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The Necessity of Developing Multimodal Transportation in Croatia as a Factor of Meeting the European Union Transportation Policy Recommendation and a Beneficial Factor for the Development of Croatian Economy

Abstract

The paper emphasises the necessity of developing multimodal transportation solutions in Croatia. Croatian transport infrastructure is not at a satisfactory stage of development, and, due to Croatia's geographical position, the development of multimodal transportation is a beneficial factor for the development of the country's economy. European Union recommends multimodal solution as less polluting and more energy efficient. Further, it is shown that the modernisation of transportation system in Croatia, by developing a multimodal transportation system, represents a comparative advantage factor for Croatian economy. The methods used are a comprehensive literature research, methods of analysis, synthesis and comparison method, as well as methods of collecting secondary sources of research. The aim of the paper is to point out the importance of developing multimodal transportation as a significant factor for economy development as well as contribution to raising awareness of this problem.

Keywords: Croatian traffic valorisation, multimodal transportation, transportation development.

1. Introduction

Croatian traffic policy is a part of the European Union traffic policy. It has very favourable geographical position since Croatia is the only middle European, Pannonia-Danube and Adriatic-Mediterranean state that has direct contact with the south-eastern territory.

The geographic position of Croatia provides contacts with two important corridors: The transversal corridor that goes from parts of Middle Europe, Pannonian and Baltic region and the parts of Eastern Europe towards the Adriatic coast, and the Mediterranean region in a wider sense. The longitudinal corridor goes from Western and Eastern Europe towards the Black Sea and the European southeast. Since there is a strong connection between economic growth and transportation, Croatia should recognize the significance of the transportation system. The current state of transportation system in Croatia is on the average satisfactory, but there is an issue with the efficiency of railway infrastructure. This results in reduction of average speeds of the network, leading to long journeys, low quality of service, and a shift to other transportation modes, in particular road transportation [22].

According to the European Commission report [18], negative consequences of road transportation are numerous. Among many, there is pollution, climate change, noise, congestion, and accidents, as problems that are closely related to many other problems in economy, health, and well-being of the citizens of European Union. There are strong recommendations for reducing road transportation in the direction of less polluting and more energy efficient modes, especially multimodal solutions. In order to research this problem in this paper, a scientific paradigm for setting the basic hypotheses has been defined as follows: Modernisation of transportation systems in Croatia by developing multimodal transportation systems represents a necessity in order to meet the European Union recommendations and give a positive incentive to Croatian economy.

The starting point of this research is focused on two objects: First, Croatia has potential for achieving benefits from developing multimodal transportation, and second, the taking into account of Croatia's geographical position. Croatian transport infrastructure is presently not in a satisfactory stage of development. Methods used in this study are analysis, synthesis, and comparison method, as well as methods of collecting secondary sources of research. The aim is to emphasise the urgency of developing multimodal transportation as a necessity in order to meet the European Union transportation policy recommendations.

2. Theoretical Framework

Achieving the best combination of cost effective and time saving transportation system represents the main aim of any transportation system. Intermodal, combined,

or multimodal transportation uses different transportation modes to carry certain goods from their origin to their final destination.

The definition of this terminology is found in a document issued by United Nations [24]. Combined transport refers to intermodal transport where the major part of the European journeying is by rail, inland, waterways or sea and any initial and/or final legs carried out by road are as short as possible. The movement of goods in the same loading unit or road vehicle, which successively uses two or more modes of transport without handling the goods themselves in changing modes, defines an intermodal transport, while multimodal transport is simply defined as carriage of goods by two or more modes of transport [24].

Although definitions of both intermodal and multimodal transport sound similar, since both contain the element of moving cargo from origin to destination by several modes of transport where each of these modes has a different transport carrier responsible, there are differences. Namely, when there is an intermodal transport, each transport carrier has its own independent contract, while in multimodal transport this movement of cargo is carried out under a single contract – single carrier during a single journey which results in significant advantages of multimodal transportation. It can be stated that multimodal transportation enables better efficiency of cargo tracking, faster delivery time, more efficient access to any part of the world, associated with responsibility and liability of a single transport carrier and minimization of total logistics expenses. In order to clarify the theoretical background, some definitions of multimodal transportation are given. One of the oldest definitions from the end of last century [8] says that multimodal transportation refers to the movement of cargo from shipper to consignee using two or more different modes under a single rate, through billing and through liability.

Further, there is a definition [21] as a movement in which two or more different transport modes are linked end-to-end in order to move freight and/or people from point of origin to point of destination. Newman and Yano [15] gave a simple definition of multimodal transportation as a combination of modes, usually ship, truck, or rail, to transport freight. The movement of cargo from the beginning point to end user, usage of minimum of two different modes and unchanged ownership of shipment are common elements in different definitions of multimodal transportation.

Multimodal transport is a very complex process that consists of some critical points because there are different parties involved (Figure 1), such as services of couriers, external logistics service providers, small transportation companies, different modes of transport, as well as multimodal transport operators [16].

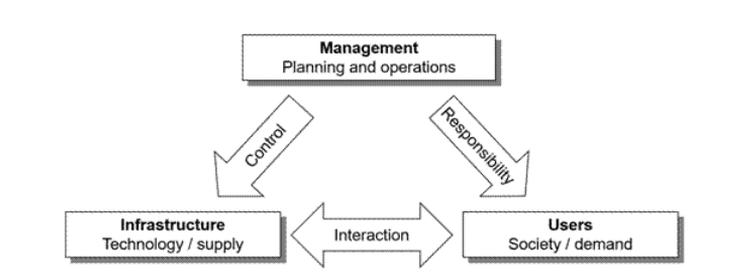


Figure 1: A Trisecting Model of the Transport System [10]

In that context, some authors gave the definition of the resilience of transport system as the ability of a transport system to prepare for and to withstand, absorb and adapt to shocks, and to recover from the consequences in a timely and efficient manner [23]; [10].

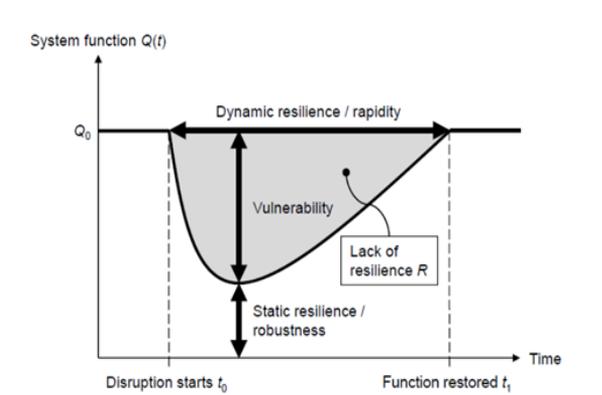


Figure 2: Resilience and Vulnerability of Transport System [10]

The relation between different partakers in multimodal transportation system and possible resilience and vulnerabilities are shown in Figure 2. The total loss of function against a specific shock is represented in the area between the straight horizontal line and the curved line [3], 2003), which is dependent on ex ante mitigation measures and ex post adaptation measures [10].

However, the importance of using of multimodal transportation for economic development growth is unquestionable. There is a strong relationship between economic growth and transportation infrastructure [12], especially in developing countries. It has been shown that investment in land and water transport infrastructure has large impacts upon economic growth and that asymmetric effects across regions are due to the non-uniform regional distribution of transport infrastructure [9]. In addition, there are studies that confirm positive effects of transport infrastructure on trade, better direct

foreign investments, as well as positive trade effects on intensive and extensive margin and transport cost reduction [2].

Even the issue of whether will trade occur at any level is associated with transport infrastructure as a factor that determines levels of trade, quality of institution, information and communication technology, and access to transport infrastructure [7]. Nevertheless, geographical and geostrategic position of a country is an important factor as well. There are findings showing that countries without sea access and transit countries have 55% higher transport costs than median coastal countries (Table 1).

In addition, in 1995, landlocked countries had an average import share in gross domestic product of 11%, compared to 28% for coastal economies [13]. The main reason is that landlocked countries are completely dependent on their neighbours' transit infrastructure for accessing international markets [20].

Table 1: *The Cost of Being Landlocked, Relative to a Coastal Economy* [13]

Transit infrastructure percentage	Own infrastructure percentile		
	25th	Median	75th
Shipping data: transport cost ratio			
25	1.33	1.48	1.67
Median	1.41	1.55	1.74
75	1.51	1.65	1.84
CIF/FOB data: (CIF/FOB-1) ratio			
25	1.31	1.43	1.65
Median	1.34	1.46	1.69
75th	1.37	1.49	1.72
Gravity model: rate volume ratio			
25	0.55	0.42	0.26
Median	0.53	0.40	0.25
75	0.50	0.38	0.24

It was shown [13] that “Improving own infrastructure to the level of the best 25 percentage among landlocked countries cuts transport cost penalty to 41%, improvement by the transit country cuts the penalty to 48%, and, if both improvements are made, the penalty drops to 33%”. Bearing in mind the geographical position of Croatia, it can be stressed that a developed transportation system, especially multimodal transportation development, is a necessity and should be used as a comparative advantage factor for economic growth.

3. Advantageous Geographical Position of the Republic of Croatia

Croatia is a middle European, Pannonia-Danube, and Adriatic-Mediterranean country and it has a unique and advantageous geographical position in Europe. It is the only country that connects its south-eastern areas. Also, over the territory of Croatia, two main corridors are connected: from Western and Eastern Europe to the Black Sea and the European south-east, and from the parts of Middle Europe, the Pannonian and Baltic region and the parts of Eastern Europe towards the Adriatic coast and the Mediterranean region in a wider sense. It is considered that, given its geographic position, especially Central Croatia (Figure 3) plays a prominent role in the transport network of Croatia and Central-Eastern Europe [17]. To the north, the region borders with Hungary; with Slovenia to the west, with Bosnia and Herzegovina to the south, the Northern Adriatic to the west and Eastern Croatia to the east. There are also two important rivers: Drava and Sava crossing the region. The main city of the region is the City of Zagreb.



Figure 3: Valorisation of the Geographic Position of Croatia Through the Network of Transport Corridors [1]

The Croatian transport system consists of 29,500 km of classified interurban roads, 22,000 km of local roads, 2,726 km of railway network, two main sea ports, and five secondary sea ports. In addition, there are river ports on the 918 km of Sava and Drava rivers and 2.5 million deadweight tons (DWT) in river and ocean-going vessel capacity, as well as nine international airports [17].

The World Bank has recognized the role of transportation system in Croatia as well, already seventeen years ago, stating that Croatia has made good progress, especially by establishing the transport sector based on market principle and liberalization of road transport [19]. The following figure (Figure 4) shows comparative data for Croatia, Czech Republic, and Slovenia regarding total inland freight transport, rail container transport, total inland transport infrastructure investment, and passenger cars per one thousand inhabitants in the years of 2000 and 2019.

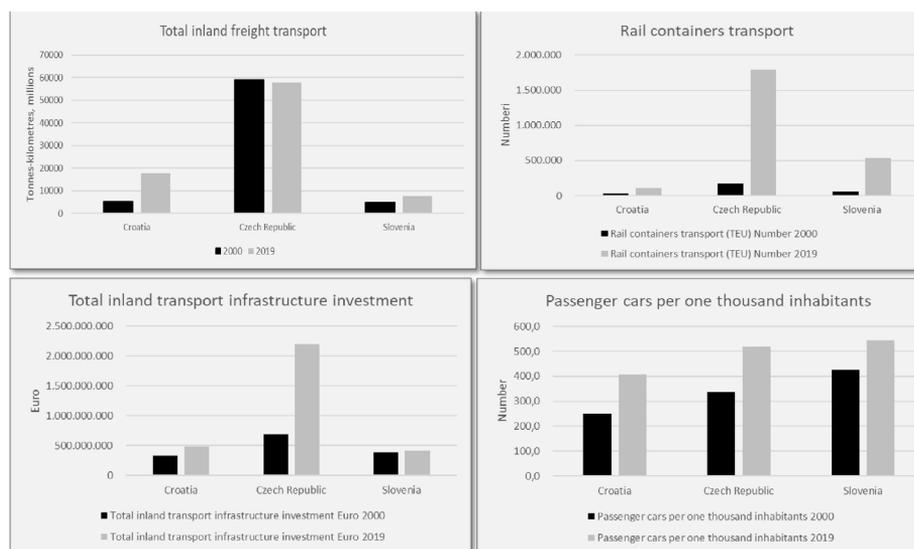
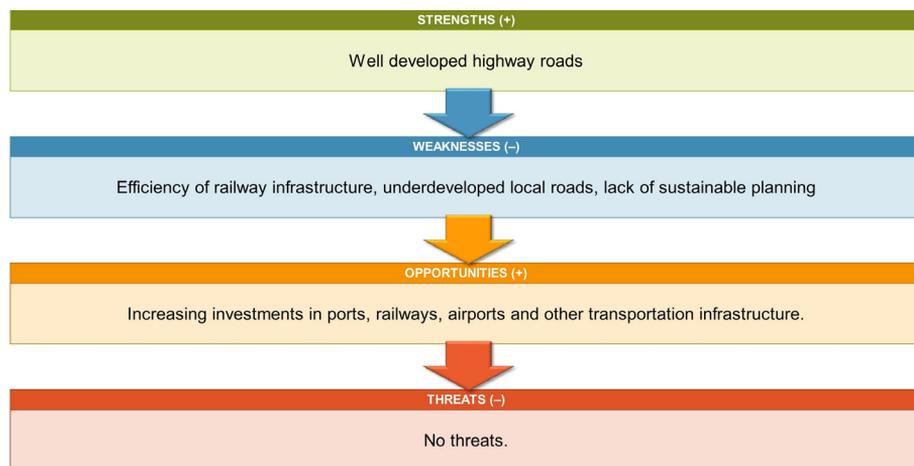


Figure 4: Comparative View of Selected Transport Data for Croatia, Czech Republic and Slovenia in 2000 and 2019. (Authors' adaption based on data from [11])

It can be seen that Croatia lags far behind Slovenia and the Czech Republic in each of the analysed areas. This is in line with the World Bank statement [19] indicating that the market share depends on the ability of railways to adapt to the new environment, requiring not only the restructuring of railways (as discussed above) but also exploring market niches, such as long-distance freight transport, multi-modal freight transport, and suburban passengers [19].



*Figure 5: SWOT Analysis of Croatian Transportation Infrastructure
(Source: authors)*

To sum up, regarding the Croatian transportation system, the main advantage lies in well developed high roads, but local roads are underdeveloped. There is a lack of sustainable planning in this area, as well as in the weakest link of the Croatian transport system – the railway infrastructure in general. However, investment in railways, airports, ports and other transportation infrastructure surely constitute a solid opportunity, as shown in a simple SWOT analysis (Figure 5).

4. Multimodal Transportation Development in Croatia is a Significant Development Factor

According to the European Commission report [18], it has been noticed that negative consequences of transport, such as pollution, climate change, noise, congestion and accidents, are bringing problems to the economy, health and well-being of citizens of the European Union. Specifically, with a continuous growth of freight and road transport, there are projections that they are going to increase by 40% by the year 2030, and even more, by 80% by the year 2050. Therefore, recommendations for reducing road transport towards less polluting and more energy efficient modes of transport were issued. Four types of actions support greater use of multimodal solutions [18]:

1. The internalisation of external costs in all modes of transport, with a view to send appropriate pricing signals to users, operators and investors. The social and environmental costs of transport should be paid in line with the polluter pays principle.
2. More targeted investments into physical infrastructure, aimed at better

interconnections between individual modal networks.

3. Direct support for intermodal transport, as provided by the
4. Combined Transport Directive (Council Directive 92/106/EEC), which aims to increase the competitiveness of the combined transport (defined as intermodal transport with a strictly limited road). The EU also provides financial support for multimodal/intermodal transport.

Further, in the document issued by the European Commission [22], the need for safer, efficient, and sustainable transport system is clearly stated, as well as the need for establishing a truly multimodal transport system. The same document offers an analysis of main current transportation system issues per member countries. The main transportation system issues in Croatia fall under three sections: Competitiveness of the rail sector, renewable energy in transport, and road safety. Regarding competitiveness of the rail sector, overall situation was poorly rated due to railway infrastructure that is significantly below the EU average. This situation results in low competitiveness, low quality of service, and a general preference of other transport modes, in particular road transport, where the quality of infrastructure is significantly higher (Current Trends and Issues, 2019). The recommendations for improving the competitiveness and quality of services are: Removing regulatory restrictions, implementing open and transparent tendering procedures, and facilitating cooperation between state-owned enterprises, private contractors, and infrastructure managers. It is considered that the improvement in the rail sector could positively affect ports by improving their cargo handling capacities and connections to EU markets, as well as creating new jobs and achieving economic growth. According to the European Alternative Fuels Observatory [6], Croatia is behind with the usage of renewable energy in the transport sector and the reduction of CO₂ emissions from transport seems to be at risk. Namely, in Croatia, in 2018, the share of battery-powered cars was not extremely low, but there were only two public charging points per vehicle, while this number in the European Union was eight [22]. Regarding the road safety issue, the data are devastating. Namely, Croatia is one of the countries with the highest fatality rates among the European Union members [22]. Although Croatia has reduced the number of road deaths in the period between 2001 and 2010, it is still among the three worst performing EU countries in terms of road safety, having 80 deaths per million inhabitants versus 49 in the European Union [5]. The situation regarding the modal split in passenger transport is satisfactory, even above the European average, which can be considered as significant factor since Croatia is a popular tourist destination (Figure 6).

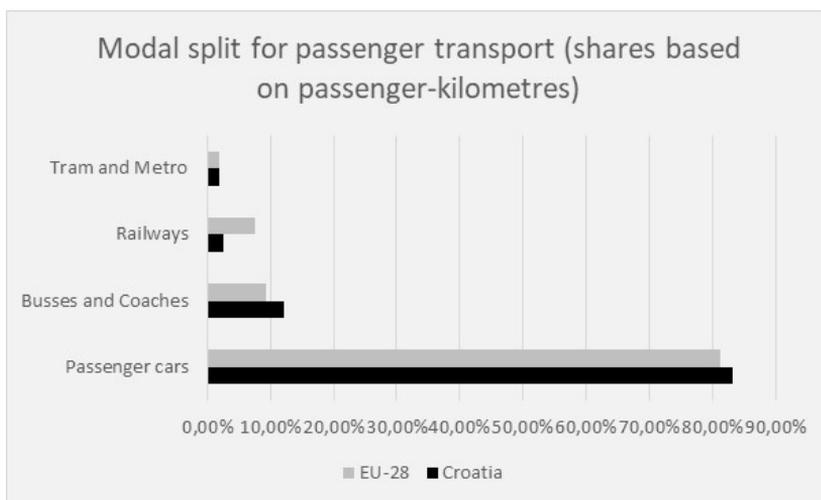


Figure 6: Modal Split for Passenger Transport (the authors' adaptation based on [4])

Regarding the modal split in railway transport, it is below the European Union average (Figure 7).

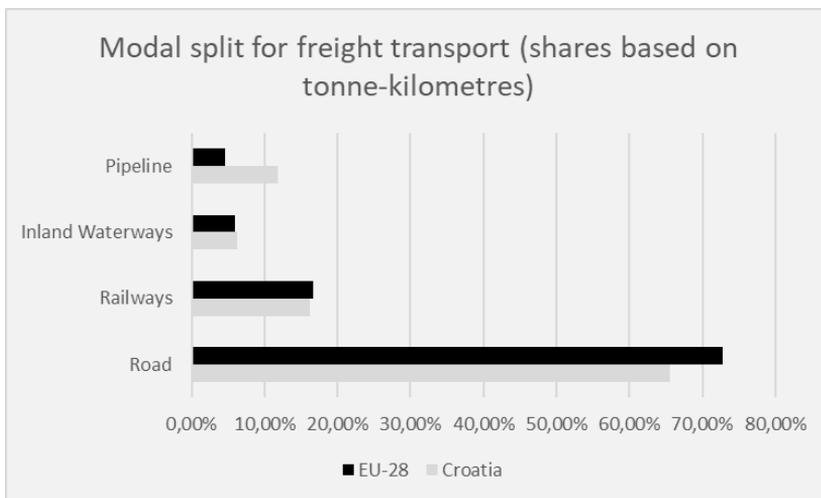


Figure 7: Modal Split for Freight Transport [4]

Although the modal split in freight transport (Table 2) is the same as the European Union average, road transport plays a less important role than is the average in the European Union countries.

Table 2: *World Bank Logistics Performance Indicator for Croatia ([14])*

World Bank's Logistics Performance Indicator (LPI)			
	2014	2016	2018
LPI RANK	55	51	49
Score	3.05	3.16	3.1
Customs	50	47	39
Score	2.95	3.07	2.98
Infrastructure	55	53	46
Score	2.92	2.99	3.01
International Shipment	61	51	58
Score	2.98	3.12	2.93
Logistics Competence	56	42	45
Score	3	3.21	3.1
Tracking and Tracing	59	52	61
Score	3.11	3.16	3.01
Timeliness	62	67	47
Score	3.37	3.39	3.59

Overall performance of the logistic sector is showing some improvement since 2014, but it is still weak (Figure 8) compared to other European Union members [14]. It can be seen that the indicator is placed in the middle, bearing in mind that scores range from 1, representing very low, to 5, representing very high indicator of logistics performance.

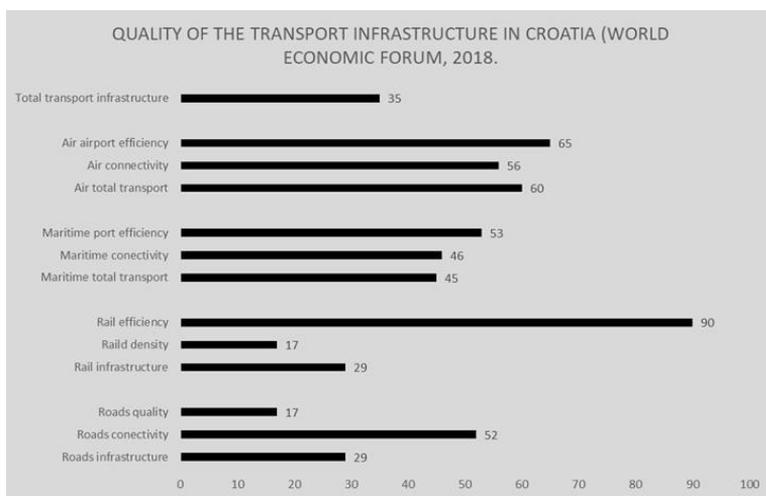


Figure 8: *Quality of the Transport Infrastructure in Croatia [25]*

Figure 8 shows the quality scores in each area from 1 to 100, where the score 100 represents the best score. According to the World Economic Forum 2018 [25], while measuring efficiency, factors such as frequency, punctuality, speed and price (including access to seaport services for landlocked countries) were taken into account. Therefore it can be stated that the general quality of transport infrastructure in 2018 in Croatia is acceptable, due to intensive investments into road infrastructure and the quality of port infrastructure, although there are additional investments needed to increase the capacity and quality of service for inland and seaports. The main problem is the efficiency of railway infrastructure due to the absence of infrastructure investments and maintenance over a longer period of time, which has led to a reduction of average speeds on the network (for freight and passenger transport). This issue is causing long journeys, low quality of service, and a shift to other transport modes, in particular road transport [22].

5. Conclusion

There is an enormous potential for the development of multimodal transportation system in the Republic Croatia. Croatia has a very advantageous geographical position since it is a middle European, Pannonia-Danube, and Adriatic-Mediterranean country, and is the only country that connects its south-eastern areas. The quality of transport infrastructure regarding the roads and port infrastructure is satisfactory on the average, but is not used to its full potential. The biggest issue is railway infrastructure, which is a significant factor of the partial mode of multimodal transportation system. In this area, Croatia is significantly behind the European Union average. This lack

causes low competitiveness, low quality of service, and a general preference of other transport modes. The negative consequences of transport, such as pollution, climate change, noise, congestion, and accidents are bringing problems to the economy, health, and well-being of the citizens of European Union while projections are showing an increase by 40 and 80% in the next ten and thirty years respectively. The recommendation of the European Commission goes towards reducing road transport in favour of multimodal solutions systems. Croatia, as a member of the EU, recognizing the importance and benefits of developing transport infrastructure and multimodal transportation system, should strongly recognize this factor as a potential comparative advantage and urgently consider improvements in this area. Some of the recommendations for improving competitiveness and quality of services are removing regulatory restrictions, implementing open and transparent tendering procedures in order to facilitate cooperation between state-owned enterprises, private constructors, and infrastructure managers. Improvement in rail sector would positively affect ports by improving their cargo handling capacities and connections to EU markets, as well as creating new jobs and achieving economy growth as well. It can therefore be concluded that modernisation of transport systems in Croatia, by developing multimodal transportation systems, represents a necessity in order to meet the European Union recommendations and to give a positive incentive to the Croatian economy.

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