

## JEDAN PRISTUP RANGIRANJU ŽELEZNIČKIH INFRASTRUKTURNIH PROJEKATA RAILWAY INFRASTRUCTURE PROJECT RANKING - ONE APPROACH

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**Sažetak** – *Da bi se zadovoljili zahtevi za boljim kvalitetom prevozne usluge mnoge železničke uprave se suočavaju sa neophodnošću konstantne obnove ili čak i izgradnje nove železničke infrastrukture. Imajući u vidu da je iznos finansijskih sredstava potrebnih za poboljšanje infrastrukture prilično ograničen, pojavljuje se potreba za identifikovanjem prioriternih infrastrukturnih projekata i rangiranje istih u kratkoročnom i dugoročnom periodu. Dakle, neophodno je da se identifikuju princip, na osnovu kojeg svaki infrastrukturni projekat može biti objektivno razmatran i ocenjen na osnovu integralnih pokazatelja. Prednost ovog modela je što se pri ocenjivanju infrastrukturnih projekata uzima u obzir generalni uslovi koje propisuju međunarodne institucije i uslovi definisani na nacionalnom nivou. Oni su grupisani u klaster obaveznih kriterijuma za ocenu. Odluke o rang listi projekata i implementaciji projekata, će se stalno proveravati upoređivanjem postojeće liste projekata sa rangom drugih infrastrukturnih projekata, koji bi se takođe mogli smatrati potencijalnim prioritetima. Ovaj rad predstaviti jedan od pristupa za rangiranje prioriternih železničkih infrastrukturnih projekata koja je već uspešno implementirana za prioritizaciju železničkih infrastrukturnih projekata u Ukrajini.*

**Ključne riječi** – *rangiranje, železničke infrastrukturni investicije, višekriterijumsko odlučivanje*

**Abstract** – *In order to satisfy the demands for higher quality services of passenger and freight transport many railways are facing with necessity of conducting of current infrastructure upgrade or even design a new one. Having in mind that amount of financial resources is rather limited; there is an issue of identifying priority infrastructure projects and ranking projects for short and medium terms. So, it is crucial to identify a principle, following which every infrastructure project can be objectively reviewed and evaluated based on calculation of integral indicators. The advantage of this model is that in the evaluation of projects takes into account the general requirements of the IFIs as well as the national ones grouped together in the form of mandatory evaluation criteria. Decisions about proceeding with the project ranking and implementation shall be justified by comparative evaluation rating of other infrastructure projects, which could be also seen as potential priority ones. This paper present one approach for prioritization of railway infrastructure projects which has been successfully used for prioritization of railway infrastructure projects in Ukraine.*

**Key words** – *ranking, railway infrastructure projects, multi-criteria approach*

### 1. INTRODUCTION

The resources available in any country for transport infrastructure improvements through investments rarely meet their respective needs [3]. Governments and relevant Ministries encounter this dilemma regularly all over the world. Under this type of severe fiscal constraints, it becomes imperative to employ a rational and structured process to determine true funding priorities, infrastructure projects [1], [7], [11].

Great-scale railway transport projects require large capital spending, and they invariably have a wide range of tangible and intangible impacts. To facilitate an efficient, equitable and environment-friendly allocation of limited resources, the impacts of a project should be weighed against those of other projects to determine funding priorities. This is a very difficult and comprehensive task because of the lack of a single and objective measure that can be used to determine the net worth of each competing project to the society [5], [8]. In democratic surrounding, this problem is compounded by the presence of many stakeholders whose differentiated interests often make the funding of a major transport project contentious and uncertain up to a great extent.

Having in mind that the growth of the economy is directly impacted by the quality of railway services, comprehensive planning and strategy for investments and improvement of railway infrastructure have to done in sense

of the multi-criteria approach where the real priorities can be identified, technically prepared as “*mature projects*” and finally presented towards the IFIs<sup>1</sup> for funding [2], [4], [9].

This paper will present one approach for prioritization of railway infrastructure investments which has been successfully used for prioritization of railway infrastructural projects in Ukraine during the project „Railway infrastructure in Ukraine: Project Identification and Preparation“[6].

## **2. METHODOLOGY CONCEPT**

The main target of infrastructure projects ranking is improvement of investment policy, aimed at development of transport infrastructure policy, through identification of a list of the most significant railway infrastructure projects, elaboration of their implementation plans per priority level, as well as monitoring, legislative and regulatory support of such infrastructural projects starting from the governmental level [11].

Identification and creation of the list of priority infrastructure projects will allow definition of precise directions for allocation of funds from the state and local budgets according to priorities, as well as search for additional resources of financing of infrastructural projects (credits from commercial banks or IFIs, state guaranteed loans, grants, engagement of private sector and capital through PPP models), which have the biggest economic and social impact on the national economy on the assumption of integral indicator of identification of prioritized infrastructure projects (evaluation rating). To facilitate an efficient, equitable and environment-friendly allocation of limited resources, the impacts of a project should be weighed against those of other projects to determine funding priorities. This is a difficult task because of the lack of a single and objective measure that can be used to determine the net worth of each competing project to the society. In a democracy, this problem is compounded by the presence of many stakeholders whose vested interests often make the funding of a major transport project contentious.

The resources available in any country for transport infrastructure improvement rarely meet the needs. Major transport projects require large capital spending, and they invariably have a wide range of tangible and intangible impacts. Objectives of defined concept, besides definition of priority projects list, have to fulfil a certain preconditions (constraints). One of the most important is for sure that this prioritization had to be in line with the national macroeconomic plans and strategy for development of the railway transport infrastructure [8].

### **2.1 Brief information on the Methodology**

Identification of the most significant infrastructural projects to be listed and elaboration of their implementation plans in terms of their priority level will follow the iterative approach and shall be done in 3 stages:

#### **First stage – DEFINITION OF TRANSPORT INFRASTRUCTURE PROJECTS PORTFOLIO FOR NEXT 5 YEARS.**

During the initial stage, a portfolio of infrastructure projects for the next 5 years will be created. Initiator of an infrastructural project will submit a properly filled investment proposal with data, which shall specify the order for selection of investment projects to be funded.

Preparation of the investment proposal is based on the results of the market and traffic study, technological, economical/financial, EIA and other relevant calculations and assessments. Basic project calculations are done without taking into account the source of financing. This approach allows choosing of optimal and economically efficient options for technological and organizational solutions for project realization.

After this initial calculation, alternative funding schemes shall be also examined: soft or commercial loans, own funds, budget or private investments. These calculations allow evaluation of different funds, which can be attracted from other resources, as well as possibilities of risk sharing with external participants.

It has to be noted that since this can be seen as a rather medium-term approach, investment proposal are being submitted only for those infrastructural projects being pre-planned for next 5 years. Investment proposal shall describe the brief project idea, its conformity with strategic tasks of the national development, actuality and economical appropriateness, as well as information which can serve as a basis for evaluation of every criterion, proposed in methodology.

#### **Second stage - IDENTIFICATION LIST OF PRIORITY INVESTMENT PROJECTS**

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<sup>1</sup> IFIs stands for the International Financial Institutions

This stage is targeted at identification of priority of investment projects, already included into portfolio of transport infrastructure projects and making a list of the most significant infrastructural projects. Every infrastructure project, registered and included into portfolio of transport infrastructure projects, is being reviewed and evaluated per relevant criteria, which are detailed in the next chapter.

Evaluation scale is chosen for every specific criterion, acquiring the defined impact coefficient on the total evaluation -final evaluation rating which shall be calculated as follows:

- where,
- $P_j$  – total score (number of points) for the project  $j$ ;
  - $K_{obl}$  – obligatory criterion, ;
  - $n$  – number of criteria;
  - $W_i$  – value of relevant criterion  $i$ ;
  - $K_{ij}$  – evaluation rating of criterion  $i$  for project  $j$ ;
  - $K_{ij\ max}$  – maximum rating of criterion  $i$  for project  $j$ ;  $K_{ij\ max} \geq K_{ij}$
  - $W_{max}$  – the highest possible evaluation rating;  $W_{max} = 100 \geq W_i$

Infrastructural projects are prioritized based on the final evaluation rating.

Infrastructural projects, having their evaluation rating more than  $P_{max} = 75$  points, can aspire to receive the financial support and be implemented in the practice. Infrastructural projects, scoring their evaluation rating less than  $P_{min} = 60$  points, are failing in the process of the competitive selection and cannot be listed among the most significant infrastructural projects [5].

Values of  $P_{max}$  and  $P_{min}$  indicators are defined according to the Methodology or corrected by decision makers. After setting up of the priority infrastructural projects list activities on identification of the accessible financial and technical aid resources can start.

In case realization of the infrastructural project was planned to be conducted with the involvement of state support and its total evaluation rating is less than  $P_{max}$ , initiator of the infrastructural project finalizes elaboration of the investment proposal and its supplementing documents in the part which concerns amending of sources and conditions of financing of infrastructural project. Such project can be enlisted among the most significant infrastructural projects with a note "Investment proposal and its supplementing documents need finalizing" and is not included into annual plan of financing of the infrastructural projects before the initiator finalizes its investment proposal and relevant supplementing documents.

### **Third stage - DEFINITION OF THE PRIORITY INFRASTRUCTURE PROJECT LIST**

Target of this stage is based on the identified list of the most significant infrastructural projects, their priority and availability of financial and technical resources and devoted to elaboration of plans for their implementation (in conformity with the Methodology).

If infrastructural project, previously being classified as one of the "most significant infrastructural projects", is not implemented and/or financed within the framework defined by its implementation plan, the project shall be reviewed in order to settle a new implementation schedule.

Revision of the list of the most significant infrastructural projects and their implementation plans is conducted in case that the relevant Ministry or some other entity which can be seen as the project initiator submits a new investment proposal, stipulated by the Methodology, but, at least, once a year.

These 3 stages, detailed above, have been graphically interpreted on the following figure.

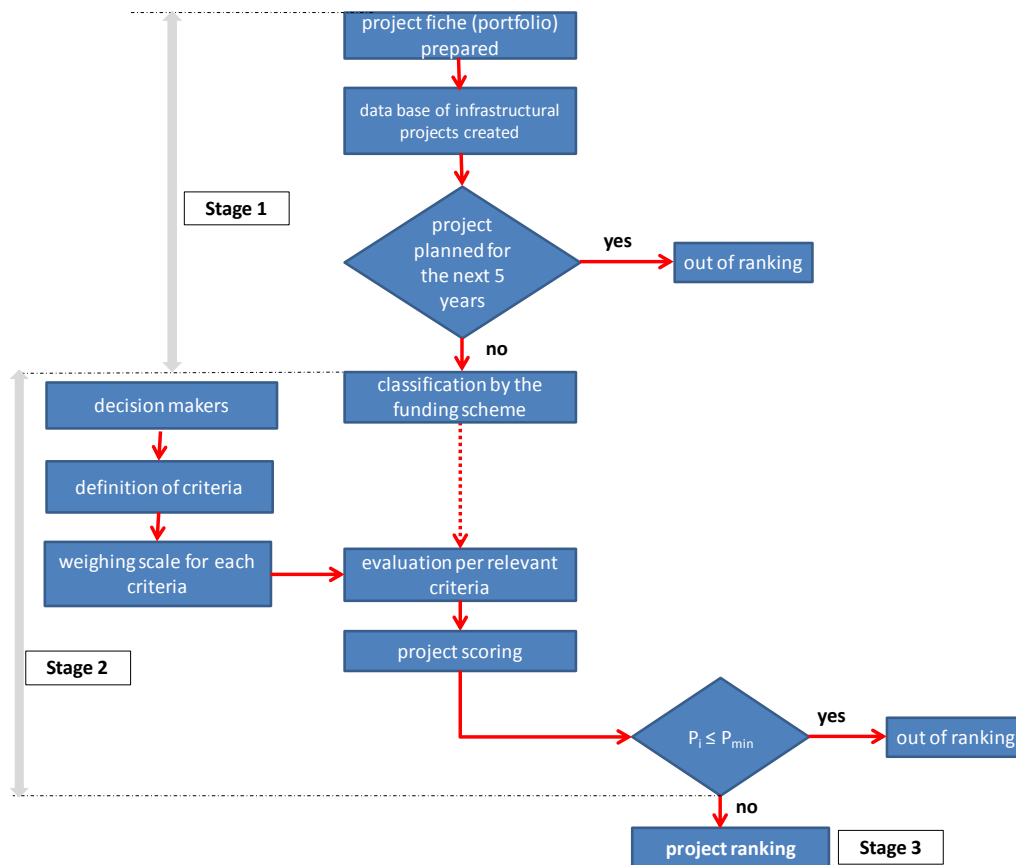


Figure 1. Methodology framework

## 2.4 Criteria of evaluation of infrastructural projects

For the purpose of the present multi criteria approach for the prioritization of the most significant infrastructural projects, and in order to reduce the subjectivity as much as possible, the following criteria with their respective criterions can be used.

Every project has been reviewed by the following criteria, which are conventionally divided into 5 different categories with their respective criterions.

### I Criteria of regional development:

**Criterion of impact of outcomes of infrastructure project on development of regions (K1)** -defines impact of realization of infrastructural project on development of regions and possibility of solving current issues of regions. Criterion value (W1) is defined in a scale from 0 to 6.

**Criterion of social development (K2)** -defines level of impact of outcomes of infrastructure project on creation of new employment possibilities and solving of urgent social problems. Criterion value (W2) is defined in a scale from 0 to 3.

### II Technological criteria

**Criterion of innovative development (K3)** -characterizes seek of the infrastructural project to apply or implement new technologies. Criterion value (W3) is defined in a scale from 0 to 2.

**Criterion of available technical capability of national companies to implement a project (K4)** defines a possibility of realization of infrastructure project by national companies solely. Criterion value (W4) is defined in a scale from 0 to 2.

**Preparedness to the project realization (K5)** -this criterion defines priority of infrastructural project depending on its possible starting date. Infrastructural project, implementation of which can be started in the shortest term, is given a higher priority rate. Criterion value (W5) in a scale from 0 to 2.

### III Economical criteria

**Criterion of cost of infrastructural project and amount of involved funds (K6)** -defines priority of investment project depending on amount of funds, what shall be raised additionally. Infrastructural project which evolves the biggest financing is given a higher priority rate. Criterion value (W6) is defined in a scale from 0 to 3.

**Criterion of the investment payback period (K7)** -defines period of payback of infrastructural project.

Infrastructural project which has the shortest payback period is given a higher priority rate. Criterion value (W7) is defined in a scale from 0 to 2.

**Criterion of impact on development and income level of other branches of economy, connected with realization of infrastructural project (K8)** -characterizes impact from realization of infrastructural project on income increase of other branches of economy, connected with realization of the project, and defines a necessity of infrastructural project implementation for further development of other branches of economy. Criterion value (W8) is defined in a scale from 0 to 2.

#### **IV Environmental and safety criteria**

**Criterion of environmental safety (K9)** -characterizes environmental safety level of infrastructural project realization. Criterion value (W9) is defined per the Methodology.

**Criterion of safety and reliability (K10)** -characterizes impact of outcomes of infrastructural project on safety and reliability level of transportation, as well as on a possibility to prevent an emergency situation of technological disaster character. Criterion value (W10) is defined per the Methodology.

#### **V. Criterion of obligatory condition**

Obligatory criterion *Kobl* is not having the number of points to be delegated as it was the case with previously mentioned criterions - there are only 2 values (1 and 0) allowing that a certain project can be ranked and listed among the most significant infrastructural projects.

If the obligatory criterion is fulfilled ( $Y, Kobl=1$ ) than a certain project can be ranked according to the above described Methodology. On the other hand, projects that are not fulfilling this criterion are having value (according to this criterion) N,  $Kobl=0$  and, in respect to the previously given formula, are having a total score of points  $P=0$  not allowing them to be taken into consideration for ranking with other infrastructural projects.

Requirements to be fulfilled by the obligatory criterion *Kobl* are presented below:

***Kobl = 1*** Investment proposal and its supplementing documents, compiled and filled in per established order, shall contain all the necessary information needed and requested by the template

***Kobl = 0*** other.

### **3. CONCLUSION**

Generally speaking, large-scale infrastructure projects, as railway infrastructure investments certainly are, have been often connected with very comprehensive and time-consuming planning processes. In these cases, the efficiency of the expected results and effects can be significantly reduced and implementation of the project can be postponed for a certain period, or even cancelled in the worst-case scenario.

Following above presented issues that could potentially occur, relevant Ministries as project Promoters or Beneficiaries are always seeking for a chance and possibility to accelerate the investment preparation processes and planning procedures in order to put a project proposal in a proper bankable form for presentation towards IFIs. This chance could be found through very close cooperation of relevant bodies engaged in the decision making process.

Prioritization mechanism stipulated in the Methodology can be very easily used as a helpful mechanism for appraisal and ranking of the most significant infrastructural projects. All potential projects to be listed as the most significant are being evaluated according to main criteria conventionally divided into 5 different categories with their respective criterions, as presented above in details.

Although large scale infrastructural projects to be funded and implanted are being picked up according to their preferences, political decisions or already secured funding schemes in arrangements with IFIs, above presented prioritization mechanism, where the level of subjectivity is downed to the lowest possible degree, should be used as a base for listing of the most infrastructural projects.

The basic algorithm which defines this prioritization approach is applicable for solving of all future similar problems, as shown on the example of Ukraine. The challenge with implementation of this model in other incumbent railways is creation of the list of all potential infrastructural projects which was also one of conclusions that have been pointed out during the ranking of projects for the West Balkan, MAP 2013 [10].

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