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How to determine KPIs in Multi-Annual Infrastructure Contract – Case Montenegro

Branislav Bošković[1], Mirjana Bugarinović[1], Nikola Stojadinović[1] and Milan Bankovic[2]

Abstract – **The transition to a contractual relationship between government and Infrastructure Manager under Directive 2012/34 /EU requires the possession of contract management skills and the development of key performance indicators (KPIs). Previous activities related to the Multi Annual Infrastructure Contract (MAIC) have been exclusively in the field of the Annual Infrastructure Maintenance Program implementation (railway maintenance, public procurement, and supervision of civil works implementation). However, under Directive 2012/34/EU it is necessary to introduce a system of performance indicators for upgrading/modernize infrastructure to obtain value for money. The paper presents a systematic approach in determining the KPIs and their merits on the example of a contract between the Government of Montenegro and the Railway Infrastructure manager of Montenegro (ŽICG JSC) with the aim to improve the operation and quality of services of ŽICG JSC and the condition of railway infrastructure in Montenegro as well.**

Keywords – **Key performance indicators, railway infrastructure Multi-annual contract.**

I. INTRODUCTION

With publication of Directive 2012/34/EU, both the state and the infrastructure manager are forced to have a long-term view of the railway infrastructure by signing a multi annual contract (Multi Annual Infrastructure Contract - MAIC) [1]. The MAIC now becomes the central document (responsibilities, operation, management) of the infrastructure manager and the mechanism by which the Government provides the infrastructure manager with medium-term financing. Infrastructure financing must be in accordance with its operation, network size and maintenance requirements that correspond to traffic safety and user needs as well as to enable infrastructure modernization. With MAIC therefore are defined the level of financial assistance that a government allocates for the maintenance of public railway infrastructure and the regulation of railway traffic over a longer period. On the other hand, the infrastructure manager must provide value for the money received, ie. it is obliged to fulfill the specific conditions of the contract related to the business, performance (level of maintenance) of the infrastructure and the quality of services that provides [2].

1 Branislav Bošković, Mirjana Bugarinović, Nikola Stojadinović, University of Belgrade - Faculty of Transport and Traffic Engineering, Vojvode Stepe 305, Belgrade, Serbia, b.boskovic@sf.bg.ac.rs, mirab@sf.bg.ac.rs, n.stojadinovic@sf.bg.ac.rs

2 Milan Bankovic, Ministry of Capital investments, Rimski trg 46, Podgorica, Montenegro, milan.bankovic@mki.gov.

The above said is defined through the so-called key performance indicators (KPIs) and their target values for each year of the contract separately. The subject of this paper is precisely the answer to the question which KPIs should be considered, how they should be defined on the example of infrastructure managers in Montenegro - Railway Infrastructure manager of MontenegroJSC (ŽICG).

In other words, the question arises as to how to determine the KPIs related to the performance of the infrastructure and the quality of services to be fulfilled by ZICG for the money received through MAIC.

II. LEGAL FRAMEWORK FOR PERFORMANCE AND KEY PERFORMANSE INDICATORS

According to Directive 2012/34/EU, in Article 30 and Annex V of this Directive [1] and in the draft Railways Law on of the Republic of Montenegro [3] are defined all mandatory elements of MAIC as well as service quality performance for which it is necessary to determine criteria and indicators. These are the following performances:

- train performance, such as in terms of line speed and reliability, and customer satisfaction,
- network capacity,
- asset management,
- activity volumes,
- safety level,
- environmental protection.

For all these infrastructure performances, it is necessary to formulate key performance indicators and determine their target values. This is not easy because the KPU should be measurable, and their target values should be in correlation with the state of infrastructure, needs of infrastructure and allocated financial resources, and on the other hand to represent the work of ZICG management (i.e., give an answer to the question of how well ZICG meets the set operational and strategic goals of development of railway infrastructure of Montenegro).

III. KEY PERFORMANCE INDIKATORS

To defining performance indicators, the authors were guided by the fact that KPIs, together with their relative importance, should represent the performance of infrastructure provided by the legal framework, consider the actual state of the railway network and its primary problems to be solved, user requirements in terms of performance, plans and possibilities of the state of Montenegro in financing the railway

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infrastructure, i.e. the needs and influential factors at this moment. The goal is that both sides (Government and ŽICG) through the given indicators, their target and realized values manage the railway infrastructure in accordance with the defined policy and strategy of transport and railway development [4], i.e. the needs of the economy and citizens of Montenegro.

As a result of the above guidelines in determining the KPIs, the following 4 groups of indicators have been defined (Table 1):

- availability, quality, and maintenance of railway infrastructure,
- utilization of railway infrastructure,
- safety, and
- productivity of infrastructure managers - ŽICG.

TABLE 1: KEY PERFORMANSE INDICATORS FOR MAIC BETWEEN THE GOVERMENT OF MONTENEGRO AND ŽICG

Asociated area and key performances indicators (KPIs)	
1. Avaliability, quality and maintenance of railway infrastructure	1.1. Ratio of planned and realized lost train kilometers due to line closure
	1.2. Number of speed restrictions on main lines
	1.3 Coefficient of lenght of speed restrictions on main lines
	1.4. Number of interferences on signalling and telecommunication devices
	1.5. Average duration of interference on signalling and telecommunication devices
	1.6. Percentage of the railway network maintenance plan realization
2. Utilization of railway infrastructure	2.1. Increase the volume of traffic
	2.2. Efficiency of using international line Bijelo Polje – Bar and Podgorica – Tuzi
	2.3. Efficiency of using regional line Podgorica – Nikšić
3. Safety	3.1. Total number of train collisions and slippage
	3.2. Number of accidents at level crossing
4. Productivity of infrastructure manager	4.1 Productivity
	4.2 Coverage of operation expenses by track access charges income

The following section will briefly describe the KPIs and reasons for introducing these KPIs.

A. Key performance indicators for avaliability, quality and maintenance of railway infrastructure

In this phase of development and condition of the railway infrastructure in Montenegro, which is characterized by many speed restrictions and interruptions in traffic due to the reconstruction and maintenance of the network, as well as system failure, six indicators have been defined in this group.

Indicator 1.1. - Ratio of planned and realized lost trainkilometers due to line closure. The indicator refers to the ratio of planned lost train kilometers due to planned line closures (interruption of traffic) during the reconstruction and maintenance of the network and realized train kilometers due to the actual duration of line closure for one year. The goal of this indicator is to stimulate the improvement of traffic conditions during the execution of works at line and at the same time consistent execution of works according to the planned dynamics and deadlines, i.e. to increase the supervision and influence on the contractors, regardless of whether it is an external contractor or a ZICG as a contractor (ongoing maintenance).

Indicator 1.2. - The number of speed restrictions on main lines is defined as the difference between the number of newly speed restrictions in one year and the number of eliminated speed restrictions by executing defined plans of all types of maintenance to reduce the number of speed restrictions on network.

Indicator 1.3. - Coefficient of length of speed restrictions on main lines. This indicator is complementary to the previous one, considering that not only the number of speed restrictions is relevant, but also their length on the main lines. It is defined as the quotient of the total length of speed restrictions and the total length of main lines.

The number of speed restrictions and the coefficient of speed restrictions reflect the current quality of infrastructure maintenance as well as the assets management (open track, station tracks and stations).

Indicator 1.4. - Number of interferences on signaling and telecommunication devices. This indicator refers to the number of train traffic disturbances caused by failures on signaling and telecommunication devices for traffic management as well as on traction facilities.

Indicator 1.5. – Average duration of interference on signaling and telecommunication devices and catenary system. Average duration of interference on signaling, telecommunication devices or catenary. This indicator is complementary to the previous KPIs and refers to the time that

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elapses from fault detection to troubleshooting (average duration of interferences on signaling and telecommunication devices for traffic management as well as on traction facilities). *Indicator 1.6.* - Percentage of the railway network maintenance plan realization refers to the % realization of the Annual program of construction, reconstruction and maintenance of railway infrastructure, organization and regulation of railway traffic. Execution of the maintenance plan requires from the top and operational management of ŽICG good organization and management of the maintenance process both in depth and in breadth of the organizational structure of the company. This indicator is very representative for the owner (Government of Montenegro) and indicates the capacities of human resources and organization of infrastructure managers. Also, the indicator indicates the degree of correlation between the plans, allocated funds and capacities of ZICG and the measures that need to be taken in order to harmonize the funds, capacities and plans. The indicator will stimulate and at the same time force the management and employees of ŽICG in these jobs to dedicate themselves to increasing efficiency, better understanding of their own capabilities and places that are bottlenecks in the maintenance process, as well as better planning. Essentially, this indicator should be correlated with the indicators related to the number and length of speed restrictions, as well as the number and length of interferences.

B. Key performance indicators of railway infrastructure capacity utilization

According to Directive 2012/34/EU, it is necessary to define performance indicators for "network capacity" and " activity volumes". Due to the closeness and close connection between these two performances, they are classified in one group called "utilization of railway infrastructure capacity". The following indicator is given for this integrated performance: the indicator of increase the volume of traffic (for the activity volumes) and the indicator of the Efficiency of using internatioal line (for the network capacity).

Indicator 2.1. – Increase the volume of traffic. Having in mind that for the infrastructure manager the basic product that sells capacity (railway infrastructure) is measured in "train km", this is the basic goal of increasing revenue from capacity sales. There are numerous reasons why the volume of income is not taken in any EU country as indicator, but the volume of traffic is, and it was proposed for ZICG as well. It is calculated as the difference between the realized total train kilometers in the current year and the total train kilometers in the previous year divided by the total train kilometers realized in the previous year and is expressed in %.

Indicator 2.2. –Efficiency of using international line Bijelo Polje - Bar and Podgorica - Tuzi. This is an indicator that refers only to international lines i.e., Bijelo Polje-Bar and Podgorica-Tuzi, where it is possible to influence the competitiveness of railways by ŽICG in cooperation with operators. It is expressed in the number of train kilometers per 1 km of main lines.

C. Safety key perfomance indicators

In terms of safety, we proposed two indicators covering two types of extraordinary events: train collisions and train slippage as one category of emergencies involving exclusively railway vehicles, and second indicator - road crossing accidents which involving road vehicles. These are indicators which the responsibility is not only ŽICG, but also the state as the owner and as one of those responsible in the safety chain. The state level should interest in the trend in whole sector not by the participants.

Indicator 3.1. - Total number of train collisions and slippage. It is expressed by the ratio between the total number of collisions and slippage of trains and the total train km realized on the network.

Indicator 3.2. - Number of accidents at level crossing. It is expressed in the number of accidents per year per 1 train km with the aim of reduction.

D. Key performances indicators of ŽICG productivity

Indicator 4.1. – Productivity. Labor productivity is expressed by the ratio of total realized train km per year and the average number of employees during the same year with the aim of increasing. ŽICG's productivity should be an expression of the vision of what infrastructure manager the Government wants to see and wants to be: stable with good financial and other business indicators, capacities that meet market needs, with competitive service, adequate organizational structure, etc.

Indicator j 4.2. - Coverage of operation expenses by track access charges income. One of the basic objectives given in Directive 2012/34/EU is for infrastructure managers to manage their costs and to strive to cover operating costs with track access charges revenues. The goal of introducing this indicator is for ZICG to have a look from that perspective, to manage the infrastructure in a commercial manner and take measures in that direction. It is calculated as the ratio between total track access charges income and total operating expenses. In addition to the mentioned KPIs that will be covered by the contract, it is proposed that ZICG introduce internal monitoring of results for an additional two indicators. Those are:

- average revenue per kilometer of route charged and
- average costs per kilometer of the route charged.

Revenues and costs are the basic measures of business results, and the kilometer of the route charged is the basic output unit for using the infrastructure capacity. By reducing revenues and costs to a basic output unit, a better insight is gained into how much and how ZICG earns and spends funds on the realization of one basic output unit and what trends are present. These are indicators that will enable a better understanding and adoption of the company's goals and take effective measures for good governance [5]. After the first observations, a decision can be made to include these indicators in the contract itself.

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E. KPIs target values determing

It is proposed to use the following criteria to determine the target values of the KPIs:

- the sum of the available state compensation volume and the expected revenue of ŽICG from track access charges for the use of railway infrastructure for the observed year;
- the relationship between the realized values of the KPIs during the previous year and the volume of financing available to ZICG during the given year;
- projects pipeline and activities list within the management of railway infrastructure, in accordance with the valid strategic documents of Montenegro;
- market prices of key raw materials, labor and energy in Montenegro at the time of negotiations, as well as projections of their movement in the year to which the Annex refers;
- ratio of the value of reconstruction works of the existing and construction of new railway infrastructure allocated to the ŽICG on the basis of the same Annex in the amount of State compensation for the given year, as well as possible impact that these works may have on productivity, regularity and safety of railway infrastructure in the given year;
- the dynamics of completion and commissioning of projects carried out outside the scope of this Contract, taking into account the expected impact of such projects on the productivity, maintenance and safety of railway infrastructure.

When the competent Ministry of Transport harmonize with ZICG all performance indicators, including the method of their calculation, it is necessary to collect data for their budget for the previous relevant period as a basis for defining the target values of the KPIs for the next year. At the same time, it is necessary to consider the volume of planned funds in relation to the previous period. KPIs target values should be checked and adjusted in MAIC for each year and determined by the annex to the contract.

IV. CONCLUSION

The multi-annual contract on railway infrastructure, in its essence, represents a financial arrangement between the Government of Montenegro and the ŽICG. The purpose of this contract, seen by the Government, is to get value for the money invested, and on the part of ZICG to provide safety and predictability of financing in the long run, i.e., the stability of financing. This contract requires ŽICG to manage the infrastructure in a commercial manner, meeting the expectations of users (train operators and end users) in terms of quality, reliability, and flexibility. Therefore, the adoption of commercial principles in business by ŽICG is now a condition for the provision of assistance by the Government of Montenegro, unlike the previous period (until the contractual relationship) when availability and capacity were the primary requirements. To meet the previous objectives, key performance indicators are introduced that the infrastructure manager needs to meet in the management of infrastructure and traffic and in maintaining the level of quality of infrastructure and traffic as well. The areas that need to be covered with indicators are defined by EU regulations, but the introduction of specific indicators depends on the current state of infrastructure and the amount of funds allocated by the governments for railway infrastructure. The definition of the KPIs for ZICG has just started from the existing, ie basic conditions in which the railway sector and infrastructure of Montenegro are located. Thus, 13 key performance indicators presented in this paper were set up.

Establishing the target values of the KPIs is currently the subject of negotiations between the Government of Montenegro and Ministry of Capital Investment and the authors plan to follow up with this topic in that direction.

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