays a major role. Smart means being able to be self-sufficient and free in mobility, even with physical disabilities. The main goals are to make mobility sustainable, emission-free, affordable and usable for every clientele, thus achieving positive effects on the environment and quality of life.

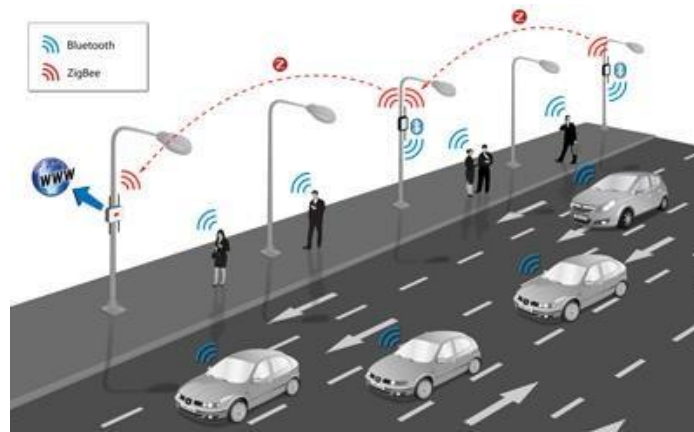
An important resource and climate-friendly alternative to the enormous individual traffic is public transport. To make them more attractive they should not only be a faster, but also a cheaper and more sustainable factor. The switch to emission-free local transport, such as electric buses, is not only planned for the future, but is already being implemented in many places. With a nationwide expansion and a corresponding promotion of efficiency, it can mean a considerable relief for the traffic routes and the emission reduction. Positive resonance can also be achieved by better linking traffic and Communication, as well as innovation, based on new smart phone

Visions of the future in which parking lots can be booked on the road, cars can drive autonomously and without accidents, taxis can serve several passengers simultaneously and efficiently, and the flow of traffic works independently and reacts flexibly to problems are no longer as far removed as some believe.

The innovative citywide information and communication technologies and sensor networks will make this possible in the future. The basic prerequisite and, at the same time, the greatest problem factor is the secure provision of data that must be usable for everyone and that should be in constant exchange in order to guarantee maximum efficiency. The public and private sector vehicles would need to communicate with each other, with the infrastructure and with all road users, to ensure optimal use and to avoid waiting and waiting times.

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**Figure 5<sup>8</sup>.** Traffic Sensing in a Smart City

One of the latest trends is car sharing. Cities propagate with slogans such as “use instead of owning” and thereby not only increase the use of carpool portals, but also of car sharing cars. Advantages such as online booking or online reservation, convenient parking in relatively central locations and solid prices further promote the use.

However, the transition to the combustion engine-free traffic is promoted. Electro mobility is the trend for a green, sustainable and emission-free (at least directly seen, because actually causes the electro mobility CO<sub>2</sub>, in the generation of electricity, unless it is green). For this purpose, the equipment with charging stations has already been greatly expanded in some cities. In addition, for e-car owners are offered cheap and central parking with charging station and sometimes there are even tax breaks or subsidies for the transition. In addition to an individual electric transport, now also some taxi companies, as already mentioned the public transport, to electric cars. Other technical innovations that contribute to the reduction of emissions in private transport are the hybrid vehicle or the fuel cell vehicle. Whereas electric cars are currently available almost exclusively for short distances, hybrid cars and fuel cell vehicles can also be used on long-haul routes. In this case, the fuel cell vehicle requires hydrogen which it converts into electrical drive energy by means of chemical reactions. For urban transport such concepts already seem sufficient, in reality, in the market, the introduction, however, remains inhibited due to the still very high initial costs or a lack of infrastructure. Elsewhere, state-

<sup>8</sup> Source: <http://www.elkjournals.com/microadmin/UploadFolder/743719>

sponsored end-use motorization is promoted, with the help of sales promotion measures such as tax relief or direct subsidies. In car-free model settlements, the expansion of bike paths and footpaths is in the foreground. In addition to pedestrian zones, there are now also some border areas in some cities. Thus, especially in recent years, the use of e-bikes, not only in everyday life, but also in the leisure sector and in all ages, increasingly through. Future perspectives still leave enormous potential for innovation open. Regardless of whether cities promote the area of the bike city or that of electric mobility, the enormous noise reduction in the cities, which promote greater implementation, is definitely positive.

In this context, the influence of the Internet should not be ignored. The possibility of the Internet as a traffic-calming factor is steadily increasing. Reasons are on the one hand the reduction of routes through opportunities such as online shopping, on the other hand, so-called co-working spaces in the vicinity of the place of residence and the possibility of home office. Many workers in the service sector are given the opportunity to work from home by using technologies such as the Internet and mobile phones, not only to avoid long journeys and stress, but also to contribute to environmental protection. Particularly in terms of urbanization, disurbanization or counter-urbanization, which is currently taking place in many places, new possibilities are offered here. Extensive networking, new technological applications and opportunities such as Internet telephony enable people of the future to live in delightful places of high quality of life, but to work in completely different regions. From this point of view, the question arises as to whether the initial trend of urbanization described in, which is forecast to be extremely strong, as well as the disurbanization or counter-urbanization, can not be mitigated or redirected by such developments. Of course, this is highly country-dependent, as there are enormous differences in population migration.

As a result, intelligent mobility concepts require innovative, infrastructural and logistic Transport and traffic concepts or in short a better traffic management. New technologies and applications that older people can master confidently, as well as a fundamental behavioral change of society and the individual, which also raises

awareness and thus situation-specific understanding, provide a further basis. In addition, more cooperation among the individual mobility providers is required and an optimized interaction between the means of transport. In order to finance such concepts, the public and the private transport sector should be linked and a common cost management should be created.

**Smart Energy.** Excessive use of finite and therefore limited sustainable fossil fuels, caused by the masses of released pollutants, not only causes enormous regional environmental problems but also affects the climate of the whole earth. The dependence on mostly politically unstable supplier countries as well as the general overload of the energy network or the problematic energy supply of the cities contribute to the necessity of action strategies.

The most important fields of action focus on three topics. Firstly, the energy turnaround, that is, the turning away from nuclear power and fossil resources, to the use of renewable and clean energy sources. Triggered by the predicted climate change or catastrophes such as in Fukushima, politics, the economy, science and research, as well as parts of the citizens, have finally recognized the problem. The share of renewable energy sources must increase significantly in order to bring the CO<sub>2</sub> values to an acceptable and lower risk level, despite the simultaneous omission of nuclear power. The nuclear phase-out of some European countries provides a first positive basis for transforming the energy supply, even if it aggravates the CO<sub>2</sub> problem. Austria and Switzerland, as well as Norway, Sweden and Finland, have been making increasing use of their geological and natural environment (such as the mountains) for many years and are promoting hydropower. In other regions of Europe, again, powerful wind farms were built on land, as well as at sea or in solar energy fields. But the promotion of alternative energy supply systems can not be seen only on a large scale. Energy production has also been promoted and will be at regional and individual level, such as the subsidization of solar panels on private rooftops.

In addition, more and more municipalities are developing problem-related awareness and carrying out their energy transition themselves. Regional biogas

plants and other measures of private power generation make the municipalities energy self-sufficient. In particular, this form of energy provision, which comes from many small producers from renewable sources, should play a key role in the future and in achieving the climate goals. Rooftop photovoltaic systems, biomass-fired heating systems, small private wind turbines on rooftops or in gardens, and geothermal energy not only provide consumers with independence, they also save a considerable amount of money.

Regarding renewable energy sources, the future holds some plans, as just described. However, even visions of the future or rather progressive plans are already in abundance. Visionaries at Delft University of Technology have designed the futuristic yet realistic “Sunny Water Lilies”, floating solar panels. Their visually stimulating design not only means sustainability and resource conservation but also a future trend and demand.

The still problematic factor leads directly to the point two of the action fields, the weakness of existing power grids. Today, not only is the networking of the networks lacking, but also the structure of the networks. Today's power grids are one-way, which means that, while there is power to the consumer, it can not be fed into the grid either at all or not without major losses. The basis of a smart city are therefore networks that allow decentralized generation and oncoming traffic and at the same time collect and pass on information about the states of all connected aggregates. which are interoperable. Key words in this context are smart grids, smart meters and smart storages. By thinking and acting wisely, these intelligent systems should not only improve energy efficiency and thus optimize CO<sub>2</sub> emissions, but also help to manage sensible and conscious power consumption. They enable more efficient storage of privately generated energy by reducing conversion losses and reducing the peak load by shifting power consumption to lower-cost, low-load times. Real time pricing enables the tariff level to be flexibly adapted to network utilization. Low tariffs, at times of electricity surplus, are supposed to persuade the consumer to use electricity counter-cyclically. For example, due to supply and demand, the washing machine jumps on automatically in the middle of the night and the electric



car starts to charge the battery. For the most part, these scenarios are still dreams of the future, but plans that can be implemented and initial attempts to do so are already a reality. By linking with communication technologies, the electricity grids must even transform into intelligent energy information networks. Gigantic data volumes of important information are distributed through a data network to the most diverse components of the system. Smart city management units should in the future control the energy supply of the city precisely and thus contribute not only to the conscious use of resources, but also to the sustainable improvement of the CO2 balance.

**Electro mobility.** In addition, successful implementation of the plans will require enhanced EU-level cooperation and EU standards and guidelines. Also important is the topic of security measures. Systems such as smart grids are highly complex and safety-sensitive due to the enormous volume of technology. Security measures against manipulation and failure must be integrated at all levels to ensure security of supply.

The third and equally important field of action is the inefficiency of existing networks and the actions of the population. As already indicated, today's power grids are not only poorly functional or insufficiently developed for future requirements, but also just as inefficient. Due to the constant change between direct and alternating current, enormous amounts of energy are already lost on the way to the consumer.

Citizens, especially westerners, have become accustomed to having energy in abundance for years and therefore consume more than they really need. A multitude of new electrical appliances as well as the prosperity and the convenience have strongly increased the individual power consumption in the past. A rethinking in the direction of renewable energies, a more conscious use of electricity and the desire for a change of behavior, is usually set equal to resignation. Likewise, the pressure and incentive to change consumption and behavior is still too low for the majority of citizens, but also for companies and institutions. Especially the area efficiency offers energy saving potentials up to 80%. Only "when energy prices are high enough, alternatives are taken from the drawers and further developed". New efficient and intelligent energy concepts must take into account all components from

generation to storage and energy efficiency, with a constant focus on regenerative energy sources. In addition, they must not ignore the needs of consumers. Energetic restructuring can not and will not take place without extensive public participation as our cities need it. Precisely for this reason, conferences such as the World Climate Summit or citizen initiatives form one of the most important foundations for attracting more and more citizens and mobilizing them for assistance.

On the basis of the first Eco-design directives in 2015, the industry has also adapted to efficiency measures and since then has been trying to make electrical appliances more efficient through new innovations. Even in the field of street lighting can be achieved by long-lasting LEDs more effective. This new energy-efficient lighting technology can also be supported by the use of intelligent sensors-based control. In addition, applications such as energy consumption monitoring based on an app for the smart phone, new opportunities.

#### **1.2.4 Planning & Management**

The problem of strong urban sprawl, as well as the general waste of space were also addressed. In the field of planning and management smart solutions in the field of urban planning or city administration but also in terms of building services engineering, environmental management or public safety are to be presented.

Promote smart action areas for an agile and working society in the context of terms such as E-government, urban gardening and second nature the attractiveness of a city, as it is greener, healthier and citizen-friendly.

E-Government refers to a citizen-friendly city administration. City applications are intended to provide citizens, but also companies, with access to up-to-date information and news from all areas of city administration and cities in a simple, compact and up-to-date way. Data sets of cities on events, doctors, apartments, environmental data, bulky waste, study opportunities, traffic information, hygiene deficiencies in restaurants and many other areas to inform the citizens. Internet links should be used to connect the data with virtual city maps to

visualize buildings, streets or venues. Personalize guidance systems that, knowing the individual goal of a person, individually and according to the personal preferences of route and transport system, lead to this goal, can help relieve the citizen. There are also plans and implementations based on a virtual citizen service to provide barrier-free and simplified access to a variety of official channels. These are intended to give citizens access to government services, such as reporting or elections, over long distances. With device-independent mobile versions for smart phones, the applications could also be used on the go. The information and communication technologies would have to be established in this way in the public administration. Key criteria for successful implementation are the timeliness, quality, availability, uniformity and device independence of the data. The possibility of data aggregation, legally compliant use and the transfer of data must also be guaranteed.

The presence of green has been considered as a solution since industrialization to reduce the health problems caused by cities. Back in the hot and unbearable summers, you used to drive out of town and into the countryside for fresh air and nature. Today, nature, lifestyle and health are brought back to the cities. Urban gardening has long since established itself as a trend. On roofs, and balconies, as well as backyards and also in the apartments, one wants to be close to nature and see green. The city dwellers create their own second nature in the middle of their habitat city. Green stands as a synonym for healthy, attractive and livable and thus smart.

In the city of the future, however, humans are not only closer to nature, but people are coming closer to agriculture in particular. Vertical farming or peri-urban agriculture is the name given to the future trend, which is gaining in importance, especially in megacities. High-rise buildings serve as vertical gardens and for the operation of inner-city agriculture.

In addition to the newly gained ecological quality of life of the cities through urban greening, the positive factors include the return of the young or well-to-do society as well as the families, but also the aesthetics of the city. The environmental

and sustainability issues must not be placed on the remaining concerns of the residents, but must be united with it.

#### **1.2.4.1 Economy**

Our cities are central hubs in the global networks of multinationals. They also play a major role as hubs of economic relations with other Asian or non-Asian cities. The intensity of economic relations depends on the size and profitability of the resident companies. The cities are thus subject to permanent competition with each other. Historical circumstances, private or public investments, as well as the local skills characterize the economic efficiency and the reputation of the companies and thus the economic power of the cities.

Due to climate change, the scarcity of resources and the aging of cities in the wake of demographic change, the structure of the economy and corporations must change as well. This need is supported by a global adjustment of living conditions and wage levels, which subsequently favors local production with reduced transport costs.

One option is the so-called Green Urban Economy. Green Urban Economy means a green, fair and local economy. Not only does it require less CO<sub>2</sub> due to shorter transport distances, but it is also more resource efficient through the use of environmentally friendly raw materials. However, it can only function through the integration of social aspects, such as environmentally friendly behaviors and changing consumer behavior. It thus supports a production that improves human well-being and at the same time leads to social justice. An economic system that is to be maintained in the long term may use or extract raw materials and energy sources only to the extent that nature still has a chance to regenerate. A fundamental transformation of the economic system is inevitable given the predicted limitations of today's resources and steady population growth. Economic progress must be decoupled from economic growth.

One of the most important goals of the cities should be to sustainably maintain and re-create many companies, and thus jobs, which lies in a sustainable economic sector. The companies have to adapt to the changing demand. Demand will increase in areas such as the environment, health or food production. However, a local production of environmentally friendly products also requires a sustainable and efficient use of the required resources. Of course, this also requires intelligent recycling and disposal systems as well as new material cycle concepts. Cross-border cooperation and cooperation across the EU should emerge for the implementation of highly effective recycling. At the same time, a central office should monitor the implementation of recycling as well as the raw material markets and their efficiency concept.

As already mentioned in the Infrastructure chapter, for an energy transition, as well as for a change in the economic system, consumer behavior and lifestyle must change. Targeting here is a support from the city administration, which must lead by example.

To be competitive, a city needs to harness and develop the local economic potential of each neighborhood. Particular emphasis should be placed here on short commodity cycles.

Higher resource and raw material efficiency not only reduces the costs of production and transport, it also strengthens competitiveness, creates urban independence and lowers greenhouse gas emissions and thus pollution as well as the ecological footprint.

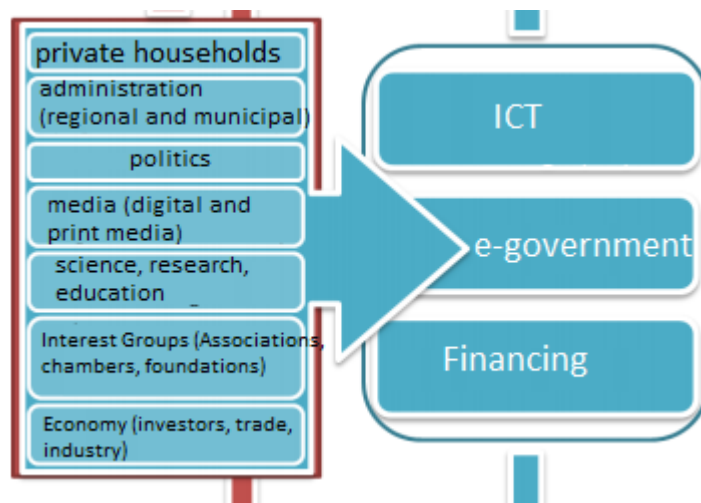
The economic sector also includes the service sector and the retail sector. In these areas, too, sustainable use of today's resources is required. The pure mass consumption idea must give way to an appreciation for products. The lifestyle of the inhabitants has to change drastically in order to make the production more sustainable.

### **1.2.4.2 Conversions**

The cities of tomorrow are places of progressive social progress, high attractiveness and engines of economic growth. They are platforms for democracy, cultural dialogue and diversity as well as places of ecological renewal.

Basic and framing factors for the successful implementation of the individual fields of action were already addressed to smart city concept. Here, the factors were defined as crosscutting issues. Probably the most important factor here can be seen the actors. Without active measures of the population and the state, the fields of action are not feasible. Another prerequisite is modern and innovative information and communication technology (ICT), based on which relatively many levels of action are built. So far, however, were hardly addressed the means of implementation. These usually require large sums of money. The following chapters will cover all three crosscutting issues in more detail.

Urban design often does not follow the principles of sustainability or a specific plan or goal. Their development is not one-to-one transferable from one city to another. A city is the mirror image of the people or citizens in their lives and represents their desires, longings, dreams but also fears dare. To the city dwellers, here are not only private households, but also the local economy, the media, politicians, city planners, Scientists or associations, associations and foundations. Each of these local stakeholders represents a wide variety of opinions, mindsets and visions of the future.



**Figure 6<sup>9</sup>.** Representation of the factors in the Smart City concept

The aim is not to neglect any of the interest groups and yet to develop common plans and visions, which will then be realized. In this context, the appeal of the broad mass of city dwellers, who are not always actively involved in problem-solving measures, is of particular relevance.

As a major problem factor are often very different opinions. Especially the economy often represents extremely opposing views, which does not necessarily reflect the attitude of the population or even of eco-activists. Without a direct pecuniary incentive, an action is rarely achieved here. Information programs, conferences and debates are therefore at the center of attention when it comes to cooperation and the transfer of knowledge between the different parties. An example of this is the recently held Urban Future - global conference in Tashkent. The conference was based on the topic smart city or Sustainable Cities and informed about current topics and fields of action in this environment, presented by various parties (described in more detail in the later chapters) (Urban Future 2017). The fundamental topic of a large number of conferences is intelligent consumption, which should not only secure the status quo for future generations, but also at the same time expand it.

Already implemented visions or targeted applications from various initiatives clearly show how great the potential of innovation is from below and what is possible

<sup>9</sup> Source: <https://www.smartnation.sg/happenings/events/SNI-Week-opening-symposium>

with good cooperation between various city stakeholders. The field of opportunity for popular referendums and popular initiatives for major urban projects is slowly increasing.

### **1.3 The main role in creating a smart city - “e-government”**

E-government can be considered as the core and most important challenge of smart cities initiatives. It refers to the use of information and communication technologies in the public sector with the aim of improving information and service delivery, reinforcing government transparency, accountability and credibility, and encouraging citizen participation in decision-making processes. In this paper, we survey the state of the art in recommender systems for the e-governance domain, showing that there are few studies on the topic and that published recommendation approaches are quite simple and focus on a very limited number of applications. Moreover, we propose a number of challenging e-government scenarios where recommender systems could be exploited, and thus represent new research opportunities.

Today, 44% of the Uzbekistan population is living in cities, a proportion that is expected to increase to 66% by 2050, as stated by the 2014 revision of the World Urbanization Prospect produced by United Nations<sup>10</sup>. The uncontrolled growth of the population and the raising demand for resources, under poor organization and management, not only make cities principal sources of congestion, pollution and waste, but also exacerbate a variety of socio-economic problems, such as the increase of poverty, unemployment and criminality in the cities. Managing urban areas thus represents one of the most important development challenges of the 21st century, including new actions on infrastructures, energy sustainability, natural environment, education, health care, and public safety, to name a few.

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<sup>10</sup> United Nations World Population Prospect, <https://esa.un.org/unpd/wup/>



Cities, however, are also a key part of the response to such problems. In particular, the concept of smart city has been conceived as an approach to address urban problems, by making use of Information and Communication Technologies (ICT) to increase the quality, efficiency and interactivity of urban services, reduce costs and resource consumption, and improve the interactions between government, citizens and businesses .

The definition of smart city differs among disciplines, and has evolved over time. In identifying eight critical factors of smart city initiatives:

- **management and organization**, which should be addressed in the context of e-government projects;
- **technology**, referring to new-generation integrated hardware, software, and network technologies that provide information systems with real-time awareness of the real world, and advanced analytics;
- **economy**, including factors around economic competitiveness as entrepreneurship, innovation, productivity and flexibility of the labor market, as well as the integration in national and global markets;
- **built infrastructure**, referring to the availability and quality of the ICT infrastructure, such as wireless connection (fiber optic channels, Wi-Fi networks, wireless hotspots), and service-oriented information systems;
- **natural environment**, the use of technology to increase sustainability and to better manage natural resources;
- **people and communities**, whose quality of life, and levels of information, education, and participation may be affected by ICT;
- **policy context**, where governmental actors and external pressures, e.g., policy agendas and politics, may influence the outcomes of IT projects;
- **governance**, which, with the use of ICT, should be accountable, responsive, and transparent, allowing collaboration, data exchange, service integration, and communication.

Among these factors, (smart) governance can be considered as the core and most important challenge of smart cities initiatives. Governance refers to a new form of governing where a network of public and private actors share the responsibility of defining policies, and regulating and providing public services. Examples of these actors –commonly referred as stakeholders– are government agencies, citizens, markets, and organizations.

In the late 2013, the concept of e-governance gained momentum in Uzbekistan, as a response to the citizens' demand for transparency and good management in public administration, which had to face its crisis of legitimacy. Actors within the institutions realized the need for openness and considering new forms of governing and management.

In 2015, in its “Governance and Development, the Ministry for development of information technologies and communications of the Republic of Uzbekistan pioneered the introduction of governance in the field of economic development, by identifying four areas of governance, namely public sector management, accountability, the legal framework for development, and information and transparency.

In this context, with the consolidation of the Web and social media, the goal of efficient implementations of governance models has brought the adoption of ICT, originating e-government frameworks. E-government has been defined as the application of ICT in the interactions of government with citizens and businesses, delivery of services, exchange of information, communication, and transactions, and in internal government operations, aiming to simplify and improve democratic, business and governmental aspects of governance. The number of e-governance solutions has increased remarkably in recent years, providing the involved stakeholders with a wide array of e-services between, which have been classified as government-to-citizens (G2C), government-to-businesses (G2B), and government-to-government (G2G) services. E-government approaches, however, have been increasingly examined and questioned. Many critics have claimed that the development of electronic public services has been mostly guided by supply side

factors, and that technological possibilities rather than user needs have determined too often the design of online public services. In reaction to this, the need for user centered e-governance services becomes more prominent.

It is in this scenario where recommender systems have new, challenging opportunities. The overwhelming load of information and services in e-governance applications allows for the development and use of particular recommendation solutions for different stakeholders and tasks. In the literature, there are few studies on recommender systems for the e-governance domain, and the majority of them proposes very simple recommendation approaches mainly focused on two particular application cases, namely providing the citizens with personalized government e-notifications and e-services, and assisting the finding of business partners in government e-services. In this paper, we shall review the state of the art, and shall extend the scope of recommender systems in e-governance, proposing potential application cases for G2C, G2B and G2G services. For each case, we shall depict data sources and types of recommendation approaches that could be explored by researchers and practitioners. Before, in the next section, we provide a brief explanation of e-governance, describing its main stakeholders and their interactions.

The public sector, and consequently the e-governance domain, is complex and involves a variety of stakeholders. Some theories have considered main 'groups' of stakeholders, such as government, citizens and businesses, while others have segmented stakeholders in terms of roles.

For instance, identified twelve e-government stakeholder roles: people as service users, people as citizens, businesses, small-to-medium sized enterprises, public administrators, government agencies, non-profit organizations, politicians, e-government managers, design and IT developers, suppliers and partners, and researchers and evaluators.

In this context, an individual may belong to several groups and play multiple roles, she could be a service user, a citizen, and an employee in a business. Simplifying the framework to government, citizens and businesses, three major e-

governance components reflecting the relationships existing among such stakeholders are commonly accepted:

- Government-to-citizens (G2C) e-government, which aims to provide citizens with a variety of online information and e-services in an efficient and cost-effective manner, and to strengthen the relationship between government and citizens using ICT. G2C services allow citizens to access government documents (e.g., legislations and regulations), make transactions (e.g., payment of taxes and city utilities), and perform bureaucratic tasks (e.g., changes of address, and application for facilities and grants). In a two-way communication, G2C services also allow citizens to message directly to public administrators, send remote electronic votes, propose, discuss and vote public initiatives.
- Government-to-businesses (G2B) e-government, which aims to facilitate interaction between the government and corporate bodies and organizations of the private sector with the purpose of providing businesses information and advice on e-business best practices. G2B services allow entrepreneurs to online access information about legislations and regulations, and relevant forms needed to comply with governmental requirements for their business (e.g., corporate tax filing and government procurement).
- Government-to-government (G2G) e-government, which aims to facilitate the online non-commercial interaction between government organizations, departments and authorities with the purpose of reducing costs, e.g. derived from paper clutter, excessive communications, and unnecessary staffing.

The different interests, objectives and benefits of target stakeholders entail dominant characteristics of e-government services. Distinct features thus may contribute to the quality a particular e-service: variety of functionalities, perceived ease of use, aesthetics, customer support, information, communication, delivery, security, reliability, trustworthiness, responsiveness, accessibility, compatibility and personalization.

## **II. ANALYSIS AND ASSESSMENT OF THE CURRENT STATE OF SMART THINGS IN UZBEKISTAN**

### **2.1 Normative legal acts on the development of ICT in Uzbekistan**

Modern Uzbekistan is a part of the world economic community, therefore, the ongoing integration processes on the international market require the country not only to enter the information society at the national, but also at the world level, i.e. entry into the Global Information Society (GIS). In fact, the global information society is a collection of information societies of a number of countries (the United States, the EU, etc.) that are part of the world economy. These societies can be formed by industrial, logistical, investment, scientific and technical and other organizations.

The organization of interaction between the participants of the global information and economic community is regulated by the “Charter of the Global Information Society”, as well as the Geneva Declaration of Principles and the “Plan of Action” to support the information society. The “Digital Solidarity Fund”, established within the framework of the United Nations, for financing international cooperation programs in the field of ICT emphasizes the importance of addressing the effective functioning of the global information society.

The strategic task of Uzbekistan is to enter the GIS as its full participant. Based on this task, a national ICT development program for short and medium-term prospects is being formed and being implemented. Currently, programs are being implemented aimed at developing infrastructure, introducing ICT in the work of government and local authorities, developing the national segment of the Internet. These program documents were adopted during 2002 -2017 and calculated until 2018.

The formation and development of the information society presupposes the creation of “e-government” - the main way of implementing information aspects of smart city, state activity, based on the use of ICT.

In recent years, many countries have begun to implement and use the achievements of information and communication technologies to maintain their numerous functions of modernizing the activities of existing institutions of power in order to:

- Improving the quality and accessibility provided to citizens and public service organizations, simplifying the procedure and reducing the time for their provision, reducing administrative costs from citizens and organizations associated with their receipt, introducing uniform standards of citizen service;
- Increase the transparency of information on the activities of public authorities, expand access to it and the direct participation of citizens, organizations and institutions of civil society in the procedures for the formation and examination of decisions taken at all levels of government;
- Improving the quality of administrative and managerial processes, improving the system of information and analytical support for decisions at all levels of government, ensuring promptness and completeness of control over the performance of public authorities, ensuring the required level of information security.

The formation of “e-government” is influenced by the following factors:

- The potential or ability of the public sector to deploy ICT infrastructure that improves the quality of services to the public and business, i.e. the country's readiness to create electronic institutions of power;
- Readiness, which means that there is action on the part of institutions of power aimed at providing information and knowledge to increase the armament (or degree of satisfaction) of the population.

Today, many developed and developing countries successfully apply various rating methodologies for assessing the level of ICT development in the public administration system, with special emphasis on online public services provided to citizens and business entities through the portals of the Single Window Centers. These services mainly include themselves interactive, transactional properties and electronic participation, which ensure citizens' communication with the government.

For effective integration into the global information society, it is necessary to move as quickly as possible from the stage of development related to the accumulation of information, to the next stage - the formation and accumulation of knowledge. Knowledge and technology of information exchange become the driving force behind the development of the economic community.

The essence of the economic transformation associated with the widespread use of ICT is their ability to promote the dissemination and use of knowledge. The Global Charter calls for the use of ICT to create a new economic infrastructure that allows for a higher level of exchange of information conducive to the development of entrepreneurship and the efficiency of national economies. Therefore, ICTs are considered, today not only as a source of increasing export potential due to increased trade in them, but also as one of the most important means of strengthening the competitiveness of industrial sectors and the economy as a whole.

The concept of the “Global Information Society” was first introduced in 1994 in the report of M. Bingaman (European Union) - “the Global Information Society”.

The transition to the information society brings with it a set of fundamentally new interrelated changes in the socio-economic structure of society, conditioned by the development and objective influence of new, more sophisticated and more productive means of production, created on the basis of widespread and widespread use of information technologies in all types and spheres of human activity and digital information processing, as well as new, network production relations formed by man for practical realities and application of these new means of production.

However, until now, despite the wide dissemination of the term “information society”, scientists and specialists have not yet come to a common understanding of its main content. There are a number of definitions that put forward to the fore. or other real features and trends of modern society. The focus of many works is the rapid development of information and communication technologies and their increasing use in all spheres of economic and social life. In general, researchers believe that “information and communication technologies mean the formation of a new era, which in the early stages will create some discomfort, but then it will prove

to be economically very profitable.” This new “techno-economic paradigm” is an “information age”, the development of which coincides with the beginning of the 21st century.

The relevance of Uzbekistan's accession to the global information space is realized, as evidenced by the appearance of a number of official documents development of information and telecommunications infrastructure and high technologies in Uzbekistan. In the development of regulatory policy, the Government of the Republic of Uzbekistan sets itself the task of large-scale introduction and use of information technologies in all spheres of the economy and society, creating favorable conditions for entering the global information society.

Currently, programs are being implemented aimed at developing infrastructure, introducing ICT in the work of government and local authorities, developing the national segment of the Internet. In order to strengthen the institutional framework of the ICT sphere, a number of regulatory and legal acts have been adopted, in particular the Presidential Decree “On the Further Development of Computerization and the Implementation of Information and Communication Technologies” (№ 3080 of May 30, 2002), the Resolution of the President of the Republic of Uzbekistan “On additional measures for the further development of information and communication technologies” (№.RP-117 of July 8, 2005), the Resolution of the President of the Republic of Uzbekistan “On measures for the further introduction and development of modern information technologies on-communication technologies” (№RP-1730 from March 21, 2012) and others. To implement these normative legal documents and implement regulatory policies, institutions have been set up that are responsible for the development of various aspects of the ICT sphere. The main body in the field of the development of computerization and information and communication technologies is the coordinating Ministry for development of information technologies and communications of the Republic of Uzbekistan. Special tasks are assigned to the state committee for communications, informatization and telecommunication Technologies as the main coordinating body for the implementation of programs for



the further introduction and development of information and communication technologies (the formation of the system of “e-government”, the creation of a national system integrating inter-departmental and departmental systems of information systems, etc.).

Thus, it is necessary to develop programs for the development of the ICT sphere and the institutional environment for Uzbekistan's entry into the global information society. Priority should be given to those segments of the ICT industry, in which domestic companies have competitive advantages in the domestic market, as well as segments of the global ICT market that have the potential for future growth.

**Institutional framework for the development of e-government in the Republic of Uzbekistan.** Over the past 10 years, the Republic of Uzbekistan has made very significant progress in the development of “e-government”. This was due to the timely adoption of laws, which, in turn, created a favorable environment for achieving tangible results in the field of “e-government.” Such achievements are impossible without a firm political will. As was noted by the first President of the Republic of Uzbekistan, I.A. Karimov, “We must realize that without a cardinal, I would say explosive progress along the way of widespread introduction of modern information and communication systems into all spheres of the economy, it is difficult to see the future in our everyday life.”<sup>11</sup>

Creation of information rich resources and provision of practical functioning of the Government portal as a single entry point for the receipt of electronic services (including the creation of a single register of interactive public services), their digitization and posting on the site, adoption of relevant laws and government decisions, improvement of the Government Portal prove Uzbekistan's steady movement towards introduction of elements of “e-government”

Consider the existing regulatory framework in the sphere (Table 1) of “e-government” in the Republic of Uzbekistan.

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<sup>11</sup> I.A. Karimov Our main goal is to follow resolutely the path of large-scale reforms and modernization of the country. // 19.01.2013

**Table 1<sup>12</sup>****Regulatory and legal framework in the field of “e-government” in the Republic of Uzbekistan**

NAME	DATE	GOALS, OBJECTIVES
<b>Laws of the Republic of Uzbekistan</b>		
	From January 13, 1992.	The Law of the Republic of Uzbekistan "On Communications" defines the general legal and economic bases for the organization of the communication system, establishes the rights and duties of enterprises, institutions, organizations, regardless of ownership and citizens, in the possession, use, disposition and management of communication facilities in the creation and operation of communication networks, provision of communication services, as well as measures of responsibility for violation of the rights granted and failure to perform duties. <sup>13</sup>
	From August 20, 1999.	The purpose of this Law is to regulate public relations in the field of creation, functioning and development of telecommunications. <sup>14</sup>
	From December 25, 1998.	The purpose of this Law is to regulate legal relations in the distribution and use of the radio-frequency spectrum. <sup>15</sup>
	From August 31, 2000.	The purpose of this Law is to regulate public relations in the field of creation, functioning and development of postal communication. <sup>16</sup>

<sup>12</sup> Compiled by the author. Source: [www.lex.uz](http://www.lex.uz)

<sup>13</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>14</sup> Law of the Republic of Uzbekistan . Source: [www.lex.uz](http://www.lex.uz)

<sup>15</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>16</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

	From December 12, 2002.	The main objectives of this Law are to ensure observance of the principles and guarantees of freedom of information, to realize the right of everyone to freely search and receive information about the information and information security of the individual, society and the state freely and without interference. <sup>17</sup>
	From December 11, 2003.	The purpose of this Law is to regulate relations in the field of informatization, use of information resources and information systems. <sup>18</sup>
	From December 11, 2003.	The purpose of this Law is to regulate relations in the use of electronic digital signatures. <sup>19</sup>
	From April 29, 2004.	The purpose of this Law is to regulate relations in the field of electronic document management. <sup>20</sup>
	From April 29, 2004.	The purpose of this Law is to regulate relations in the field of electronic commerce. <sup>21</sup>
	From December 16, 2005	The purpose of this Law is to regulate relations in the field of electronic payments. <sup>22</sup>

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<sup>17</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>18</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>19</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>20</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>21</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

<sup>22</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

	From May 5, 2014	The purpose of this Law is to regulate relations in the field of openness of the activities of public authorities and government. <sup>23</sup>
<b>Decrees of the President of the Republic of Uzbekistan</b>		
	3080 From May 30, 2002	The adoption of this decree served as an occasion for the institutionalization of ICT by transforming the Uzbek Post and Telecommunications Agency into the Uzbek Agency for Communication and Informatization, and thereby defining it as the responsible state body in regulating and implementing initiatives and programs in the field of ICT
	4475 From October 16, 2012	Expansion of the provision of remote state interactive services in all spheres. Approval of the composition of working groups for the development of the Concept and the Comprehensive Program for the Implementation of the Electronic Government System with a view to further improving public administration in the field of communications, information and telecommunication technologies.
<b>Resolutions of the President of the Republic of Uzbekistan</b>		
	117 From July 8, 2005	Development of telecommunications infrastructure and adoption of the state program for the use of ICT by state bodies
	1730 From March 21, 2012	Implementation of additional measures for the creation of the National Information System (NIS), which includes 32 state information systems, through the deepening of the integration of existing information systems controlled by the state and other public bodies and individuals, on the basis of a common technical policy.

<sup>23</sup> Law of the Republic of Uzbekistan. Source: [www.lex.uz](http://www.lex.uz)

	1836 From October 23, 2012	Determination of the status, main tasks, functions, rights and organizational bases of the activities of the State Committee for Communications, Informatization and Telecommunication Technologies of the Republic of Uzbekistan
	1989 From June 27, 2013	As part of the implementation of this resolution, the State Committee on Communications, Informatization and Telecommunication Technologies has created new structures - the Electronic Government Development Center and the Information Security Center. They face the most important goals and tasks aimed at accelerating the development of information resources, systems and networks of the country.
	2045, From September 25, 2013	Formation of the National Geographic Information System of the Republic of Uzbekistan as an integral part of the "electronic government" system, providing for the creation of a satellite geodetic network, a unified computerized system of state cadastre and real estate registration, and on this basis providing the necessary information and resource base for the rational use and protection of natural resources, regions of the republic.
<b>Decrees of the Government (Cabinet of Ministers of the Republic of Uzbekistan)</b>		
	259 From December 17, 2007.	Creation and support of the Governmental portal of the Republic of Uzbekistan, which is a system-forming element of the infrastructure of electronic and information interaction of organizations, as well as between legal entities and individuals.
	181 From August 23, 2007	Accounting and registration of state information resources is entrusted to the "Uzinfocom" Center of the State Communications, Informatization and Telecommunication Technologies Committee ". Typical regulations for each direction of public services that provide requirements, including the characteristics of the processes, the form, content and outcome of the provision of public services, are defined.

		A register of basic interactive public services has been created.
	259 From December 17, 2007	Improving the presentation of information resources and the provision of interactive services on the Government portal.
	116 From April 21, 2009	Definition 102 of the type of information to be provided over the Internet by public authorities, grouped into nine thematic domains. The resolution also established the regularity of updating information.
	355 From December 11, 2012	Determination of the status, main tasks, functions, rights and organizational bases of the activities of the State Communications, Informatization and Telecommunication Technologies Committee of the Republic of Uzbekistan and State Inspection on Supervision in the Sphere of Communication, Informatization and Telecommunication Technologies.
	18, From January 25, 2013	Increasing the efficiency of implementing complex programs for the introduction of modern information and telecommunication technologies. The state order for the implementation of projects on the introduction and development of information and communication technologies is a single register of projects for the implementation of interdepartmental integrated information systems of state bodies, the formation of the system of "e-government", national search systems and data centers for storing, processing and managing data banks and providing various interactive services.
	250, From September 16, 2013	Creation of the Center for the Development of the Electronic Government System and the Center for Information Security. The tasks and directions of activity of the Center for Development of the "e-government" system are the development of strategic directions for further development of the "e-government" system, improvement of business processes of state bodies in the provision of public services to the population and business entities, as well as system monitoring of the implementation and development of

		information and communication technologies in the Republic of Uzbekistan. The objectives of the Information Security Center include ensuring the security of information systems and government resources, identifying and analyzing threats to information security, and developing solutions to improve the information security of the "e-government" system.
	268 From October 2, 2013	Amendments to some decisions of the Government of the Republic of Uzbekistan
	355, From December 31, 2013	Creation of conditions for systemic collection and formation of reliable indicators of the development of information and communication technologies in the Republic of Uzbekistan, as well as introduction of a rating system for assessing the effectiveness of the introduction of information and communication technologies in state and economic management bodies and local authorities.
	73 From March 27, 2014	Increase the skills of managers and specialists of state and economic management bodies, state authorities in the field in the field of information and communication technologies, organize systematic work on the continuous improvement of professional skill of employees of state and economic bodies of all levels in accordance with the trends of introduction and development of the "e-government" system.
	102, From April 23, 2014	Ensuring regular study of the quality and reliability of information submitted for assessing the effectiveness of the introduction of information and communication technologies in the activities of state and economic management bodies, state authorities in the field.
	2836, From September 21, 2007	Providing in-depth and comprehensive study of the level of ICT introduction in the sectors and spheres of the economy of the republic, coordination of activities aimed at the formation and implementation of targeted programs for the development of modern means

		of communication, information and communications, developing proposals for further reforming and modernizing postal, telecommunications and publishing and printing effectiveness of the mass media, improvement of forms and methods of ensuring information security.
	3900 From August 29, 2012	The Working Group carries out a critical analysis of the state of development of the sphere of information and telecommunication technologies, data transmission networks and development of proposals for further improving the management and organization of the national communications and information system.



The main documents in the field of “e-government” are the presidential decree of June 27, 2013 “On measures for the further development of the National Information and Communication System of the Republic of Uzbekistan”, the Cabinet of Ministers Resolution of September 16, 2013 “On measures to organize the Center for the Development of the Electronic Government "and the Center for Information Security under the State Committee for Communications, Informatization and Telecommunication Technologies”, Cabinet Decree of December 31 2013 “On measures to implement the system assessment of the state of development in the Republic of information and communication technologies of Uzbekistan.”

The next key step in the process of planning and setting priorities is the bill “On Electronic Government” (Table 1). The working group is working on the document, which has studied in detail the foreign experience of the legal regulation of public relations in the field of “e-government”.

It announced that the draft Law of the Republic of Uzbekistan “On Electronic Government” had been prepared and submitted to ministries and departments for consideration. At the moment, the proposals have been discussed and the relevant amendments are being made to the draft law.

It should be noted that the creation of a national strategy for “e-government” of a new generation would involve both central authorities’ state authorities (republican level) and local authorities. This is a very important step forward, which emphasizes the deeper penetration of new interactive digital technologies into public administration.

Another positive aspect is the need to study and use the best practices of other countries in the issues of “e-government” (in studies conducted by working groups). It is important that measures are taken to avoid mistakes that often occur in this area and to apply positive experience on the example of other countries.

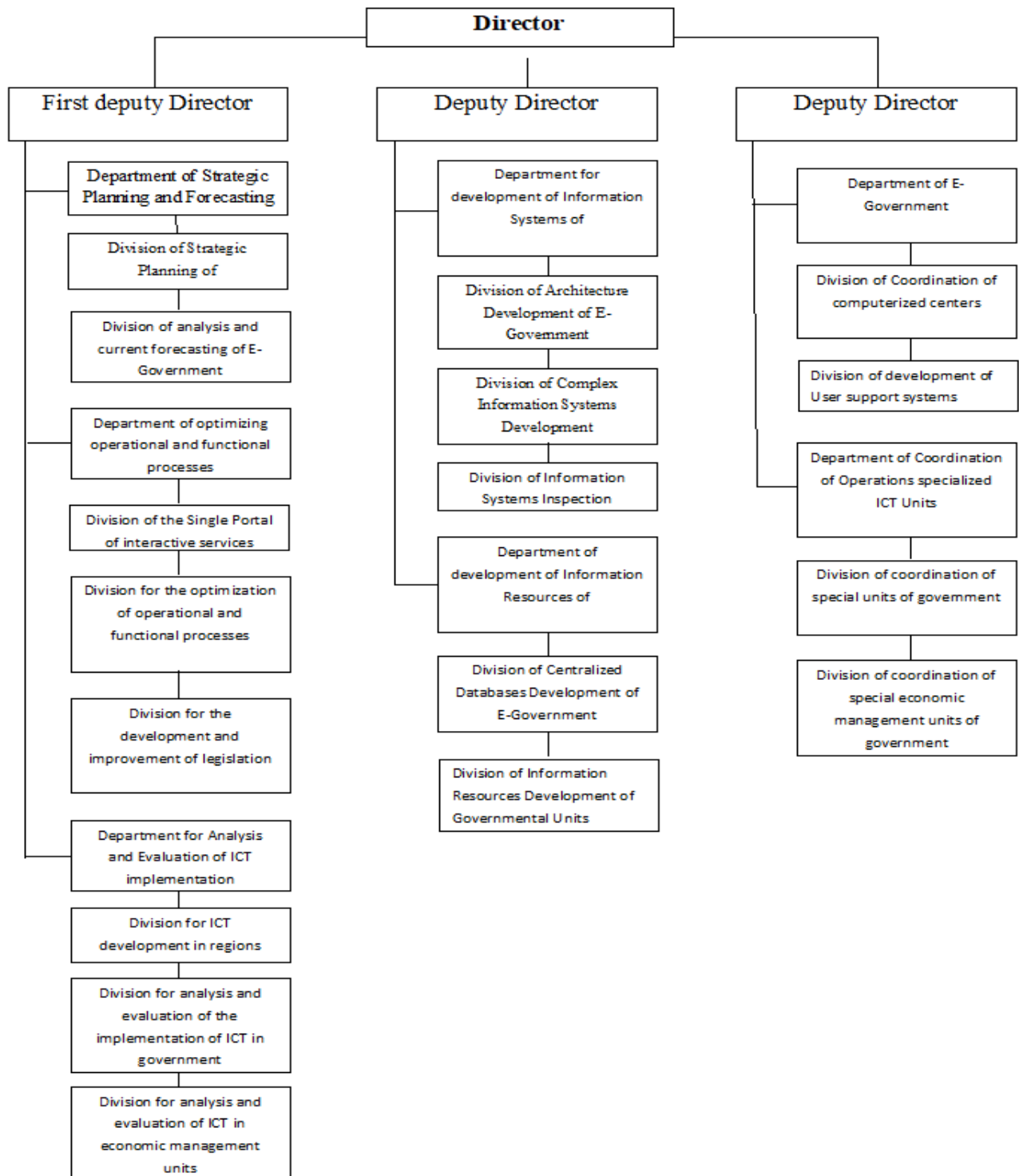
The laws and regulations adopted over the past two years represent a breakthrough in the regulatory environment necessary to significantly accelerate the development of e-government in Uzbekistan. These fundamental changes are

characterized by a departure from a gradual, evolutionary approach for implementing a more significant advance through the implementation in 2017-2021 of qualitatively new solutions for the development of e-government in the Republic of Uzbekistan. This is supported by the rapid pace of technological change, growing personal experience and the existence of political will.

In general, many laws and changes were adopted in recent years in the field of e-government in Uzbekistan. The purpose of these events was to accelerate progress in this area. Laws intend to modernize, strengthen and define priorities for the provision of services as the main goal of the development of e-government. Modernization of the legal environment should be continued and consolidated through the development and adoption of an all-embracing interagency interoperability strategy to create an effective mechanism for the integration of various information systems.

The state is aware of the need to bring the regulatory framework in line with the current needs of electronic document management and electronic public services. The implementation of the project e-government is impossible without the development of a regulatory and legal framework governing the construction of e-government.

## Organizational structure of «Electronic Government» system development Center



**Figure 7<sup>24</sup>.** Organizational structure of «Electronic Government» system development Center

<sup>24</sup> Source: [https://egovernment.uz/ru/about\\_center/activity/](https://egovernment.uz/ru/about_center/activity/)

## **2.2 The results that achieved by e-government**

“Electronic Government” system development center was established under the State Committee for communication, informatization and telecommunication technologies of the Republic of Uzbekistan on the basis of the government decision (RCM No. 250 dated September 16, 2013), whose main tasks are:

- Developing strategic directions for further development and improvement of "Electronic government" system on the basis of the analysis and research of global trends and the experience of foreign countries;
- Providing a single technological approach on formation of Electronic government system, which provides a consistent mechanism design, development and integration of information systems, information resources and databases used in government organization, the organization of normative-methodical support of projects of "Electronic government";
- Arranging of a systemic reorganization of functional and operational processes of government authorities' activity, preparation of proposals on optimization, improvement and implementation of innovative mechanisms for managing business processes associated with the provision of public services;
- Conducting target analysis and preparation of proposals on improvement of the existing legal framework for the effective implementation of the "Electronic government" system;
- Conducting systematic monitoring and evaluation of the implementation and development of information and communication technologies, including the study on the effectiveness of implementation of information systems and resources, conducting system of rating on the implementation effectiveness of information and communication technologies in the activities of state bodies within "e-Government" system
- Developing a method for determining the key performance indicators of the effectiveness of the provision and use of online government services,

the target indicators and implementation indicators of projects within the “Electronic government” system.

The ultimate goal of implementing E-government in Uzbekistan is the creation of a perfect e-governance, which is able significantly to improve the possibility of providing interactive services; accountability and transparency of the government authorities. The availability and individualized services; informing and effective participation of citizen in the political processes; the free information exchange; optimization of public services to individuals and businesses; support and empowerment of self-service of citizen; increase the participation of all voters in the election processes of administration and management of the country and others.

Structure of the «Electronic Government» system development Center consists of seven departments, each of which has its own tasks and consists of several divisions.

- The Department for Strategic Planning and Forecasting deals with formation of plans for implementation and further development of the "e-Government" and determination of the key directions of system development, in line with international trends as well as the preparation of special studies, collection and analysis of facts that affect the effective implementation of the system;
- The Department for the optimization of operational and functional processes involved in an analysis of existing processes and the development of proposals for optimization of functional and operational processes of the activities of the state and economic management, preparation of proposals for improving the delivery of public services to citizens and businesses within the implementation of "e-Government" system as well as the development of the methodology for determining the key performance indicators for provision and use of online services;
- The main objectives of the Department for analysis and assessment of the implementation of ICT include: analysis and evaluation of the implementation of ICT in public and economic administration, local

authorities, as well as monitoring the state of ICT development in regions of the Republic of Uzbekistan;

- The Department for the development of information systems is responsible for the development of “e-Government” architecture and complex of information systems as well as the expertise of information systems;
- The Department for the development of information resources of “e-Government” system is engaged in the development of centralized databases of “e-Government”, departmental information resources, as well as the single interactive state services portal;
- The Department for the development of the "e-Government" system in the regions is involved in coordinating the Centers of computerization and developing the Customer support centers in regions;
- Along with other departments, there is the Department for the coordination of specialized structural units, which is responsible for coordinating the activities of the specialized units of government agencies and business management, as well as local authorities.

In addition to the above-mentioned departments, the structure of the Center includes administrative staff in form of Financial, International and other departments.

## **Results of activity of «Electronic Government» system development Center.**

The impact of information technology on the interconnectedness of people, on improving the effectiveness of public administration and on empowering citizens removes any doubts about the importance of ensuring the universal availability of these technologies. With a competent approach, e-government can become a locomotive for the development of society, making the government more efficient, accountable and transparent. This transformation requires changes not only in the "external" part of the service provision sector for the population, but also in the integration and reengineering of intra-departmental and interdepartmental business processes in the public sector.

**Legislation in the field of e-government.** Over the past 10 years, the Government of Uzbekistan has carried out numerous reforms on the phased introduction of ICT in all areas and has made significant progress in advancing information technologies for the development and implementation of the concept of e-government. A legal framework has been created and is constantly improving, opening up opportunities for the development of ICT. National programs have been developed and are being implemented. The total bandwidth of access channels from Uzbekistan to the external Internet backbones in the last decade has increased more than 500 times, and the number of licensed Internet providers has increased from 135 in 2002 to 626 in 2016. The number of Internet users in the country has reached 15.5 million. In 2005 was created and since then used actively the national electronic digital signature infrastructure (EDS).

In our country, e-government implementation began in 2004, when the concept of e-government development in Uzbekistan was adopted.

The development of the sphere of communication, information and telecommunication technologies as an important factor in improving the well-being of the people and economic growth of the country is one of the main priorities of the state policy of Uzbekistan. This is confirmed by the presidential decree of June 27, 2013, which approved the Comprehensive Development Program of the National

Information and Communication System of the Republic of Uzbekistan for 2013-2020.

The main objectives of the program are the further development and widespread introduction of modern ICT in all sectors of the economy and spheres of life, ensuring the accelerated development of information resources, systems and networks, as well as expanding the range and improving the interactive public services provided to business entities and the population.

This program is also known as a master plan for the development of e-government. This decree also formed the republican commission for the coordination and implementation of this program; the commission includes the heads of a number of key ministries and departments, as well as the prime minister (chairman of the commission). The electronic Government development center and the Information Security center have been created.

The Republican Commission was established to coordinate the activities of the state and economic management bodies, monitor and make decisions on further improving the provision of interactive public services, optimize the functional and operational processes and procedures of state bodies. The purpose of the program is to further develop and widely implement modern ICT in all sectors of the economy and areas of life of the country, to ensure the accelerated development of information resources, systems and networks, and to stimulate the expansion of the range and improvement of interactive public services to business entities and the population.

One of the objectives of the Program was the creation of the Electronic Government Development Center (Cabinet of Ministers Resolution No. 250 of September 16, 2013), the main tasks of which are:

- Development of strategic directions for the further development and improvement of the "Electronic Government" system, including on the basis of analysis and research of world trends and experience of foreign countries.
- Ensuring a unified technological approach in the formation of the e-government system, which provides for an agreed mechanism for the design,



development and integration of information systems, information resources and databases used in government agencies, and the organization of regulatory and methodological support for the implementation of the projects of the Electronic Government system.

- Organization of systemic reorganization of functional and operational processes of government bodies, preparation of proposals for optimization, improvement and implementation of innovative business process management mechanisms related to the provision of public services.
- Conducting system monitoring, assessing the state of implementation and development of information and communication technologies, including studying the effectiveness of implementing information systems and resources, maintaining a rating system for assessing the effectiveness of the implementation of information and communication technologies in the activities of state bodies within the Electronic Government system.

The next step in further improving the system of public administration, as well as the e-government system, is the formation in 2015 by a decree of the President of the Ministry for the Development of Information Technologies and Communications of the Republic of Uzbekistan (UP-4702 of February 4, 2015).

The second part of the Integrated Program for the Development of the National Information and Communication System determines such tasks as ensuring and improving the communication of citizens with state bodies in electronic form, the introduction of the principles of a "single window", and the creation of information systems and e-government databases.

To date, six integrated information systems (IIS) have been created and implemented:

- Clearing system for calculating the payment of retail payments in real time, taking into account further integration with the billing systems of service providers.

- IIS "Xarid" for the provision of interactive services in the field of public procurement.
- IIS "Soliq" for providing interactive services in the field of taxation.
- IIS "Litsenziya" for the provision of interactive services in the field of licensing and licensing procedures.
- IIS "Bojxona" for the provision of interactive services for customs clearance of goods.
- IIS "Byudjet" to ensure the collection, processing, systematization and storage of information on planning, progress in the execution of the state budget.

In the stage of development and implementation are:

- IIS "Nafaqa" for provision of interactive services in the sphere of pension provision.
- IIS "Sog'liqni Saqlash" to provide interactive services in the field of health care and further development of the National Integrated Health Information System.
- IIS "Ta'lim" for providing interactive services in the field of education.
- IIS "Kommunal" for the provision of interactive services in the field of municipal services.
- IIS "Adliya-2" for collection, processing, systematization and storage of information on the activities of courts, their decisions, enforcement of court decisions, as well as information on the activities of the notary.
- IIS "Davlat Boshqaruvi" to provide consolidated statistical information of state bodies.

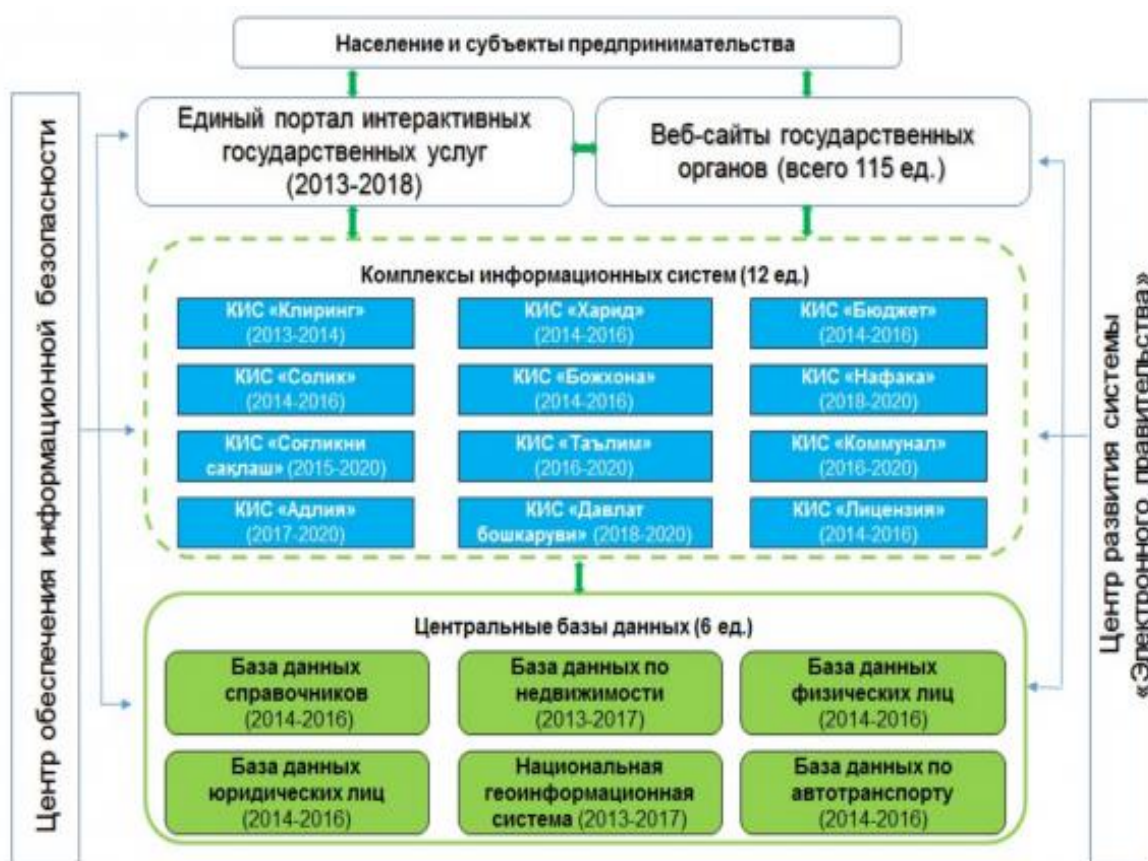
The commissioning of these systems will create favorable conditions for small businesses and private entrepreneurship in the system of state and corporate purchases, develop competition, effectively use financial means by optimizing prices for goods (work, services), and ensure transparency in the implementation of

state

and

corporate

orders.



**Figure 8<sup>25</sup>.** The scheme of organization of the system "Electronic government"

**Electronic digital signature.** An important role in the interaction of government agencies with users in the electronic government is played by electronic documents which information recorded in electronic form, confirmed by an electronic digital signature and having other requisites for an electronic document that allow it to be identified. The main tool for making electronic documents legal is EDS.

EDS is designed to identify the person who signed the electronic document, and is analogous to the handwritten signature in cases provided for by law. Electronic signature is used in the performance of civil law transactions, the provision of public services, the performance of public functions, while performing other legally significant actions in electronic form.

<sup>25</sup> Source: [https://egovernment.uz/ru/about\\_egov/state\\_administration/](https://egovernment.uz/ru/about_egov/state_administration/)

Resolution of the Cabinet of Ministers No. 190 of 15.07.2015 establishes the procedure according to which the issuance of an EDS certificate providing free access to all types of services rendered by state and economic management bodies, state authorities in the field and commercial banks is performed by the EDS key registration center - Scientific and information center of new technologies at the State Tax Committee of the Republic of Uzbekistan

In order to provide information and technological interaction between the IP of state bodies and commercial banks used for the provision of services, starting from January 1, 2016, a unified information system for user identification using EDS was launched, the use of which for citizens is free of charge.



**Figure 9<sup>26</sup>.** The order of issuing EDS

**Portal of municipal services and housing stock.** One of the socially oriented projects in the field of information technologies was the portal of the municipal economy and housing fund E- Kommunal.uz, which has been developed since 2012. The portal was created with the aim of facilitating the exchange of information between the population, controlling bodies and homeowners' associations, as well as public utilities. The resource contains detailed information on housing and communal services, including legislation, tariffs, necessary addresses and contact information.

<sup>26</sup> Source: my.gov.uz

Over the past four years, new opportunities, new requirements for the presentation of information services and various services, in connection with which the portal e-kommunal.uz redesigned and updated in 2017.

**Virtual Reception of the President of the Republic of Uzbekistan.** One of the elements of e-government is also the virtual reception hall of the President of the Republic of Uzbekistan, established on September 24, 2016 in the network.

This virtual reception is organized in order to radically improve the work on economic, social, financial and legal analysis, as well as to resolve issues submitted by individuals and legal entities before the Prime Minister, now to the President of the Republic of Uzbekistan, since after the election of the President of the Republic of Uzbekistan on December 4, 2016 and the victory of the incumbent Prime Minister PM.gov.uz was transformed into the Virtual Reception of the President of the Republic of Uzbekistan (“PM” - “Prezidentga murojaat”, “Appeal to the President”).

Appeals through the site have become the most popular way of referring citizens to state bodies. 957 thousand applications were submitted through the site, 302.2 thousand - by phone and 310.9 thousand - through the foster-office of the Liberal Democratic Party of Uzbekistan (UzLiDeP), from which the elected head of the state was nominated for presidency.

Very important is the fact that the creation of a virtual reception and e-government as a whole contributes to the expansion of gender equality in the receipt of services, and also enables people with disabilities to verbally communicate through the call-center.

### III. THE WAY OF DEVELOPMENT OF “SMART CITY” IN UZBEKISTAN

#### 3.1 E-government application cases for developing “smart city”

In this section, we propose several application cases where recommendation approaches could be exploited to enhance and improve e-governance services. For each case, we depict main recommendation goals, possible item profile data sources and representations, and potential recommendation strategies.

**Recommender systems for G2C e-services government-to-citizen** (electronic) services can be categorized in terms of the degree or level of interaction between the government and the citizens, distinguishing among information, consultation, participation and co-design. At the e-information level, government websites provide information on policies and programs, laws and regulations, budgets, and other issues of public interest. The government also offers software tools –such as email subscription lists, online newsgroups, and web forums– for the dissemination, and timely access and use of public information and services. Recommender systems may assist the accomplishment of these communication tasks in a personalized fashion, by actively informing or helping citizens to locate relevant government decisions and actions, and administrative information and services, which match their interests and needs, thus decreasing their time consumed and increasing their satisfaction. At the e-consultation level, governments offer online consultation mechanisms and tools, which present citizens with choices about public policy topics, allowing for the deliberation in real time, as well as the access to archived audios and videos of public meetings. With them, citizens are encouraged to contribute to the government consultations. In this context, recommender systems may allow citizens to be informed about discussions and others’ opinions on consulted issues that could affect their lives or could be related with their profiles, in terms of their age, gender, marital and parental status, home location, and professional occupation. Recommender systems thus could help government to obtain more citizens’ votes, and consequently improve its citizen-

centered decision- and policy-making. At the e-participation level, local governments intend to incorporate citizens into decision-making processes, in most cases by means of participatory budgeting. For such purpose, they provide online participation platforms where citizens can propose, discuss, give feedback, and vote for initiatives aimed to solve or improve a wide range of situations and problems in different aspects of a city, such as health and social care, culture and education, energy and environment, and urban mobility and transport. For a particular citizen, the number of initiatives and discussions in an e-participation platform may be overwhelming, and recommender systems could help filtering and ranking those that are more relevant for a particular citizen based on previous explicit interests, initiatives and comments, and implicitly analyzed behavior with others' proposals and discussions. In this way, recommender systems not only may promote the citizens' participation, but also could increase their engagement. Based on these levels and issues, we identify the following cases where recommender systems could improve G2C e-services:

- Case 1: providing the citizens with personalized government e-notifications and e-services. In this case, both content-based and collaborative filtering strategies could be applied, by considering the profiles of both the target citizen and liked-minded citizens. Besides, we believe that the provision of context-aware e-service recommendations has a potential interest in certain situations where, among other aspects, periods of time (e.g., a particular tax collection campaign), locations (e.g., the target citizen's neighborhood), and personal events (e.g., the pending birth of a citizen's child) should be taken into account.

- Case 2: keeping the government informed about the citizens' problems, concerns and opinions expressed in e-consultation and e-participation platforms, and external social media, such as online social networks and microblogging systems. Recommender systems thus may act as useful tools of anticipatory policymaking, allowing the government to anticipate to future problems. In this case, natural language processing and opinion mining techniques should be applied to the

contents generated by citizens for providing the responsible administrative departments and managers with the most relevant issues, according to identified domains and topics of interest. Content-based filtering thus may be the most appropriate recommendation strategy to use.

- Case 3: assisting the citizens in finding relevant proposals, discussions, individuals and associations in e-participation platforms, according to personal interests explicitly declared through votes, or implicitly expressed by means of online comments and social links. Hence, in addition to collaborative and hybrid filtering approaches, social-based recommender systems could be used to exploit the social network structure of the platforms.

**Recommender systems for G2B services.** Government-to-business e-services allow companies and government agencies to exchange information and conduct businesses with each other more efficiently than they usually do off the web. For instance, government websites provide companies with single places to find and make use of multiple services, such as updating corporate information, locating applications and forms, sending payments, and requesting answers to particular questions, to name a few. In this context, each company can create and maintain an online profile with heterogeneous information such as its location, business activities and products, resources, and past and on-going projects. Based on such profile, a recommender system may suggest not only government e-services relevant for the company, but also (information about) related government laws, regulations and procedures, which usually are difficult to find and understand for company executives and managers. This would increase the transparency, openness, and efficiency of the legal and administrative processes between companies and government agencies. Some government web portals also offer e-procurement services, with which companies can learn about (purchasing) needs of the government agencies, and agencies can ask the companies for proposal responses. A recommender system could enhance such e-services by directly providing a list of companies that may be interested in working on particular needs of certain



government agency. Conversely, a recommender system may provide a company with a list of existing government agency needs that are related to its business activities. In the latter case, the system could also recommend business partners with which address particular government needs, e.g., by collaborating in the context of a public funded project. This could be done at local, regional or national level, increasing the range of companies working with/for the government. Moreover, government web platforms may shape virtual workspaces where companies and government agencies can coordinate the work in contracted projects, by sharing a common site to conduct online meetings, review plans, and manage processes. Recommender systems could enhance these services by suggesting (external) resources, events, and news of interest for the projects. Considering these applications, we propose the following application cases where recommender systems could improve G2B e-services:

- Case 4: assisting the finding of business partners in government e-services. In this case, companies and business products would be categorized according to certain taxonomy or ontology, and thus content and semantic-based recommendation approaches would be the most straightforward to apply. Nonetheless, if ratings or even trust information is available, collaborative filtering and trust-based recommendations may be convenient to enhance the former approaches. The target of the recommendations could be either the public administration –which may need industry partners for the realization of its initiatives and actions, at multiple dimensions, e.g., technological, commercial, financial, social, and political– or the companies –, which may need the collaboration of other partners for particular tasks of their businesses and projects (oriented to the citizens or the government).

- Case 5: informing the companies about events that involve or are related with their businesses and the government agencies, such as public calls, initiatives and projects, grants and subventions, and exhibitions, fairs, seminars and conferences. In this context, we believe that potential recommendation approaches

may go beyond these explicit events, suggesting business opportunities according to implicit government and citizens' needs, especially at municipal level. In both cases, mining data published in government web portals, and citizen generated contents in social media, would be a mandatory initial task for any recommender system in this context.

- Case 6: providing the companies with a personalized, online support in legal and administrative consultancy on government laws, regulations and procedures, according to their business profiles, and at either local, regional, national or international level. Hence, a recommender system may suggest particular electronic administrative resources and services, such as online application forms of food service establishment permit, liquor license and other local permits for a restaurant.

**Recommender systems for G2G services.** Government-to-government e-services aim to support better coordination and cooperation between government agencies, departments and employees. A common situation is that each governmental organization has developed its own information systems in isolation. Effective and efficient (electronic) communication, however, is needed to get commitment and to support decision-making, which is complicated due to the large number of involved stakeholders, such as politicians, information managers, and administrative departments, and ICT teams. Recommender systems could be the basis to further exploit and increase the government electronic interoperability, by retrieving information resources relevant to particular administrative and legal processes within and between government stakeholders. They, for instance, could be incorporated into e-services for cross-departmental information communication and management. In addition to (certain) lack of interoperability, governmental organizations are usually characterized by rigid and cryptic, vertical hierarchies, which has been shown to generate citizens' disaffection. Initiatives such as "the New Public Management", "Open Government", and "Smart Government" aim to provide more transparency and flexibility, and thus restore the confidence on the public sector. In this context, recommender systems accounting for the current needs

of government and its public officials, may make the management of human resources more effective and efficient. For instance, in a horizontal perspective, they could recommend the best government employees for certain tasks and positions, and suggest relevant job and academic opportunities for each employee in government projects and learning programs. According to these issues, we propose the following application cases where recommender systems may improve G2G-services.

- Case 7: enhancing the government electronic interoperability. Recommender systems could assist the interchange of data, case files, and other documents between government agents, by suggesting those that might be relevant on certain administrative/legal process. To provide this functionality, database integration among government agencies is needed, which unfortunately is still a pending problem in general, even at local level. Addressed such issue, for this case, in addition to content-based recommendation approaches, we envision cross-domain recommender systems as effective solutions to aggregate and transfer knowledge towards different agents.

- Case 8: improving the e-management of human resources in government. As e-services for government agencies, recommender systems may suggest public officials who could perform particular tasks or take certain government positions. For such purpose, each government employee should have associated an academic and professional profile, as well as information about work availability and restrictions. Taking such type of user profiles into account, we believe that constraint-based recommender systems may be an effective approach to improve human resource management processes within and between government agencies.

- Case 9: providing government employees with personalized recommendations of professional events. As e-services for government officials, recommender systems could generate personalized suggestions of available job positions, new promotion examinations, and seminars and courses offered by government agencies. The employees' profiles may be the same as those presented

in Case 8, for the e-management of human resources in government. In fact, these two recommendation applications can be considered as government-to-employee (G2E) e-services, which in the literature have already been considered as a particular type of G2G e-services.

### **3.2 Problems of interactive government services and its decisions**

Considered, the issues related to the provision of state interactive (electronic) services within the framework of “e-government”. An approach based on the use of inherited information systems is proposed. Formulated, the problems of the regulatory framework that prevent to the construction of systems.

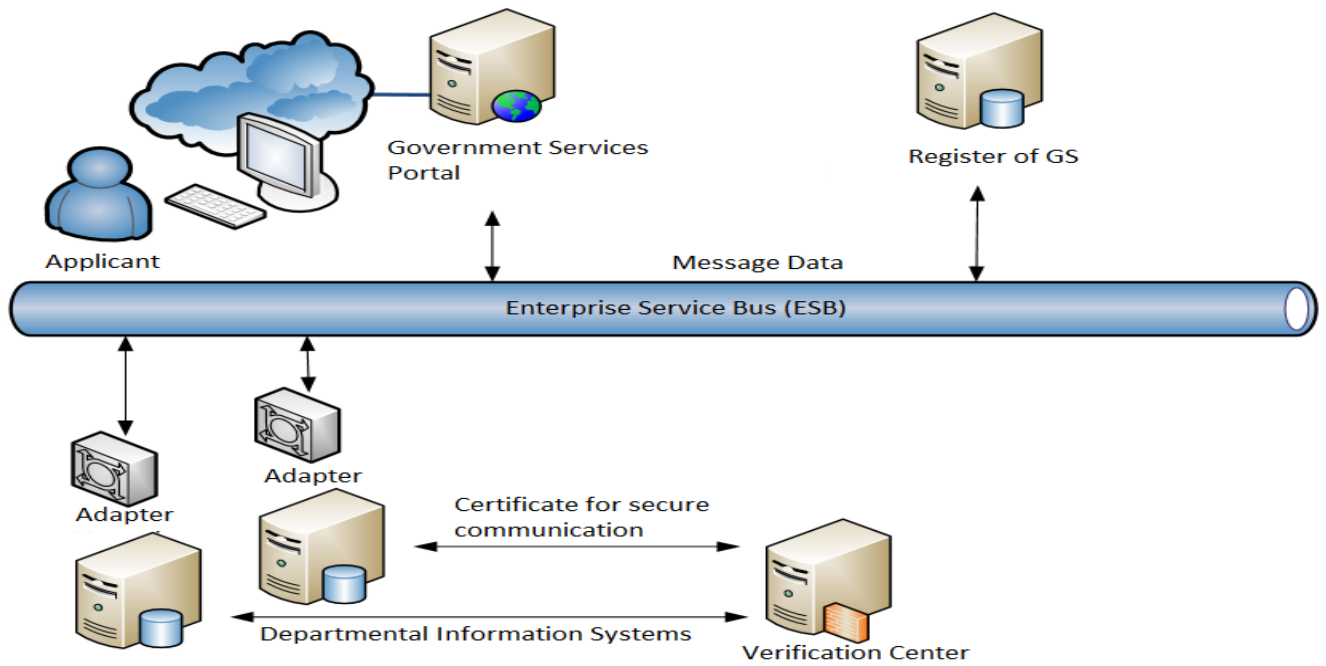
The terms “e-government” and “provision of services in electronic form” are increasingly referred to in the speeches of state officials, are heard in the press. The declared goal of electronic (interactive, smart services) provision of public services is "to improve the quality and accessibility of public services for citizens and organizations, to simplify the procedure and reduce the time of their provision, to reduce administrative costs for citizens and organizations associated with their receipt, the introduction of uniform standards of service citizens ".

Let's try to figure out what can really be done in this area and how it can work. Let us also consider what problems prevent us from achieving the desired goal. To begin with, consider the state of informatization in various state and municipal authorities. There is so-called “scrappy automation”, when individual processes are automated in individual sections, at the same time there is no inter-system integration not only between different bodies, but also within them. As a rule, in the discussions on e-government, the issues of data transport and the format of their use are discussed, while the theme of automation of the proper managerial processes does not sound. We will focus on discussing the actual organization of the provision of interactive government services (IGS) in electronic form as a process. The abandonment of existing systems and the construction of a certain unified state information system from scratch, which will perform all the processes related to the

provision of (IGS), can be considered a pure utopia. The only viable option is to build a system for providing state services on the basis of integration of existing systems.

**System architecture.** The system for obtaining electronic public services should be a distributed structure that allows applicants (recipients of services) to access them via the Internet. The point of entry for services should be the portals of public or municipal authorities (hereinafter-the Interactive Government Services Portal (IGSP)). Interaction between the portals of GS of different levels can be adjusted, due to the possibility of users switching from portals of regional portals to higher and lower portals, as well as to departmental portals and back via hyperlinks. Through the IGSP, various forms, forms of documents, included in the information for the provision of IGS, are filled out and the process of providing the service is launched. Also through the portal, the applicant can receive all information about the state of the service (the stage of its passage through the system of receiving electronic public services).

The most interesting from the point of view of their automation are services that, when implemented, require the interaction of two or more agencies. The architecture of the system providing the provision of public services in the interaction of several departments will have the form shown in the figure.



**Figure 10<sup>27</sup>.** Architecture of the public service delivery system

The architecture is based on the subsystem of interdepartmental interaction - an integration platform based on a service-oriented architecture and enterprise service bus (ESB)

The purpose of the subsystem is to ensure:

- Informational interaction of departmental systems;
- Centralized maintenance of information on the integration landscape (member systems, description of the structure and formats of data involved in the exchange);
- Administration of information exchange processes between information systems.

The integration platform should have open interfaces for possible further development and integration with other systems.

Existing departmental systems are equipped with additional, specially designed adapters to connect to the interaction system. Adapters are able to work

<sup>27</sup> Source: egov.uz

with messages from / to the service bus, which, with this approach, is a transport for guaranteed transmission of events / messages of a certain format between loosely coupled systems.

If the departmental system has some API that allows access to its functions “from the outside,” the adapter will use these calls. If this is not possible, the adapter will be forced to directly access the data of such a system. In this case, the adapter can be quite complicated. The development of adapters for various departmental systems will be the most time-consuming task when incorporating existing information systems into an integrated system for the provision of electronic public services. An essential advantage of the described approach is the possibility of connecting new systems gradually.

**Register of IGS.** The system should be able to compile chains of management processes for the provision of public services (workflow). Managing the chains of management processes is entrusted to a separate information subsystem - the register of IGS, which also connects to the corporate service bus. The main functions of the Register of IGS are:

- The alignment of process chains during the execution of GS, the dispatching of events / messages between application software systems, including taking into account logical conditions;
- Collection and storage of information on the progress of rendering all GS that have passed through the system;
- Tracking the regulations of the GS and the performance discipline of all participants in the process of providing it.

Functions for maintaining the register should be assigned to only one participant in the information exchange (the operator of the register of IGS).

Let's explain by an example, what exactly is the function of dispatching events / messages during the execution of GS. Consider a hypothetical service associated with owning real estate. This means that the departmental system that provides the service sends a request with the applicant's data (the message). The Register of IGS

send this message to the departmental system of the Bureau of Technical Inventory, which is looking for property belonging to the applicant. The search result in the form of a message is sent by the IGS register to the source system, which continues the prescribed chain. (Here it is workflow). It gives us to change the business process (the regulation of the provision of public services) in future: let it be required to obtain information not only on the applicant himself, but also on his spouse.

Now the register of the IGS should apply to the departmental registry office (find a spouse), then send the data both of the applicant himself and the found spouse to the Bureau of Technical Inventory, and after receiving the response, return the results to the first system.

After in the same business process, you can integrate or, conversely, replace / exclude any system. The Register of IGS must be reconfigured to manage the new chain.

Another feature of the IGS register should be the ability to refine the branching situations of the process chain depending on the fulfillment of the condition (for example, the military commissariat system receives a request only if the male applicant is male). Branching can also be performed depending on the result of the previous process. A special case is the interruption of the performance of IGS, if, for example, the applicant has not passed the audit at any stage.

Moreover, finally, it is possible that when the service is transferred to manual mode, this will be in non-standard situations, when decisions should be made by a person. The Register of IGS must provide both the translation of the service into manual mode and its return to the automated processing flow.

Using the system of providing electronic public services. Let us consider how the above scheme will perform its task.

To perform the service, the applicant must fill out the registration form on the IGSP and provide (fill in) the documents necessary for the service. The procedure for providing electronic copies of documents and their legitimacy must be fixed by any normative documents. At the first stage, the process of providing the applicant with documents or copies thereof can be organized on the basis of personal presence.



The Regulation on the execution of IGS is registered in the chains of management processes, which are monitored by the register of IGS.

The information necessary to start the process is forwarded from the portal to the relevant departmental system (where exactly - the decision is made by the register of IGS), and the process of providing the service begins.

At the completion of each link of the process, the necessary event / message is sent by the departmental system (its adapter) to the register of IGS, which decides what to do next. Thus, the current state of the service and its entire history are always known to the registry. With the help of the portal, the applicant is always able to see the status of his application and trace the process of obtaining the service. Also, the applicant has the right, if necessary, to inform the service provider of any errors or omissions noticed during its execution.

All information exchange occurs through a subsystem of interdepartmental exchange.

Upon completion of the performance or, if necessary, the presence of the applicant, the latter is sent an information message to the IGS portal or to a personal e-mail address with the relevant information. Documents and / or the result of the service upon completion of the service are sent to the applicant by mail or issued personally to the appropriate authority that performed the IGS.

## **IV. LIFE SAFETY AT THE ENTERPRISE**

### **4.1. Hypodynamia**

The term “hypodynamia” translated from Latin means “mobility”. Under this means the restriction of motor activity, which occurs as a result of a sedentary lifestyle.

Hypodynamia is a very common condition that can be observed not just in a large, but in a huge number of people.

Hypodynamia is a very common condition that can be observed not just in a large, but in a huge number of people.

In medicine, there is a fairly close concept of hypokinesia, which implies a decrease or complete absence of motor activity, usually caused by fairly objective reasons. Doctors attribute to such causes some serious diseases, specific working conditions in a limited space, prolonged bed rest or plaster cast and a number of others. The main difference between hypokinesia and hypodynamia is that in the second case, the movements are carried out, but in a very small volume and with insufficient load on the muscular apparatus. In both cases, the muscle load is minimal, which leads to a decrease in muscle strength, volume and weight of muscle tissue.

Hypodynamia is often called the scourge of modern civilization. The validity of this statement becomes obvious if we remember how the human body was formed in the process of evolution of the animal world. Physical activity was necessary for our ancestors just to survive. The ancient man was forced to be in constant motion to get food and save his life and his offspring. Thus, the need for movement was laid in the human genes as one of the conditions for the normal functioning of the body in the harsh environment.

The genetic program of a person remains unchanged throughout the last millennia, but his lifestyle has undergone very significant changes. The movement for the survival ceased to be a necessity. Scientific and technological advances have helped modern man to provide himself with a comfortable living environment with minimal physical exertion. Advanced cars, trains and planes transport us over

enormous distances, tons of cargo are raised with a simple press of the desired button. Working day of a city dweller, as well as his rest, often takes place in a chair at the computer. Thus, all our movements are limited to the road from the entrance to the car. Even the TV channels we switch using the remote control. Of course, some number of movements inevitably makes every person .

However, these movements are very monotonous, aimed at one muscle group and do not contribute to the physical development of the body.

At first glance, it seems that there is nothing wrong with such a comfortable and convenient existence of a person. What is alarming to doctors all over the world, who are not tired of repeating the need for physical education and sports, the positive impact of dosed physical activity on human health, and the dangers that invariably fraught with a sedentary lifestyle?

The life of modern man, thanks to the technical process and the benefits of modern civilization, has become much more convenient than, say, some 20-30 years ago. Transport takes us to the right place, eliminating the need to walk long distances, household appliances help us cope with household chores. People began to move less. To do something, you do not need to make much effort. As a result, the human muscles, most of the time at rest, begin to lose elasticity, lost ease of movement and hypodynamia occurs – a painful condition caused by a decrease in physical activity. Hypodynamia is called the disease of modern civilization. The causes of inactivity can be different. Low motor activity can be caused by any disease or prolonged bed rest, but, most often, it is caused by a sedentary lifestyle. Stable to complete the work, the body needs sufficient physical activity and load on the muscles, that affect health and human health.

The main symptom of hypodynamia is: General weakness, rapid heartbeat, increased fatigue, even with relatively small loads, unstable emotional state, increased nervousness.

Physical inactivity can have serious consequences. If there is no need for physical activity, muscle tone is reduced, endurance is reduced, human strength is lost, as a result, vegetative – vascular dystonia can develop, metabolism is disturbed.

Over time, hypodynamia leads to disorders in the musculoskeletal system: the development of osteoporosis, osteoarthritis and osteochondrosis. Hypodynamia affects the activity of the cardiovascular system, it leads to the emergence of hypertension and coronary heart disease. Also, hypodynamia affects the respiratory system, it can threaten the development of lung diseases. Hypodynamia can cause disorders of the digestive system and intestines. Changes in the endocrine system lead to obesity and metabolic disorders.

With hypodynamia, the work of the brain deteriorates, mental activity and ability to work are reduced, there is rapid fatigue, General weakness, insomnia.

In case of hypodynamia, there is a decrease in the strength of heart contractions, a weakening of the venous and arterial vessels, this, in turn, leads to a deterioration of blood circulation and varicose veins.

The effect of hypodynamia on the musculoskeletal system is expressed in a decrease in muscle mass and the appearance of a fat layer between muscle fibers. As a result, muscle tone is reduced.

#### **4.2. Human performance and intrapsychological load**

The effectiveness of labor activity is largely determined by the efficiency of the body. Performance-the value of the functional capabilities of the human body, characterized by the number and quality of work performed over time.

Physiologists have found that the performance - the variable and this is due to changes in the nature of the flow of physiological and mental functions in the body. High working capacity in any kind of activity is provided only when the work rhythm coincides with the natural frequency of the daily rhythm of physiological functions of the body.

Human performance during the work shift is characterized by phase development. The main phases of the work are as follows:

- working or increasing efficiency, during which there is a restructuring of physiological functions from the previous human activity to production.

Depending on the nature of work and individual characteristics, this phase lasts from a few minutes to 1.5 hours;

- stable high performance, characterized by the fact that the human body is set relative stability or even some decrease in the tension of physiological functions. This state is combined with high labor indicators (increase in production, decrease in marriage, reduce the cost of working time for operations, reduce downtime, erroneous actions). Depending on the severity of the work, the phase of steady working capacity can be kept for 2-2, 5 or more hours;
- development of fatigue and the associated decline in performance, which lasts from a few minutes to 1-1.5 hours and is characterized by a deterioration in the functional state of the body and its performance.

The dynamics of performance for the shift graphically is a curve, increasing in the first hours, then passing at the achieved high level and decreasing to the lunch break. The described working phases are repeated after the break. The run-in phase is faster and the steady-state phase is lower in level and less long than before the lunch break. In the second half of the shift, the decrease in work capacity comes earlier and develops stronger due to deeper fatigue.

For the dynamics of human performance during the day, week is characterized by the same pattern as for the performance during the shift. At different times of the day the human body reacts differently to physical and neuropsychic stress. In accordance with the daily cycle of work, its highest level is observed in the morning and afternoon hours: from 8 to 12 hours of the first half of the day and from 14 to 16 hours of the second. In the evening hours, the work capacity decreases, reaching its minimum at night.

During the week, human performance is not a stable value, and is subject to certain changes. In the first days of the week, the efficiency gradually increases due to the gradual entry into work. Reaching the highest level on the third day, the efficiency gradually decreases, falling sharply to the last day of the working week.

Work and rest regimes should take into account the peculiarities of changes in performance. If the working time coincides with the periods of the highest efficiency, the worker will be able to perform maximum work with minimal energy consumption and minimal fatigue.

Fatigue — a temporary state of the organ or the whole body, characterized by a decrease in its performance as a result of prolonged or excessive load.

Fatigue is a reversible physiological condition. If the performance is not restored to the beginning of the next period of work, fatigue can go into fatigue — a more permanent decrease in performance, which can lead to a decrease in immunity and the development of various diseases. Fatigue and fatigue can cause increased injuries in the workplace.

The workload is a set of measurable impacts that affect a person in the work system. In the science of work, in contrast to everyday speech, the load is a free concept. Loads can have in different situations and under different aspects as positive, as neutral or as negative effects on the person. Thus, music in your free time can be considered as interesting, exciting, but in the planned work time or other, requiring concentration of activities, can act as a hindrance. Loud music, for example, at a disco or through the player's headphones, can damage the hearing with long and frequent exposure, even if it is subjectively taken as pleasant.

Workload as a set of identifiable effects on humans in a production system describes the load of a person through the working of the task or the environment. For example, they talk about the load when lifting and carrying (work involving the retention of something), when observing, when standing (work with a certain posture of the body), when loading from the climate (load due to the impact of climate) and when the load from shift work (location of working time and rest time). In addition to these load - creating factors, other factors may also be acting, for example, from the social environment in the workplace such as the production climate, the attitude towards colleagues and managers, insufficient information about organizational activities, workplace insecurity and many others (see also-how to improve the workplace).

Loads are indicated by their type, size and duration of their impact on people. The impacts that create the load can be identified through the description of the work system, i.e. the work order, the work process, and the situational conditions.

If the size of the load is determined quantitatively by reproducible measurements, it is customary to talk about the magnitude of the load, if the size of the load is described only qualitatively, it is designated as a load factor. An example for the magnitude of the load is a hard dynamic muscular work. An indication of the load value of such work, such as "Cycling", can be obtained by using the operating conditions (in this example on an electric bike Ergometer with a braking result of 80 W to 60 rpm").

Load factors can be described verbally [e.g., "limited communication at work", "narrow time connection", "the combination of indications with the scale of division is not obvious" or "the subject of labor is difficult to handle manually (smooth, large....)"] and are put in order for different working systems ("A more than B"). It is possible to describe the workloads by type, size, duration, order and load application during one shift.

Working tension is the individual impact of workloads on a person depending on his qualities and abilities. Give some examples. In the future, short terms such as workload and tension will be used instead of workload and tension.

### **4.3. Economy and ecology**

The most General philosophical sense, corresponding to the modern broad understanding of ecology as a field of knowledge, consists in the consideration and disclosure of the laws of development of a certain set of organisms, objects, components of communities and communities in the interactions in systems of biogeocenoses, noobiogeocenoses, biosphere from the point of view of the subject or object (usually living or with the participation of living), taken as Central in this system. The object under consideration may be an industrial enterprise, a branch of the national economy or human activity in General on the Earth.

Currently, the greening of various disciplines is rapidly developing, which means the process of continuous and consistent implementation of systems of technological, managerial and other solutions that allow to improve the efficiency of the use of natural resources and conditions along with the improvement or at least preservation of the quality of the natural environment (or environment in General) at the local, regional and global levels. There is a concept and the greening of production technologies, the essence of which is to apply measures to prevent negative effects on the environment. The implementation of technology greening is carried out by the development of low-waste technologies or technological chains that give the output of a minimum of harmful emissions.

The broad front is currently conducting research on the limits of allowable loads on the natural environment and the development of integrated ways of overcoming the resulting objective limits in the nature. This also applies not to the environment, and ikonologii – scientific discipline that explores “econecol”. Economic school (economy + ecology) – the designation of the totality of phenomena that include society as a socio-economic whole (but primarily the economy and technology) and natural resources that are in a positive feedback relationship with irrational environmental management. As an example, the rapid development of the economy in the region with large environmental resources and good overall environmental conditions, and Vice versa, the rapid development of



the economy without taking into account environmental constraints then leads to a forced stagnation in the economy.

Currently, many sectors of ecology have a pronounced practical orientation and are of great importance for the development of various sectors of the economy. In this regard, new scientific and practical disciplines appeared at the intersection of ecology and the sphere of human practice: applied ecology, designed to optimize human relations with the biosphere, engineering ecology, studying the interaction of society with the natural environment in the process of social production, etc.

Currently, many engineering disciplines try to close themselves within the framework of their production and see their task only in the development of closed, waste-free and other "environmentally friendly" technologies that can reduce their harmful effects on the natural environment. But the problem of rational interaction of production with nature in this way is not completely solved, since in this case one of the components of the system — nature — is excluded from consideration. The study of the process of social production with the environment requires the use of both engineering methods and environmental, which led to the development of a new scientific direction at the junction of technical, natural and social Sciences, called engineering ecology.

The peculiarity of energy production is the direct impact on the natural environment in the process of fuel extraction and combustion, and the changes in natural components are very obvious. Natural-industrial systems depend on the accepted qualitative and quantitative parameters of technological processes and differ from each other in structure, functioning and nature of interaction with the natural environment. In fact, even the same qualitative and quantitative parameters of technological processes natural and industrial systems differ from each other by the uniqueness of environmental conditions, which leads to different interactions with the environment of production. Therefore, the subject of research in environmental engineering is the interaction of technological and natural processes in natural and industrial systems.

The development of eco-oriented business can significantly change the environmental situation in the world, improve environmental protection and use of natural resources. It is obvious that it is impossible to solve environmental problems, to reach a sustainable type of development without overall improvement of the country's economic situation, effective macroeconomic policy.

The deterioration of the environmental situation in Uzbekistan is influenced by a number of economic and legal factors operating in different spheres, at different levels and with different scale of impact:

- macroeconomic policies leading to extensive use of natural resources;
- investment policy focused on the development of resource-exploiting sectors of the economy;
- inefficient sectoral policies (fuel and energy complex, agriculture, forestry, etc.);
- imperfect legislation;
- uncertainty of ownership of natural resources;
- lack of an eco-balanced long - term economic strategy, underestimation of sustainable development;
- at the regional and local level, the indirect effects of nature protection (economic and social), global benefits are underestimated;
- inflation, economic crisis and economic instability hinder the implementation of long-term projects, which include most environmental projects;
- natural-resource nature of the export;
- there is a strong incentive to generate significant and rapid profits from the over-exploitation and / or sale of natural resources (oil, gas, forest, ore, etc.), etc

Now the most important thing is the creation of the state through effective, indirect and direct economic instruments and regulators of a favorable climate for the development of eco-oriented business. In this regard, we will consider the impact

of economic reforms in Russia on the preservation of the environment, evaluate the most promising areas of business development in this area.

Across the economy, at the macro level we can distinguish the following important areas of economic reforms: structural ecologic restructuring, change of investment policy in the direction of ecological and balanced priorities, improve the mechanisms of privatization, reform of property rights, demonopolization, creation of ecological and consistent system of taxes, loans, subsidies, trade tariffs and duties, etc. All of these mechanisms and reforms is inevitable in varying degrees, affect the development of business related to environmental activities.

This is another property of the modern "man-made" thinking of world structures — focus on achieving quick results. The environmental consequences of such results are usually seen in the future, often negative, and the overall environmental and economic damage is disproportionately greater than the short-term benefits.

It is important to reject and revise many stereotypes in decision-making processes. Modern traditional approaches to economic development are based on the amount of natural resources used. The more resources used, the better for the country. On oil, gas, forest, land and other resources, there are many absurd examples where natural resources are fantastic from one end of the natural product chain, and from the other-the eternal shortage and shortage of goods and services derived from these resources.



## CONCLUSION

The successful adaptation of the cities, according to the consequences of the past, is not only an internal affair of the cities themselves. The politics, the economy, but also the inhabitants themselves are in demand in all their commitment, their creativity and their awareness. The cities of the earth are cultural and architectural heritage of the past, knowledge centers and points of creativity of today and also the living spaces of our common future. It is important to preserve this heritage for future generations.

Under the influence of such factors as globalization, the formation of the information society and the development of human potential, the emergence of new functions of the state and the growth of the institutional complexity of the civil service, the process of forming an "electronic government" and "smart city" are under way in Uzbekistan.

One can make a conclusion about the complexity of the new form of public administration. Despite the active support of the ideas of "e-government" both from the political and financial point of view, the implementation of the program has not yet been properly developed. The implementation of the e-government project is impossible without strong political will. Among the main obstacles can be listed: "digital inequality" and heterogeneous coverage of the country's territory by computer networks, low computer literacy and apolitically of the population, and sometimes reluctance of state employees to work at a new level, etc.

At the same time, it is important to remember that the main goal of smart city and an "e-government" are the satisfaction of the needs of citizens. Proceeding from this, the following recommendations for the improvement of the e-government project are proposed:

1. Raising awareness of smart services. One of the possible instruments is the government's use of social media, active involvement of young people in the promotion of the "e-government" project.

2. Orientation to the interoperability of e-government. At the same time, state services must guarantee the security of personal data and necessarily conduct an independent audit of the implementation of the e-government program.

E-government is an important challenge and core of smart cities initiatives, and is envisioned to enable the “smart” governance in the cities. Among the current limitations of e-governance services, the lack of personalization for specific stakeholders has been identified as one of the most prominent. This aspect is where recommender systems have new opportunities. The overwhelming load of information and services in e-governance applications can make more prominent the development and use of personalized recommendation solutions for the different stakeholders and tasks. Surveying the literature, we have identified that there are still few studies on recommender systems for the e-governance domain, and that the majority have proposed very simple recommendation approaches focused on limited application cases, namely providing the citizens with personalized government e-notifications and e-services, and assisting the finding of business partners in government e-services. For these reasons, in this paper, we have proposed a number of potential applications, depicting some data sources (e.g., government web portals, and social media) and types of recommendation approaches that could be explored.

We have not, however, addressed issues in smart cities that may be considered in the design and implementation of e-governance recommendation solutions, such as the exploitation of real-time sensor data from the Internet of Things, the particular interests, objectives and benefits of the target stakeholders, and the appropriate recommendation goals and evaluation metrics, such as the citizens’ engagement. These aspects are of high interest, and would be tackled in further analysis

**Existing problems.** The problems that prevent us from getting the wonderful picture described above are not of a technical nature (everything that is described is realizable for quite real time and money), but an organizational and legal nature.

The main problem is, in our opinion, the absence of any legal acts allow to organize on a legal basis the provision of certain IGS in an interactive mode. If we disassemble in more detail, we can distinguish the following aspects.

A special problem is the transfer of information between departments of various levels of subordination: federal, regional and municipal.

A separate aspect of the transfer of information is the need to comply with the requirements of the law on personal data (most of the information transmitted for the execution of public services will relate to personal data). This is a very important topic, the discussion of which requires a separate article. Now we will mention that the literal interpretation of certain provisions of this law and a number of accompanying by-laws actually makes the transfer of personal data beyond the boundaries of a particular system impossible, moreover, it will often be impossible to process personal data.

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