



Smart Transportation Alliance

# Rating the success of transport infrastructure project delivery

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TECHNICAL PAPER 02/2017

September 2017

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## 1. Introduction

The need for transport infrastructure is justified by its contribution to economic development and the direct and indirect beneficiaries it creates, who, in turn, provide direct (such as tolls, fares and other forms of user fees) and indirect (such as potentially greater tax revenues) funding streams in support of the respective investment(s). The potential for revenues has allowed private actors to be directly involved in project financing, despite the sunk nature of these investments. Well-recognised tools have been developed/used to assess the viability of transport infrastructure investments such as cost-benefit analysis (CBA) and multi-criteria decision analysis (MCDA) which compare the costs of delivery and operation/maintenance to benefits generated by the infrastructure. Other techniques consider the environmental and social impacts of project alternatives such as life-cycle assessment (LCA) and social life-cycle assessment (SLCA). Many of these techniques are supported by frameworks and rating systems providing market signals to decision makers.

However, all developed techniques and methodologies focus on the planning stage of transport infrastructure delivery, while the reality of project delivery has raised concerns given the number of projects overshooting initial estimates of cost and time to completion and achieving traffic and revenue figures below forecasts (see Flybjerg et al, 2004). In this context, viability, as assessed through the aforementioned techniques, is undermined and risks related to these investments increase, leading to the demonstration of risk-averse behaviours and strategies. Stricter international regulations with respect to capital requirements for banks (e.g. Basel III or Solvency II) or the need for governments to provide guarantees (OECD, 2014) are examples of institutional responses to the increased risk perceived by investors with respect to transport infrastructure delivery following the global financial crisis.

In order to assess the risk exposure of invested capital, many investors rely on third-party due diligence and relevant market signals. These are provided in the form of ratings issued by specialist rating agencies. “Creditworthiness ratings” or “credit assessments” concern “the assessment of a project “owner’s” likelihood of default” (including delayed payment of debt). However, before resorting to the assessment of the project “owner’s” ability to honour debt obligations or assessing their riskiness of default, it is equally important – if not more so – to assess the likelihood of the project itself achieving its target performance outcomes (Pantelias and Roumboutsos, 2015).

Experts and researchers are well-aware of this fact. To this end, considerable research has been undertaken to identify factors that support and contribute to successful transport infrastructure delivery. However, decision makers are faced with a plethora of factors, which cannot always be simultaneously managed, while missing the tools to make informed trade-offs.

The BENEFIT EU Horizon 2020 funded project addressed this gap by providing decision makers with a rating system to assess the potential of an infrastructure project to reach its anticipated cost and time to completion, as well as traffic and revenue targets, based on its implementation structure and conditions, which are not considered in the planning stage, but formulated thereafter.

## 2. Background & Concept

Case study analysis has been the primary tool employed by researchers to identify factors influencing the successful delivery of projects, including transport infrastructure. These factors may be grouped as described below.

The **Business Model** and its Value Proposition. In transport infrastructure, the Business Model is characterised by the level of integration of the project and its encompassing activities. Notably, while some characteristics will enhance the model's ability to generate revenues, other characteristics will reduce construction, operation and maintenance costs. A Business Model is related to strategy, value creation and value capture and may be employed as an "opportunity" facilitator. In a project setting, "value" concerns "use-value" and how specific characteristics/qualities are perceived by users in relation to their needs. Value capture is then related to the potential of use-value to generate strategic value.

**The Funding Scheme.** This describes the mix of revenue streams produced by the business model and how they are captured. These may be direct revenues (e.g. revenues generated by the use activities); and/or indirect revenues described as benefits to society. They may lead to economic growth and, ultimately, support the relevant government / public authority budget and/or generate investment returns for the private sector (if/when involved).

**The Financing Scheme.** This describes the mix of financing sources contributed for the delivery of the Business Model. In many ways, the Business Model planned the resulting Funding Scheme envisaged will guide the structuring of the Financing Scheme as different risk profiles, incentives and motives are put forward.

**Governance.** This concerns the interaction between the formal institutions and other actors involved in the delivery of a transport infrastructure project. It is primarily based on the conditions formulating the contractual relations in the provision of the infrastructure.

Finally, all the above factors are influenced by:

- **The Implementation context** which encompasses financial-economic conditions, regulations and policies describing and defining the national implementation environment of the project.
- The characteristics (typology) of the infrastructure **transport mode** concerned.

The BENEFIT Framework connects these groups of factors as shown in Figure 1 below:

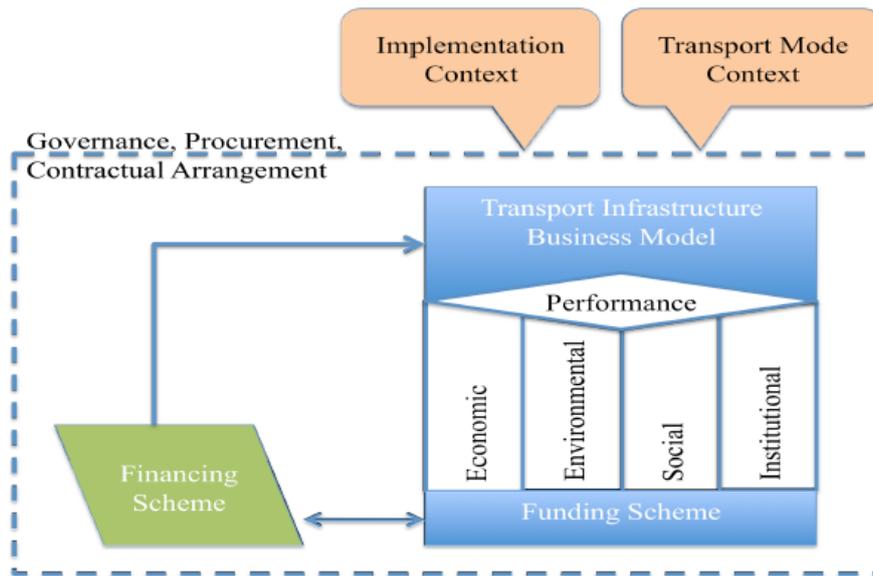


Figure 1: BENEFIT Framework

In effect, Figure 1 describes the transport infrastructure delivery system. The study of this system and its dynamics becomes essential in understanding the interactions of its elements (factors) that influence transport infrastructure delivery. As a result, a purely qualitative (case study) approach is useful but insufficient and needs to be complemented by additional quantitative analyses. This is facilitated by the BENEFIT concept.

The BENEFIT concept concerns expressing the system elements and capturing their system function(s) through appropriately selected, developed and validated quantitative indicators. These indicators can be used to study:

- Interrelations between elements.
- The combinations of elements leading to successful project performance.
- The conditions under which the adverse impact of elements may be mitigated, compensated for or overcome.
- The type of Business Models, Governance Arrangements and Financing Schemes (all three elements expressed through indicator values) that might be successfully implemented given the indicator values of the remaining system elements.
- The type of activities (value propositions), engagements, and financing needed to improve Business Models, Governance Arrangements and Financing Schemes based on their existing indicator values.

Ultimately, the combination of findings from the above indicator-based investigations constitutes the basis for the development of the Transport Infrastructure Resilience Index (TIRESI) and its rating system quantifying “the ability of a Transport Infrastructure project to

*withstand, adjust to, and recover from changes within its structural elements that affect its capability to deliver specific outcomes” (Roumboutsos et al, 2017).*

### 3. Methodology leading to the TIRESI rating system & Indicators

#### 3.1 Methodology

The BENEFIT background and concept were tested against 86 case studies from 18 European Countries covering all modes of transport infrastructure (see list of projects and description in the BENEFIT wiki [www.benefit4transport.eu](http://www.benefit4transport.eu)). An in-depth qualitative case study analysis per mode was initially conducted and findings were compared with existing literature confirming on the one hand that the sample produced results which are comparable to other reported findings and, on the other, the usability of the BENEFIT framework as an analysis guide.

Indicators were, then, developed to represent and validate the elements of the BENEFIT framework. Through the use of the BENEFIT concept, case studies were analysed using their indicator representation. A multi-method analysis was conducted including fuzzy-set Qualitative Comparative Analysis (fsQCA), Importance analysis (Bayesian network analysis) and Econometric Analysis. The combination of all three analysis methods produced a wealth of information allowing to identify combinations of indicators (factors) that would lead to the successful attainment of project outcomes.

By identifying combinations of indicators and their respective values, a rating system could be heuristically developed to rate the likelihood of achieving a specific target outcome per transport mode.

Figure 2, below, describes the methodology followed.

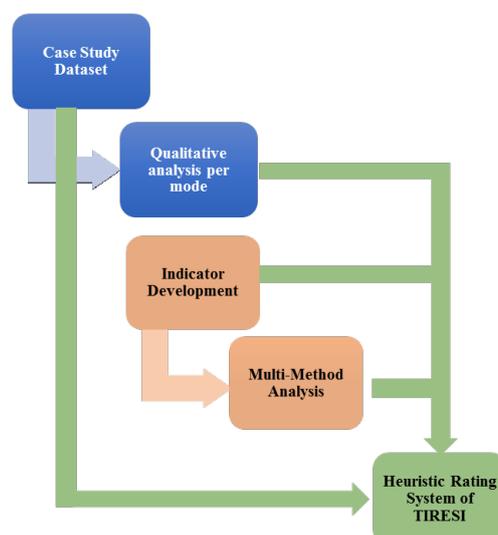


Figure 2: Methodology leading to TIRESI rating system

### 3.2 The Indicators

The indicators developed to represent the elements of the BENEFIT framework were initially constructed and subsequently validated based on the collected case studies. They were then operationalised by determining mathematical formulations (where appropriate). All indicators (with one exception) were constructed so that they take values in the range [0, 1]. Higher indicator values reflect project characteristics that exhibit less risk and/or less cost compared to lower values. The brief description of the indicators follows.

The **implementation context** is described by two indicators: The Financial-Economic (FEI) and the Institutional (InI) indicators. These indicators encompass more than their title may suggest and are built based on international indices published by prominent international institutions (World Bank Governance Indicators, OECD indicators of regulation in energy, transport and communications (ETCR), World Economic Forum (WEF) indicators). More specifically, *the Institutional indicator shows the extent to which the political, legal and regulatory, and administrative context in a country is stable and of a high quality*. The Financial-Economic indicator measures more broadly the business environment and can be seen as *a proxy of the level of productivity of a country* as it focuses on the capacity of the national economy to achieve sustained economic growth over the medium term, controlling for the current level of economic development.

The **Business Model element** is described by two composite indicators representing the two major parts of the business model, i.e. costs and revenues. The corresponding indicators also aim to capture conditions improving efficiency and effectiveness which essentially lead to Cost Saving and Revenue Support.

- The Cost Saving Indicator (CSI) includes the ability to construct (level of civil works/ technical difficulty; capability to construct based on the market position of the contractor with respect to construction or respective project delivery capability (example for rolling stock); construction risk allocation as per contractual agreement; assessment of optimal construction risk allocation based solely on the capability to construct); ability to monitor / control / plan and provide political support of the respective public or contracting authority; adoption of innovation and its successful application; and life cycle planning and operation (life cycle planning verification; capability to operate based on the market position of the operator; operation risk allocation as per contractual agreement; assessment of optimal operational risk allocation based solely on the capability to operate). It is evident, based on the above description, that the CSI, in all practical terms, *illustrates a measure of a project's efficiency during construction and operation*.
- The Revenue Support Indicator (RSI) is also a composite indicator that includes the level of competition of the new (greenfield) and existing (brownfield) parts of the

project expressing the level of business development scope designed to attract demand (e.g. airports etc.); the level of project exclusivity with respect to its position in the transport network (e.g. metros, bridge and tunnel projects, ports airports under certain conditions); and the level to which a transport network supports the project's exclusivity. The RSI also includes revenue sources attached to the project (traffic from new and brownfield operation as well as traffic from other transport infrastructure bundled in the project as well as revenues related to non-transport services all in relation to the capability to manage demand; demand risk allocation; assessment of demand risk allocation based on the capability to manage demand; quality of service). Notably, the RSI may be considered a measure of the project's ability to generate revenues, and also *a measure of the project's efficiency in exploiting the potential sources of revenue.*

The **Governance element** is described by the composite Governance Indicator (GI), which refers to factors setting the governance scene within a project. In this respect, it is defined by the contractual conditions and the process leading to them. In principle, the GI is *a measure of the contractual governance efficiency and flexibility.*

The **Funding Scheme element** is described by two indicators: The Remuneration Attractiveness Indicator (RAI) and the Revenue Robustness Indicator (RRI). *The indicators consider the project income and revenue streams weighted against the associated risks* and are also cumulatively expressed as per the percentage of cost coverage they represent.

The **Financing Scheme element** is expressed through one indicator, the Financing Scheme Indicator (FSI), which reflects an *expanded version of the weighted average cost of capital of the project* that is able to consider financing contributions from both public and private sources.

Finally, the **transport mode context** is described with one indicator within the system: The Reliability Availability Indicator (IRA). Notably, other characteristics relevant to this element constitute input to the system and cannot be changed during implementation (e.g. infrastructure type, type of users, etc.).

## 4. Lessons Learnt & Recommendations

### 4.1 Lessons Learnt

The ability to transfer project information into an "indicator space" extends the potential of explanatory analysis in this field of practice. It allows the consideration of multiple factors which, in combination and based on their respective values, become facilitators or barriers to the achievement of project goals. The observations stemming from the comparative analysis of the results of the multi-method analysis approach followed has justified this effort.

A first key finding from the BENEFIT indicator analysis is that some indicators are more prominent than others while neither single indicators nor specific combinations of them are able to secure the successful attainment of single outcome targets, let alone of all four outcome targets simultaneously.

Additionally, indicators may be distinguished as exogenous or endogenous to the project depending on the level of influence project decision-makers may have on indicator values. In this context, the Financial-Economic and Institutional Indicators are exogenous while all others are endogenous. Furthermore, amongst the endogenous indicators, while all are set at project award (initiation), some may be changed more easily than others or demonstrate more variations, such as the funding and financing scheme indicators.

More specifically:

### **Indicators Exogenous to the project**

- The Financial-Economic indicator (FEI) is an important indicator, but does not have the same impact on all modes. Road projects are particularly sensitive to the FEI as it was found to influence all outcomes apart from revenues. For urban transit projects, the FEI could have a varying affect which may be offset by other indicators. In bridge and tunnel projects, the negative impact of a low and/or decreasing FEI may also be offset by high values of other indicators (GI, CSI and RSI). For airports, the FEI influenced cost and time targets but traffic and revenues should consider an extended version of it.
- The Institutional indicator (InI) has been identified as potentially the most important external indicator across all modes and for all outcomes. In many cases, it was identified to be able to offset the impact of a low or decreasing FEI.

### **Indicators Endogenous to the project**

- The Governance indicator reflects in many ways the level of institutional maturity in the country of project procurement. In this effect, it may compensate and/or enhance the Institutional Indicator.
- The Cost Saving indicator describes the project's technical difficulty and also the capabilities of key project actors: the builders' to construct, the operators to operate, and the monitoring authority's to monitor the project in consideration. This indicator was found to contribute to all outcomes and, in most cases, works in combination with GI. More specifically, it was found in many cases that a low value of the CSI could be offset by a higher value of GI and vice versa.
- The Revenue Support indicator could only have a positive role. However, it is not always possible to have a high value and/or in many cases the projects are not designed for a high value of the RSI.

- The Remuneration Attractiveness Indicator can act as a policy tool. Demand-based remuneration schemes (low value of RAI) work well under positive exogenous conditions. In an adverse context, a low value of RAI needs to be supported by other indicators.
- The Revenue Robustness Indicator expresses the riskiness of the project revenue streams as well as the estimated level of cost coverage.

What is noticeable is the importance of the overall Business Model and Governance indicators across all modes and outcomes with the exception of revenues for roads, where the influence of the implementation context is far more prominent. The same indicators are also important for ports, although positive outcomes may be achieved under poor conditions for these specific projects. It should also be noted that while the Governance indicator is based on the contractual setup and reflects the tendering procedure, both Business Model indicators (CSI and RSI) are composite and for each mode particular aspects of them may be of greater importance.

Another point of interest is the Financing Scheme indicator (FSI) and its role in developing strategic trade-offs between cost and time outcomes. It was observed that projects with high contributions of public sector (high value of FSI) seek to achieve “on-budget” targets, while in cases where private financing is dominant (low FSI), there is an effort to predominantly achieve “on-time” targets. In addition, supporting project revenues lead to higher values of the FSI.

In summary, while the outcomes of transport infrastructure projects are partly influenced by factors outside the managerial ability of the parties involved, there are many other internal project factors that may be used to improve their potential of achieving expected outcome targets. This is an important input for the development of the rating methodology as it suggests that project resilience could be improved by managing internal project parameters since external factors are not within the influence of project stakeholders. Further to this remark, it also interesting to note that between the endogenous indicators there are three, namely the Remuneration Attractiveness, Revenue Robustness and Financing Scheme Indicators, that may be considered “**policy indicators**” as they drive project outcomes differently according to their values. This is a sharp contrast with respect to the other internal indicators for which, when important, high (low) values are associated with high (low) likelihood of achieving outcome targets.

## 4.2 Recommendations

Lessons learnt from the indicator multi-method analysis can be transformed to meaningful recommendations, as follows:

### Implementation Context

### *Furthering the development of strong institutions in support of competitiveness*

While governments strive to improve economies and foster growth and development, the global nature of the economy will always remain a risk factor which may adversely influence mobility and infrastructure project delivery and operation. However, further support to national institutions and their improvement apart from other benefits, will also enhance transport infrastructure project resilience. It was found that projects delivered in a strong institutional environment were better positioned to weather the global financial crisis.

## **Project Structure**

### *Promoting viable and mature projects*

- The preparation of mature projects has been a long-standing recommendation. Well-prepared, well-justified, and well-planned projects, including life cycle planning, are a pre-requisite for achieving projects delivered within cost and time targets.
- Well-justified projects with well-developed demand forecasts are a long-standing recommendation. However, it is important that demand forecasts also consider a wider range of potential growth scenarios as the last twenty years in Europe we have seen fluctuations in the global competitiveness ranging within  $\pm 30\%$ . Also, a longer duration of such fluctuations should be taken into account as well as the respective willingness to pay.
- A transport infrastructure project's network connectivity is of great importance and should be considered as part of project justification and planning, as it is of equal importance to project exclusivity.
- Whether addressing greenfield or brownfield projects of any level of complexity or investment size, it is important to diligently develop, lay down and follow well-defined procedures in project design, justification and planning. Normally, this refers to an iterative process whereby costs and benefits are assessed until tender, award and financial close are concluded.
- The combination with other services and integrated (bundled) projects should be considered and exploited. Emphasis should be placed in developing projects for which a risk portfolio of revenue streams may be created.
- Innovation should not be avoided or over-rated. It is important that innovation is carefully selected with respect to its level of maturity and its expected benefits/efficiencies and implemented by competent contractors who can take full responsibility of related risks by holding the relevant expertise.
- Finally, emphasis needs to be placed on the front-end of project development (planning, procurement, financial close) in order to provide the necessary tools that

will enhance and facilitate managerial flexibility. Such flexibility should also allow corrective actions to be taken during the life-cycle of the project by aiming to minimise relevant future transaction costs.

### *Actor Competences and Capabilities*

- Strengthening the competences of the public contracting authority has been identified as an important measure that can enhance the performance of projects with respect to achieving their project management goals. In addition, a competent contracting authority will be able to prepare mature projects and well-designed tenders suited to the needs of each project. Special emphasis is required particularly towards improving the competence of local and regional authorities.

Notably, apart from the improvement of human resources, competences also include the provision of financial resources needed. It is estimated that local authorities do not only lack appropriate human resources, but also the financial resources to systematically prepare, tender and monitor projects (including data collection).

- Tenders should be designed so as to attract the interest of competent contractors for the specific project, who are able to manage and bear the technical risks of the project.
- The ability to manage, control and influence demand should be a key consideration when assigning the operation of transport infrastructure projects and should be properly considered in tender preparation.
- Finally, under the current conditions, the PPP model of project delivery needs to be based more on the anticipated benefits due to the competences of the concessionaire rather than the need to contribute to the public budget.

### *Responsibility Sharing - Risk allocation*

- Risk management is a well-developed field and well-defined risk management practices should be followed.
- Appropriate risk allocation should be applied to both PPPs and public projects on the same basis.
- Appropriate risk allocation, including demand and revenue risk, leads to less costly projects, as risk premiums and potential risk impacts are limited.
- In the particular case of demand/revenue risk, risk allocation should take into consideration both the level of control/cooperation (level of exclusivity, the impact of network connectivity on the project's exclusivity and the project's business scope) characterising the project vis-a-vis each party's respective competence.

- In general, risk allocation to the private sector is considered “appropriate” when the private party has the competence and the managerial capability to influence the conditions leading to risk.

### **Governance**

- Well-designed tenders, prepared by a competent public contracting authority in a country with supporting institutions are the prerequisites for good governance. Contracts should include terms and conditions which support the “efficiency/effectiveness of governance” and “contractual flexibility”.
- With each renegotiation, if specific terms are not included in the original contract, the quality of governance declines. Public authorities should properly consider this fact.
- In PPPs, short contractual periods have proven useful in many cases (see e.g. urban transit projects). Short contractual periods allow the public sector to re-adjust policies without undermining governance, especially given new mobility patterns that might emerge due to innovation and changes in other societal sectors. The length, however, of the contractual period, even when shorter, needs to be properly estimated.

### **Funding and Financing Schemes**

- As the performance of a project, in terms of cost and time to completion and the attainment of traffic and revenue forecasts, appears to rely less on the type of financing and more on project characteristics, projects considered to be delivered as PPPs and those considered for public financing should be prepared and matured following the same procedure.
- While evidence was not found on a differing performance between traditional and PPP procurement, it was found that the financing scheme structure creates incentives and induces trade-offs between cost and time to completion, as well as traffic and revenue targets. The impact of these trade-offs on transport infrastructure project goals (relief of congestion, reduction of travel time, environmental impact etc.) should be carefully considered, as project benefits and welfare gains might be reduced or lost.
- In addition, given the fact that PPPs are costlier in terms of the employed capital, it is important to define in purely monetary terms the benefits that will be accrued through PPP procurement. In this context, respective methodologies of comparison should be reviewed and revised to take into account the financial contributions required by the public sector.
- It is important to differentiate remuneration methods from revenue schemes. This would allow for proper and fair user charges in accordance to willingness to pay and

the implementation of public tariff and mobility policies. Remuneration schemes also reinforce potential incentives and trade-offs.

## 5. Rating System and Applications<sup>1</sup>

The scope of the above recommendations is to enhance “*the ability of a Transport Infrastructure project to withstand, adjust to and recover from changes within its structural elements that affect its capability to deliver specific outcomes*” and, therefore, its resilience, herewith expressed through a Transport Infrastructure Resilience Index (TIRESI) and its rating. **The essential added value of the TIRESI is its capacity of transforming previously fragmented and discerned knowledge and experience into a useable and applicable tool.**

The quantification methodology of the TIRESI is based on the development of a rating system which aims to classify/categorise projects based on their likelihood of attaining specific outcome targets (i.e. cost and time to completion, traffic and revenue forecasts).

### 5.1 The rating system

A key finding from the synthesis of the BENEFIT analyses has been the fact that each transport infrastructure mode is influenced differently by the implementation context and that different indicators contribute in each case to the achievement of project outcome targets. This finding guides the assessment of resilience towards an infrastructure mode-specific process.

The TIRESI quantification methodology is based on the explanatory power of the BENEFIT Framework indicators and the understanding of their interrelations as identified from the analyses conducted. In effect, although overarching conditions may be present which influence the performance of many or all transport modes, there are also significant differences between the combinations of indicators and their respective values that are needed to attain specific outcome targets per mode.

The rating system developed to support the TIRESI is detailed and transparent. It is based on considerations that facilitate the easy recognition of the likelihood of reaching pre-defined project outcomes as well as potential vulnerabilities of the project implementation system. More specifically, project rating categories have been defined as follows:

- Rating A: projects have a high likelihood of reaching a specific target outcome as they are delivered within a positive implementation context (FEI and InI). These projects

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<sup>1</sup> To further facilitate the rating assessment, the TIRESI rating system is supported by a user-friendly web-based assessment tool that computes the system indicators as well as the various performance ratings based on information provided by the user. For more information on the application please visit: <http://www.tiresias-online.com/benefit/>.

demonstrate a well-structured business model (indicators CSI and RSI), Governance flexibility (GI), and supportive policy decisions (indicators RAI, RRI and FSI).

- Rating B<sub>EX</sub>: projects have an average likelihood of reaching a specific target outcome as they demonstrate a well-structured business model (indicators CSI and RSI), Governance flexibility (GI), and supportive policy decisions (indicators RAI, RRI and FSI). These projects are delivered within a marginally positive implementation context (FEI and InI).
- Rating B<sub>EN</sub>: projects have an average likelihood of reaching a specific target outcome as they are delivered in a positive implementation context (FEI and InI) but lack a well-structured business model (indicators CSI and RSI), Governance flexibility (GI), and/or supportive policy decisions (indicators RAI, RRI and FSI).
- Rating C: projects have a poor likelihood of reaching a specific target outcome as they are delivered in a poor implementation context (FEI and InI) and lack a well-structured business model (indicators CSI and RSI), Governance flexibility (GI), as well as supportive policy decisions (indicators RAI, RRI and FSI).

A slightly better or worse likelihood per rating is noted with a (+) or (-) notch.

The TIRESI takes two forms, a Static (S-TIRESI) and a Dynamic (D-TIRESI). The S-TIRESI is described through the above rating categories. The D-TIRESI is assessed on top of the S-TIRESI by determining the percentage change needed in the key implementation context indicator (FEI or InI) for S-TIRESI to move down or up a rating category (e.g. from B<sub>EN</sub> to A or vice versa). The D-TIRESI values represent the vulnerability or stability of the S-TIRESI rating with respect to the outcome target under consideration.

As highlighted from the outset, the BENEFIT Framework is heuristic in nature. In effect, it is built on and continuously learns from information captured from project data.

In its current state of development, TIRESI is able to provide ratings for four outcomes (cost and time to completion, traffic and revenue forecasts) in the case of road, bridge and tunnel, and urban transit projects. It is also capable of providing ratings for cost and time to completion for airport projects. Within the current effort, rail project outcomes could not be rated as insufficient data was available for analysis. All port project outcomes as well as airport project traffic and revenue outcomes require an adjustment of the indicator composition in order to represent the market interrelations of these transport infrastructure modes. As a result, for these cases/modes, the TIRESI could also not provide meaningful ratings.

## 5.2 TIRESI applicability: Monitoring and Improving on Project Performance

The TIRESI and the BENEFIT Framework indicators have all been developed based on project information which is readily available in the public domain. They do not require proprietary information or highly detailed data to produce results, which makes their implementation very straightforward. In its current formulation, the TIRESI is well-positioned to:

- Assist in building and testing various ex-ante project implementation scenarios providing support to:
  - Public Authorities to:
    - Better allocate risks or assess the influence that project structure decisions may have on the project's potential of reaching specific outcome targets under various implementation context conditions. Through this process, it may also allow for the identification of adverse factors and the specification of corresponding mitigation and other performance-enhancing actions, including modifications to funding and financing schemes.
    - Create improved and supportive project procurement processes.
    - Assess alternative implementation scenarios under (re) negotiations.
  - Private parties to:
    - Consider and evaluate investment options.
    - Investigate and gauge the impact of their involvement on project outcomes.
    - Assess alternative scenarios under (re)negotiations.
- Assist in monitoring project "health" during implementation and operation.
- Assist in estimating the impact of new financing and funding schemes on project outcomes due to the TIRESI's capability to consider both current as well as potential future funding and financing schemes.
- Improve the creditworthiness of a project as it provides information with respect to the ability of a project to mitigate downside impacts through risk management rather than by placing the emphasis on its financing structure. In this context, the TIRESI can act complementarily to existing commercial credit ratings, as the combination of the two ratings (Credit and TIRESI) can provide a more comprehensive assessment of project resilience: Managerial and Financial.

Finally, in practical terms, TIRESI ratings reflect likelihoods and not an absolute certainty. Consequently, project managers should consider a poor rating as a warning sign reflecting the need for close project monitoring and effective risk management. More importantly, the TIRESI ratings are meant to be used as a guiding tool to be employed by all stakeholders, throughout the project lifetime. Ratings should also be used in correlation with the identified, in each case, resilience drivers to support decisions on actionable project elements and factors. Obviously, certain project characteristics (and therefore the corresponding indicator values) are difficult or undesirable to change as time elapses in a project's lifetime. Rating tables may then be useful in assessing trade-offs.

## 6. Acknowledgements

The contents are partly based on research carried out within the framework of the BENEFIT (Business Models for enhancing Funding and enabling Financing for Infrastructure in Transport) project. The BENEFIT project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 635973.

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