

## PUBLIC ADMINISTRATION

**PUBLIC ADMINISTRATION OF PUBLIC TRANSPORT THROUGH IMPLEMENTATION OF AN INFORMATION AND COMMUNICATION MECHANISM**

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DOI: [https://doi.org/10.31435/rsglobal\\_ws/31012020/6899](https://doi.org/10.31435/rsglobal_ws/31012020/6899)

**ARTICLE INFO**

**Received:** 20 November 2019

**Accepted:** 23 January 2020

**Published:** 31 January 2020

**KEYWORDS**

public administration,  
information and communication  
mechanism,  
smart-cities,  
technologies,  
services,  
urban land public transport,  
capital city.

**ABSTRACT**

The theoretical aspects of application of information and communication mechanism in the field of public transport are defined. The object of study is the field of public land transport services. The purpose of the article is to analyze the world experience in implementing information and communication mechanism and substantiate the need for the use of appropriate technologies in the public administration of the sphere of services in the land public transport in the capital city. The conceptual foundations of creating smart-cities are revealed. The attention is focused on the information and communication technologies as one of the areas of smart-specialization of the city of Kyiv. The world tendencies of introduction of the information-communication or smart-technologies are presented. The problems of functioning of urban transport system are revealed. The feasibility of introducing an intelligent transport system has been proved. The key issues that need to be addressed to improve the current situation in the field of the land public transport in the city of Kyiv are outlined. There is also an emphasis on improving the performance of the carrier-company. The relationship between the information-communication, regulatory, organizational, financial mechanisms is revealed. The need to involve the city dwellers in the development of the management decisions is emphasized.

**Citation:** Davyd Shatirishvili. (2020) Public Administration of Public Transport Through Implementation of an Information and Communication Mechanism. *World Science*. 1(53), Vol.2. doi: 10.31435/rsglobal\_ws/31012020/6899

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**Introduction.** World surveys indicate that today more than 50% of the total population lives in the cities, and about 180 thousand people move to such settlements every day. According to experts by 2050 this figure will increase to 70%, i.e. 6.7 billion people (2/3 of the world's inhabitants) will live in the cities. Thus, in the recent decades the urbanization processes have shaped the world as a key factor in the sustainable development of the individual regions and countries as a whole. They actualized the problems in the field of settlement, planning, architecture, transport, etc., that characterize the "status" of the city: central or provincial [1]. In Ukraine there are transformational changes in the process of formation and development of the smart-cities, in particular the use of innovative technologies in different areas of life of the residents. The research into the problems and international practices of the use of the information and communication mechanism will improve the

field of provision of services in the land public transport. This mechanism is aimed at improving the local policies and ensuring a high level of satisfaction for the residents with the service they provide.

The development of the information society is one of Ukraine's priorities in achieving European standards of quality of services, openness and transparency of the activity of the public authorities, business and so on. The purpose of the article is to analyze the world experience in implementing the information and communication mechanism and substantiate the need for the use of appropriate technologies in the public management of the sphere of services in the land public transport in the capital city. Some issues concerning the development of the smart-city and the application of the information and communication mechanism in the public management of the sphere of services in the urban land public transport are covered in the works of G. Charnock, P. Chau, S. Cymbal, Yu. Dashchuk, A. Diskina, A. Dushkina, L. Galapup, H. Gong, W. Jang, W. Jin, M. Lepkyy, H. March, V. Moroz, O. Palant, S. Poon, R. Ribera-Fumaz, N. Vasylieva, O. Vasylieva, E. Vodovozov and others.

**Research results.** The modern city provides its residents with a variety of living, working and leisure facilities and public services, including in the public transport. The transformational processes taking place in the society are characterized by the introduction of innovative technologies, which become a factor in improving the efficiency of the economy and public relations. It is established that e-government is a form of public management organization which, due to the widespread use of the latest technologies, ensures openness of interaction between the state, business and the public, as well as access of different categories of consumers to the public services [17]. In 2017 the Swedish IT company EasyPark conducted a study on the use of ICT, that identified the following key criteria for evaluating the "digital" cities: 4G mobile communication, large number of Wi-Fi hotspots, smartphones as universal service management, smart parking, car-sharing, optimized traffic system, online access to the public services, waste recycling, active civic position of the residents, clean sources of energy [11].

In order to build an information society, to use information and communication technologies, to create information electronic resources and to protect the intellectual property thereon, a regulatory framework has been formed in Ukraine. The reform of decentralization of the power relations in Ukraine has intensified the emergence and development of the smart-cities that are based on the use of Big Data technology, which makes the urban infrastructure management in one place and synchronizes the activities of all its elements. The main directions of the smart-specialization of the city of Kyiv - the capital of Ukraine, are defined by the information and communication technologies, pharmaceuticals and creative industry. This smart-specialization activates long-term structural changes in the economy, that is, it is planned to form a policy that will allow the capital to occupy important niches in the global markets in the future. Ensuring a decent standard of living depends on the right choice of the city management policy and sound management decisions based on sustainable development. The 2025 Development Strategy identifies Kyiv as an innovation center in the Eastern European region with a strong competitive position and clear development priorities; a city that develops its uniqueness and historical heritage, is constantly improving the quality of life of the residents and attractiveness for doing business and attracting investment [8; 19; 21].

In 2019 the Smart City Observatory of the IMD Center for Global Competitiveness, together with the University of Singapore for Technology and Design, conducted a joint study that identified the top 100 "smartest cities" in the world (including health and safety, mobility and civic engagement). The survey of the urban residents shows a real picture of the achievements of each city. The use of the smart innovation combines strategic approaches to the public management. Multimodal information is used to improve the efficient operation of the transport infrastructure. Big Data is collected from car sensors, surveillance cameras, RFID-tags, sensors on the roads and railways. The systems require a comprehensive management and maintenance approach [14; 27].

The management of the city should be through a developed and implemented integrated service model, which contains an open service-oriented architecture of the city, a Standard of service for the residents of the metropolitan city and other, which together will ensure the provision of quality public services. The intelligent transport system means the integration of the operational management of all modes of the transport and the ability to respond to events in real time. It provides innovative modeling of the transport systems and regulation of the traffic flows, which ultimately qualitatively increases the level of interaction of all the road users compared to the conventional transport systems [8]. The problems of functioning of the urban transport system can be attributed to the objective (increasing the need of the residents and visitors of the city for displacement, the level of motorization

of the population and the disproportion between the level of motorization and the pace of the road construction, which affects the intensity of the use of individual transport, as well as reducing the efficiency of the land public transport) and subjective (imperfection of the legal, organizational and administrative support for the development of the road transport complex, financial support for the operation of the road networks and transport infrastructure, unresolved property issues and issues of delineation of the ownership rights and management of the objects of the transport infrastructure, obsolescence of the model of relations between the public authorities and the business).

In the following we will take a closer look at such information and communication mechanism tools as the introduction of an intelligent transport system; systems of contactless payment for travel and security of the information and communication system. According to approximate estimates in the traffic jams an average resident of Kyiv loses annually 360 hours or 45 8-hour days a year. In the cities across the EU the material costs caused by the traffic jam are estimated at 1% of GDP annually. Therefore, for the smooth running of the land movement, including the electric public transport in Kyiv they are working on the creation of a single Control center for monitoring the work of the transport and information gathering, to install on all the streets working closed-circuit television cameras.

The automated control system of the urban land passenger traffic should record the current situation in the city, carry out operational management of the communal traffic and traffic lights, monitor the implementation of the vehicle traffic schedules, control the fuel costs. In order to improve the efficiency of the utility companies, the automation of their operation and the functioning of the public transport should be adjusted [21]. It is revealed that a citywide data center in Rio de Janeiro (Brazil) integrates the information flows from 30 organizations, including emergency services, public transport traffic, infrastructure status, weather forecast, etc. downloaded by the staff and the public from the phone, internet or radio. Since 2015 Eindhoven (Netherlands) has implemented a system for monitoring the humidity and smoothness of the road surface, which is installed on special vehicles. The data is transmitted to the central monitoring station, the hazardous sections of the road are identified, the drivers are alerted via the road information displays and navigation maps. The Verizon's intelligent traffic management system collects and processes data throughout the road infrastructure, ultimately reducing vehicle traffic stops by 44%, 41% of delaying traffic signals, 20% of traveling time, 15% of fuel costs [14; 22].

According to the Information and Communication Technologies Department of the Kyiv City State Administration with the installation of 7000 CCTV cameras crime in the city was reduced by 56%, more than 2000 crimes were solved, and another 600 cameras in different parts of the city are planned for 2020. The surveillance at all the entrances and departures of the city allows to calculate how much traffic goes in and out, at what time of transit and how much traffic is in the city and so on. 54 settlements around the capital are connected to the video surveillance. This is one of the elements of the future intelligent transport system that will allow maximum unloading of the roads. To implement individual projects to ensure the operation of the smart public transportation system, a financial instrument such as the participation budget can be used. It is an open process of discussion and decision-making in which every resident of the city has the opportunity to submit their own proposal and by voting to decide how to spend a certain part of the local budget [10; 20]. Such projects include the acquisition and installation of CCTV cameras, smart traffic lights and dashboards, which will have a positive effect on the road traffic and reduce the level of exhaust emissions, the creation of inclusive transport infrastructure, i.e. accessible to persons with disabilities and other low-mobility groups. According to the results of the voting of the projects of the Public Budget for 2020 it was found that the most popular areas are education, sports, culture and tourism, public space and housing and communal services.

You can also attract grants from the international financial organizations for the development of the urban infrastructure, or create a Fund for the development of a public transport system in a megalopolis or metropolitan area (for the long term) "Comfortable Movement" for the acquisition or development of appropriate equipment or technological solutions. Funds can be raised through crowdfunding. The introduction of an intelligent transport system will allow the unloading of the transport infrastructure, reduce the cost of maintaining the roads and parking spaces, the number of road accidents and the level of air pollution, improve the mobility of the pedestrians, cyclists and users of the public transport, reduce the time spent on the city traffic and increase the level of safety on the city roads. The intelligent system of the land public transport is aimed at integration with the external systems of management and control of the transport complex, accounting for real passenger traffic,

constant monitoring of the situation of the passenger transportation, optimization of the costs for maintenance of the park and carrying out remote control of the technical condition of the vehicles. For example, in Seoul (South Korea) 300 bus stops are equipped with terminals that communicate wirelessly with 9300 buses that have Internet modems and GPS-receivers [9].

The international experience shows that there are three models of the urban public transport management: administrative (France, Canada, USA), free (UK, South American countries) and regulated markets (Czech Republic, Poland, Baltic countries and Scandinavia) [7]. The provided administrative regulation in the market of the transport services is dominated by one carrier-company. The main instruments of such policy are the application of the administrative levers to the management of the urban public transport and the exercise of administrative control over the costs and revenues. This model requires significant budget financing. According to the market model the private sector is being formed and competition is developing. In a free market the involvement of the city authorities in managing the public transport is limited to controlling the technical condition of the rolling stock and the qualifications of the drivers. The transport carriers independently determine the routes, make schedules, formulate tariffs. But such a model will exacerbate social problems in Kyiv: pricing policy does not always correspond to the quality of the services provided and consumer opportunities, and more. The regulated market provides for various forms of relationships, including contractual agreements between the city administration and the transport companies in accordance with the tasks, conditions, opportunities and interests of the both parties. In the case of limited competition the city administration or the authorized structure places stringent requirements on the timetable, fare and fleet of the vehicles used, to control the professional competence of the carrier, to meet the requirements of safety and technical suitability of the vehicles [18]. We believe that it is appropriate to use this model in Kyiv.

In Finland, Denmark and the Netherlands the fare depends on the length of the trip and the route. The electronic toll cards have a limited duration, are used on all modes of the public transport and are differentiated by the distance of the trip. The card is non-personalized and has the function of returning the unused money. The passenger registration takes place at the entrance (in some lounges via the turnstile) and at the exit of the vehicle. If you do not register the card at the exit, the increase of the amount will not be stopped [23]. In the Piedmont (Italy) administrative area the electronic ticketing system is a reliable source of the passenger information. It is reliable in protecting the personal data of the passengers. On the basis of the information received from the smart-cards a detailed analysis of the time and length of the travel of each individual passenger is carried out, and the travel chains are tracked [5]. In Dresden (Germany) the transport operator has introduced e-ticketing systems for smart-cards and mobile phones, as well as registration at the entrance and exit of the vehicle – “Be in / Be out”, which allows automatic payment for the payment for travel depending on the point of landing and disembarkation of the passenger. It is introduced the integrated model of the electronic fare system differentiated for different consumer groups – the ticket: one-way, daily, multiple, weekly or monthly (with different tariffs). All tickets allow you to transfer to different routes of the operators, which is very convenient for introduction in Kyiv. The presence of the aforementioned, as well as vending machines at stops and in the tram salons, devices for printing tickets in the buses, increased the attractiveness of the public transport for the users and affected the increase in the number of passengers [23].

In Kyiv about 80% of the public transport users are regular passengers. There is a single electronic ticket in two types: material (“Kyiv Smart Card” transport card, printed one-time QR-ticket) and electronic (generated QR-card in a smartphone). About 500 thousand people use the electronic ticket every day, and 800 thousand residents use the Kyiv Card. About 1200 “electronic composters” have been installed in the public land transport project, and some of the turnstiles in the subway have been upgraded. The controllers must be provided with special devices for checking the passenger’s transport card. For the convenience of the passengers more than 100 public transport stops were equipped with information boards that inform the arrival time of the transport, but this is not enough [15; 20]. The utility service providers with electronic ticket entry not only optimize their services, but also reduce the losses by collecting tolls more fully and personalizing the benefits. The process of handing over, transferring, storing and accounting for cash until collection is quite laborious and involves criminal and other human-related risks. The introduction of the automated system of receiving and storing the proceeds involves the use of automated deposit machines with modules for the automatic reception of banknotes and coins [7; 13].

The automated fare system has the following benefits for: the passengers - fast and convenient to pay for the fare, the drivers - do not waste time making payments, the local authority - to assess the real picture of the traffic congestion and turnover, the number of privileges and implement various



tariff systems. In our opinion, the carrier should be paid for the successful trips on the route, not for the passengers. This will mean that the drivers will not wait long for the customers at the stop, and during rush hours the salon will not be crowded. A single ticket for all the types of the public transport (land and underground) in the capital city minimizes the corruption schemes. Its introduction eliminates the privileged routes and clearly organizes the timetable of the carriers. This practice is integrated with the control system and on-board electronic information systems [25].

In the capital city the control of the payment of the public transportation by the public transport can be carried out by the means of special terminals, which will control the last validation of the means of payment for the passenger fare. The preferential categories of consumers should similarly record their travel with the help of a "Kyiv Card", that needs to be adapted to the new payment model. This approach will make accurate and transparent the process of accounting for the passenger services actually provided and their payment. In the future the electronic transport tickets will become the most popular means of payment for the public transport [7]. A significant problem of the smart-cities is the presence of a large number of different embedded technologies and practical solutions that interact with each other, direct and remote operation of the information systems, huge amounts of data for analysis and storage. Information security and cybersecurity are fundamental components of the public services, as urban transport infrastructure is vulnerable to criminals and terrorists. This involves the development and implementation by the local government of a Cybersecurity Strategy, implementation of measures to eliminate the consequences in case of attack or loss of data and their restoration, control over the state of the networks, which in the complex will allow not only to reduce the degree of risk, but also to react actively in the identification of the problems [24].

The Internet of Things (IoT) Platform and the establishment of a maximum number of sensors to provide objective information on the environmental situation in the city will be addressed in Kyiv in 2020. In particular, there is a need for about 1000 sensors to be installed that will show the state of the air [20]. A significant number of IoT devices are found to be capable of attacking the network data. Cyberattacks can be done from a single smartphone or workplace. In a city where thousands of devices interact with both users and each other, the security implications are significant. The network can be broken by certain hackers, attackers or single players.

It is very important for the modern metropolis to receive timely information. This applies not only to comfort but also to safety in the event of emergencies and minimizing their effects through effective alerting. There are a number of channels for getting information, including convenient applications for mobile phones and smartphones, websites, social groups. However, a number of people do not use such services. In emergency situations informing the passengers should not depend on the availability or performance of a particular smartphone or Internet access. The information and communication technologies are innovative solutions for managing, servicing and controlling the work of the entire transport industry in the city [12].

**Conclusions.** The use of smart-technologies helps the public authorities and businesses providing public transportation services to the public to improve their efficiency. A publicity campaign should be launched to promote the use of the information and communication technologies. This will clearly help understand and identify the existing problems, analyze and plan the urban development from the perspective of improving the efficiency, accessibility, equity, comfort and quality of life for its citizens in real time, as well as monitoring the results. The innovative technologies provide fundamentally new opportunities for their application in the process of making and implementing the management decisions [6]. Achieving a high level of smart-city development depends on resource provision and the utmost willingness to invest in such technologies.

We believe that active involvement of the citizens in the management decision-making with the use of ICT in the public transport will increase the efficiency and effectiveness of the service activities of the public authorities and providers of such services. The public authorities should provide a systematic approach to establishing and complying with the requirements for the development and further functioning of the information and communication (technological) architectures, security systems, identification in accordance with the international technical and management standards, as well as the adoption and implementation of management decisions and projects that automate the current processes, on a continuous basis, improve the quality, accessibility, comfort of the services provided to the residents, etc. [26]. The use of ICT in its activities enables the local governments to promptly communicate their decisions to the public and receive feedback. In turn, the residents, through their involvement in the various processes taking place

in the city, have the opportunity to influence the management decisions, monitor their implementation, offer alternative ways to solve urgent problems, improve the quality, accessibility and comfort of the public services, taking into account the special consumer needs [16]. The digital transformation should become a leading strategic direction for the development of an enterprise providing passenger transportation services. The introduction of the modern technologies into the business processes implies not only the availability of modern equipment and software, but also the change of approaches to management, corporate, including ethical, culture, external communications and more. The introduction of ICT changes the format of coordinating the activities of the operational, regular, dispatching offices in the municipal services responsible for the public safety and daily life of the territorial communities.

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