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SMART TECHNOLOGIES IN THE TRANSPORT MANAGEMENT SYSTEM: EXPERIENCE OF THE EUROPEAN COUNTRIES

The main reasons that hinder the development of transport logistics in Ukraine are identified: technical and technological backlog of the domestic transport system; insufficient level of maintenance of the transport infrastructure; lack of private investment; increase in the cost of transport services. The main criteria for evaluating smart technologies are highlighted: environmental friendliness, energy efficiency, security, mobility; optimization of the traffic system; economy. Innovative tools for improving transport management in the EU countries that contribute to smart management are identified: car sharing; smart parking; the only integrated intelligent transport system of the city; drones; electronic control system of the transport system. Generalized directions of the development of transport support: electrification of transport; the use of new energy sources (primarily hydrogen); the use of new types of vehicles and their hybridization; vehicle robotics, unmanned vehicles; replacement of material movements with information; improvement of transport logistics.

Key words: innovations, development, system, smart technologies, transport, transport infrastructure, transport logistics, management.

Formulation of the problem. One of the priority tasks of Ukraine in the context of European integration is the dynamic development of the domestic transport system with the help of smart technologies. Transport takes a leading place in the life of any country. Therefore, the improvement of the transport management system is possible only through the introduction of innovative smart technologies.

The use of smart technologies in the transportation management system is constantly expanding, as well as the opportunity to explore their updated versions and capabilities systematically. By conducting such an analysis, many organizations will be able to modernize their own transport.

The EU's main objective is to create an environmentally friendly, safe and energy efficient single European transport system. Such circumstances testify to the need for scientific research to determine strategic directions for the development of transport security management in Ukraine.

Analysis of recent research and publications. The systematic view that strategic logistical management of

economic development of the country should be based on the introduction of innovative logistics technologies was formulated by S.V. Smerichevskaya [1]. Smart Transportation Matters was addressed by Matthew N.O. Sadiku, Adebowale E. Shadare, Sarhan M. Musa [2]. However, a number of issues remained unresolved.

Formulating the goals of the article. Research of the experience of the European countries on smart technologies in the transport management system.

Presenting of main material. The transport system of Ukraine consists of transport infrastructure, vehicles and management system. The largest volume of cargo turnover is carried out by road and rail. Thus, in 2018, their share in the overall structure of freight traffic was 73.4 % and 19.6 %, respectively [3, p. 30].

The activity of all modes of transport is coordinated by the Ministry of Infrastructure of Ukraine. The Law of Ukraine “On Transport” [4] states that the Unified Transport System of Ukraine is formed by:

- public transport (rail, water, road, air, electric, metro);
- industrial railway transport; departmental transport; pipeline transport; ways to connect to the public.

The main reasons hampering the development of transport logistics in Ukraine are [5]:

- firstly, the technical and technological backlog of the domestic transport system in comparison with the developed European countries;
- secondly, insufficient level of maintenance of the transport infrastructure as a whole;
- thirdly, lack of private investment;
- fourthly, the increase in the cost of transport services.

The current state of transport infrastructure and the level of transportation organization does not meet the European standards of quality of transport services and the principles of the concept of sustainable (balanced) development [6, p. 34].

The European Union had defined Intelligent Transportation Systems (ITS) as a system, “in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport”.

Intelligent transportation includes the use of several technologies, from basic management systems such as car navigation; traffic signal control systems; container management systems; automatic number plate recognition or speed cameras to monitor applications, such as security CCTV systems; and to more advanced applications that integrate live data and feedback from a number of other sources. ITS technologies allows users make better use of the transportation network and also paves the way for the development of smarter infrastructure to meet future demands. The evolution of intelligent transportation systems is providing a growing number of technology solutions for transportation managers as they seek to operate and maintain the systems more efficiently and improve performance [7].

An example of the benefits of the implementation of intelligent transportation technologies can be found in Austria, where the country’s Autobahn and Highway Financial Stock Corporation (ASFiNAG), turned to Cisco’s Connected Roadways solutions to bring the “internet of things” to its roadside sensors. The result is a highway designed to monitor itself, send information to drivers and predict traffic to ensure lanes stay clear of congestion [7].

Smart technologies in the transportation management system are interpreted in Figure 1.

In our opinion, we can distinguish the following criteria for the assessment of smart technologies in the transport management system (Fig. 2).

The main criteria for the assessment of smart technologies in the transport management system in the European countries have become (Fig. 2):

- environmental friendliness (use of ecotransport: electric cars, electric bicycles, electric scooters, trains and trams). For example, in 2021, the German automotive industry will produce about 1.3 million electric vehicles. There is an increase in the level of demand for electric vehicles among the EU countries, in particular in the Norwegian market. In the EU, in such countries as the Netherlands, Germany, Belgium, Italy, France and Austria, electric bicycles have become the fastest growing segment of eco-transport;
- energy efficiency (reduction of fuel consumption by vehicles per kilometer, including expedient (efficient) use of fuel);
- security (digitization of transport based on the use of electronic vision and Big Data technologies (control of each vehicle and significant unloading of traffic flows, as well as improving the level of traffic safety);
- mobility (multimodal model of transport, permanent mobility);
- optimization of the traffic system (intelligent transport systems, in particular “smart” highways (transport detectors flexibly regulate the density of traffic flows);
- economy (saving time and energy).

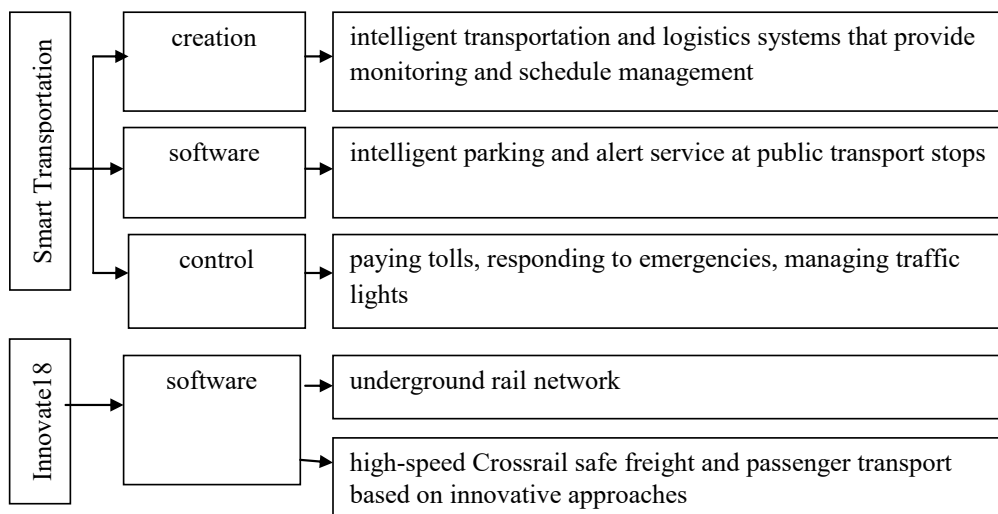


Fig. 1. Smart technologies in the transportation management system

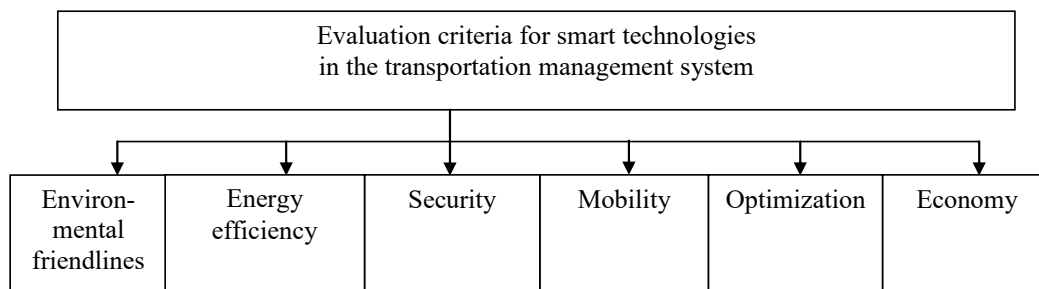


Fig. 2. Criteria for evaluation of smart technologies in the transport management system

Source: own design

Innovative tools for improving transport management in EU countries are smart technologies that promote smart governance, including:

- car sharing (car exchange services);
- smart parking (sensor network allows you to quickly find free parking spaces);
- the only integrated intelligent transport system of the city, which includes two automated systems: 1) the account of payment of fare (electronic ticket); 2) dispatching control (monitoring, management and control of passenger traffic, including the display of traffic on the map by GPS trackers, information boards at stops with timetables);
- drones (delivery of goods, monitoring, disaster relief (delivery of medicines and essentials, assistance in search and rescue operations), crime prevention, national borders) are particularly effective in agriculture, energy, transport and logistics, oil and gas industry, military affairs, etc.;
- electronic control system of transport system.

Based on the size of the market and the requirements for mobile devices on the network, there are the following major opportunities for mobile network operators: telematics service with Usage Based Insurance (UBI) and Fleet Management, smart parking service based on the Narrow-Band IoT (NB-IoT) network technology, Emergency Service Network (ESN) based on LongTerm Evolution (LTE) network and enhanced Advanced Driver Assistance Systems (ADAS) based on LTE-V or 5G network [8, c. 4].

Thus, the experience of the European Union states that the implementation of “Cyber-Physical Systems” (CPS), including on transport, is a strategically effective tool, in particular the systematization of transport systems through digitization and the use of innovative environmentally friendly technologies on vehicles. Areas of systematic development of transport support are the following:

- electrification of transport;
- use of new energy sources (especially hydrogen);
- use of new types of vehicles and their hybridization;
- robotization of vehicles, unmanned transport;
- substitution of material movements by information;
- improvement of transport logistics.

The development of transport security is possible through cross-border cooperation programs: Poland-Belarus-Ukraine and Ukraine-Romania, financed by the European Union under the European Neighborhood and Partnership Instrument (ENPI).

A non-profit program for the transfer of efficient technologies and business experience – PUM Netherlands Senior Experts – helps to solve problems related to the greening of transport.

All of these programs are aimed at: firstly, ensuring efficient mobility, reducing congestion, increasing security, developing smart equipment, infrastructure and services to improve the transport system; secondly, the introduction of new technologies and increased resource efficiency (in the transport sector, this is the “greening” of vehicles).

Conclusions. Thus, the main reasons that hinder the development of transport logistics in Ukraine are the following: technical and technological backlog of the domestic transport system; insufficient level of maintenance of the transport infrastructure as a whole; lack of private investment; rising cost of transport services. The main criteria for the evaluation of smart technologies in the transport management system in European countries include: environmental friendliness, energy efficiency, security, mobility, optimization, economy.

The experience of EU countries shows that innovative tools for improving transport management are smart technologies that contribute to smart governance: car sharing; smart parking; the city’s only integrated intelligent transportation system; drones; electronic system of transport system management.

The directions of systematic development of transport support are: electrification of transport; the use of new sources of energy (primarily hydrogen); the use of new types of vehicles and their hybridization; robotization of vehicles, unmanned transport; substitution of material movements by information; improvement of transport logistics.

Logistics of Ukraine’s economy through smart technologies will become a promising direction for further research.

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СМАРТ-ТЕХНОЛОГІЇ В СИСТЕМІ УПРАВЛІННЯ ТРАНСПОРТНИМ ЗАБЕЗПЕЧЕННЯМ: ДОСВІД ЄВРОПЕЙСЬКИХ КРАЇН

Досліджено європейський досвід смарт-технологій в системі управління транспортним забезпеченням. Визначено основні причини, що стримують розвиток транспортної логістики в Україні: техніко-технологічне відставання вітчизняної транспортної системи; недостатній рівень технічного обслуговування транспортної інфраструктури в цілому; нестача приватних інвестицій; зростання вартості транспортних послуг. Виокремлено основні критерії оцінки smart-технологій в системі управління транспортним забезпеченням у європейських країнах: екологічність (застосування екотранспорту: електромобілів, електровелосипедів, електричних скутерів, поїздів і трамваїв), енергоефективність (зменшення споживання палива транспортними засобами на кілометр), безпечність (діджиталізація транспорту на основі використання електронного зору і технологій Big Data (контроль кожного транспортного засобу та значне розвантаження транспортних потоків, а також підвищення рівня безпечності руху), мобільність (мультимодальна модель перевезень, стала мобільність); оптимізація системи руху транспорту (інтелектуальні транспортні системи, зокрема «розумні» транспортні магістралі (транспортні детектори гнучко регулюють щільність транспортних потоків); економічність (економія часу і енергоресурсів). Визначено інноваційні інструменти удосконалення управління транспортним забезпеченням у країнах ЄС є smart-технологій, які сприяють smart-управлінню (smart governance): каршерінг (послуги з обміну автомобілями); розумна парковка (сенсорна мережа дозволяє швидко знайти вільні місця для паркування); єдина інтегрована інтелектуальна транспортна система міста, що включає дві автоматизовані системи: 1) облік оплати проїзду (електронний квиток); 2) диспетчерське управління (моніторинг, управління та контроль пасажирських перевезень, зокрема відображення руху транспорту на карті по GPS-трекерах, інформаційні табло на зупинках із розкладом руху); дрони; електронна система управління транспортною системою. Узагальнено напрями сестейнового розвитку транспортного забезпечення: електрифікація транспорту; використання нових джерел енергії (перш за все водню); використання нових видів транспортних засобів та їх гібридизація; роботизація транспортних засобів, безпілотний транспорт; заміщення матеріальних переміщень інформаційними; вдосконалення транспортної логістики.

Ключові слова: інновації, розвиток, система, смарт-технології, транспорт, транспортна інфраструктура, транспортна логістика, управління.

СМАРТ-ТЕХНОЛОГИИ В СИСТЕМЕ УПРАВЛЕНИЯ ТРАНСПОРТНЫМ ОБЕСПЕЧЕНИЕМ: ОПЫТ ЕВРОПЕЙСКИХ СТРАН

Определены основные причины, которые сдерживают развитие транспортной логистики в Украине: технико-технологическое отставание отечественной транспортной системы; недостаточный уровень технического обслуживания транспортной инфраструктуры в целом; недостаток частных инвестиций; рост стоимости транспортных услуг. Выделены основные критерии оценки smart-технологий: экологичность, энергоэффективность, безопасность, мобильность; оптимизация системы движения транспорта; экономичность. Определены инновационные инструменты усовершенствования управления транспортным обеспечением в странах ЕС, которые способствуют smart-управлению: каршеринг; умная парковка; единственная интегрирована интеллектуальная транспортная система города; дрони; электронная система управления транспортной системой. Обобщенно направления сестейнового развития транспортного обеспечения: электрификация транспорта; использование новых источников энергии (прежде всего водорода); использования новых видов транспортных средств и их гибридизация; роботизация транспортных средств, беспилотный транспорт; замещение материальных перемещений информационными; совершенствование транспортной логистики.

Ключевые слова: инновации, развитие, система, смарт-технологии, транспорт, транспортная инфраструктура, транспортная логистика, управление.