

## **BOSNIA AND HERZEGOVINA IN THE COMMON EUROPEAN RESEARCH AND DEVELOPMENT AREA IN THE FIELD OF TRANSPORT AND TRANSPORT TECHNOLOGY**

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### *Original scientific work*

*Summary: The European Union directs a significant part of its financial resources to research and innovation projects. Transport and transport in terms of channeling funds is a priority area of the European Union. Development trends are geared towards the application of artificial intelligence and the fourth industrial revolution. Bosnia and Herzegovina is territorially positioned in the European transport area, ie with its geographical position it participates in several main European transport corridors. In terms of research and development in the field of transport and transport technology, Bosnia and Herzegovina cannot be viewed as a separate entity. The paper describes the general guidelines for harmonization around a common architecture for intelligent transport systems, ie the development of innovative technologies in the field of transport and transportation. The described methodological concepts enable the European compatibility of ITS systems developed in the territory of Bosnia and Herzegovina, taking into account the individual requirements and needs of the transport and transport sector of Bosnia and Herzegovina. The paper describes the methodological guidelines for the development of intelligent transport systems based on artificial intelligence and industry 4.0. The aim of this scientific research is to provide a conceptual basis for launching joint research and development projects of the European Union and Bosnia and Herzegovina based on a unique architecture.*

**Keywords:** *Research, development, ITS architecture, artificial intelligence, industry 4.0*

## 1. Introduction

Bosnia and Herzegovina is territorially positioned in the European transport area and based on this fact, there is a need to follow the European Union in terms of research and development, which directs a significant part of financial resources to research and innovation projects. In this way, it is possible to ensure that, together with the EU, it is always up to date with technological advances in transport. Research, development and application of intelligent transport systems to improve the use of existing infrastructure and ensure connections between different types of travel will enable the creation of cleaner, safer and more efficient traffic in Bosnia and Herzegovina.

This scientific paper proposes guidelines for the inclusion of Bosnia and Herzegovina in the common EU research area based on intelligent transport systems. In terms of research and innovation, Intelligent Transport Systems integrates telecommunications, electronics and information technologies with transport engineering, artificial intelligence and industry 4.0 concepts for the purpose of planning, designing, managing and maintaining transport systems. The application of robotic technologies and artificial intelligence in the road transport sector and its interfaces with other modes of transport makes a significant contribution to improving environmental protection, efficiency, including energy efficiency, and road safety, including the transport of dangerous goods, public safety and passenger and freight mobility. while at the same time ensuring an increase in the level of competitiveness and employment.

## 2. Guidelines for the inclusion of Bosnia and Herzegovina in the common EU research area

A modern and functionally designed transport system is inconceivable without research and innovation and is one of the

basic conditions for successful economic growth.

Remaining competitive and using science and technology to contribute to a more efficient transport system and economic growth is a challenge facing not only Bosnia and Herzegovina but most European countries. The lower level of spending on research and development by the state and the private sector is a key reason for the lack of significant economic growth. The non-investment of the business sector in research and development is also a threat in the European Union.

Guidelines for the inclusion of Bosnia and Herzegovina in the common EU research area can be found in various EU initiatives. One such initiative in which Bosnia and Herzegovina should look for its space is the Joint Research Center (JRC), which is a scientific and professional component of the European Commission, whose main role is to provide scientific and professional support to European Union policies. The direct actions of the Joint Research Center focus on EU policy priorities in accordance with the strategic documents.

The mission of the Joint Research Center as a scientific-professional service at the European Commission is to provide independent and evidence-based scientific and technical support to European Union policies throughout the policy cycle. Thanks to close cooperation with Directorates-General, the JRC addresses key societal challenges by stimulating innovation by developing new methods, tools and standards and sharing its knowledge and skills with Member States, the scientific community and international partners, open and potential cooperation with Bosnia and Herzegovina as an international partner. Scientific and professional cooperation with the Joint Research Center can be achieved through the participation of Bosnian scientists in professional courses and workshops of the JRC, joint research projects, networking of institutions, cooperation agreements, access to the JRC infrastructure and through employment opportunities and job creation.

places in the Joint Research Center, ie its institutes.

Through specialized workshops, conferences and advanced trainings in the field of its competencies, the Joint Research Center offers the possibility of insight into scientific and technical methods that form the basis for the implementation of EU policies. This technical and scientific assistance within the Enlargement and Integration Activities is intended primarily for organizations from the new EU Member States and candidate countries, potential candidate countries and the like. One of the priority areas of the JRC is a low-carbon economy and efficient management of resources such as the environment, climate change, energy and transport.

Transport is a major driver of European economic competitiveness and growth and ensures the mobility of people and goods needed to establish a complete European single market and open society. It is also one of Europe's greatest strengths in terms of industrial capability and quality of service, and has a leading role in many world markets. The transport industry and the production of transport equipment together account for 6.3% of the Union's GDP. At the same time, the European transport industry is facing fierce competition from other parts of the world. The development of technology will be needed to secure Europe's future and achieve a competitive advantage and alleviate the shortcomings of the current transport system.

#### **4. European research projects in the field of intelligent transport systems, application of artificial intelligence and industry concepts**

The aim of European research projects in the field of transport in general and intelligent transport systems, the application of artificial intelligence and industry 4.0 concepts is to develop a safer, more environmentally friendly and "smarter" pan-European transport system.

Research and innovation are aimed at benefiting all citizens and are in line with environmental standards and contribute to increasing the competitiveness of the

European transport industry. Also, the goal is to achieve sustainable mobility through radical changes in the transport system through innovation and the implementation of greener, safer and smarter transport solutions. Research and innovation are expected to drive progress that will help achieve key EU transport policy goals. Significant determinants of EU projects in the field of intelligent transport systems, application of artificial intelligence and industry concepts 4.0 can be reduced to the following objectives [1], [2], [3].

- For efficient, environmentally friendly transport, the goal is to reduce the impact of transport on the climate and the environment by improving the efficiency of the use of natural resources and reducing dependence on fossil fuels. The focus of activities will be to reduce resource consumption and greenhouse gas emissions and improve vehicle efficiency, accelerate the development and implementation of a new generation of electric vehicles and propulsion systems on alternative fuels.

- For greater mobility, less congestion, greater safety, the goal is to reconcile the growing needs of mobility with improved traffic fluidity, through innovative solutions for a better, inclusive and safe transport system. The focus of the activities will be on reducing congestion, increasing accessibility and user needs by promoting an integrated approach to door-to-door traffic to improve intermodality and the deployment of smart planning and solution management to reduce accidents and achieve greater safety.

- In order to achieve the global leadership of the European transport industry, the goal is to strengthen competitiveness

- and the performance of the European transport industry and related services. The focus of the activities will be to develop a new generation of innovative means of transport and prepare the ground for the next, working on new concepts and designs for a smart management and production system.

- In the area of socio-economic research and future-oriented transport policy-making activities, the aim is to support the improved creation of transport policies needed to

promote innovation and respond to transport challenges and related societal needs. The focus of the activities will be to improve the understanding of socio-economic trends in the field of transport and to provide decision makers with evidence-based and analytical data..

### **5. Establishment of an EU harmonized architecture for intelligent transport systems in Bosnia and Herzegovina**

- The establishment of ITS architectures in Bosnia and Herzegovina is a precondition for more serious involvement of Bosnia and Herzegovina and EU researchers and development space in the field of transport, ie intelligent transport systems. It is a complex technological and research development project whose purpose is to explore and define a coherent, open and usable system platform for the beginning of the complete development and implementation of numerous ITS services in Bosnia and Herzegovina. The national ITS architecture in Bosnia and Herzegovina would enable EU-compatible, faster, harmonized and efficient development of ITS subsystems and applications with significant benefits for users, service providers, equipment manufacturers and other actors such as telecom operators, tourism companies, information providers and dr.

The initial elements of the introduction of ITS already exist in Bosnia and Herzegovina and are mainly related to the new highway infrastructure such as:

- electronic toll collection (without stopping the vehicle)
- variable sign system (according to road conditions)
- harmonization of traffic flow on the motorway
- detection of violators in road traffic, etc.

However, there is an almost complete absence of innovative technologies in urban areas in Bosnia and Herzegovina. The costs of waiting and congestion in urban and suburban transport in the EU today are

estimated at around 1.5% of GDP. Reducing these costs and increasing traffic flow and transport efficiency is approximately 20-30%, depending on specific conditions. Reducing noise and environmental pollution by introducing ITS can also have greater benefits for the wider community in Bosnia and Herzegovina.

The initial steps in defining the ITS architecture in Bosnia and Herzegovina should start from defining and harmonizing user requirements and based on functional processes with higher-level ITS functions adapted to the context of Bosnia and Herzegovina. According to the preliminary analyzes of the authors of this paper and the consultation of experts in the field of ITS, the primary processes in Bosnia and Herzegovina could be:

- pre-trip information for passengers in public transport,
- travel information for drivers,
- P&R (park & ride) system with remote payment,
- electronic payment of tolls and tickets,
- road traffic management,
- management of city distribution of goods,
- management of transport of dangerous goods,
- management and resolution of incidents and traffic accidents,
- administrative (customs) procedures,
- protection in the public transport system, etc.

The identified processes include a number of actors who exchange data and harmonize their processes according to the templates developed in the ITS architecture of Bosnia and Herzegovina. The logical model needs to define structures that meet the set requirements of integration and enable the performance of functional processes with appropriate interfaces, data warehouses, etc. Higher level functions and the relationships between them need to be set up to ensure

compatibility, cost savings and a high level of service quality for the end user. Openness, flexibility and faster implementation of new ITS services would benefit ITS service providers and other actors on the supply side. Physical entities in which functional processes and communication links between vehicles, centers, roadside equipment and other subsystems are realized would follow the establishment of the ITS architecture in Bosnia and Herzegovina.

## Conclusion

Orienting Bosnia and Herzegovina towards research and innovation in the field of intelligent transport systems, application of artificial intelligence and industry concepts 4.0 means adapting the principles, measures and instruments to guide the development of transport infrastructure and technology in line with economic goals. In the 21st century, the application of ITS solutions marks a step towards sustainable development.

The transport development strategy in Bosnia and Herzegovina should be in close interaction with research and innovation projects. As an explanation of the previous statement, it is enough to look at the current programs and guidelines for the development of European transport infrastructure. The existing trans-European network (TEN) in the EU and the pan-European corridors are adapting to the ITS criteria and some of them pass through Bosnia and Herzegovina. The emphasis is on the modernization of the road mode of transport with more environmentally and energy-efficient procedures for the transport of passengers and goods, with a complete transport service from end to end.

The advanced effects of the ITS solution include reducing waiting times and losses, saving fuel and energy, increasing the safety and protection of passengers and cargo, better information for service users, better integration, etc. In rail and air transport, there have long been technical and organizational solutions that can be integrated into ITS as a transmodal system. Since ITS is a key determinant of the development of transport, transport and logistics in the first half of the

21st century, it is to be expected that increased innovation and research activities in this area and more agile involvement of Bosnia and Herzegovina in the common European research area.

## 6. Literature

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