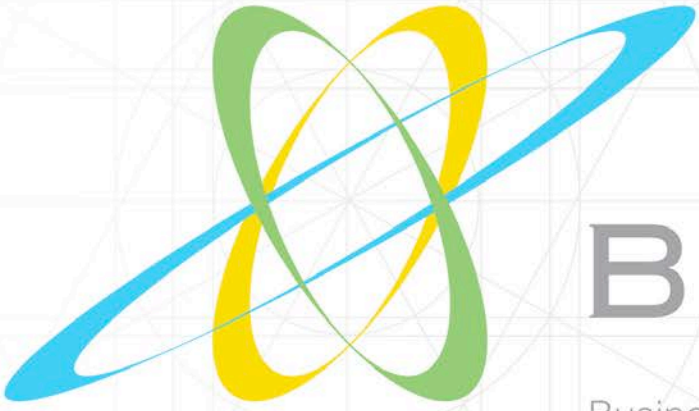

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Business Models for Enhancing Funding
& Enabling Financing for Infrastructure in Transport

Deliverable: D 2.2 – Funding Schemes & Business Models

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Business Models for Enhancing Funding
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Grant Agreement No.: 635973
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The Partnership

University of the Aegean,
Department of Shipping, Trade and Transport

Project Coordinator

TPR
Department of Transport and Regional Economics
University of Antwerp

PA&M
Public Administration & Management
University of Antwerp

UNIVERSITY of OULU
OULUN YLIOPISTO

Cerema

KIT
Karlsruhe Institute of Technology

TRT

UNIVERSITY OF TWENTE.

Road and Bridge
Research Institute

TÉCNICO
LISBOA

TIS
TRANSPORTES, INOVAÇÃO E SISTEMAS

Bartlett School of Construction & Project Management
UCL

omega centre
Centre for Mega Projects in Transport and Development
UCL

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UNIVERSIDAD DE LAS PALMAS
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Document summary information

Authors and contributors

Initials	Author	Organisation
D2.2.i – Business Model Typology		
AR	Athena Roumboutsos	University of the Aegean
JTV	Hans Voordijk	University of Twente
IC	Ibsen Cardenas	University of Twente
D2.2.ii – Funding Scheme Typology		
JB	Joao Bernardino	Consultores em Transportes Inovação e Sistemas, S.A.
DC	Daniela Carvalho	Consultores em Transportes Inovação e Sistemas, S.A.
D2.2.iii - Transport Mode Context Typology		
TV	Thierry Vanelslander	University of Antwerp
EM	Eleni Moschouli	University of Antwerp
D2.2.iv – Implementation Context Typology		
KV	Koen Verhoest	University of Antwerp
TW	Tom Williems	University of Antwerp
D.2.2 – Analysis of funding Schemes		
JB	Joao Bernardino	Consultores em Transportes Inovação e Sistemas, S.A.
DC	Daniela Carvalho	Consultores em Transportes Inovação e Sistemas, S.A.
AR	Athena Roumboutsos	University of the Aegean
PM	Panagiota Moraiti	University of the Aegean
IK	Iosif Karouzos	University of the Aegean

Quality Control

	Who	Date
Checked by External reviewer	Yves Crozet	20/04/2015
Checked by internal reviewer	Silvia Maffii	03/03/2015
Checked by Task Leader	Thierry Vanelslander	18/02/2015
Checked by WP Leader	Thierry Vanelslander	18/02/2015
Checked by Project Coordinator	Athena Roumboutsos	18/03/2015

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Glossary

Within BENEFIT certain terms are used throughout. These are described here.

Collective BENEFIT database: This is the BENEFIT database consisting, at the start of the project, of seventy-five case studies of funding transport infrastructure and twenty-four country profiles. These are published data from COST Action TU1001 and the OMEGA Centre megaprojects. During the course of the project, the database will be supplemented with at least twenty-eight more cases of funding/financing infrastructure (in particular public funding/financing, which are less represented).

Funding Scheme: A funding scheme is considered to be any combination of private and public income generated by or towards the infrastructure over its life cycle. These may include any combination of user contribution (tolls, fees, fares etc.) or public contributions based on direct and indirect taxation etc.. Public funding may also take on the form of availability fees, shadow tolls etc.

Financing Scheme: A Financing scheme is considered to be any combination of public and/or private financial investments required by the infrastructure over its life cycle.

Business model: The business model describes the business case of the overall investment. Depending on the setting, it may be narrowed, including strictly the infrastructure projects considered, or it may be widened, including other planned and commonly designed activities in order to capture other "planning gains" (and other value-added services) and even exploiting synergies across the sectors (eg. transport, energy, ICT). The latter incorporates the notion of innovative procurement and other approaches to infrastructure delivery, now in the pilot phase.

Key Elements: Elements are groups of variable dimensions of the same context, which influence the performance of the funding scheme and financing scheme. Elements, as noted in figure 1.1.1, are the implementation environment (socio-political, micro and macro economical, institutional, regulatory, etc.); the transport mode (functionality; natural and contractual exclusivity, etc.); business model structure; funding scheme; financing scheme and governance arrangement (risk allocation; decision process; ownership rights, etc.).

Typology: A typology concerns groups of factors describing an Element that contribute in demonstrating a particular behaviour. Example: Negative Private investment environment type in the implementation context typology. The group of factors leading to the demonstration of this behaviour may be: poor growth forecast, lack of enabling legal framework etc. Typologies for every element (context) will be generated during the project using the collective BENEFIT database (country profiles and case studies) as field examples and desk research. Quantitative and qualitative analysis are the analytical tools that may be used.

Decision Matching Framework: This is the Analysis and Decision Framework to be developed by the BENEFIT project. The framework will contain typologies influencing the overall performance of the investment. It will initially be developed using hypotheses of optimum matching between types, which are confirmed as Matching Principles (rules describing by which optimum performance may be achieved) during the course of the project. As such, it could be used as an analysis tool (eg. identification of "mismatches") or decision tool (eg. given the types of elements, which funding scheme type is most appropriate) or project rating framework (expressed as the risk to match a specific financing scheme) or project rating enhancing framework (which types may be changed and in which direction to improve project rating).

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1. Introduction

BENEFIT takes an innovative approach by analysing funding schemes within an inter-related system. Funding schemes are successful (or not) depending on the Business Model that generates them. The performance of the Business Model is affected by the implementation and the transport mode context. It is matched successfully (or not) by a financing scheme. Relations between actors are described by a governance model (contracting arrangements). These are key elements in Transport Infrastructure Provision, Operation and Maintenance, as illustrated in figure 1.

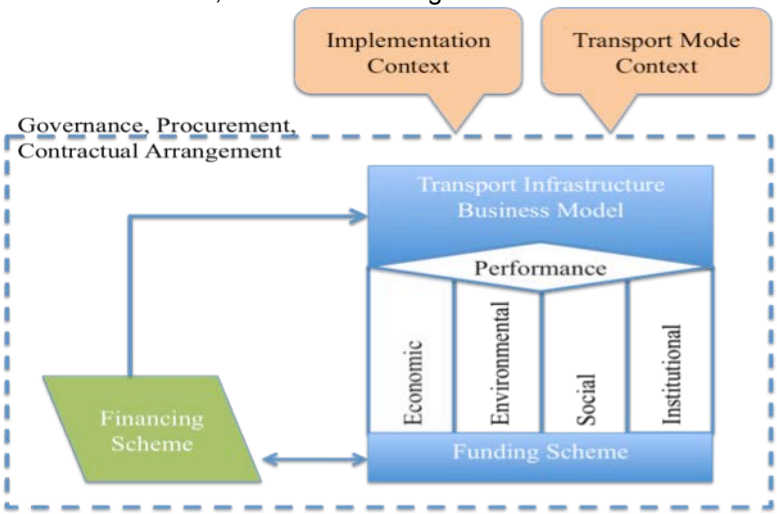

Figure 1: BENEFIT Key Elements in Transport Infrastructure Provision, Operation and Maintenance

Success is a measure of the appropriate matching of elements. Within BENEFIT funding and financing schemes are analysed in this respect. Describing these key elements through their characteristics and attributes and clustering each of them into typologies is the basis of, first, developing a generic framework. Identifying best matches in their inter-relations (matching principles) leads to move from a generic framework to a powerful decision making one (Decision Matching Framework) that is developed to guide policy makers and providers of funding (and financing) extensive comparative information on the advantages and limitations of different funding schemes for transport infrastructure projects and improve the awareness of policy makers on the needs of projects serving an efficient and performing transport network within the horizon 2050. Besides, the framework allows policy makers to identify changes that may be undertaken in order to improve the potential of success, such as improving the value proposition of the business model.

In developing this framework, BENEFIT takes stock of case studies known to its partners in combination with a meta-analysis of relevant EC funded research and other studies carried out with respect to funding schemes for transport (and other) infrastructure and direct contact with key stakeholder groups. More specifically, BENEFIT uses the published case study descriptions of seventy-five transport infrastructure projects funded and financed by public and private resources from nineteen European and four non–European Countries covering all modes of transport. It also exploits twenty-four European country profiles with respect to contextual issues (institutions, regulations, macroeconomic and other settings) influencing funding and financing of transport infrastructure. This data has been produced within the framework of activities undertaken by the OMEGA Centre for Mega Projects in Transport and Development and the COST Action TU1001 on Public Private Partnerships in Transport: Trends and Theory. In addition, BENEFIT, through its partnership and respective experts, consolidates almost twenty years of successful European Commission research with respect to issues related to transport infrastructure and planning, assessment and pricing of transport services. Therefore, its approach is supported by the tacit knowledge and insights of the BENEFIT partnership with respect to infrastructure projects in transport.

By applying the Decision Matching Framework, BENEFIT undertakes:

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- An ex-post analysis and assessment of alternative funding schemes (public, PPP and other) based on existing experiences in different transport sectors and geographical areas and their assessment with respect to economic development, value for public money, user benefits, life-cycle investment, efficiency, governance and procurement modalities, etc.; and, provide lessons learned, identification of the limitations of the various schemes and the impact of the economic and financial crisis.

- An ex-ante (forward) analysis and assessment of the potential of transport investments and the related funding schemes, including innovative procurement schemes still in a pilot phase, to contribute to economic recovery, growth and employment, in view of future infrastructure needs with a 2050 horizon for modern infrastructure, smart pricing and funding.

BENEFIT is concluded within twenty one months and bears the following innovative aspects:

- Transport infrastructure business models and their project rating: Improved value propositions lead to funding schemes with enhanced creditworthiness enabling viable financing, balancing of project financing and funding risks, increasing the value basis of stakeholders and highlighting the potential of transport investments.

- Transferability of findings with respect to lessons learned, limitations and the impact of the economic and financial crisis through the introduction of typologies.

- Open-access case study database in a wiki format, allowing for continuous updates and providing a knowledge base serving both practitioners and researchers.

1.1 Contribution of this Report to the BENEFIT Project - Typologies

The key concept of the BENEFIT project is the analysis and re-construction of transport infrastructure funding and financing through a system described by its elements, as shown in figure 1. These elements are described through their key characteristics vis-à-vis the funding and financing schemes: the "typologies". These key characteristics are clustered as "dimensions". Each dimension, in turn, is described by indicators, which provide "values'.

Using these typologies, the property space may be re-structured generically allowing for objective analysis of cases and, also, the creation of a framework guiding decision-making. Achieving the "ideal type" is an objective.

For each element of the transport infrastructure delivery system (see figure 1), a typology is identified. More specifically, a typology is identified for:

1. The implementation context, i.e. the particular political, legal/regulatory, social etc. environment the infrastructure is delivered in.

2. The transport mode context, i.e. the transport mode particularities and specificities the infrastructure is developed to serve.

3. The transport infrastructure Business Model, i.e. the value proposition of the infrastructure as it is bundled with other offerings and services.

4. The funding scheme, i.e. the revenue stream that is generated through the business model, which contributes in "paying back" the investment. Notably, as shown in figure 1, the funding scheme is generated by the economic, environmental, social and institutional outcomes of the business model.

5. The financing scheme, i.e. the structure of the investment, and, finally,

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6. The Governance scheme, i.e. the rules and stakeholder relations organizing and regulating the infrastructure delivery system.

The implementation and transport mode context, describe to a large extent the business model that may be developed. The business model will create economic, environmental, social and institutional outcomes and, ultimately, produce relevant and respective funding schemes. Governance introduces an external change to this initial setting by introducing new rules and relationships. Finally, the financing scheme reflects the financing capacity created.

In this approach, the typologies of the implementation and transport mode context, as well as those of the business model and funding scheme are considered in one entity described in this report, D2.2.

The typologies of the financing scheme and the Governance are described in separate reports, D2.3 and D2.4 respectively.

More specifically, this is the deliverable of task 2.2 of Work Package 2. The scope of task 2.2:

"Concerns the comprehensive analysis of funding schemes (as direct and indirect revenue streams generated through the delivery and operation of transport infrastructure. This consist of revenue streams from infrastructure users; government funding (invest, re-invest, and other regular); other, like third party contributions or revenues from value added services or combinations thereof). Emphasis will be placed on transport charging and pricing models. Business models are viewed with respect to their ability to include value propositions not strictly related to the transport infrastructure. This task also includes the generation of typologies connected to the transport mode context and the implementation context. To sum up, within this task typologies of the following key elements will be generated: (i) business models – UAEGEAN, UT (ii) funding schemes - TIS; (iii) transport mode context – UA and (iv) implementation context – UA, IBDIM, UCLAN.".

The typologies are not meant to take into account "structural bias" that is present in many projects, especially in terms of the economic justification of projects based on time saving and traffic demand. In particular, the overall approach assumes that the decision to implement the project has been taken and in this context the model is to initially serve for ex-post assessment (task 4.1, stage 2). "Structural bias" and the accompanying political decisions are to be identified ex-post as "system failures" that may not be attributed to influence external to the business model. In other words, the proposed model does not intend to re-assess the Cost Benefit Analysis (CBA) or any other project assessment tool used.

1.2 Report Structure

As mentioned previously, this report is focused on the identification of the typologies concerning the implementation and transport mode context, as well as those of the business model and funding scheme. They are derived, in principal, from desk research based on supporting theory, which justifies the selection of the key characteristics (dimensions) of each element. For each element, indicators are identified, which may be used to construct the value of each dimension of the typology. The validation of the proposed dimensions and indicators will take place in task 4.1 – stage 2 of the BENEFIT project.

The proposed typologies for each of the four elements are presented in the respective four sub-sections of section 2 of this report. For each element, the background, the rational for the proposed dimensions and their respective indicators, as well as the influence they bear on the potential economic, environmental, social and institutional outcomes and the funding and financing schemes is identified.

The inter-relations of the proposed typologies are discussed in section 3. Conclusions end the report.

The comprehensive analysis of funding schemes as per the scope of work described in the BENEFIT proposal and contract is in Annex.

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2. The Proposed Typologies

In the present section, the typologies for the four elements: implementation context, transport mode context, business model and funding scheme are presented.

2.1 Implementation Context Typology

This section deals with the identification and detailed explanation of the key dimensions, which are supposed to be crucial regarding the implementation context of transport infrastructure projects. Based on the following six dimensions – the general political, legal/regulatory, administrative, macro-economic, financial context and specific governmental PPP support – a typology on implementation context of a certain country is constructed, combining different well-established indicators of leading international organizations with previous research on this topic (see the COST Action TU1001 on Public Private Partnerships in Transport: Trends and Theory).

The implementation context is considered in general important to the success or failure of a certain public policy. Before we explain in detail which dimensions and variables we take into consideration for constructing the implementation context typology, it is important to state very clearly that we approach transport infrastructure policy as just any other type of public policy regarding implementation context. Or in other words, we have chosen to deal with *implementation context in general terms for both substantive and pragmatic reasons*. Although transport infrastructure policy has some specific characteristics as a policy domain or area, we argue that many of these elements are covered by the 'transport mode context' (see section 2.2). In order to avoid potentially confusing redundancies or overlaps, the typology on implementation context will be general in nature. There is one exception: as part of the legal and regulatory framework we will make use of a transport specific indicator (OECD ETCR) to get an insight into the level of market liberalization. This is justifiable because it serves only as a supplement to two other more general indicators, and because it provides highly relevant information in an EU policy context. In addition, there is also a more pragmatic line of reasoning. It would be very difficult to gather the necessary data on implementation context just for transport infrastructure policy. The existing indexes developed by international organizations like the OECD or World Bank which attempt to capture aspects like the level of corruption or independence of the judicial system make no distinction between different policy domains. Therefore, we also follow this approach and we will describe the implementation context for transport infrastructure project in general terms. When dealing with the specific dimension of governmental support for privately financed transport infrastructure projects (also known as PPPs), use will be made of more specific variables and indicators related to transport infrastructure policy.

2.1.1 Background

'Context matters' or 'putting it into context' is a very common phrase, which is to be found quite frequently in public policy documents and scholarly literature. Many policy experts indeed reach for 'context' as an important element in their explanations and recommendations, but if it is that important we also need to know more or less what this 'implementation context' means (Pollitt, 2013). Because it can mean so many things to so many different people, it is important to specify its precise meaning (otherwise it risks becoming useless for analytical and scientific purposes). By developing a rich but concise typology, we want to address exactly that question and *provide a better understanding of the implementation context of large transport infrastructure projects at country level*. It is the ambition to formulate a 'hands on' and comprehensive overview of the different relevant dimensions of implementation context. The proposed classification focuses on *six distinct dimensions*: the extent to which the (1) political, (2) regulatory, (3) administrative, (4) economic, (5) financial context in general is conducive for transport infrastructure projects, and the level of (6) governmental support for privately financed transport infrastructure projects (public-private partnerships or PPPs). If we combine these six dimensions we get a detailed and workable insight of how the implementation context looks like for transport infrastructure projects, which are either publicly or privately financed.

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For the general implementation context for transport projects, we used the following criteria to select relevant indicators: We searched for indicators

1. Measuring the political, regulatory, administrative, economic, financial context (dimensions) which are relevant for the take-up and performance of infrastructure projects
2. Covering the 18 countries BENEFIT project case have been prepared from
3. Which preferably show some differentiation between the involved countries
4. As the instrument to be developed in the project needs to be applicable in many countries, we gave preference to indexes and indicators available for many countries in the world and certainly for Europe
5. For which data over a larger period of time exists (optimally from 2000 or before onwards) as the projects in our database were closed in an earlier point in time for which we need information in order to understand the context at the time of contract closure
6. Which are preferably accepted to a certain extent by the international community of practitioners/scientists or where criticisms are not index-specific
7. Which do not overlap (considerably) but at the same time give a good and relevant picture of the involved dimension
8. Which are not mode-specific (so not covering mode-specific legislation, division of competences etc.) – see mode typology
9. Which are not project-specific (see other typologies)

As the criteria make clear, the selection process has been *a quest for finding the best indicators which are rich in information but within some important practical boundaries* (longitudinal, all countries, freely available, etc.). We mainly used indicators/indices developed by leading international organizations like the World Bank, OECD and World Economic Forum to substantiate the general implementation context typology (dimensions one to five), because they are well established and satisfy all the practical demands. For dimension six – the governmental support for the privately financed projects – we would suggest to stay close to the PPP governmental support index as developed by Verhoest et al. (2015). This information can be gathered for most countries in the BENEFIT project from the COST country profiles/PPP-GSI index.
Before moving on to explain the selection of the six dimensions and the main aspects or variables which are part of it, it is important to take a step back and specify the overarching ambition or goal of this 'implementation context' typology. It would have been possible to capture the context by simply referring to one existing index like the 'global competitiveness index' developed by the World Economic Forum. Although this index is indeed valuable and broadly conceived (and we will use it), we have opted to *use a combination of different indicators* (often composed by different organizations) to get a deeper and richer insight into this complex notion of an implementation context. We argue that this option is preferable to using only one index, because it contains more relevant and diverse information. By first identifying the main dimensions given the scope of the research project, and afterwards searching for the best available indicators for each dimension we aim to create some additional insights.

2.1.2 Key Characteristics of the Implementation Context Typology

The proposed classification focuses on *six distinct dimensions*: the extent to which the (1) political, (2) regulatory, (3) administrative, (4) economic, (5) financial context in general is conducive for large transport infrastructure projects, and the level of (6) governmental support for privately financed transport infrastructure projects (public-private partnerships or PPPs). If we combine these six dimensions we get a detailed and workable insight of how the implementation context looks like for transport infrastructure projects, which are either publicly or privately financed.

Dimension 1. Political capacity, support and policies

To start the description of the implementation context, we will first look at the dimension 'political capacity, support and policies' in general. This dimension deals with several broad aspects or variables that provide a better understanding of the 'political climate' of a certain country. The three aspects, which are identified here – *political stability, control of corruption and political participation* – are considered to be important conditions for all kinds of public policies, including transport policies. It is important to note that the dimension 'political capacity, support and policies' has *a general scope and is not focused on or limited to*

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transport policies. Moreover, we do focus in dimension six on the specific governmental arrangements developed for privately financed and operated infrastructure projects (PPP governmental support). The combination of political stability, control of corruption and political participation will provide a political structure or climate that is conducive for undertaking large infrastructure projects.

(A) Political Stability

First, we start with the aspect of political stability. It is almost self-evident that basic political stability and the absence of violence are essential conditions for the construction and maintenance of transport infrastructure. In addition, it is also crucial for attracting private investments in infrastructure projects. This aspect is captured by *the 'political stability and absence of violence index' developed by the World Bank*. It is one of the six 'worldwide governance indicators', which exist since 1996 and are systematically updated since 2002 for all countries worldwide. It basically captures the perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.

It is a combination of *the perceptions of a very diverse group of respondents*, collected in large number of surveys and other cross-country assessments of governance. This aggregated indicator combines the views of a large number of enterprise, citizen and expert survey respondents in industrial and developing countries. They are based on 32 individual data sources produced by a variety of survey institutes, think tanks, non-governmental organizations, international organizations, and private sector firms. *The practical advantages of this indicator are obvious*: since 2002 systematically gathered, for all countries in our sample and freely available.

The aggregated nature of the index however has of course both advantages and disadvantages. *The advantage is the fact that multiple viewpoints are captured, and therefore its empirical richness*. Yet, it is very difficult to decompose the index into its many components which has led to *some criticisms* (too complex, not reproducible, etc.) (Kaufmann, 2007). These formulated criticisms are actually applicable to every kind of aggregated index, and is not specially aimed at the ones developed by the World Bank. Given the purpose of this typology of implementation context in this research project, it is methodologically and conceptually sound to use these indexes because we need it to get an overview of the political climate in a certain country. Or in other words, we will use it in an aggregated manner to compare different European countries in general terms, not for statistically purposes. Moreover, a second relevant disadvantage is the fact that the index *measures the perceptions of political stability of survey respondents and not the actual political stability*. Again, it is important to keep these potential pitfalls and limitations of the indexes in mind, but given the purpose of the using them in this research project and the lack of better available alternatives the choice is defendable.

There are some alternative indicators, which attempt to measure the same aspect. For example, the 'order and security' and 'fundamental rights' variables, which are parts of *the Rule of Law index developed by the World Justice Project.* We did not opt for this indicator for three main reasons: it is composed by a private organization (and therefore possibly less reliable), it is limited in time (starts in 2010), and it is severely limited in coverage of countries (in 2014 99, but in 2010 only 30). As the criticisms addressed to the World Bank indicators are also applicable to this one, there seems no reason to choose for it. Finally, we did define political stability broadly and did not include a more specific definition like cabinet turnover (see for instance the work of political scientist Arend Lijphart (2012) for two reasons: for not being on the same conceptual level as the other aspects, and for having no direct impact on public policy (including transport policies).

(B) Control of Corruption

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A second important aspect of 'political capacity, support and policies' is the absence or control of corruption. Less corruption in a country is for the private sector an important factor to invest their capital in public infrastructure and this is demonstrated by several empirical studies (see e.g. Hammami, et.al (2007), Galilea & Medda (2010), Percoco, (2014)). Especially given the often large investments sums, public infrastructure is vulnerable to possible capture by private elites and interests. Therefore, the size of corruption in a country and the way a government deals with it supplements political stability to get an idea about political capacity and policies in general.

We propose to use *the 'control of corruption index' developed by the World Bank*. It is also one of the worldwide governance indicators and captures the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. As mentioned above, the same practical advantages of this index can be put forward (longitudinal, all countries, availability). It is also an aggregated index on corruption, which measures perceptions of control of corruption and not corruption itself.

There are several alternative indicators which attempt to measure corruption and which could also be used. We will now indicate which other indexes there are and explain why we did not opt for them. First, the 'absence of corruption' variable, which is part of Rule of Law index developed by the *World Justice Project* (see above dimension 'political stability' for explanation why it is not chosen for). Second, the 'corruption perception index', developed by *Transparency International*. It is not chosen for because it is developed by a private organization and because it is already included in the 'control of corruption index' of the World Bank. The scope of this latter index is thus more broad and richer in information. Third, the 'ethics & corruption' variable, which is part of the 'global competitiveness index' developed by the *World Economic Forum*. Although we did not choose for it, it is a good potential alternative, which is quite similar to the World Bank index. Yet, the World Bank index has the additional advantage of being more established and well-known.

(C) Political Participation

The third identified aspect is called *political participation*. The ability of individual citizens and civil society to participate, openly criticize and influence in policy-making is highly relevant for all kinds of public policy. We argue that especially for transport infrastructure policy this aspect of bottom-up political participation is important, because there often so many affected stakeholders directly involved (Galilea & Medda, 2010; Percoco, 2014). Research has identified that meaningful community consultation and involvement in infrastructure investment decisions is critical to making public planning accountable, raising citizen support for a project, and improving the policy outcomes of specific initiatives (see also Innes & Booher, 2004; Siemiatycki, 2010). The arguments pro community consultation and participation seem straightforward: raise public support, benefit from local knowledge and experience, avoid legal cases which could block the projects, etc. (Illsley, 2003) Flyvbjerg et al. also state in their seminal study of megaprojects "that there is little evidence that efficiency and democracy are trade-offs for megaproject decision making. Quite the opposite." (Flyvbjerg, Bruzelius, & Rothengatter, 2003, p. 139).

There are no direct indicators which measure the level of community participation or consultation in transport infrastructure projects, so we need to search for the best available 'proxy indicator'. The aspect political participation will be captured by *the 'Democracy Index' developed by The Economist/Economist Intelligence Unit*. It encompasses five sub-items, which give a good insight into how open and democratic public policy-making is organized in a certain country. There have been up till now five published editions of this democracy index (2006, 2008, 2010, 2011, 2012) and it is based on the ratings for 60 indicators grouped in five categories: electoral process and pluralism; civil liberties; the functioning of government; political participation; and political culture. It is a combination of expert assessments and public opinion surveys and covers 165 countries (with all the BENEFIT project countries included).

This index has interesting practical advantages: it is partially longitudinal, includes many countries, and is freely available. It is also *an aggregated index on democracy*, with both advantages and disadvantages. Perceptions of democracy are measured and not democracy itself. There are several potential alternative indicators. First, the 'constraints on government powers' and 'open government' variables, which are parts

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of the *Rule of Law index developed by the World Justice Project* (see above dimension 'political stability' for explanation why it is not chosen for). Second, the *'voice & accountability' indicator*, which is one of the six worldwide governance indicators developed by *the World Bank*. This is however a very broad indicator which goes beyond political participation, and which risks potential overlap with the rule of law dimension. Third, the 'consultation on rule-making' variable, which is part of *Better Life Index developed by the OECD*. Although this is a very interesting indicator, it is unfortunately only available for 2013.

Dimension 2. Legal and regulatory framework

The second main dimension of the general implementation context of transport infrastructure projects is the presence or absence of *a solid legal and regulatory framework*. The legal structure can be seen as a fundamental supplementary to the political structure, discussed earlier. The legal and regulatory framework dimension is composed of three aspects: *the rule of law, the regulatory quality and the extent of liberalization of transport markets*. This section is a combination of two rather general variables on the rule of law and regulatory quality in a country and the more specific variable on the level in liberalization in the policy domain of transport. By integrating both elements we will gain a deeper insight into this crucial legal structure of the implementation context.

(A) Rule of Law

The first aspect we will discuss here is the state of *the 'rule of law' in general*. Effective rule of law is crucial when dealing with large and impactful public policy endeavors like transport infrastructure projects. In addition, it may influence and guarantee private sector investment and its sustainability in the near future (Hammami, et.al, 2006). Shareholders and stakeholders need to be able to rely on the judicial system to safeguard their basic (property) rights. We propose to use *the 'Rule of Law' index*, which is one of the six worldwide governance indicators developed by *the World Bank*. It captures the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The index offers longitudinal data, for all countries and is freely available. It is also an aggregated index on the rule of law, which measures the perceptions of the rule of law.

There are several potential alternative indicators to capture the notion 'rule of law'. First, either the 'Rule of Law Index' (aggregate) or the specific 'civil/criminal/informal justice' variables, which are part of Rule of Law index developed by *the World Justice Project* (see above dimension 'political stability' for explanation why it is not chosen for). Second, the 'undue influence score' (judicial independence and favouritism), which is part of the 'global competitiveness index' developed by *the World Economic Forum*. Although it is an interesting and valuable potential alternative, it is not chosen for because it is less established and well-known.

(B) Regulatory Quality

The second aspect of the 'legal and regulatory framework' dimension is what we call the *'regulatory quality'*. It is a necessary component to build public trust, enhance effectiveness and efficiency in the public sector and to promote private sector involvement in transport infrastructure (and to keep them interested for more investments in the near future) (Delhi & Mahalingam, 2013, Percoco, 2014). We will use *the 'regulatory quality' index*, which is one of the six worldwide governance indicators developed by *the World Bank*. It captures the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. This compilation of the perceptions of a very diverse group of respondents on the quality of the regulatory framework has important practical advantages: longitudinal, all countries, availability. It is also an aggregated index, which measures perceptions of regulatory quality and not regulatory quality itself.

There are many different potential indicators of regulatory quality. First, the 'regulatory enforcement' indicator, which is part of *Rule of Law index developed by the World Justice Project* (see above dimension 'political stability' for explanation why it is not chosen for). Second, the 'protecting minority investors' and 'enforcing contract' scores in the *'Ease Doing Business' index from World Bank Group*. Although these scores are provide some interesting material on very specific aspects of regulatory framework, our preference goes to a coherent and comprehensive indicator. Third, the 'security' and 'property rights'

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scores, parts of the global competitiveness index developed by the *World Economic Forum*. Again, these are rather specific aspects of regulatory framework, and our preference goes to a coherent and comprehensive indicator.

(C) Liberalization of transport markets

In order to really grasp the functioning of transport infrastructure projects, it may be interesting to take into account the extent of liberalization in transport markets. How easy or difficult is the access to certain markets? What about rules and realities of social and technical harmonization, which is said to be so important in an EU context? What about state grants and pricing mechanisms, which could affect the functioning of markets? We will use *the OECD indicators of regulation in energy, transport and communications (ETCR)*, which summarize regulatory provisions in seven sectors: telecoms, electricity, gas, post, rail, air passenger transport, and road freight. These indicators basically provide a measure of the degree of public ownership, vertical integration (only energy), entry regulation and market concentration. Although there is an aggregated ETCR score, we will focus exclusively on the indicators dealing with transport (rail, air and road transport) and thus compose *a transport related version of this ETCR score*.

The ETCR indicators have been estimated in a long-time series and are therefore well suited for time-series analysis. It encompasses 34 OECD countries (since 1975) and a set of non OECD countries in 2013. All ETCR indicators range from a minimum of 0 (corresponding to full deregulation) to a maximum of 6 (corresponding to the most restrictive conditions for competition). Potential limitations are the overlap with dimension 2 on legal and regulatory framework. Another potential problem is the absence of Serbia in the OECD sample, which is one of the BENEFIT countries.

Dimension 3: Public sector capacity

The third dimension of the implementation context for transport infrastructure projects is of an administrative nature; it is about *public sector capacity*. In order to realize a successful uptake and performance of a large infrastructure project, a skilled and experienced public sector partner is needed. We distinguish two main aspects or components in the general dimension 'public sector capacity': *it is a combination of both government effectiveness and government efficiency*. While the first aspect captures more the traditional 'Weberian' bureaucratic characteristics, the second aspect captures the entrepreneurial 'New Public Management' public sector reform elements (Pollitt & Bouckaert, 2011). By dealing with both aspects we are able to present a comprehensive picture of the public sector capacity in a certain country.

(A) Government effectiveness

In transport infrastructure projects a strong and reliable public sector – with a sufficient level of expertise, experience, and commitment – is crucial for the building the necessary trust relationship with private sector companies (Hammami, 2006; Zagosdzon, 2013; Reside, 2009). We propose to use *the 'government effectiveness index'*, which is one of the six worldwide governance indicators developed by the *World Bank*. It captures the perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

As mentioned above, some practical advantages of this index can be put forward (longitudinal, all countries, availability). It is also an aggregated index on government effectiveness, which measures perceptions of government effectiveness and not government effectiveness itself. In addition, the notion of 'quality' (in this case of public services or products) can be interpreted very narrowly (e.g. on time, on budget), or broadly (e.g. spatial and social concerns) (Jeffares, Sullivan, & Bovaird, 2013; Voets, Van Dooren, & De Rynck, 2008). One can also make an important distinction between for instance product quality versus process quality. Thus 'quality' is an inherently difficult concept to measure, which strengthens our choice for an aggregated indicator like the 'government effectiveness' one of the World Bank because it captures so many different opinions and viewpoints.

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(B) Government efficiency

Given the complexity of building public infrastructure and the high (financial) incentives to deliver it as quick as possible, the role of the public sector as an efficient partner is important to take into account. If the public sector does not deliver itself, private sector will probably lose interest to invest or participate. The *'government efficiency score'* will be used. This is an indicator, which is part of the global competitiveness index developed by the *World Economic Forum*. The index is published each year since 2004. It is a mix of theory and empirical research; containing 110 variables of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations. The index has 12 pillars, each pillar representing an area considered as an important determinant of competitiveness.

Government efficiency is one of these pillars and it is composed by 5 sub-items, each time a ranking and a score from 1-7: wastefulness of government spending, burden of government regulation, efficiency of legal framework in settling disputes, efficiency of legal framework in challenging regulations and transparency of government policymaking. Potential caveats of this 'government efficiency score' are the same as the abovementioned: its aggregated nature, its measurement of the perception of efficiency and not efficiency itself. Moreover, there is some potential overlap with dimension 2 on the legal and regulatory framework. Yet, there is a clear difference between them. While the dimension 2 focuses the procedural aspects of the legal structure, this indicator here focuses on the outcomes of the legal structure.

Dimension 4. Marco-economic situation

The fourth dimension of the implementation context is the macro-economic situation of a certain country. The general macro-economic environment will influence significantly the various public policy options a government has at its disposal. Can the government invest itself in transport infrastructure project or does it need private capital in order to realize these public investments? (Hamami, et.al, 2006; Zagozdzon,2013) We will *use the macro-economic environment score*, which is part of the global competitiveness index developed by the *World Economic Forum*. This score is composed by 5 sub-items (including each time a score from 1-7 and a ranking for the country): (1) *government budget balance, % of GDP*, (2) *gross national savings, % of GDP*, (3) *Inflation, annual % change*, (4) *government debt, % of GDP*, (5) *country credit rating, 0-100* (best).

The macro-economic environment score is since 2004 annually and systematically gathered and it is a mix of theory and empirical research dealing with 110 variables of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations. This large research undertaking results in 12 pillars, each pillar representing an area considered as an important determinant of competitiveness. The macro-economic environment is one of those 12 pillars.

The aggregated nature of this macro-economic environment score has both advantages and disadvantages. One could also use separate indicators like GDP per capita, government debt to GDP, exchange rate, inflation rate, etc. Although this would be a valuable alternative, we argue that it is better to combine these individual indicators in some kind of total or 'overview' score. The very idea of a macro-economic environment – which takes different relevant elements into account at the same time – is better suited given the purpose of our research project. Another potential alternative would be the country risk allocation by the OECD. This option is not chosen for because there is almost none differentiation between the countries in the BENEFIT sample. The macro-economic scores of the World Economic Forum however do vary a lot between these European countries. It makes differentiation between them possible.

Dimension 5. Financial conditions

Given the high investments costs of transport projects the maturity, efficiency and trust in financial markets is crucial in to get them financed and realized (Bing et.al ,2005). Is there access to private capital when needed or not? In order to get a good and comprehensive insight into this often difficult and technical domain, *the 'financial market development'* score, which is part of the global competitiveness index developed by the *World Economic Forum* is a good entry. It is composed of two main items – *efficiency and trustworthiness* – each time having a ranking and a score from 1-7. Efficiency in terms of financial

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market development means here: availability of financial services, affordability of financial services, financing through local equity market, ease of access to loans and venture capital availability. Trustworthiness means: soundness of banks, regulation of securities exchanges and legal rights index.

The financial market development score is also one of the 12 pillars of the global competitiveness index. It is an aggregated indicator, which is in this regard an important asset, because we need to have a clear and understandable overview. This is also the reason why we did not choose a single financial indicator like the credit rating of a certain country for instance – which could mean many different things when looked at in isolation. The proposed aggregated indicator is much richer in information and provides therefore a more nuanced assessment. We also think that the combination of efficiency and trustworthiness is a potential strength, because both need to be considered in combination. Yet, there may be a potential overlap between the trustworthiness part and the legal and regulatory framework.

Dimension 6: Governmental PPP support

In this sixth and last dimension we will focus on the extent to which national governments provide an institutional framework that is either conducive or preventive for the introduction and diffusion of privately financed transport infrastructure (also known as public-private partnerships or PPPs). Although this is a rather specific dimension, we argue that it is an relevant one given the growing importance of PPPs in the world of infrastructure projects in the last decade. Governments are said to mainly develop their support for PPPs along three aspects: by designing policies and expressing *political commitment*, by articulating the *legal and regulative framework* and by creating *supporting arrangements*. The PPP Governmental Support Index (GSI) by Verhoest et al. (2015) measures these three aspects regarding PPPs.

The article maps and compares the governmental support in 20 European countries, which have different politico-administrative traditions and regimes. The development of the indicators, their measurement and the collection of data were carried out as part of the COST TU1001 Action on PPP in transport. The data collection was allocated to country teams, which delivered a full country profile based on the analysis of legislation, policy documents, other documents and selected interviews. Country profiles consist of a narrative part (see Verhoest et al., 2013) and of a standardised data set alongside the variables and indicators. The PPP GSI gives a total score between 1 (no support) and 4 (full support) for each country, as the average of the scores on many different indicators.

Governments are said to mainly develop their support for PPPs along three dimensions: by designing policies and expressing political commitment, by articulating the legal and regulative framework and by creating supporting arrangements. As academic sources remain at a quite general level on how to further detail and operationalize these main dimensions, we will use practitioner-oriented literature produced by international organisations and consultancy firms, which provide guidelines for governments (Verhoest et al. 2015).

Explicit PPP policies and long term political commitment – which is the first dimension of governmental support for PPPs – is crucial to create legitimacy for it as a public investment instrument (Matos-Castaño et al., 2014), which will in turn stimulate the growth and the development of a pipeline of projects. Long-term policy and political commitment is seen in PPP literature as a key variable with which to manoeuvre successful PPPs projects (see Flinders, 2005; Johnston, 2010; Jooste et al., 2011; Dehli et al., 2010). Moreover, PPP policies serve to define PPP in comparison to other infrastructure service procurement options, as well as to describe the reasons and goals for adopting the schemes. Finally, PPP policies can encourage good relationships by directing and coordinating cooperation between interested sectors and government institutions. Of crucial importance, according to the more detailed practitioner literature, are the existence and regular update of an explicitly adopted policy document on PPPs, as well as a clear programme for specific PPP projects. Moreover, clear political support for PPPs expressed by the main political parties with some stability over time is said to be crucial (see IMF, 2004; UNESCAP 2005; OECD, 2006; Deloitte, 2007; World Bank and PPIAF, 2012). An outline of a proposed PPP policy covers the following topics: definition and scope; objective of the PPP programme; principles of PPP agreements; risk allocations in PPP projects; establishment of PPP unit; PPP procedures and auditing the PPP programme (PPIAF, 2012) (Verhoest et al. 2015).

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The legal and regulatory framework on PPP represents the *second dimension* of government support for PPP. Research has illustrated that both "hard" and "soft" regulations apply to PPPs (see Mörth, 2007; Bovis, 2013), which can either be enabling or prohibitive for the uptake of PPPs in various national contexts. Moreover, a high diversity in national approaches to the regulation of PPPs is found in the literature, with some countries having launched specialised PPP laws and formal procedures for financing and green-lighting of projects, whereas others have adopted a less formalised and essentially more decentralised approach (Petersen, 2011; Bovis, 2013). This dimension relates to the presence and content of a specifically stipulated legal framework for PPP, and relevant provisions in PPP-related and public procurement regulation (World Bank and PPIAF, 2012; see also FIMA s.d.; UNCITRAL, 2001; EIU, 2011). The perhaps most detailed overview of relevant legal and regulatory dimensions for PPPs has been provided by the European Investment Bank (EIB, 2011) and the European Bank for Reconstruction and Development (EBRD, 2012) and will be used to construct this part of the PPP-GSI (see Table 2.1.1) (Verhoest et al. 2015).

The *third dimension* in which governments may support PPPs explicitly is that of PPP-supporting arrangements, of which the existence of a dedicated PPP unit is one crucial element. The role and functioning of PPP-supporting arrangements has recently become a major theme in research; such units are considered to be major players vis-à-vis shaping the national and local institutional conditions for PPP development (Jooste et al., 2011; Mahalingam et al., 2011). The implementation of PPP policies and the development of projects are thus likely to be affected by the presence or absence and working of these institutions in relation to their role and functioning, organisational structure, formal authority, working procedures and institutional logic (Jooste & Scott, 2012; Farrugia, Reynolds & Orr, 2008). According to a number of policy and practitioner-oriented papers, relevant elements in a supportive institutional framework include: a) the formal organization of PPP units or agencies and their role; b) the presence or absence of fixed procedures for PPP project appraisal and prioritisation; and c) standardised PPP contracts and/or processes for implementing PPPs (EIB, 2004; OECD, 2010; World Bank & PPIAF, 2006) (Verhoest et al. 2015). Table 2.1.1 summarizes the construction of the PPP-GSI index.

Table 2.1.1: Operationalisation of PPP Governmental Support into the PPP-GSI-index

Dimension	Indicators		Sub-indicators	Scores			
				4	3	2	1
Policy and political commitment	33,33 %	Existence of a strategy document of PPP policy		Yes, published before 2006 and updated afterwards	Yes, published before 2006, but not updated	Yes, recently published and not updated	Non-existent
	33,33 %	Existence of a general PPP programme		Yes, incl. transport-specific programme, clear time schedule	Yes, incl. transport-specific programme, but no clear time schedule	Yes, but only general PPP programme, no clear schedule	Non-existent
	33,33 %	Political support		Rather strong, stable or increasing	Rather strong, decreasing	Rather low, increasing	Rather low, stable or decreasing
Legal and regulatory framework	50%	Specific PPP or concession law: (a) existence	(1) General PPP or concession law; (2) PPP law in transport; (3) procurement law; (4) in-line with EU	All four criteria are met	Three criteria are met	Two criteria are met	One or no criterion is met
		Specific PPP or concession law: (b) scope regarding definitions of four items	definition of (1) PPP; (2) eligible sectors and types of infrastructures/ services; (3) contracting authorities; (4) eligible private party	All four criteria are met	Three criteria are met	Two criteria are met	One or no criterion is met

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Dimension	Indicators		Sub-indicators	Scores			
				4	3	2	1
	50%	Elements provided in the general legal framework (including public procurement law)	4 sub-indicators covering procedures and recommendations, 5 sub-indicators about mandatory provisions in PPP contract[1]	8 to 9 sub-indicators are met	6 to 7 sub-indicators are met	4 to 5 sub-indicators are met	0 to 3 sub-indicators are met
PPP-supporting bodies	33%	Acting public institutions/PPP-supporting units	Existence of a PPP support unit	Yes, since before 2006	Yes, since 2006 or later	No, not anymore	No, never existed
			Legal and organisational basis of PPP support unit	Private legal body with private sector participation	Private legal body without private sector participation	Public (law) body under ministry	Non-existent
			General functions PPP Support unit	Dissemination, policy function and green lighting	Dissemination and policy guidance or green lighting	Dissemination only	Non-existent
			Staff size of unit	20 or more	5 to 20	< 5	Never existed
	33%	Procedures for project appraisal and prioritisation, role of main sectors in project stages	Existence of standard ex ante evaluation instruments	Mandatory for all projects	Mandatory beyond threshold	Existing, but not mandatory	Non-existent
			Use of standard ex-ante evaluation in PPP projects	Used in all projects	Used in majority of projects	Used in minority of projects	Not used
			Existence of a third party scrutinizing and approving PPP projects before project on tender	Yes	Yes, beyond certain threshold	No, not anymore	Not at all
			Existence of a third party scrutinising and approving PPP projects before final contract signed	Yes	Yes, beyond certain threshold	No, not anymore	Not at all
	33%	Standardised processes and documents for PPPs in transport	Use of standardised contracts for PPP in transport	Used in majority of projects	Used in minority of projects	Existent but not used	Non-existent
			Use of standardised PPP model in transport	Used in majority of projects	Used in minority of projects	Existent but not used	Non-existent

The next overview table (2.1.2) explains the essence of the six dimensions, the general political, regulatory, administrative, economic and financial context and the specific governmental PPP support, which are deemed necessary to describe the implementation context for transport infrastructure projects.

[1] Does the prevailing legislation include provisions and procedures regarding the following elements: selection of private partner through competitive procedures; non-competitive procedure in exceptional circumstances; procedures for unsolicited proposals; review procedures; contract termination events; compensation provisions; provisions for collection of fees or payments by government; public authorities to support and provide guarantees and step-in rights for lenders or substitution by a new private partner?

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Table 2.1.2. Implementation context for publicly financed and privately financed infrastructure projects

Table 2.1.2.a Political capacity, support and policies

Variables / aspects	Main indicators	Explanation and sub-items	Data source and information (e.g. countries covered, time period, availability data)	Rationales and limitations
Political stability	Political stability & absence of violence index	captures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism	Worldwide Governance indicators/ World Bank - Time: 1996-2014; - Method: surveys and other cross-country assessments of governance; - Individual data sources have been rescaled to run from 0 (low) to 1 (high); - Coverage: all countries.	Rationales: - Essential conditions for the construction and maintenance of public infrastructure; in general but also to attract private investors. Missing: - Political stability in terms of cabinets (e.g. Arend Lijphart's cabinet turn-over) Limitations: - Aggregated indicator; - Measurement of perceptions
Corruption	Control of corruption index	captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Worldwide Governance indicators/ World Bank - Time: 1996-2014; - Method: surveys and other cross-country assessments of governance; - Individual data sources have been rescaled to run from 0 (low) to 1 (high); - Coverage: all countries.	Rationales: - Less corruption in a country is for the private sector an important and attractive factor to invest their capital in public infrastructure Public infrastructure is vulnerable to possible capture by private elites and interests. Limitations: - Aggregated indicator; - Measurement of perceptions
Political Participation	Democracy index	Encompasses 5 subitems: - Electoral process - Functioning of the government - Political participation - Political culture - Civil liberties	The Economist/ The Economist Intelligence Unit - Time: 2006, 2008, 2010, 2011, 2012; - The index has a 0 to 10 scale, and is based on the ratings for 60 indicators grouped in five categories - Method: combination of expert assessments & public opinion surveys; - Coverage: 165 countries.	Rationales: - The ability of citizens and civil society to participate and influence transport policy is important given the many affected stakeholders Limitations: - Aggregated indicator; - Measurement of perceptions

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Table 2.1.2.b Legal and regulatory framework

Variables / aspects	Main indicators	Explanation and sub-items	Data sources (e.g. countries covered, time period, availability data)	Rationales and limitations
Rule of Law	Rule of Law Index	captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Worldwide Governance indicators/ World Bank – Time: 1996-2014; – Method: surveys and other cross-country assessments of governance; – Individual data sources have been rescaled to run from 0 (low) to 1 (high); – Coverage: all countries.	Rationales: – Guarantees private sector investment and its sustainability in the near future Shareholders and stakeholders need to be able to rely on the judicial system to safeguard their basic (property) rights. Limitations: – Aggregated indicator; – Measurement of perceptions.
Regulatory Quality	Regulatory quality index	captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Worldwide Governance indicators/World Bank – Time: 1996-2014; – Method: surveys and other cross-country assessments of governance; – Individual data sources have been rescaled to run from 0 (low) to 1 (high); – **Coverage: all countries.**	Rationales: – Regulatory quality is necessary to promote private sector involvement in transport infrastructure; Limitations: – Aggregated indicator; – Measurement of perceptions .
Liberalization of transport markets	ETCR	The OECD indicators of regulation in energy, transport and communications (ETCR) summarize regulatory provisions in seven sectors: telecoms, electricity, gas, post, rail, air passenger transport, and road freight. It is possible to isolate the indicators which are related to transport and combine them to a 'transport related' version of the ETCR.	The ETCR indicators have been estimated in a long-time series and are therefore well suited for time-series analysis. – Since 1975 till 2013; – 34 OECD countries + set of non OECD countries in 2013 – Range from a minimum of 0 (full deregulation) to a maximum of 6 (most restrictive conditions for competition).	Rationales: – Measure of the degree of public ownership, vertical integration (only energy), entry regulation and market concentration. – The extent of admission to the occupation, access to the market, social and technical harmonisation, the use of state grants and pricing mechanisms are all important elements to understand the functioning of transport infrastructure projects. Limitations: – Serbia (one of the BENEFIT countries) is not included in the OECD sample; – Potential overlap with dimension 2 on regulatory quality; – An aggregated ETCR score exists, but it may be preferable to develop a 'transport related' version of the ETCR score (and exclude the telecom, energy and post variables).

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Table 2.1.2.c Public sector/public sector capacity[2]

Variables / aspects	Main indicators	Explanation and sub-items	Data sources (e.g. countries covered, time period, availability data)	Rationales and limitations
Government effectiveness	Government effectiveness index	Captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Worldwide Governance indicators/ World Bank – Time: 1996-2014; – Method: surveys and other cross-country assessments of governance; – Individual data sources have been rescaled to run from 0 (low) to 1 (high); – Coverage: all countries.	Rationales: – A reliable public sector (expertise, experience, commitment) is crucial for the building the necessary trust relationship with private sector companies; Missing: – Quality can be interpreted very narrowly (e.g. on time, on budget), or broadly (e.g. spatial and social concerns); and product quality versus process quality. Limitations: – Aggregated indicator; – Measurement of perceptions
Government efficiency	Government efficiency score (part of the global competitiveness index)	Government efficiency is composed by 5 subitems, each time a ranking and a score from 1-7: – Wastefulness of government spending – Burden of government regulation – Efficiency of legal framework in settling disputes – Efficiency of legal framework in challenging regulations – Transparency of government policymaking	Global competitiveness index/ World Economic Forum – Time: 2004-2015; – Method: 110 variables, of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations; – 2 figures: ranking (… /144) and score (1-7). – Coverage: 144 countries.	Rationales: – The role of the public sector as reliable and efficient partner is important to take into account. Limitation: – Potential overlap with section 2.

[2] A possible addendum to this general dimension of 'public sector capacity' is a measurement of the infrastructure needs. One way of doing this is using the 'quality of infrastructure score' which is part of the global competitiveness index developed by the World Economic Forum. This score is composed by 5 sub-items, each time getting a ranking and a score from 1-7: quality of overall infrastructure, quality of roads, quality of railway infrastructure, quality of port infrastructure, quality of airport infrastructure and the available airline seat kilometers. There are two main reasons why this addendum is not part of the final selection of indexes: it is a very specific indicator which is difficult to use in combination with very broad indicators like government effectiveness and efficiency, and the notion of quality of infrastructure can be interpreted very differently. Which criteria should be used: punctuality, frequency, comfort, etc.?

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Table 2.1.2.d Macro-economic situation[3]

Variables / aspects	Main indicators	Explanation and sub-items	Data sources (e.g. countries covered, time period, availability data)	Rationales and limitations
Macro-economic environment	Macro-economic environment score (part of the global competitiveness index)	Macro-economic environment is composed by 5 sub-items, each time a ranking and a score from 1-7: – Government budget balance, % of GDP – Gross national savings, % of GDP – Inflation, annual % change – Government debt, % of GDP – Country credit rating, 0-100 (best)	Global competitiveness index/ World Economic Forum – Time: 2004-2015; – Method: 110 variables, of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations; – 2 figures: ranking (… /144) and score (1-7). – Coverage: 144 countries.	Rationales: – The macroeconomic environment will influence the various options to publicly or privately invest in infrastructure projects ; Limitations: – An aggregated or total score

Table 2.1.2.e Financial conditions

Variables/ aspects	Main indicators	Explanation and sub-items	Data sources (e.g. countries covered, time period, availability data)	Rationales and limitations
Financial Market	Financial market development score (part of the global competitiveness index)	Financial market development is composed by 2 main items – efficiency and trustworthiness – each time a ranking and a score from 1-7: **A.** Efficiency: – Availability of financial services – Affordability of financial services – Financing through local equity market – Ease of access to loans – Venture capital availability **B.** Trustworthiness: – Soundness of banks – Regulation of securities exchanges – Legal rights index	Global competitiveness index/ World Economic Forum – Time: 2004-2015; – Method: 110 variables, of which two thirds come from the Executive Opinion Survey, and one third comes from publicly available sources such as the United Nations; – 2 figures: ranking (… /144) and score (1-7). – Coverage: 144 countries.	Rationales: – Maturity, efficiency and trust in financial market is important element when talking about large investments in infrastructure projects Limitations: – Aggregated or total score.

[3] Another possible addendum to this 'macro-economic environment' score is the investment in inland transport infrastructure measured as a % of GDP of a certain country. The International Transport Forum (ITF) collects, on annual basis from all its Member countries, data on investment and maintenance spending on transport infrastructures (see OECD statistics). The reasons for not including this indicator in the final selection are twofold: it is a very specific indicator, which is probably somewhat redundant with the overall macro-economic environment, and the result could be interpreted very differently. There are different reasons to invest in infrastructure: because the current state is bad and in urgent need of investments, or because the government wants to stay on top and is looking forward to future challenges in terms of transport?

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Table 2.1.2.f Governmental PPP Support

Variables/ aspects	Main indicators	Explanation and sub-items	Data sources (e.g. countries covered, time period, availability data)	Rationales and limitations
PPP Governmental Support	PPP GSI	Index of the governmental support for PPPs, which measures the extent to which national governments provide an institutional framework that is conducive for the introduction and diffusion of PPPs within transport infrastructure. It has three subitems: - Policy and political commitment regarding PPPs; - Legal and regulatory framework regarding PPPs; - Presence/absence of PPP supporting arrangements.	PPP GSI is developed by and explained in Verhoest K. et al. (2015): - 1 final score between 1 (no support) and 4 (full support) - Based on scores from 1 (no support) to 4 (full support) on several sub-indicators; - 20 European countries; - Based on COST TU1001 Action on PPP in Transport data collection. - Only in 2013.	Rationales: - Look into specific PPP arrangements: whether PPP as a policy method or tool is as such facilitated by specific initiatives. Limitations: - Potential overlap with dimensions legal framework and public sector capacity. No longitudinal comparison as it is only measured in 2013.

2.1.3 Relation of the Proposed Implementation Context Typology to Project Outcomes

After explaining each of the six identified dimensions of the implementation context typology, it may be interesting to indicate already some preliminary expectations about the impact or influence of each dimension on transport infrastructure projects. For example, if and to what extent a broad range of stakeholders has been consulted and was given the opportunity to voice their concerns, remarks and suggestions regarding a certain infrastructure project (which is part of the political participation dimension) could possibly influence the social and environmental outcomes. The respective score of a country on the variable 'government efficiency' is expected to give an indication on the economic outcomes of a project, while the variable 'government effectiveness' is more linked with the institutional outcomes. A multitude of such combinations between variables and dimensions with the project outcomes are possible. The next table 2.1.3 summarizes these preliminary expectations based on the literature review used for the development of the implementation context typology.

Table 2.1.3: overview of expectations between dimensions of typology and project outcomes

Dimensions	Variables	Economic	Social	Environmental	Institutional
Political	Stability	X			X
	Corruption	X	X		X
	Participation		X	X	
Legal	Rule of Law		X	X	X
	Regulatory Quality	X			X
	Liberalization	X			
Administrative	Effectiveness		X	X	X
	Efficiency	X			
Economic	Macro-economic environment	X	(X)	(X)	
Financial	Financial conditions	X	(X)	(X)	
PPP GSI	Political	X			X
	Legal	X			X
	Support	X			X

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2.1.4 Relation of the Proposed Implementation Context Typology to Funding and Financing Schemes

The same exercise of specifying 'a priori' some preliminary expectations could be repeated regarding the most likely impact of the scores of a country on certain variables and dimensions on the funding and financing schemes of a project. The implementation context will influence the options between which governments can choose to fund and finance their planned infrastructure projects. For example, the macro-economic environment (measured by several indicators like public debt, growth rate and inflation rate) is expected to have an important impact on how much private sector capital is desired or needed to finance public infrastructure projects. The same goes for the maturity of the financial markets in a certain country: how easy is the access to large sums of private investment capital? It is however broader than just economic and financial dimensions. Control of corruption for instance is expected to be as important to attract and sustain the interest of private sector companies to invest their capital in infrastructure projects.

Table 2.1.4: Overview of expectations between dimensions of typology and funding/financing schemes

Dimensions	Variables	Funding	Financing
Political	Stability		X
	Corruption		X
	Participation	X	
Legal	Rule of Law		X
	Regulatory Quality		X
	Liberalization	X	X
Administrative	Effectiveness	X	X
	Efficiency		X
Economic	Macro-economic environment	X	X
Financial	Financial conditions	X	X
PPP GSI	Political		X
	Legal		X

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2.2 Transport Mode Context Typology

One of the typologies generated in BENEFIT is connected to the Transport Mode Context. The aim is to create/build a typology for all the modes of transport generically, focusing on the criterion of funding schemes. The creation of this typology or in other words the creation of a categorization/classification of modes of transport based on their different characteristics/criteria will be based mainly on the book "Transport Economics" of Blauwens, De Baere and Van de Voorde (2014) and on the scientific paper "Worldwide trends in transport infrastructure" (Vergauwen et al, 2009).. These characteristics of the transport modes will be presented as dimensions, and for each dimension/characteristic sub- dimensions, with indicators so as to measure each (sub-) dimension are proposed. Indicators are used to give an idea of the effectiveness, to evaluate the level of realization of particular characteristics (Meersman et al., 2005). In transport infrastructure investment a large number of indicators can be used.

Within BENEFIT, transport modes are examined from the perspective of funding schemes. In other words, we focus on transport modes taking into account the impact (direct or indirect) that the different characteristics of the modes of transport could have on funding in particular. The BENEFIT project itself focuses on the analysis of funding schemes within an inter-related system.

Funding schemes are ways/schemes through which we try to take back the money we spent for the construction, management, maintenance and operation of a transport infrastructure (European Commission, 2007 and The Law Library of Congress, 2014). The main methods of raising funds for transport infrastructure or in other words the main sources of funding are: 1) taxation and 2) user fees. Some of the forms of taxation for fund-raising are the following: fuel tax, sales tax, property taxes, land value taxation, income taxation, vehicle/per kilometre taxes, parking site taxes etc. (Litman, 2014). User fees may be congestion charges/fees, emission fees, or tolling etc. (Litman, 2014).

2.2.1 General Background of the Transport Mode Context

Transport modes are the means by which freight and people achieve mobility. They fall into one of three basic types, depending on over what surface they travel: (i) land transportation (road, rail and pipelines), (ii) water transportation (maritime transportation and inland navigation), and (iii) air transportation. When more than one mode is used for transport, then this type of transportation is called intermodal. Each mode is characterized by a set of operational, technical and commercial characteristics (Rodrigue et al, 2013).

Transport modes can be classified by type of load: passenger transport and freight transport. Passenger transport is classified in terms of usage in (i) individual and common and in (ii) Regular; Irregular, Special forms of regular and Taxi service. In terms of availability, passenger transport is classified as private and public. Also, another classification could be scheduled (fixed routes, with fixed stops at fixed times) and non-scheduled transportation (for example chartering).

With regard to goods/freight transportation, one classification is (i) own-account transportation versus (ii) professional transportation. Own account transportation refers to the transportation of freight using the organization's own vehicles whereas professional transportation refers to the transportation of freight by calling on a third party to transport the organization's goods (Blauwens et al, 2014).

Other classifications of modes of transport could be by (i) transit time and (ii) cost of transportation (Chamber of Commerce of the United States, 2006) and by (i) life expectancy, (ii) volume of investments and (iii) maintenance costs (Vergauwen et al, 2009).

It is also important to point out the factors that determine the choice of a mode (for freight and for passengers) are: (i) the quantity, (ii) the type of commodity that should be transported, (iii) its value, (iv)) the distance that should be covered and (v) the accessing capacity of the mode. So as to make it more load-specific, it is also important to mention how we choose a mode of transport when we talk about passenger and freight transport. Referring to the former, the factors that are important are price, speed, comfort, and accessibility, whereas for the latter one, the type of goods and the distance are of a crucial importance. (Blauwens et al, 2014)

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The above classifications are vital input for constructing the transport mode typology. More specifically, classifications used in the Transport Mode Typology are: type of load (passengers and freight), life expectancy (referred as lifetime in the typology), investments, value of the commodity, speed, accessibility and maintenance costs. The rest of the classifications, for example the classification of passenger transport in terms of usage and availability, even if they are not used in the typology, offer a useful background so as to understand the different existing classifications of the transport modes and as a result so as to build our typology. To be more specific, even if the classification of passenger transport in terms of usage is not used as such (i) individual and common (ii) regular and irregular, the general classification of "passenger transport in terms of usage" is used but with different respective indicators. To sum up, the general background of the transport modes helps us construct the skeleton of the typology.

2.2.2 Key Characteristics of the Transport Mode Context Typology

Based on the broader overview of possible dimensions in section 2.2.1, the basic dimensions/characteristics of the transport modes that are proposed and structure the transport mode typology are the following nine (see Annex 1): 1) Type of Load, 2) Costs, 3) Lifetime, 4) Level of sunkness of investment, 5) Operational Characteristics, 6) Performance, 7) Location, 8) Sensitivity to external risks and 9) Regulation - Deregulation level.

With respect to the ninth dimension, the categorization of transport modes can be made based on regulations that the government/state imposes. In Annex 1, the following seven dimensions/regulations are presented: 1) Admission to the occupation, 2) Access to the market, 3) Social harmonization, 4) Technical harmonization, 5) Pricing, 6) State grants and 7) Market. In this way, the level of regulation/deregulation of each transport mode can be observed and we can also understand how liberalised is each market (for example "the rail market").

For each of the above-mentioned (sub) dimensions, indicators are proposed so as to measure these dimensions. The impact of each indicator (direct or indirect) on funding of transport infrastructure is indicated.

Sub-dimension 1: Type of Load

The type of load is one of the key characteristics based on which transport modes are classified. The load can be passengers, freight or both, and as an indicator for this dimension, the ratio "passengers to freight" is proposed. Its impact on funding is indirect. Passenger transport (sub dimension 1a) can be classified based on 1) usage, 2) value attributed to passenger transportation and 3) speed: high-low. The usage can be measured through the 1) number of passengers per hour and 2) the number of passenger vehicles-kms. Notably, vehicles-kms describe all modes of transportation, a vehicle being a car, truck, vessel, train-vehicle, airplane etc.

Transport modes can be classified based on their typical speed (kms/hour) but the impact of the speed on funding of transport infrastructure is indirect, as its direct impact is on the demand for a particular transport mode.

Freight transport can be also classified based on 1) usage of freight, 2) value of freight (high-low) and 3) speed. Usage of freight and its more measurable indicator "number of freight-vehicle-kms" has a direct impact on funding whereas the volume of freight-tonnage per hour has an indirect impact. The 3rd indicator of the "freight dimension", ratio high/low value of freight has an indirect impact on funding as well because it is connected with transport companies' willingness to pay.

Sub-dimension 2: Construction, Operation and Maintenance Costs

The costs for the construction, maintenance and operation of different transport infrastructures have a direct impact on funding because if the magnitude of construction cost per km is higher for example, this means that higher financing is needed and as a result higher funding so as to recover the amount of money spent for the construction of the transport infrastructure (the same logic for maintenance cost/km).

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Also, the indicators CAPEX and OPEX are proposed for measuring the construction cost (CAPEX) and the maintenance and operation cost (OPEX) respectively (direct impact).

Sub-dimension 3: Lifetime
Lifetime refers to the number of years of operation of transport infrastructure and has a direct impact on funding because the years of operation generating revenues. Project life cycle and contract duration of the infrastructure are also used so as to measure the lifetime of the infrastructure and have a direct impact on funding of transport infrastructure.

Sub-dimension 4: Level of investment sunkness
The level of sunkness of investment refers to sunk investments which are investments that have been already incurred and cannot be recovered[4]. We examine separately the level of sunkness of the transport infrastructure and the superstructure (equipment). So as to see how easily we will recover the money we already spent on the construction, we should take into account the level of sunkness of our investment (non sunk/sunk investments), which directly influences the funding procedure.

Sub-dimension 5: Operational characteristics
Operational flexibility refers to the ability of each transport mode to reduce discontinuity. Rerouting is proposed as an indicator to measure this dimension, which has an indirect impact on funding of transport infrastructure.

Sub-dimension 6: Performance indicators
Performance indicators, which are also called measures of effectiveness, are measurable outcomes used to evaluate progress toward established goals and objectives. Seven performance indicators are proposed:

1) accessibility which is measured through the number barriers,
2) availability which is measured through the hours of availability of a transport infrastructure per day or other defined period of time (%),
3) reliability (both of infrastructure and operations) is measured as the % time of disruptions during operation[5],
4) safety and security which is measured through the number of fatalities, the number of heavily and light injured people and the cost of accidents,
5) average speed measured through kilometres per hour,
6) maintainability through % of non-availability due to maintenance and
7) capacity through vehicles per hour. All of the above indicators have an indirect impact on funding apart from availability and maintainability, which directly influence funding.

Sub-dimension 7: Location
Location and the respective proposed indicator “type of connection” (interurban and urban & link and node) has an indirect impact on funding of transport infrastructure. The type of connection of infrastructures can have an impact on kms travelled and as a result indirectly on funding of transport infrastructure. Also, a distinction can be made based on the position of the network: a transport infrastructure can be a 1) node, 2) node within a node (for example, a port terminal may be described as a node within a node-terminal within port), 3) link and 4) link within a link (for example a bridge may be described as a link within a link). For ‘nodes’ (seaports, airports, bus terminals, etc.), the type of connection plays through the type of ‘hub’ status that the infrastructure has: international gateway, national importance, regional importance, etc. Level of integration is an additional indicator used to measure the location dimension and means that all modes or types of transport (rail, road, water, and air) operate as one 'seamless' entity - for the benefit of the fare-paying customer[6]. The levels of transport integration are the following: 1) physical integration (connectivity), 2) operational integration, 3) governance integration and 4) ICT integration (Information & Communication Technology).

[4] Rail tracks can to a high extent be re-used. Road asphalt can to a high extent not be re-used, at least not for the same purpose. The same goes for port dock constructions, airport runways, etc.
[5] Possible sources are congestion, accidents, etc.
[6] For instance, integrated ticketing ensures that passengers can use the same pass or ticket for bus, rail, metro, etc.

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Sub-dimension 8: Sensitivity to external risks

Sensitivity to external risks is the 8th proposed dimension of the transport mode context typology and refers, indicatively, to the following risks: 1) regulatory, 2) financial, 3) revenue, 4) design, 5) construction, 6) maintenance, 7) exploitation, 8) demand, 9) force majeure and 10) climate change. All the above mentioned risks have a direct impact on funding transport infrastructure.

Two indicators are used for the measurement of all the above mentioned external risks: 1) risk assessment, which is the product of the risk probability occurrence and its impact (cost) on the project. and 2) Risk allocation and mitigation measures by which risk probability is reduced (through optimal risk allocation) and the impact of the risk is eventually reduced (through proper mitigation measures).

Sub-dimension 9: Regulation and Deregulation Level

In order to have a better understanding of the 9th dimension "Regulation and Deregulation Level", it is useful to define what regulation is. A regulation consists of requirements the government imposes on individuals and private firms to achieve government's purposes. These include better and cheaper services and goods and protection of existing firms from "unfair" (and fair) competition (Litan, 2008). According to economists, there are two types of regulation: economic and social. "Economic regulation" refers to rules which limit who can enter a business (entry controls_ occupational licensing) and what prices they may charge (price controls). For example, for many years, airlines and railroads price caps were set. If markets are reasonably competitive, there is no reason for price regulations. For example, if there are multiple firms and thus choices for consumers, price regulations of transport modes start dismantling (deregulation). However, there will always be a case for some regulation, even in a well-functioning economy (Litan, 2008).

"Social regulation" (for example setting standards for emissions, requiring that firms use specific technologies, establishing the number of driving hours, or the fares for commuters and elderly people, etc.) refers to the rules governing how a business or an individual carries out its activities, aiming to the correction of "market failures". One of the most common market failures is when firms (or individuals) do not take into account the costs their activities may impose on third parties (externalities) (Litan, 2008).

Although the government repeatedly states that transport is an independent sector, it has still imposed strict regulation with regard to passenger and goods transport. This regulation is evident at different levels such as: 1) admission to the occupation (licensing system), 2) access to the market, 3) technical regulation, 4) social legislation, 5) pricing policy and 6) aid and competitive policy (Blauwens et al., 2014).

There is a controversy between the proponents of regulation of transportation and the proponents of deregulation. On the one hand, the supporters of regulation consider regulation as necessary to protect the public interest. On the other hand, deregulation of transportation is highly desirable so as 1) to increase freedom and limit the restrictions (entry barriers & price controls), 2) so as to increase competition which a) will press rates downwards and b) will squeeze the monopoly profits out of the system (Moore, 1982). Clearly, the objective of the deregulation is the "free market", which is a market free from any kind of intervention by the government/state.

Each Member State is responsible for bringing its own national regulations into line with European rules. The directives may be implemented in different ways within each national legislation because they are binding in terms of the desired end but not with regard to the means by which it is attained (Blauwens et al., 2014).

State Grants is the only regulation, which (could) have a direct impact on funding of transport infrastructure. State grants regulation refers to 1) grants offered so as to cover infrastructure costs (direct impact), 2) to grants offered so as to help transport companies survive (indirect impact) and 3) to grants/subsidies offered so as to cover the operation of the infrastructure (indirect impact) (see Annex 1).

Based on all the above dimensions and their respective indicators, which are presented in-depth in Annex 1, we selected the most critical ones for funding of transport infrastructure and we present them in Table

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1. In table 1, three basic dimensions of indicators are presented: 1) Investment, 2) Users and 3) Market strength/competitiveness.

Dimension 1. Investment
In the investment dimension we included the follow sub-dimensions:

- Level of sunkness of investment with the respective indicator “non sunk/sunk investments”
- Investments and/or costs with respective indicators:
  - CAPEX
  - OPEX
- Lifetime with respective indicators:
  - Project/infrastructure (Investment) life cycle,
  - Contract duration over infrastructure life

Dimension 2. Users
The users’ dimension includes the following sub-dimensions and respective indicators:

- Users with selected indicators:
  - number of freight vehicle-kms, and
  - number of passenger vehicle-kms,
- Operational flexibility-continuity with selected indicator rerouting,
- Performance with selected indicators:
  - reliability, % time of disruptions during operation,
  - availability, % of available use over period of time
  - maintainability, % not available due to maintenance,
  - cost of accidents and
  - vehicles /hour
- Risks

Dimension 3. Market strength/competitiveness
In the market strength/competitiveness dimension the following (sub)-dimensions and respective indicators are proposed:

- Location,
- Level of integration
- Level of exclusivity
- Level of regulation-deregulation with the following indicators selected:
  - noise level per mode,
  - % of emissions per mode,
  - degree of tariff freedom,
  - grants to cover infrastructure cost,
  - grants/subsidies to cover the operation of the infrastructure and
  - Liberalisation Index-LIB index (see table 2.2.1).

To sum up, our typology is looking for standard values of the selected indicators. It is not meant to be project-specific, as that is part of the Business Model typology. In other words, we are examining the proposed dimensions from a generic perspective.

Table 2.2.1 Transport Mode Context Typology

Dimensions	Sub-Dimensions	Indicators	Direct/Indirect Impact on funding and financing schemes
Investment	Level of Sunkness of investment ▪ Infrastructure ▪ Superstructure	Non sunk/sunk investments	Direct
	Investments/Costs	Construction - CAPEX	Direct

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Dimensions	Sub-Dimensions	Indicators	Direct/Indirect Impact on funding and financing schemes
		Maintenance and Operation OPEX	Direct
	Lifetime	Project/infrastructure (Investment) life cycle	Direct
		Contract duration/ infrastructure life1	Direct
II. Users	Users	Number of freight vehicle-kms	Direct
		Number of passenger vehicle-kms	Direct
	Operational flexibility - continuity	Rerouting	Indirect
	Performance	Reliability % time of disruptions during operation	Indirect
		Availability % of availability (i.e. days in year)	Direct
		Maintainability % not available due to maintenance,	Direct
		Safety & security cost of accidents	Indirect
	Capacity	vehicles /hour	Indirect
	Risks	Demand risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Regulatory risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Financial risk[7] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Revenue risk[1] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Design risk[4] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Construction risk[8] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Maintenance risk[6] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Exploitation risk[6] ▪ Risk Assessment ▪ Allocation/mitigation	Direct
		Force majeure[6] ▪ Risk Assessment	Direct

[7] Also considered in the Financing Typology
[8] Also considered in the Business Model Typology

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Dimensions	Sub-Dimensions	Indicators	Direct/Indirect Impact on funding and financing schemes
		▪ Allocation/mitigation	
		Climate change risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct
III. Market Strength / Competitive	Location	Type of connection: ▪ Interurban ▪ International ▪ National ▪ Regional ▪ Local ▪ Urban	Indirect
		▪ Node within a Node ▪ Link within a Link ▪ Node ▪ Link	Indirect
	Level of Regulation - Deregulation	Technical Harmonisation Noise & pollution emissions ▪ Noise level per mode ▪ % of emissions per mode	Indirect
		Pricing ▪ degree of tariff freedom	Indirect
		State grants ▪ grants to cover infrastructure costs ▪ grants/subsidies to cover the operation of the infrastructure	Direct
		Market Liberalisation Index-LIB index	Indirect
	Level of integration	physical integration	Indirect
		operational integration	Indirect
		governance integration	Indirect
		ICT integration	Indirect
	Level of Exclusivity	Natural or induced monopoly and influence of the transport network	Indirect

2.2.3 Relation of the Proposed Transport Mode Context Typology to Project Outcomes (Economic, Social, Environmental, Institutional)

In table 2.2.1, the impact on funding of transport infrastructure (economic outcome) was examined. In table 2.2.2, the impact of the transport mode dimensions/indicators on social, environmental and institutional outcomes is also examined. The dimensions and their respective indicators, which were described in Table 2.2.1 have an impact not only on economic outcomes (funding of transport infrastructure) but also on social, environmental and institutional outcomes. The impact on social outcomes concerns the effects of the indicators on the social fabric of the community and the well-being of the individuals. The impact on institutional outcomes concerns the effects of the indicators on governance decisions and regulations.

More particularly, in table 2.2.2 we present the impact of the most important dimensions and indicators on economic, social, environmental and institutional outcomes (for more information regarding the impact of

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all the indicators proposed in Annex 1, see Annex 3). In the 1st Dimension, "Investment", we concluded that the indicator "non sunk/sunk investment" has a direct impact on funding and thus a direct impact on economic outcomes but no impact on social, environmental and institutional outcomes. The costs (construction, maintenance, operation) have direct impact on funding and as a result a direct impact on economic outcomes but also have an impact on social and institutional outcomes. The construction, maintenance and operation of transport infrastructures are closely related to economic development and social welfare and that is why we indicate in table 2.2.2 that there is a direct impact on social outcomes. The above mentioned costs have also direct impact on institutional outcomes because state regulations or governance decisions will be probably directly affected depending on how high or low these costs are (especially if the transport infrastructure is public funded or for example we have a PPP). Lifetime indicators a) infrastructure life cycle and b) contract duration have a direct impact on funding and as a result a direct impact on economic outcomes but no impact on the three other categories.

Examining our 2nd Dimension, "users", and its 1st sub-dimension "users", we observe that the indicators a) number of freight vehicle-kms and b) number of passenger vehicle-kms have a direct impact on funding and as a result a direct impact on economic outcomes. Also they have a direct impact on social outcomes because these indicators could show economic development (for example, more vehicles-kms could create more jobs) and as a result affect the well-being of individuals. They have a direct impact on environmental outcomes as well because more vehicles-kms (passenger or freight vehicles) create more negative externalities (pollution, noise etc.). Operational flexibility and its respective indicator "rerouting" has an indirect impact on economic outcomes and a direct impact on the institutional ones because normally state has the control of cases like these. Also, rerouting could have an indirect impact on social and environmental outcomes. All the performance indicators presented in table 2 (1) reliability, 2) availability, 3) maintainability, 4) safety and security and 5) capacity have a direct impact on institutional outcomes and all of them apart from capacity have a direct impact on social outcomes as well because they have a strong impact on social well-being of individuals. On the one hand, availability and maintainability have a direct impact on funding and as a result a direct impact on economic outcomes. On the other hand, reliability, safety and security and capacity have an indirect impact on funding and consequently an indirect impact on economic outcomes. All risks have a direct impact on institutional outcomes because in many cases, risks are allocated between public and private partners. The impact of the risks on economic outcomes is direct.

In the 3rd Dimension "market strength/competitiveness", type of connection (interurban/urban and node/link) has an indirect impact on economic outcomes. In the 2nd sub-dimension, the indicators a) noise level per mode and b) % of emissions per mode have both indirect impact on economic outcomes and direct impact on social, environmental and institutional outcomes. Noise and pollution emissions are closely connected with the well-being and the quality of life of people (social impact), with the environmental damage that can cause (environmental impact) and the state takes decisions so as to mitigate and alleviate the environmental problems (institutional impact). Degree of tariff freedom has a direct impact on economic, social and institutional outcomes, whereas states grants dimension has different impacts on each outcome under examination. Firstly, grants offered to cover infrastructure costs have a direct impact on economic and institutional outcomes and an indirect impact on social and environmental outcomes because more grants for transport infrastructure probably mean more jobs in the transport sector and in general they would lead to economic development (social impact) and as a result pollution would be increased (environmental impact). The grants or subsidies that are offered so as to cover the operation of the infrastructure have an indirect impact on funding and as a result an indirect impact on economic outcomes, a direct impact on social outcomes and a direct one on institutional outcomes. Last but not least the indicator of the 2nd sub-dimension is the "liberalization index", which has an indirect impact on economic outcomes and a direct impact on institutional outcomes. In the 3rd sub-dimension, all the mentioned levels of integration have an indirect impact on economic outcomes and a direct impact on institutional outcomes. The physical integration level has also an indirect impact on social outcomes because it could affect indirectly the quality of life and the well-being of individuals. The last indicator presented in table 2.2.2 "level of exclusivity" has an indirect impact on economic outcomes and a direct one on institutional ones (for more information see Annex 3).

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Table 2.2.2 Transport Mode Context Typology Influence on Project Outcomes

Dimensions	Sub-Dimensions	Indicators	Economic	Social	Environmental	Institutional
I Investment	Level of Sunkness of investment ▪ Infrastructure ▪ Superstructure	Non sunk/sunk investments	Direct			
	Investments/Costs	Construction - CAPEX	Direct	Direct		Direct
		Maintenance and Operation OPEX	Direct	Direct		Direct
	Lifetime	Project/infrastructure (Investment) life cycle	Direct			
		Contract duration/ infrastructure life[1]	Direct			
II. Users	Users	Number of freight vehicle-kms	Direct	Direct	Direct	
		Number of passenger vehicle-kms	Direct	Direct	Direct	
	Operational flexibility - continuity	Rerouting	Indirect	Indirect	Indirect	Direct
	Performance	Reliability % time of disruptions during operation	Indirect	Direct		Direct
		Availability % of availability (i.e. days in year)	Direct	Direct		Direct
		Maintainability % not available due to maintenance,	Direct	Direct		Direct
		Safety & security cost of accidents	Indirect	Direct		Direct
	Capacity	vehicles /hour	Indirect			Direct
	Risks	Demand risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Regulatory risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Financial risk[9] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Revenue risk[1] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Design risk[4] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Construction risk[10] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Maintenance risk[6] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Exploitation risk[6] ▪ Risk Assessment ▪ Allocation/mitigation	Direct			Direct
		Force majeure[6]	Direct			Direct

[9] Also considered in the Financing Typology
[10] Also considered in the Business Model Typology

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Dimensions	Sub-Dimensions	Indicators	Economic	Social	Environmental	Institutional
		▪ Risk Assessment ▪ Allocation/mitigation				
		Climate change risk ▪ Risk Assessment ▪ Allocation/mitigation	Direct	Direct	Direct	Direct
III. Market Strength / Competitive	Location	Type of connection: ▪ Interurban ▪ International ▪ National ▪ Regional ▪ Local ▪ Urban	Indirect			
		- Node within a Node - Link within a Link - Node - Link	Indirect			
	Level of Regulation - Deregulation	Technical Harmonisation Noise & pollution emissions ▪ Noise level per mode ▪ % of emissions per mode	Indirect	Direct	Direct	Direct
		Pricing ▪ degree of tariff freedom	Direct	Direct		Direct
		State grants ▪ grants to cover infrastructure costs ▪ grants/subsidies to cover the operation of the infrastructure	Direct Indirect	Indirect	Indirect	Direct
		Market Liberalisation Index_LIB index	Indirect			Direct
	Level of integration	physical integration	Indirect	Indirect		Direct
		operational integration	Indirect			Direct
		governance integration	Indirect			Direct
		ICT integration	Indirect			Direct
	Level of Exclusivity	Natural or induced monopoly and influence of the transport network	Indirect			Direct

Source: own composition, based on the wider international scientific literature, research projects, and contacts with business actors

2.2.4 Relation of the Proposed Transport Mode Context Typology to Project Funding and Financing Schemes

Some of the dimensions/indicators described in table 2.2.1 have direct impact on the funding of transport infrastructure and these ones are gathered and presented in table 2.2.3. The indicators, which have an indirect impact on funding are not included in the table. Also, the impact of all the proposed indicators on financing schemes is indirect and that is why they are not included in the following table.

Table 2.2.3: Transport Mode Impact on Funding Schemes (Direct Impact)

Sub-Dimension	Indicator
1. Level of Sunkness of investment	Non sunk/sunk investments
2. Costs	CAPEX

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	OPEX
3. Lifetime	a. Project/infrastructure (Investment) life cycle
	b. Contract duration/ infrastructure life[1]
4. Risks	1. Demand risk
	2. Regulatory risk
	3. Financial risk
	4. Revenue risk
	5.Construction Risks
	6.Maintenance Risks
	7. Design
	8.Exploitation risk
	9. Force majeure3
	10. Climate change risk
5. users	a. number of freight vehicle-kms
	b. number of passenger vehicle-kms
6. Performance[11]	% of availability (i.e. days in year)
	% not available due to maintenance
7. Regulation-Deregulation level	
- State grants	grants to cover infrastructure costs

[11] Also considered in the Business Model Typology

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2.3 Business Model Typology

2.3.1 Business Models

A business model defines the way by which a firm delivers value to customers, entices customers to pay for value, and converts those payments to profit (Teece, 2010). In practice, a business model describes the organizational and financial 'architecture' of a business (Chesbrough and Rosenbloom, 2002). Business models describe how resources are combined and transformed in order to generate value for customers and other stakeholders, and how rewards are realized (Magretta, 2002). Business models relate to value chains (Porter, 1985), value streams (Davies, 2004), and value constellations (Normann and Ramirez, 1994) among multiple business actors. In these models, the quest is to identify the elements and relationships that describe the business. Osterwalder (2004) defines a business model as being "the rationale of how an organization creates, delivers, and captures value" and any business model can be fully characterized in nine dimensions – or building blocks, being: Customer Segment; Value Propositions; Channels; Customer Relationships; Revenue Streams; Key Resources; Key Activities; Key Partnerships; Cost Structure; which can be described as follows:

- Customer Segments: The different groups of people or organizations an enterprise aims to reach and serve.
- Value Propositions: Solutions to customer problems, customer needs to be satisfied and the bundle of products and services that create value for a specific Customer Segment.
- Channels: Means by which a company communicates with and reaches its Customer Segments to deliver a Value Proposition, comprising a company's interface with customers.
- Customer Relationships: The types of relationships a company establishes and maintains with specific Customer Segments.
- Revenue Streams: The result of value propositions successfully offered to customers. This element represents the cash a company generates from each Customer Segment.
- Key Resources: The assets required to offer and deliver the previously described elements.
- Key Activities: Activities performed though the Key Resources to offer and deliver the previously described elements.
- Key Partnerships: The network of suppliers and partners that make the business model work. Some activities are outsourced and some resources are acquired outside the enterprise. Companies create alliances to optimize their business models, reduce risk, or acquire resources.
- Cost Structure: The costs incurred to operate a business model. Costs are calculated after defining Key Resources, Key Activities, and Key Partnerships.

2.3.2 Transport Infrastructure and Competitiveness

Transport infrastructure generates value for users and the society. Transport projects bear multiple impacts and are designed not only to address the principal issue of demand in transportation but also weight out, minimize or improve external present and future effects on time saving, air quality, noise, safety, energy consumption, economic growth, land use and real estate development. In addition, to the value transport infrastructure generates, it also bears the characteristics of a natural monopoly, which is strengthened by its position in the transport networks and the travel and supply chains it serves.

More specifically, an important aspect of transport infrastructure is "competitiveness". In a transport network, "competiveness" is characterised by the "uniqueness" of the infrastructure or, in other terms, its

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"monopoly" status in the network. "Monopoly status" may be secured by the natural position of the infrastructure (project) in the network in combination with the dominant travel /supply chains or it may be induced or enhanced by restricting competition from other transport services. This is a common situation in cases of private financing of infrastructure.

In addition, "competitiveness" may be induced through competition. In this context, relative forms of deregulation ultimately aim at the provision of improved quality services by experienced costumer-focused private and public operators. In this respect, competitiveness is related to the quality of performance of the transport project and the provision of added value services. This has been a key characteristic of developments in transport infrastructure over the years, as operator services have been extended to include services and innovations that are not strictly related to the core transportation offer. The evolution of Business Models per transport mode is very much connected to the provision of added services as well as inclusion of other entrepreneurial activities exploiting key characteristics of infrastructure, the travel behaviour (passengers) or supply chain development (freight). Examples include exploitation of travel time (eg. ICT provision for mobile working), transit waiting time (commercial services), freight monitoring services, real estate development in support of supply chains (eg. storage facilities) and others. This evolution increases the value proposition of the infrastructure and, consequently, that of the investment by supporting and enhancing the revenue stream. These aspects are discussed further in the next section.

Notably, transportation is a network service and as such, its value is very much dependent on its "complementarity", which often coincides with the concept of "transport integration" and the elimination of barriers to intermodality. "Intermodal transport is a quality factor of the level of integration between different transport modes. In that respect more intermodality means more integration and complementarity between modes, which provides scope for a more efficient use of the transport system" (EC, 1997). The EC Transport White Paper (EC, 2011) focuses on longer distance supranational transport with an emphasis on both freight and passenger transport with special emphasis on integration (Preston, 2012). With respect to a specific project-infrastructure, integration is of added-value to the user but may not, always, present a positive outcome for the project as integration may lead to "synergy" or "additivity" or even "substitutability" when traffic is greater, equal or less than the traffic demand for the specific service before its integration to the transport network. Hence, when focused on a specific part of the transport system (infrastructure project) network integration may not always be in favour of its ability to generate income for its operator. This may be regarded as co-opetition as the final competitive position of the infrastructure is the combined outcome of its "uniqueness" in the transport network and its complementarity (or cooperation) with other parts of the network.

However, investments in transport infrastructure, especially greenfield ones, come with significant risks, especially with respect to the sunk part of the investment, as traffic forecasts of new services, usually, come with considerable risk. Creating transport investment business models, which may reduce the overall risk or including "contractual provisions" which would restrict competition are formulations evidenced in the private financing of transport infrastructure.

In conclusion, level of network integration (complementarily) and competitiveness in terms of competitive position in the network and overall value offer describe transport business models and their capability to secure revenue streams. However, the overall economic performance of a business model is a combination of costs and revenues. Based on the business model concept, three categories of value propositions are discussed in the following parts.

2.3.2.1 Evidenced Value Propositions Supporting Revenue Streams

Transport infrastructure investments are characterised, in principle, as sunk. Once completed it is not possible to change the main service offer (value proposition). The level of "sunkness" varies amongst the transport infrastructure modes and is discussed under the transport mode context typology of this report. The capability to improve and enhance the overall value proposition and attract other customer segments varies and evolves with respect to the various transport mode infrastructures. In addition, securing revenues in many cases is highly dependent on the managerial skills of the infrastructure operator and the

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respective knowledge of the particular market. This is especially true for airports and their ability to attract airlines and ports and their ability to attract reliable supply chains.

As noted earlier, business models are essentially management tools by which to reach costumer segments and secure revenues. Quality of service and pricing is a core value proposition addressing the transportation user. Exploitation of the infrastructure by "bundling" with other economic activities increases the number of "customer segments".

The Transportation Service Offer based on Quality of Service and Price

Considering strictly the transportation service offer, the ability to "capture customers" is based on the relation of quality and price.

Road, bridge and tunnel projects have limited ability to attract "customers". Quite often, toll rates are used as a tool of limited effectiveness by which to manage demand (Fayard et al., 2012; Bain, 2009; Mackie and Preston, 1998). Quality of engineering and traffic management contribute to the "level of service" and address the user sense of fairness (cfr. Viegas, 2001) in the case of tolls (cfr. Vassalo, 2007). Intelligent transport systems and their harmonisation over networks improve the service level (cfr. Tomás et al, 2013). Convenience stations on motorways serve as quality provision and also as small additional revenue to the main revenue source of the road. Common quality attributes perceived by the user are vehicle tear, fuel kilometers saved, the achieved standard of safety and security, along with availability and reliability.

Admittedly, safety and security as well as availability and reliability are service quality attributes, which are important in any transport service offer. However, for other transport infrastructure modes, ICT applications and solutions have been significantly exploited as a source of additional service. Electronic ticketing is now extensively used to provide convenience and time saving to rail, airport and urban transit users. Combined electronic sales of tickets also provide value services to "costumers", who may travel "seamlessly" between modes. In addition, stemming from the "always connected" idea for mobile users/workers, providing pure Internet access during travel and in transit has become the norm for rail and airport services.

ICT solutions are also used to provide quality service for freight. E-freight and paperless exchange of information concerning freight transactions presents the trend in handling of freight in rail, ports and airports, which provides efficiency and, therefore, service to entities (operators, shippers, forwarders and others) handling the transportation of freight.

Availability and reliability are important features of any service, especially in transportation where the notion of availability and reliability is frequently connected with safety and security. An example, which applies to all infrastructure types, is the increased capability to operate under adverse weather conditions and reduce downtime.

Transport Service Offer Enhanced by Bundling with Other Economic Activities

However, apart from value propositions directly linked to the transportation service, transport infrastructure business models have been evolving in the direction of including other revenue generating activities, which may also be directed to non-transport service users. For example, airports in many parts of the world are no longer viewed as public utilities but rather as private enterprises aiming to maximize shareholder value and profits from a fixed facility (Adler et al., 2010). In order to diversify revenue sources and minimize the economic risk of dependence on air services (influenced by airline selection and the intervention of national and international regulators (Adler and Gellman, 2012) as well as the vulnerability to exogenous shocks such as terrorism, extreme weather events, strikes, and airline collapses), airport property is developed as a surplus to core aviation requirements. This development is often in the form of business parks and retail complexes (Morrison, 2009). This approach is captured in the concept of the "airport city" (Peneda et al., 2011), which from a spatial perspective concerns airport-centric development (Freestone and Baker, 2011). This trend is more evident in major global hub airports such as Schiphol (Amsterdam), Frankfurt, Hong Kong, and Dallas–Fort Worth (Kasarda, 2009). The "airport city" model

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places the emphasis on real estate development and is combined with the tendency to secure monopoly status in cases of concessions (Cruz and Marques, 2011) to further minimize the pure air-service risk. A similar approach is gradually taken with respect to terminals, rail and other, and the inclusion of commercial activities and services based on renting premises and space, also described as value co-creation. For example, Jaakkola and Alexander (2014) describe the ‘‘Adopt a Station’’ scheme as a partnership between ScotRail and groups of citizens invited to ‘‘adopt’’ railway stations. The scheme also supports community entrepreneurship.

In addition to exploiting spatial development, transport infrastructure may increase revenues by becoming the platform for other revenue generating activities such as energy production or by supporting upstream and downstream innovations. These include, for example, support services for electric vehicles (road), cold ironing (ports) and many other potential applications. Amongst these other non-transport related activities, a well-known and widely spread revenue generating activity is that of advertisements.

2.3.2.2 Evidenced Value Propositions Reducing Construction, Operation and Maintenance Costs

While there are a number of added-value propositions that enhance the revenue stream, there are also propositions that reduce the cost (Capital Expenditures, CAPEX, and Operational Expenditure, OPEX) of the infrastructure. These include innovations in the construction phase that reduce time and cost and improve safety and quality. Equally so, materials, techniques and other innovations adopted may reduce the cost of operation and maintenance. Life-cycle planning and management are consider crucial in this respect with emphasis placed on building to operate and considering whole life cycle costs of the infrastructure as opposed to phase optimization, which usually leads to reduced construction costs and considerable operation and maintenance costs.

It is also important to note that value propositions designed to improve the quality of service (and therefore revenues) may also have a positive impact on operation and maintenance costs. For example, electronic ticketing and charging, in general, as well as paperless transactions also have a positive impact (reduction) on operational costs. More specifically, ICT solutions are being employed in all transport modes to improve and also reduce the cost of surveillance, monitoring of operations, remote maintenance, software upgrades and many others.

Notably, reduction of the overall cost of construction, operation and maintenance relies on life-cycle costing, on the one hand, and innovation and the introduction of new materials, technologies and ICT solutions on the other.

2.3.3 Evidenced Value Proposition Through Contractual Arrangements

Notably, as described previously, a business model is a management tool by which to secure revenue, create “captive customers” and reduce cost. Value added investments might be designed to create a portfolio of services to balance the revenue risk. However, the same outcome may be observed when contractually addressing the project investment. The present part considers contractual enhancements of the business model mostly evidenced in situations where the investment is undertaken by the private sector, as in the case of PPPs. These arrangements usually focus on addressing risk. With respect to the Business Model discussion, the present part looks into arrangements with respect to risk, which either secure revenue streams or reduce costs.

Central in any contractual arrangement is the optimal allocation/sharing of projects risks. It leads to minimizing the project cost by reducing the probability of risk occurrence through the exploitation of managerial capabilities and by allowing for managerial flexibility with respect to mitigation measures (cfr. Flyvbjerg, 2009). Risk allocation is contractually described and also results from the procurement method selected by the contracting authority.

Co-opetition, as described earlier in section 2.3.2 is a key characteristic of the transport infrastructure as it describes the balance between the “monopoly” status of the infrastructure and its need to be well integrated in the transport network. This integration might be in support of revenue streams or not. In

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many cases (usually concessions) the competitive position of the infrastructure may be contractually enhanced and induced safeguarding the investment from competition (cfr. Roumboutsos and Pantelias, 2015).

The topic of "bundling" was discussed in section 2.3.2.1. This topic is further discussed here from the aspect of contractually including in the project transport infrastructure that is additional to the core investment in an effort to either improve the operation ability of the infrastructure or include a brownfield part with known and secured demand (and therefore revenues) to reduce the overall demand risk and/or provide cross-financing reducing the need for project financing (and therefore the cost of the project, Flyvberg, 2009). The latter is discussed in the D2.3 report. Hence under bundling and business models, we may consider the bundling of the principle investment with:

- Brownfield projects which are connected with less ambiguity with respect to their traffic demand (for example a greenfield motorway is "bundled" with a brownfield motorway (cfr. Nikolaidis and Roumboutsos, 2013);
- Brownfield or greenfield projects, which enhance the operational performance of the core transport investment (eg. a greenfield tramway project "bundled" with operation of the existing bus transit network (cfr. Bonnet and Chomat, 2013).

Notably, concessionaires may be protected against revenue risk through other configurations, such as minimum revenue guarantees. The emphasis, however, here is on activities included in the business model.

2.3.4 Key Characteristics of the Transport Business Model Typology

Summarizing the discussion on Business Models with respect to securing revenue streams (funding as it is considered in the BENEFIT project – see glossary) and reducing costs we may identify four dimensions for this typology, which are descriptive of the robustness of the business model:

Dimension 1. Revenue enhancing through "bundling"

Two types of bundling were identified. Bundling with:

- Transport related services and infrastructure with a scope of reducing the revenue/demand risk

As discussed, these concern:

- Investments in infrastructure which are additional to the principle (or core investment and may be assessed as the ratio of the core investment over the total investment.
- The bundling with brownfield transport infrastructure with known and secure demand. In this case the assessment is made through the ratio of known or demonstrated demand over the total demand forecast.

- Non-transport related activities.

As discussed in section 2.3.2.1, these include a variety of activities aiming also at non transportation services, which increase the costumer segments of the Business Model. These activities may be assessed through the share of revenues from these activities over the total revenues, the share of users/customers over the total number served by the investment and/or the share of non-transport related investments over the total investment.

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Dimension 2. Revenue protection

- Protection against competition (positioning of infrastructure in the network and induced through the contract) in combination with required coopetition as foreseen in the planning of the transport network

As discussed in the beginning of 2.3.2 and in 2.3.2.3 the position of the infrastructure in the network is characterized by its level of exclusivity (monopoly status) and level of integration with the transport network. A favourable combination, natural or contractually induce, may protect the projects revenue stream. The proposed indicator is qualitative.

- Provision of services creating "captive" users

Quality is key in the provision of transport services. Table 2.3.1 below, lists a number of common indicators assessing quality. Some of these indicators may be observed such as availability (cfr. Åhrén, 2008) or reliability (cfr. Ministry of Transport of New Zealand, 2013). Others are latent and while there may be various indicators (cfr. Humplick and Paterson, 1994; Bhouri et al, 2013; Wardman et al, 2014) as, also, proposed in the table, user/costumer satisfaction may be considered the aggregate indicator for quality.

Dimension 3. Cost efficiency (saving) of Construction, Operational and Maintenance

In section 2.3.2.2 value proposition aiming at cost reduction were briefly discussed. In summary they include the following:

- Life cycle planning

Life cycle planning is considered key in the promotion of cost reduction through the life cycle of the project. While this process may be affected in all cases of infrastructure investment, it is considered to take place in all cases where the construction phase is bundled with the operation one. Here a binary [1,0] indicator is proposed.

- The adoption of innovation or other efficiency interventions in construction or operation.

As noted, cost reduction in construction and operation is usually related to the adoption of new materials, techniques and technologies. The measure of successful innovation included in the delivery of the infrastructure and its services is proposed as an indicator. The adoption of innovation concerns related cost of investment and outputs expressed as efficiency (reduction of operating or construction costs, reduction in energy consumption and direct environmental impact). The proposed indicators in table 2.3.1 reflect this proposal.

There is one objective indicator with respect to maintenance, which is widely applied and included in the proposed indicators: maintenability.

- Optimal risk allocation with respect to risk connected to the business model (design, construction, operation, maintenance, exploitation and others).

Optimal risk allocation is core in the overall cost minimization of any undertaking. While effected ex-ante, it is only ex-post assessed as an overall qualitative assessment considering the initial rational allocation of risk (for example construction risk can only be allocated to a technically competent partner), the ex-post resulting cost overruns and their underlining reasons and other relevant information. Under this reasoning, a qualitative indicator is proposed as a measure.

Dimension 4. Agent's capability to manage the business model

At this point, a final dimension is added to the business model: The agent's capability to manage all the above. By "agent" the operator responsibly for implementing the business model is referred to. This is related to the two of original dimensions of the Osterwalder's model: 1.Key activities and 2. Key

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resources now being merged into one dimension called “Key competences” (cfr. Kraaijenbrink, 2012; Kraaijenbrink et al, 2010). Beyond the business model: The Value Model).

This dimension is purely qualitative and concerns the capability to manage:

- Traffic demand risk. In many ways this is also related to the “revenue protection” dimension and the position of the infrastructure in the network.
- Revenue risk. This also concerns whether the operator-agent is assigned a business development strategy within the project or the principal obligation to provide transport service.
- Innovate and include cost efficiency measures. This is a combined assessment of contractual incentives and agent’s track record in innovation and cost efficiency.

Table 2.3.1 summarises the proposed dimensions and indicators for the Business Model Typology including the proposed indicator variables (described as Measure in the table) and variables that are key in the assessing the dimension are may be easier to obtain (described as key measure in the table).

Table 2.3.1: Dimensions and indicators of Business Model Typology

#	Dimension	Indicators	Measure	Key Measure
1	Revenue Enhancement	Non transport related activities	Non transport related revenues over total (%)	Non transport related revenues over total (%)
			Non transport related users over total (%)	
		Non transport related investments	Non transport related investments over total (%)	
		Bundling with Brownfield project	Ex-ante secured demand over total forecasted (%)	
		Bundling with other transport infrastructure investment	Core investment over total investment (%)	Core investment over total investment (%)
2	Revenue Protection	Level of Coopetition	Qualitative indicator assessed based on the combination of level of exclusivity (scale of 1 to 6) and level of integration.	
		Level of service	Reliability: Time of disruptions during operation over time of operation (%)	Level of user satisfaction
			Availability Time available over period (eg. year) of operation	
			Safety & Security Accidents over number of users (or % reduced) Fatalities over number of users (or % reduced) Security incidents over number of users (or % reduced)	
			Comfort & Convenience Time saved over alternative route (%) Reduction of fuel Consumed vs fuel consumption on alternative route (%)	

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#	Dimension	Indicators	Measure	Key Measure
			Ratio of wait time to net transportation time (%) Ratio of congestion time to net transportation time (%) Ratio of interchange time (within mode, between mode) to net transportation time (%)	
3	Cost Saving	Life cycle planning	Binary indicator [1, 0]	Binary indicator [1, 0]
		Adoption of innovation	Relevant cost on investments (%)	Binary indicator [1, 0]
			Reduction in construction time (%)	
			Reduction in operation costs (%)	
			Reduction in energy consumption (%)	
			Reduction in emissions (%)	
			Reduction in noise (%)	
			Maintainability (% not available due to maintenance, Expenditure on maintenance)	
		Optimal Risk Allocation	Qualitative indicator	
4	Capability to manage the Business Model	Capability to manage Traffic demand risk	Qualitative indicator	
		Capability to manage revenue risk	Qualitative indicator ranging from serve provider to business developer.	
		Capability to innovate	Qualitative indicator	

The combination of these four dimensions builds robustness into the business model. The contribution of each dimension to the overall Business Model Robustness is the focus of research in the next BENEFIT work tasks.

Finally, It is important to mention that transport business models have a highly *dynamic* character. Different stakeholders in a transport business model have different perspectives on what value is and how this value has to be created and captured. The impact of external changes and development is also different on the different stakeholders. For example, a change in transport policy or infrastructure pricing (eg. a higher toll) is perceived differently by the various stakeholders. As the context changes, the value appropriated changes. The same occurs for risks. Different stakeholders perceive risks differently, also over time (cfr. Roumboutsos et al, 2013). Similarly, it is worth noting that, while transportation business models are essential management tools for creating and appropriating value, yet, strategic decisions about responsibility and risk shape the type of business model to be developed. Such a responsibility for activities and risk allocation requires certain types of organisational forms and relationships amongst clients, private partners and public authorities (Davies, Frederiksen and Dewulf, 2010; van den Hurk and Verhoest, 2015), which are organised through the applied governance structure. This is further elaborated in the report D2.3 of the BENEFIT project.

2.3.5 Relation of the Proposed Business Model Typology to Project Outcomes

As noted in the introduction and illustrated in the BENEFIT concept (see figure 1), the transport Business Model demonstrates economic, environmental, social and institutional outcomes. The influence the proposed dimensions and indicators may have on these outcomes is qualitatively assessed and presented in table 2.3.2.

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Table 2.3.2: Influence of proposed Business Model Typology on Economic, Social, Environmental and Institutional Outcomes/Performance

Dimensions	Indicators	Economic	Social	Environmental	Institutional
Revenue Enhancement	Non transport related activities	X	X		X
	Non transport related investments	X			
	Bundling with Brownfield project	X	X		X
	Bundling with other transport infrastructure investment	X	X		X
Revenue Protection	Level of Co-opetition	X	X	X	X
	Level of service	X	X	X	X
Cost Saving	Life cycle planning	X	X	X	X
	Adoption of innovation	X	X	X	X
	Optimal Risk Allocation	X			X
Capability to manage the business model	Traffic demand risk	X	X	X	X
	Revenue Risk	X	X	X	X
	Innovative Character	X	X	X	X

2.3.6 Relation of the Proposed Business Model Typology to Funding and Financing Schemes

The guiding principal in selecting and proposing the specific Business Model Typology (Dimensions and indicators) has been the influence on the revenue streams and cost of the project. Revenue streams are equivalent to the funding scheme (with in BENEFIT see glossary) and also influence in the financing scheme. Funding schemes, represent the means by which revenues are collected. Table 2.3.3 illustrates the relation between the proposed indicators and the funding schemes. Financing schemes in many ways describe the perceived risk of the funding scheme making the later more or less attractive for financers. This is also illustrated in table 2.3.3 and represents a qualitative assessment.

The fourth proposed dimension is not included in the table below, as, for all practical reasons, it describes the potential to achieve the anticipated impacts.

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Table 2.3.3: Influence of proposed Business Model Typology on funding and financing Schemes

Dimensions	Revenue Enhancement				Revenue Protection		Cost Saving		
Indicators	Non transport related activities	Non transport related investments	Bundling with Brownfield project	Bundling with other transport infrastructure investment	Level of Co-opetition	Level of service	Life cycle planning	Adoption of innovation	Optimal Risk Allocation
Funding Schemes									
Level of Use									
Passengers/ cargo			X		X	X			
Externalities									
Environmental emissions	X	X				X		X	
Marginal infrastructure costs	X	X	X	X			X	X	
Safety	X	X	X	X	X	X	X	X	X
Fuel consumption (fuel taxation)					X	X	X	X	
Consumption of commercial activities bundled with infrastructure	X	X			X	X		X	
Land Value capture									
Property taxation	X	X	X	X					
Stakeholder funding	X	X	X	X					
Financing Schemes	X	X	X	X	X	X	X	X	X

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2.4 Funding Schemes Typology

In the scope of the BENEFIT typologies, f*unding schemes* refer both to the origin of revenue streams, i.e. by whom and how is the income provided, and remuneration, i.e. to whom and how the revenues related to the project are attributed.

Funding of transport infrastructure poses essentially two types of challenges in the framework of BENEFIT:

- The first one is concerned with whether it is viable to fund a given project, considering its characteristics and the related interests of the various stakeholders.
- The second challenge is about the impacts of each possible funding scheme on the various factors that contribute to the economic, social, environmental and institutional performance of the project; in this way, the design of the funding scheme of a project should aim to optimize this performance.

In the scope of funding schemes, BENEFIT aims to build a framework to advise policy makers on funding schemes regarding the need to make it viable and maximize the performance of a given project, considering its characteristics and context. With that final aim in mind, the typologies of funding schemes are defined to enable the building of a matching framework towards a clear assessment of the performance of the transport infrastructure business model under different funding and financing schemes. Annex 4 presents a detailed characterization of the performance factors that are directly affected by the design of a transport infrastructure funding scheme. Those relevant performance factors are the building blocks of the funding schemes typology:

- Cost recovery
- Revenue risk
- Incentives
- Allocative efficiency
- Internalization of environmental costs
- Public acceptability and equity
- Marginal costs of funding

The effects of funding schemes on the performance issues above are variable not only across the types of funding scheme identified but also within some of them, depending on their specific characteristics. These effects may be more closely assessed considering those basic characteristics. The definition of the basic characteristics and potential effects on performance factors are addressed in the following section and considered in the definition of the funding schemes typology.

2.4.1 Key Characteristics and effects on Funding Schemes Typology

The selection of basic elements to characterize revenue streams was based on the criteria of being exhaustive – covering the widest range of types of funding currently or potentially applied in transport infrastructure provision – and capturing the essential attributes relevant for the characterization of their effects on the relevant performance factors.

If a funding scheme is characterized by a set of revenue streams originated or collected for the purpose of a project, to characterize the funding scheme as a whole it is necessary to distinguish the characteristics of each of the revenue streams that compose it. The definition of a funding scheme must therefore include the detailed characterization of each of its composing revenue streams.

Secondly, it is necessary to characterize how those revenue streams are distributed throughout actors. To optimize risk allocation and incentives, funding schemes include a remuneration scheme to the agent which is not directly given by the revenue streams, but by a re-composition of its remuneration flows with given criteria appropriate to the optimization of the contractual arrangement. The characterization of a

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funding scheme therefore includes the definition of the remuneration scheme, i.e. to whom and how the revenues related to the project are attributed.

2.4.1.1 Revenue streams

The first element that characterizes a funding revenue stream is the funding agent, i.e. the party who supplies the funding. The funding agent influences a number of key elements (see also Annex 4):

- Revenue stream risk: credit rating of funding agent;
- Behaviour incentives to the funding party, impacting on economic, social and environmental factors;
- Public acceptability and equity: benefits of the infrastructure to funding agent, perceived equity effects;
- Ability to raise the revenues: willingness to pay of the agent.

Table 2.4.1 – Possible funding agents

Funding Agent	Description
General Public	Funding via public entity at various possible levels • EU • National • Regional • Local
Users	Users may be: • Infrastructure users: Entity or final user which operates the vehicles using the infrastructure • Final users: individual passengers or cargo owners • Consumers: Consumers of commercial bundled activities
Stakeholders	Other entities, which get value from the infrastructure. e.g.: • Property owners • Businesses directly serviced by infrastructure

The second element, also related to *revenue stream*, refers to the revenue indexation, i.e. the basic variable to which the revenue stream is indexed.
This element is crucial to understand and characterize in detail the effects on most performance issues, directly affecting the following:

- Revenue stream risk: depending on risk of related indexation variable;
- Behaviour incentives to infrastructure users (allocative efficiency and internalization of environmental costs);
- Public acceptability and equity: sense of fairness in the relation of payments to their indexation variable;
- Ability to raise the revenues: transaction costs.

It is noteworthy that not all revenues generated by the project are necessarily created with the main aim of funding the project but to achieve other goals. This is particularly the case of all sorts of external costs, including congestion, environment and safety costs. They do nonetheless generate revenues that should not be ignored as a potential source of funding for the project.

Table 2.4.2– Revenue stream indexation variables

Revenue indexation	Description
User-pays	Applies if the user-pays principle is applied and the indexation refers to how much the infrastructure is being used by its users, i.e. based on what variable is the user charge being calculated. Indexation variables can be: • Distance • Time • Size or weight or space occupied

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Revenue indexation	Description
	• Number of passengers • Cargo loaded
Externality internalization	Applies whenever the user charges are calculated on the basis of the externalities caused by users. The most common types of variables of indexation are: • Congestion or scarcity: if charges are calculated in a way that limits the number of users to a given level. This applies for example in airports or ports where price is set to match demand and capacity. Note: when this is the case it usually applies cumulatively to the 'Level of use (user-pays)' indexation. • Environmental emissions: CO2 or local pollutants. • Marginal infrastructure costs: wear and tear costs caused on the infrastructure or other variable costs. • Safety: user charges partly calculated on the basis of accident risk.
Consumption	Consumption of commercial activities bundled with infrastructure
Value capture	If the funding is supplied by stakeholders (not directly by using the infrastructure) who benefit in some way from that infrastructure. Two possible general types are: • Property taxation • Stakeholder direct funding
Earmarking	For example Fuel consumption taxes, parking tariffs, urban road pricing, kilometre taxation, etc. Specify…
General public budget	Fixed revenues from local, national or European public budget.

2.4.1.2 Remuneration schemes

Remuneration refers to how the entity responsible for the investment and/or operation in the infrastructure is paid. The funds might be directly collected by this agent or they may be supplied by the principal (public party). In the first type of remuneration, the relevant attributes of the income flow to the Agent are well characterized by the elements and indicators defined for revenue streams above, since that income flow coincides with the revenue streams generated by/for the project. Otherwise, if the Agent is not remunerated through the direct collection of revenues but from payments made by the Principal defined on the basis of certain criteria, a specific characterization of the remuneration scheme is required as a basis to assess its effects on the relevant performance factors. The remuneration affects in particular the:

- revenue risks and;
- operational incentives

faced by the Agent.

As above, a remuneration scheme is composed of several different income streams, where each is characterized by a different method. The remuneration methods may be indexed to variables related to the project performance, as characterized by relevant performance indicators.

Table 2.4.3: Remuneration methods

Remuneration methods	Description
Usage payment	Payments proportional to usage of the infrastructure (e.g. user charges, shadow tolls…)
Availability payment	Payments (or penalties) dependent on whether the full capacity and normal quality of the infrastructure is made available to its users.
Quality performance payments	Payments (or penalties) dependent on quality of service criteria

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Remuneration methods	Description
	that go beyond 'availability'.
Subventions	Fixed subsidies, possibly indexed to macroeconomic variables (e.g. inflation)

2.4.1.3 Funding schemes and effects on performance factors

The effects of funding schemes on the performance factors are determined both from general characteristics of those schemes and from specific characteristics of those schemes within the local economic, social and institutional context. The later must be assessed at a project level. But still some general characteristics of each type of funding scheme allow to produce a general assessment at a theoretical level. The following tables present a general theoretical assessment of the interaction of types of the most common types of funding schemes (as characterized in Annex 4) with the relevant performance sectors, considering the basic characteristics of the types of funding (see Table 2 of Annex 4).

2.4.2 Key Characteristics of the Funding Schemes Typology

The typologies of funding schemes should be defined with the final aim of building a matching framework towards a clear assessment of the performance of the transport infrastructure business model under different funding and financing schemes.

A proper definition of funding schemes typologies should thus be built upon criteria that allow to relate characteristics of the funding schemes to specific performance factors of the transport infrastructure project.

2.4.2.1 Dimensions

The building blocks (dimensions) of the funding scheme typology are the performance factors which were identified as being directly influenced by the funding schemes: cost recovery, revenue risk, incentives to Agent, allocative efficiency, internalization of environmental costs, acceptability and equity and marginal costs of funding. They are synthesized in the table 2.4.4 below.

With a view to the creation of a matching framework, it should be possible to characterize each performance factor (dimension) in terms of its positive or negative effect on desirable goals, considering an assessment within the context of a given case/project. The third column in the table defines what is the optimal desirable outcome of each dimension, which may be fully, partially or inadequately met in a given project scenario.

The scale of assessment of the performance of each dimension may be more or less detailed depending on the available data, precision of the estimation method and objectives of the assessment. In its simplest form, it can be assessed as a binomial variable featuring a *positive* or *negative* rating.

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Table 2.4.4: Performance factors dimension (related either to revenue streams or remuneration schemes)

#	Dimension	Description	Optimal outcome (within Project scenario)
I	Cost recovery	Ability of the available income sources to cover the costs of the Project.	The expected income streams fully cover the costs of the Project
II.	Risk of income	Risk of revenues, considering the revenue streams and remuneration schemes that base such incomes.	Project revenues have *low* risk
III.	Incentives to Agent	Incentives towards the project Agent caused by the way its income streams are being generated.	Income revenues are fully aligned with desirable operating behaviour by Agent
IV.	Allocative efficiency	Effects of some forms of funding (particularly pricing) on the efficiency of deployment of the available infrastructures.	Demand allocation in infrastructure network is efficient
V.	Internalization of environmental costs	Effects of some forms of funding (like pricing) on a possible effective internalization of external environmental costs including climate change, local air pollution and noise (or even safety costs).	External costs caused by infrastructure users are internalized
VI.	Acceptability and equity	Effects of each type of funding on public acceptability and/or equity concerns and consequent political viability of the scheme. Even though they are different issues, acceptability and equity are very correlated and therefore aggregated here into a single dimension.	Funding scheme obtains acceptance by public
VII.	Marginal costs of funding	Transaction and market distortion costs caused by the sources of revenue streams	Costs of funding are minimal

2.4.2.2 Indicators

The previous section identifies the basic characteristics of funding schemes and their potential effects on the performance factors / dimensions. The indicators below were selected considering on the basis of such analysis.

Their quantitative assessment and effects on the funding typology dimensions depend on two distinct aspects of analysis:

- The intrinsic characteristics of revenue and income streams, in particular the identification of the funding agent and the indexation of the income stream;
- Factors external to the specifications of the revenue and income streams, which influence the performance factors, including variables like the macroeconomic setup (influencing, for example, demand risk), local culture (acceptability), governance and regulatory issues, competitive environment and other mode specific aspects.

As described in the previous section, some general characteristics of each type of funding scheme allow to determine a partial valuation of some indicators, while a full valuation must be realized at project level considering internal and external contextual elements.

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Table 2.4.5: Funding scheme typology indicators

#	Dimension	Indicator	Type of variable and possible scale [direction of effect on dimension*]
I.	Cost recovery	Share of coverage of project costs assured by the funding scheme	Expected revenues as % of full project costs [+]
II.	Risk of income	Repeat the following indicator for each income source i: *Indicator*: Risk of income stream i *Sub-indicators*: a: Share of income stream i on total revenues b: Risk of income source i	 Scale: 1 (very low risk) to 4 (very high risk) a: 0-100% b: scale: 1 (very low risk) to 4 (very high risk) [Full Risk of income = ∑(a.b)]
III.	Incentives to Agent	Share of income stream indexed to demand-based criteria	% [**]
		Share of income stream indexed to availability criteria	% [+]
		Share of income stream indexed to quality performance criteria	% [+]
		Share of fixed income stream (e.g. Fixed subsidies, possibly indexed to external macroeconomic variables independent of the Project) or other income streams not indexed to demand, availability or quality criteria	% [-]
IV.	Allocative efficiency	Adherence of infrastructure use pricing scheme to internalization of marginal costs of congestion/scarcity	Scale: 1 to 4 (1 - not related; 4 - fully related) [+]
		Adherence of infrastructure use pricing scheme to internalization of marginal costs of infrastructure use (wear & tear costs, etc)	Scale: 1 to 4 (1 - not related; 4 - fully related) [+]
		Application of consistent marginal cost pricing scheme in concurrent infrastructure	Boolean (yes/no) [+]
		Application of user-pays principle	Boolean (yes/no) [-]
V.	Internalization of environmental costs	Adherence of infrastructure use pricing scheme to internalization of environmental costs	Scale: 1 to 4 (1 - not related; 4 - fully related) [+]
		Application of consistent environmental pricing scheme in concurrent infrastructure	Boolean (yes/no) [+]
VI.	Public acceptability and equity	Direct benefits of project to Funding Agent(s)	Scale: 1 to 4 (1 - no benefits to funding agent(s); 4 - full alignment of benefits to funding agent) [+]
		Perception that pricing revenue is applied towards a desired objective (e.g. Urban tolls applied to fund collective transport)	Scale: 1 to 4 (1 - application of revenues not transparent ; 4 - application of revenue transparent and towards a desired objective) [+]

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#	Dimension	Indicator	Type of variable and possible scale [direction of effect on dimension*]
		Perceived equity effects	Scale: 1 to 4 (1 - negative equity effects perceived; 4 - appropriate equity effects perceived) [+]
		Previous application of pricing (applicable to brownfield projects)	Boolean (yes/no) [+]
VII.	Marginal costs of funding	Marginal costs of public funding (applicable for public budget and earmarked revenues)	MCF(i) = 1 + α, with α = marginal costs / revenue collected i - revenue stream [-]
		Marginal costs of infrastructure use charging	

Legend
** +: positive effect ; - : negative effect*
*** Direction of effect depends on competitive and pricing characteristics of Project. Generally there tends to be positive [+] (negative [-]) effects if there is a (not) competitive environment and infrastructure pricing is (not) regulated.*

2.4.2.3 Relation to Project Outcomes (Economic, Social, Environmental, Institutional)

A general assessment of effects of each funding scheme performance dimension on the overall types of outcomes of the Project is outlined in the table 2.4.6 below.

The main issues of effect on general economic, social, environmental and institutional outcomes are the following:

Economic effects:

- Cost recovery and risk of revenue have economic influence to the extent that they may render a Project financially feasible or not feasible. If the Project is socio-economically beneficial but there is not a sufficient and reliable funding, it will not happen and its benefits will not be harvested;
- Incentives to the Agent have a direct economic effect: to deliver an optimum consumer surplus, the income streams must be fully aligned with the needs of its clients, the infrastructure users;
- Allocative efficiency is about making the best use of the available (infrastructure) resources;
- Costs of funding vary per source of funding and correspond to a direct cost to society.

Social effects:

- Equity of the applied funding scheme with respect to redistribution effects is the essential social outcome of the funding scheme applied;
- The incentives faced by the Agent may also affect equity concerns since they may or not incorporate the objective of not discriminating some users on the basis of their economic or other specific conditions;

Environmental effects:

- In what concerns funding schemes, the environmental outcome is affected by the extent to which the pricing scheme of the infrastructure and concurrent transport infrastructure/services are properly internalizing environmental costs in order to make users take environmental impacts into account in their mobility decisions.

Institutional effects:

- Cost recovery is an institutional challenge in itself; the existing institutions (in the general sense) should be able to set up the framework conditions such that the economic and social interests in the Project are mobilized to generate the sources of funding necessary to realize the Project;

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- Allocative efficiency as well as internalization of environmental costs are objectives that often conflict with the objectives of cost recovery and acceptability/equity. Such conflicts create an institutional challenge, often with different institutions (including laws) pushing for different goals;
- Public acceptability is a political constraint to the application of certain funding schemes;
- The transaction costs of collecting funding are an economic as well as institutional challenge; often the real transaction costs are higher than potential transaction costs of some funding solutions due to institutional/legal constraints.

Table 2.4.6: Funding scheme typology indicators influence on project outcomes

Dimension	Indicator	Economic	Social	Environmental	Institutional
I. Cost recovery	Level of coverage of project costs	X			X
II. Risk of income	Risk of income (aggregate)	X			
III. Incentives to Agent	Share of income - demand-based criteria	X	X		
	Share of income – availability				
	Share of income - quality performance				
	Share of income - not related to performance				
IV. Allocative efficiency	Adherence of pricing to internalization of marginal costs of congestion/scarcity	X			X
	Adherence of pricing to internalization of marginal costs of infrastructure use				
	Application of consistent pricing in concurrent infrastructure				
	Application of user-pays principle				
V. Internalization of environmental costs	Adherence of pricing to internalization of environmental costs			X	X
	Application of consistent pricing in concurrent infrastructure				
VI. Public acceptability and equity	Direct benefits of project to Funding Agent(s)		X		X
	Perception that revenue applied towards desired objective				
	Perceived equity effects				
	Previous application of pricing				
VII. Marginal costs of funding	Marginal costs of funding (aggregate)	X			X

2.4.2.4 Relation to Financing Schemes

The key characteristics of funding schemes in respect to the ability to generate financing schemes, which make the project viable, are the following:

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a) That the expected income from funding schemes is sufficient to cover for the costs of the Project and give some profit to investors;
b) That the risk premium borne out of the risk assessment of such expected revenues are within a positive financial assessment for the investors;
c) That the Project is politically feasible and does not present severe political risks.

These elements are respectively directly related to the following *dimensions*:

a) Cost recovery
b) Risk of income
c) Incentives to Agent; Allocative efficiency; Internalization of environmental costs; Public acceptability; Marginal costs of funding

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3. Interrelations of Proposed Typologies and Conclusions

Typologies for the four of the six elements composing the BENEFIT concept of the infrastructure delivery model, where considered and proposed focusing on the characteristics of each element as they influence the performance of the delivery model.

More specifically:

Implementation Context

When dealing with public policy processes the phrase "context matters" is found quite frequently in government documents and scholarly literature. Many policy practitioners and experts indeed reach for 'context' as an important element in their explanations and recommendations. If it is that important we also need to know more or less what this 'implementation context' means, because otherwise it risks becoming useless for analytical and scientific purposes. By developing a rich but concise typology, we address exactly that question and *provide a better understanding of the implementation context of transport infrastructure projects at country level*. This section of the deliverable formulates a workable and comprehensive overview of the different relevant dimensions of implementation context. The proposed classification focuses on *six distinct dimensions*: the extent to which the (1) political, (2) regulatory, (3) administrative, (4) economic, (5) financial context in general is conducive for transport infrastructure projects, and the level of (6) governmental support for privately financed transport infrastructure projects (public-private partnerships or PPPs). If we combine these six dimensions we get a detailed and 'hands on'/usable typology of how the implementation context looks like for transport infrastructure projects which are either publicly or privately financed.

The selection process of the indicator(s) for each dimension of the implementation context has been *a quest for finding the best available indicator(s) which are empirically rich in information but within some important practical boundaries* (longitudinal, all countries, freely available, etc.). We mainly used indicators/indices developed by leading international organizations like the World Bank, Economist Intelligence Unit, OECD and World Economic Forum to substantiate the general implementation context typology (dimensions one to five), because they are (1) well established and known by the international policy community and (2) satisfy all the practical demands. For dimension six – the governmental support for the privately financed projects – we would suggest to use the PPP governmental support index as developed by Verhoest et al. (2015). This information can be gathered for most countries in the BENEFIT sample from the COST country profiles/PPP-GSI index.

A possible alternative route to capture the implementation context could have been to simply refer to one existing index like the 'global competitiveness index' developed by the World Economic Forum. Although this index is indeed valuable and broadly conceived (and we will use it), we have opted to *use a combination of different indicators* (often composed by different organizations) to get a deeper and richer insight into this complex notion of an implementation context. We argue that this option is preferable to using only one index, because it contains more relevant and diverse information. By first identifying the main dimensions given the scope of the research project, and afterwards searching for the best available indicators for each dimension we aim to create some additional insights.

Transport Mode Context

Transport modes are the means by which freight and people achieve mobility. They fall into one of three basic types, depending on over what surface they travel: 1) land transportation (road, rail and pipelines), 2) water transportation (maritime transportation and inland navigation), and 3) air transportation. The main focus is on transport modes taking into account the impact (direct or indirect) that the different characteristics of the modes of transport could have on funding of transport infrastructure in particular.

The basic dimensions/characteristics of the transport modes that are proposed and structure the transport mode typology are the following nine: 1) Type of Load, 2) Costs, 3) Lifetime, 4) Level of sunkness of investment, 5) Operational Characteristics, 6) Performance, 7) Location, 8) Sensitivity to external risks and 9) Regulation - Deregulation level. On the one hand, the objective of the deregulation is the "free market",

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which is a market free from any kind of intervention by the government/state. On the other hand, regulation is evident at different levels such as: 1) admission to the occupation (licensing system), 2) access to the market, 3) technical regulation, 4) social legislation, 5) pricing policy and 6) aid and competitive policy, which are used in our typology as sub-dimensions.

For all the above-mentioned dimensions/characteristics including the ones of regulation level, specific indicators are proposed. Based on all these dimensions and their respective indicators, the most critical ones for funding of transport infrastructure were selected and classified in **three basic groups: 1) Investment, 2) Users and 3) Market strength and competitiveness**. For "Investment", three sub-dimensions and their respective indicators are proposed: 1) Level of sunkness of investment with the respective indicator "non sunk/sunk investments", 2) Investments and/or costs with the respective indicators CAPEX and OPEX and 3) Lifetime with respective indicators the project/infrastructure (investment) life cycle and the contract duration over infrastructure life. For "Users", four sub-dimensions and their respective indicators are proposed: 1) Users with the indicators number of freight vehicle-kms, and number of passenger vehicle-kms, 2) Operational flexibility-continuity with the selected indicator rerouting, 3) Performance with the following selected indicators: reliability (% time of disruptions during operation), availability (% of available use over period of time), maintainability (% not available due to maintenance), cost of accidents and vehicles/hour and 4) Risks, with the following respective indicators: demand risk , regulatory risk, financial risk, revenue risk, design risk, construction risk, maintenance risk, exploitation risk, force majeure and climate change risk. For all these risk indicators, risk allocation, assessment and mitigation are proposed as more measurable indicators. For "Market strength and competitiveness", four sub-dimensions and their respective indicators are proposed: 1) Location with the selected indicators a) type of connection and b) node-link distinction, 2) Level of Regulation – Deregulation with the indicators a) noise level per mode, b) % of emissions per mode, c) degree of tariff freedom, d) grants to cover infrastructure costs, e) grants/subsidies to cover the operation of the infrastructure and market liberalisation index, 3) Level of integration with the indicators of physical, operational, governance and ICT integration and 4) Level of exclusivity with the proposed indicator natural or induced monopoly and influence of the transport network.

Apart from the impact of the indicators on funding of transport infrastructure (impact on economic outcomes), their impact on social, environmental and institutional outcomes is also examined (direct or indirect impact). For "Investment", we concluded that "costs" for example (construction, maintenance, operation) have direct impact on funding and as a result a direct impact on economic outcomes but also have an impact on social and institutional outcomes. The construction, maintenance and operation of transport infrastructures are closely related to economic development and social welfare and that is why there is a direct impact on social outcomes. The above mentioned costs have also direct impact on institutional outcomes because state regulations or governance decisions will be probably directly affected depending on how high or low these costs are (especially if the transport infrastructure is public funded or for example we have a PPP). Also, for "users", and its 1st sub-dimension "users" for example, we observe that the indicators a) number of freight vehicle-kms and b) number of passenger vehicle-kms have a direct impact on funding and as a result a direct impact on economic outcomes. Also, they have a direct impact on social outcomes because these indicators could show economic development (for example, more vehicles-kms could create more jobs) and as a result affect the well-being of individuals. They have a direct impact on environmental outcomes as well because more vehicles-kms (passenger or freight vehicles) create more negative externalities (pollution, noise etc.). For "market strength/competitiveness", the indicators a) noise level per mode and b) % of emissions per mode have both indirect impact on economic outcomes and direct impact on social, environmental and institutional outcomes. Noise and pollution emissions are closely connected with the well-being and the quality of life of people (social impact), with the environmental damage that can cause (environmental impact) and the state takes decisions so as to mitigate and alleviate the environmental problems (institutional impact).

Business Models

Business models are being developed and applied in infrastructure industries. These models are used as a management tool for creating and appropriating value. More specifically, a business model defines the way by which value is delivered to customers, entices customers to pay for value and converts those payments to profit.

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In BENEFIT a number suitable factors that can characterize business models for transport infrastructures has been identified. These factors are expected to bring more value for stakeholders in a project.

The identified factors were clustered into the following categories, described roughly as follows:

- Revenue enhancing through 'bundling' with other investments different from the core infrastructure investment,
- Revenue protection via mainly protection against competition,
- Cost savings during the life cycle and by means of the adoption of innovations (i.e. new technologies) as well as thru robust risk allocation,
- Capability to manage the business model

Intricate relationships were inferred as existing between factors in the business models and those in the schemes of funding and financing considered in the BENEFIT Project. The scientific investigation of these relationships will disclose critical funding and financial factors that likely create and capture value for new transportation projects.

Finding Schemes
In the scope of the BENEFIT typologies, f*unding schemes* refer both to the origin of revenue streams, i.e. by whom and how is the income provided, and remuneration, i.e. to whom and how the revenues related to the project are attributed. The basic characteristics considered for characterization of a funding scheme are the source of revenue (the agent which supplies the funding) and the indexation of the revenue (from which basic variables are the revenues generated). Furthermore, these revenues may be directly allocated as income to the party responsible for carrying the project, or they may intermediated between the public party (who collects the revenue) and private party through a remuneration which draws more a more appropriate risk allocation and incentives between them.

There are essentially two types of challenges related to the issue of funding schemes: the viability to fund a given project; the impacts of each possible funding scheme on the various factors that contribute to the economic, social, environmental and institutional performance of the project. Considering these two challenges, the BENEFIT typology considers a set of dimensions, which reflect the performance of the funding scheme in relation to elements that are crucial to the challenges above. With relation to the funding viability issue, the relevant dimensions are (I) Cost Recovery and (II) Revenue Risk. With relation to the project performance, the five relevant dimensions are (III) Incentives to Agent, (IV) Allocative Efficiency, (V) Internalization of Environmental Costs, (VI) Public Acceptability and (VII) Equity and Marginal Costs of Funding.

Their relative importance for viability and performance of the project varies depending on the specific setup of the project and its context and the priorities of the policy maker. Likewise, the effects of funding schemes on the performance issues defined as dimensions are variable in several ways: across the types of funding scheme identified; within funding schemes, depending on their specific characteristics and; the transport mode and implementation contexts. For example, the risk of income depends on the source of the revenue (e.g. State or infrastructure users), of the specific risk of the revenue source for the case in question (e.g. demand risk), which derive from a wider socio-economic and institutional context (e.g. economic and policy stability). The challenge for a systematized analysis and guidelines will be to distinguish clearly the information that can be derived from the general characteristics of the funding scheme / project and which possibly need to be analysed on a case-by-case basis for the definition of an optimal funding scheme. The indicators created, the analysis and presentations of the lines of variation of the linkage between funding schemes and performance issues (Annex 4) and the coming systematization of dimensions in an integrated scenario analysis package will be the basis for the creation of hypotheses (WP3).

Interrelations
As noted in the introduction, the implementation and transport mode context describe to a large extent the business model that may be developed. The business model will create economic, environmental, social and institutional outcomes and, ultimately, produce relevant and respective funding schemes. Table 3.1

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presents the summary of the dimensions for the typologies studied herewith. This summary also suggests the inter-relations of the typology dimensions and potential feedback and balancing loops that are present and define the success (or lesser so) of an infrastructure project over its life-cycle.

Table 3.1: Summary of Proposed Typology Dimensions

Implementation Context	Transport Mode Context	Business Model	Funding Scheme
Marco-economic situation	Investment	Revenue Enhancement	Cost recovery
Financial conditions	Users	Revenue Protection	Risk of income
Public sector capacity	Market Strength / Competitive	Cost Saving	Incentives to Agent
Political capacity, support and policies		Capability to manage the business model	Marginal costs of funding
Legal and regulatory framework			Allocative efficiency
Governmental PPP support			Internalization of environmental costs
			Public acceptability and equity

The "Marco-economic situation" and "Financial conditions" will define, to a large extent, the potential of "Cost recovery" and the "Risk of income". Along with the other four dimensions of the implementation context, Agents' incentives will be influenced. The implementation context along with the dimensions of the transport mode typology will define how "revenue enhancement and protection" may be effected. "Cost efficiency" will depend on "Agents' Incentives" and their "capability to manage the business model". "Political capacity", the "Legal and regulatory framework" influence the "marginal costs of funding", "allocative efficiency", the level of "internalization of environmental costs" and "public acceptability and equity" but also the type of activities that may be included in the business model and the permissible (legally) revenue streams.

Furthermore, the specificities of each transport mode will have a strong influence on the Project characterization the business model that it may support as well as other dimensions of the funding scheme. For example:

- The ability for cost recovery from user charge revenues widely vary between modes due to economies of scale and user willingness to pay. The rail sector in particular is characterized by an impossibility to rely solely on user charges;
- The competitive environment within different modes, affecting incentives for good performance and revenue risks (the Market strength dimension).
- The different perspectives of citizens regarding the acceptable means to fund different types of infrastructure; for example funding of roads through user charging may be an acceptability issue.
- Different transport modes have a different vulnerability with respect to macro-economic influence.

Finally, apart from the expected inter-relations between the proposed dimensions of element typologies, it is worth noting that the underlining notion that strings all dimensions, either explicitly or implicitly, is that of risk and its various manifestations in the elements composing the project part of the infrastructure delivery model.

The governance element and the respective typology delivered under the BENEFIT report D2.4, concerns the governance structure put in place to manage the risk. The financing scheme element typology (see BENEFIT deliverable D2.3) matches the final risk profile of the infrastructure project. All these elements and their inter-relations are studied to develop the "matching framework" in task 3.1.

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ANNEX 1: Transport Mode Context Typology

Dimension	Description	Indicator	More measurable indicators	Direct or Indirect impact on funding and financing
1.Type of Load/Flow	Classifying transport modes according to their load: which can be passengers, freight or both.	The mix of passengers and freight	Ratio "passengers to freight"	Indirect
a. Passengers	Passenger transport can be classified based on the criteria in the next column:	Usage	Number of passengers per hour	Indirect
			Number of passenger vehicles-kms	Direct
		Value attributed to passenger transportation	Ratio high/low cost	Indirect
		Speed: High -Low	kms/hour	Indirect
b. Freight	Freight transport can be classified based on the criteria in the next column:	Usage of freight	Volume of freight-tonnage per hour	Indirect
			Number of freight-vehicles-kms	Direct
		High/Low value freight	Ratio high/low value	Indirect
		Speed: High -Low	kms/hour	Indirect
2.Costs	Costs for the construction and maintenance of the different transport modes	1. Magnitude of construction cost/km	Cost / km	Direct
			CAPEX	Direct
		2. Magnitude of Maintenance cost/km	Cost / km	Direct
			OPEX	Direct
		3. Operation cost		
3. Lifetime	In which way the duration of a transport infrastructure could be important for its funding.	1.Duration of lifetime or service life (of transport infrastructures)	Years of operation of transport infrastructure	Direct
		2.Project/Infrastructure (Investment life cycle)		Direct
		3.Contract duration/infrastructure life		Direct
4. Level of sunkness of investment	Sunk investment: an investment that has been already incurred and cannot be recovered. -Infrastructure - superstructure	Non sunk/sunk investments		Direct
5. Operational characteristic	The operational flexibility refers to the ability of each transport mode to reduce discontinuity. For example, vehicles can serve several purposes but are rarely able to move outside roads, this is the reason why road transport has average operational flexibility. Flexibility is improved thanks to containerization.	Operational flexibility	Rerouting	Indirect
6.Performance	Performance indicators, which are also called measures of effectiveness, are	1.Accessibility	Number of obstacles	Indirect
		2.Availability	Hours of availability of a transport infrastructure per day	Indirect

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Dimension	Description	Indicator	More measurable indicators	Direct or Indirect impact on funding and financing
	measurable outcomes used to evaluate progress toward established goals and objectives.		% of availability (i.e. days in year)	Direct
		3.Reliability	Degree of trust/satisfaction for each mode	Indirect
			%time of disruptions during operation	Indirect
		4.Safety and security	Number of deaths, heavily and light injured	Indirect
			cost of accidents	Indirect
		5.Average speed	Kms/hour	Indirect
		6. Maintainability	% not available due to maintenance	Direct
		7. capacity	vehicles/hour	Indirect
7.Location	Important geographical factor for the categorization of transport modes	Type of connection (national or international	- Interurban road - international - national - regional - local - Urban	Indirect
			- Node within a Node - Link within a Link - Node - Link	Indirect
		Level of exclusivity	Natural or induced monopoly and influence of the transport network	Indirect
		Level of integration: Transport Integration means that all modes or types of transport (rail, road, water, and air) operate as one 'seamless' entity - for the benefit of the fare paying customer.	1.Physical integration	indirect
			2.operational integration	indirect
			3.governance integration	indirect
			4.ICT integration	Indirect
8.Sensitivity to external risks	The effect of different kind of risks and financial crisis on each mode of transport.	**1.** Regulatory risk	1.Assessment 2. allocation/ mitigation	Direct
		2. Financial risk	1.Assessment 2. allocation/ mitigation	Direct
		3. Revenue risk	1.Assessment 2. allocation/ mitigation	Direct
		4.Design Risks	1.Assessment 2. allocation/ mitigation	Direct
		5.Construction Risks	1.Assessment 2. allocation/ mitigation	Direct
		6.Maintenance Risks	1.Assessment 2. allocation/ mitigation	Direct
		7.Exploitation risk	1.Assessment 2. allocation/ mitigation	Direct
		8. Demand risk	1.Assessment 2. allocation/ mitigation	Direct
		9. Force Majeure	1.Assessment 2. allocation/ mitigation	Direct
		10. Climate change risk	1.Assessment 2. allocation/ mitigation	Direct
9. Regulation-Deregulation level	The level of government's/state's intervention through regulations.			
a)Admission to the	There are three	% of bauliers without		Indirect

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Dimension	Description	Indicator	More measurable indicators	Direct or Indirect impact on funding and financing
occupation	necessary conditions so as someone to be admitted to the occupation (in some transport modes): 1) good repute, 2) professional competence and 3) financial standing.	serious/repeated or recent criminal offences		Indirect
		Number of official certificates		Indirect
		Available capital and reserves per vehicle/boat etc.		Indirect
b) Access to the market	Regulation 484/2002 certifies that the driver is legally employed by the transport operator who owns the vehicle.	Number of permits per Member State		Indirect
		Number of legally employed drivers/ boatmasters etc.		Indirect
c) Social Harmonisation	In order to achieve social harmonisation, the following rules should be followed: 1) Specific driving/ flying time	Driving hours per day		Indirect
	2) Work time	Working hours per day		Indirect
	3) Rest periods of drivers/captains etc.	Rest hours per day		Indirect
d) Technical Harmonisation	It refers to:1) environmental norms, 2) safety norms, 3) maximum weight of vehicles	1.Noise and pollution emissions		
			1.Noise level/decibels per mode	indirect
			2. % of emissions per mode	indirect
		2.Average speed per hour	Km/hour	Indirect
		3.Number of accidents		Indirect
		4.Tonnes per vehicle/vessel etc.		Indirect
e) Pricing	It refers to rules about what prices the transport companies may charge or not exceed.	Level of freedom on the fixing of rates	Degree of tariff freedom	Indirect
f) State grants	Granting aids to transport companies so as them to cover infrastructure costs	Amount of money offered by the State as aid:		
		1. grants to cover infrastructure costs		Direct
		2. grants to help transport companies survive		Indirect
		3. Grants/subsidies to cover the operation of the infrastructure		Indirect
g) Market	Regulations of revitalising the market of a transport mode (White Paper, A strategy for revitalizing the Communities railways" so as to help railways to win back the lost market shares. 1996) and regulations	Level of liberalisation of the market _use of LIB-Liberalisation Index	LIB index	Indirect

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Dimension	Description	Indicator	More measurable indicators	Direct or Indirect impact on funding and financing
	about liberalising the market.			

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ANNEX 2: «Regulation – Deregulation Level» Dimension

Regulation in Road Transport

On the one hand, the

1a) own-account road haulage is free from regulation. No operator's license is required, there is free access to the market and no price regulation. The vehicles must meet the technical requirements and comply with all traffic and safety regulations. On the other hand, 1b) third-party road haulage is not free from regulation. 1b1) Admission to the occupation of road haulage operator is strictly regulated. A new Regulation (1071/2009) was imposed on 21 October 2009 which sets out that enterprises engaged in the occupation of road transport operator shall have an effective and stable establishment in a Member State in which it keeps its core business documents. Before the introduction of this regulation, three conditions were necessary so as a road haulier to be active: a) good repute (not been convicted of serious criminal offences), b) professional competence (official certificate required to prove it) and c) financial standing (available capital and reserves of 9 000 euro for the 1st vehicle and 5 000 for each additional one). The new Regulation obliges each enterprise which will be active in road transport to designate at least one natural person who satisfies the requirements of good repute and professional competence. An indicator for the good repute could be the number of hauliers without serious/repeated/recent criminal offences. An indicator for the professional competence could be the number of the official certificates and an indicator for financial standing could be the available capital and reserves per vehicle. Also, in general regarding the admission to the occupation regulation, the number of road passenger transport enterprises (with seats for 9 or more passengers) and the number of road hauliers (with vehicles of over 3.5 tonnes maximum authorized mass) could be used as an indicator (Blauwens et al, 2014)

1b2) The regulations regarding admission to the occupation and access to the market are strictly related in professional road haulage. In other words, a haulier can only have access to the national or international market if he/she fulfils the conditions for admission to the occupation. One of the existing regulations, the Regulation 484/2002 of 1 March 2002 introduced the driver attestation which is required from every lorry driver originating from a non-member country. This attestation must certify that the driver is legally employed by the transport operator who owns the vehicle. An indicator for this regulation could be the number of "driver attestations" or the number of legally employed drivers from third countries (non-member country) working for hauliers in the Member States.

1b3) The regulation 3820/85 of 20 December 1985 of the road haulage refers to "social harmonization": driving time and rest time (replaced by the regulation 561/2006). This regulation was set to fix maximum driving times but not working times. That is why the Directive 2002/15 was launched in March 2002 so as limitations to be set on working time as well. Under Regulation 3821/85 of 20 December 1985, tachographs (special devices to record driving time, work time, waiting time and the rest periods of the driver) must be used by every lorry. Some indicators for the social harmonization regulation could be a) driving hours per day, b) working hours per day, c) waiting hours per day and d) hours of driver's rest per day.

1b4) Technical harmonization applies to four main areas: 1) dimension of vehicles, 2) maximum authorized weights of vehicles, 3) environmental norms like noise pollution and emission norms (externalities or external costs that should be internalized) and 4) safety norms (speed limitation). The indicators 1) "height and width meters" per vehicle, 2) tonnes per vehicle, 3) various indicators which measure the gas emissions and the noise levels and 4) km/hour (speed) or/and proportion of road accidents caused by freight transport could be used respectively.

1b5) Pricing: there is complete freedom on the fixing of rates (tariffs are set between the parties).It is also important to stress that through pricing externalities like pollution could be internalized. This means that for example the polluters (such as road haulage undertakings) will be charged with the damage costs of the pollution they generate.

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1b6) Tolls and user charges: are important on this report because we examine the typology of the different transport modes and also the typology of the existing regulation for each different transport mode but with a focus on funding schemes. BENEFIT project itself focuses on the analysis of funding schemes within an inter-related system. Funding schemes are ways/schemes through which we try to take back the money we spent for the construction, management, maintenance and operation of a transport infrastructure (European Commission, 2007 and Law Library of Congress, 2014). One of the means to fund road infrastructure is toll roads which are mentioned in the bibliography as tolling systems, tolls or mobility rates as well (Law Library of Congress, 2014). Tolls refer to a specified amount payable for a vehicle traveling a given distance on the infrastructure. User charges refer to a specific amount of money which allows a vehicle to use the infrastructure for a given period (Blauwens et al., 2014). On 17 June 1999, Directive 99/62/EEC was adopted and set common rules on annual taxes, distance-related tolls and time based user charges for heavy goods vehicles (over 12 tonnes) for the use of certain infrastructure ("Eurovignette" Directive). Some indicators to measure the above mentioned Directive could be the annual revenues received through tax vehicle, annual revenues from the "tolls per km" (per-kilometer fee) and from the user charges. In order to tackle congestion and environmental damage a new directive (2006/38) was adopted in 2006 extending the possibilities to calculate tolls according to a vehicle's emissions and the level of damage it causes (Blauwens et al., 2014). So internalization of the external costs is achieved (or at least tries to) through tolls and user charges. It is also important to mention that financial crisis created an increased interest for private public partnerships as a means to fund road infrastructure. Many governments seek to find private finance so as to limit public spending. (Perkens, 2013)

Regulation in Rail transport

For many years the government regulation for European railways was strict but the last two decades (from 2001) liberalization of the railway market and competition are promoted (directive 2001/12). New licenses are encouraged as well (Blauwens et al., 2014). It is evident that deregulation of railway sector is the goal. An indicator for assessing the deregulation/ liberalisation of the railway market could be the Rail Liberalisation Index- LIB index. This indicator presents information on the relative degree of opening in the European rail transport markets.

Another worth mentioned regulation is a much older one, the regulation 1107/70 (1970) which laid down the conditions under which Member States can grant aids to railway companies to cover infrastructure costs (funding schemes).

When the Directives did not bring the desirable results, they were followed by a White Paper. This was the case in 1996 when European Commission published the White Paper "A strategy for revitalizing the Communities railways" so as to help railways to win back the lost market shares. The market share of railways (%) could be used here as an indicator in this case.

Another regulation was proposed by the Commission in 2008 1) to strengthen European integration of national rail infrastructures, 2) to achieve a better balance between passenger and freight traffic (the proportion of passenger and freight traffic as a possible indicator) and 3) to achieve development of intermodality.

Regulation of inland waterway transport

The regulations of inland waterway transport refer to 1) the technical conditions that should be fulfilled by the vessels, 2) to the technical certificates that should be issued and 3) to the conditions related to the access to the occupation of carrier of goods by waterway (professional competence, good repute and financial standing). Regulations were also created because so as to limit the surplus fleet capacity (scraping regulation) but what is critical to point out is the Directive (96/75/EC of November 1996) stating that pricing and chartering in the national and international market in the Community by inland waterways had to be completely liberalized by 1 January 2000 (Rail Liberalisation Index- LIB index could be used as an indicator). So, liberalization is evident not only in rail transport but also in inland waterway transport. Last but not least, there are regulations like Regulation 2255/96 that made it possible for Member States to grant aid necessary for the development of inland waterway transport. This aid concerned investments in infrastructure at hinterland waterway terminals and investment in installations for loading and unloading

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(Blauwens et al., 2014). The annual amount of money offered as aid by each Member State could be used as an indicator regarding this regulation/dimension.

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ANNEX 3: Transport Mode Context Typology Impact on the Projects Outcomes

Dimension	Description	Indicator	More measurable indicators	Economic	Social	Environmental	Institutional
1.Type of Load/Flow	Classifying transport modes according to their load: which can be passengers, freight or both.	The mix of passengers and freight	Ratio "passengers to freight"	Indirect			
a. Passengers	Passenger transport can be classified based on the criteria in the next column:	Usage: regular passenger transportation	Number of passengers per hour	Indirect		Indirect	
			Number of passenger vehicles-kms	Direct	Direct	Direct	
		Value attributed to passenger transportation	Ratio high/low cost	Indirect	Indirect		
		Speed: High -Low	kms/hour	Indirect			
b. Freight	Freight transport can be classified based on the criteria in the next column:	Usage of freight	Volume of freight-tonnage per hour	Indirect		Indirect	
			Number of freight-vehicles-kms	Direct	Direct	Direct	
		High/Low value freight	Ratio high/low value	Indirect			
		Speed: High -Low	kms/hour	Indirect			
2.Costs	Costs for the construction and maintenance of the different transport modes	1. Magnitude of construction cost/km	Cost / km	Direct	Direct		Direct
			CAPEX	Direct	Direct		Direct
		2. Magnitude of Maintenance cost/km	Cost / km	Direct	Direct		Direct
			OPEX	Direct	Direct		Direct
		3. Operation cost					
3. Lifetime	In which way the duration of a transport infrastructure could be important for its funding.	1.Duration of lifetime or service life (of transport infrastructures)	Years of operation of transport infrastructure	Direct			
		2.Project/Infrastructure (Investment life cycle)		Direct			
		3.Contract duration/infrastructure life		Direct			
4. Level of sunkness of investment	Sunk investment: an investment that has been already incurred and cannot be recovered. -Infrastructure	Non sunk/sunk investments		Direct			

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Dimension	Description	Indicator	More measurable indicators	Economic	Social	Environmental	Institutional
	- superstructure						
5. Operational characteristic	The operational flexibility refers to the ability of each transport mode to reduce discontinuity. For example, vehicles can serve several purposes but are rarely able to move outside roads, this is the reason why road transport has average operational flexibility. Flexibility is improved thanks to containerization.	Operational flexibility	Rerouting	Indirect	Indirect	Indirect	Direct
6.Performance	Performance indicators, which are also called measures of effectiveness, are measurable outcomes used to evaluate progress toward established goals and objectives.	1.Accessibility	Number of obstacles	Indirect	Direct		Direct
				Indirect	Direct		
		2.Availability	Hours of availability of a transport infrastructure per day	Indirect	Direct		Direct
			% of availability (i.e. days in year)	Direct	Direct		Direct
		3.Reliability	Degree of trust/satisfaction for each mode	Indirect	Direct		
			%time of disruptions during operation	Indirect	Direct		Direct
		4.Safety and security	Number of deaths, heavily and light injured	Indirect	Direct		
			cost of accidents	Indirect	Direct		Direct
		5.Average speed	Kms/hour	Indirect			
		6. Maintainability	% not available due to maintenance	Direct	Direct		Direct
		7. capacity	vehicles/hour	Indirect			Direct

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Dimension	Description	Indicator	More measurable indicators	Economic	Social	Environmental	Institutional
7.Location	Important geographical factor for the categorization of transport modes	Type of connection (national or international	- Interurban road - international - national - regional - local - Urban	Indirect			
			- Node within a Node - Link within a Link - Node - Link	Indirect			
		Level of exclusivity	Natural or induced monopoly and influence of the transport network	Indirect			Direct
		Level of integration Transport Integration means that all modes or types of transport (rail, road, water, air) operate as one 'seamless' entity - for the benefit of the fare paying customer.	1.Physical integration	indirect	Indirect		Direct
			2.operational integration	indirect			Direct
			3.governance integration	indirect			Direct
			4.ICT integration	indirect			Direct
8.Sensitivity to external risks	The effect of different kind of risks and financial crisis on each mode of transport.	Regulatory risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Financial risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Revenue risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Design Risks	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Construction Risks	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Maintenance Risks	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Exploitation risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Demand risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
		Force Majeure	1.Assessment 2. allocation/ mitigation	Direct			Direct

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Dimension	Description	Indicator	More measurable indicators	Economic	Social	Environmental	Institutional
		Climate change risk	1.Assessment 2. allocation/ mitigation	Direct			Direct
9. Regulation-Deregulation level	The level of government's/ state's intervention through regulations.						
a)Admission to the occupation	There are three necessary conditions so as someone to be admitted to the occupation (in some transport modes): 1) good repute, 2) professional competence and 3) financial standing.	% of hauliers without serious/repeated or recent criminal offences		Indirect			Direct
		Number of official certificates		Indirect	Direct	Indirect	Direct
		Available capital and reserves per vehicle/boat etc.		Indirect			Direct
b) Access to the market	Regulation 484/2002 certifies that the driver is legally employed by the transport operator who owns the vehicle.	Number of permits per Member State		Indirect	Direct	Indirect	Direct
		Number of legally employed drivers/ boatmasters etc.		Indirect	Direct	Indirect	Direct
c) Social Harmonisation	In order to achieve social harmonisation, the following rules should be followed: 1) Specific driving/ flying time	Driving hours per day		Indirect	Direct	Direct	Direct
	2) Work time	Working hours per day		Indirect	Direct	Indirect	Direct
	3) Rest periods of drivers/captains etc.	Rest hours per day		Indirect	Direct		Direct
d) Technical Harmonisation	It refers to:1) environmental norms, 2) safety norms, 3) maximum weight of vehicles	1.Noise and pollution emissions					
			1.Noise level/decibels per mode	indirect	Direct	Direct	Direct
			2. % of emissions per mode	indirect	Direct	Direct	Direct
		2.Average speed per hour	Km/hour	Indirect			Direct
		3.Number of accidents		Indirect	Direct		
		4.Tonnes per vehicle/vessel etc.		Indirect			Direct

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Dimension	Description	Indicator	More measurable indicators	Economic	Social	Environmental	Institutional
e) Pricing	It refers to rules about what prices the transport companies may charge or not exceed.	Level of freedom on the fixing of rates	Degree of tariff freedom	Indirect	Direct		Direct
f) State grants	Granting aids to transport companies so as them to cover infrastructure costs	Amount of money offered by the State as aid:					
		grants to cover infrastructure costs		Direct	Indirect	Indirect	Direct
		grants to help transport companies survive		Indirect			
		Grants/subsidies to cover the operation of the infrastructure		Indirect	Indirect		Direct
g) Market	Regulations of revitalising the market of a transport mode (White Paper, A strategy for revitalizing the Communities railways" so as to help railways to win back the lost market shares. 1996) and regulations about liberalising the market.	Level of liberalisation of the market _use of LIB-Liberalisation Index	LIB index	Indirect			Direct

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ANNEX 4: Analysis of Funding Schemes

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1. Introduction

According to the BENEFIT project Glossary, “a funding scheme is considered to be any combination of private and public income generated by or towards the infrastructure over its life cycle. These may include any combination of user contribution (tolls, fees, fares etc.) or public contributions based on direct and indirect taxation etc. Public funding may also take on the form of availability fees, shadow tolls etc.” In this sense, a funding scheme is considered to be:

- The various revenue streams generated by the infrastructure or stemming from the existence of the infrastructure, and
- The remuneration schemes put in place in case of private financing of the infrastructure investment.

Revenue streams are connected with the way the infrastructure produces revenue as well as with how the respective infrastructure services are charged. Hence, the topic/issue of charging and pricing of infrastructure, which has been a long discussed and studied topic in national, European and International policy and research is of concern, as it is also connected to issues of equity and mobility. These issues are also related to the risk of demand for the specific services offered, as transport demonstrates considerable price elasticity.

When considering remuneration schemes, these may be connected or not to the revenue streams. Remuneration or repayments may be addressed to:

- The private investor, as return on investment and/or equity and for the transport services offered;
- The public sector, as returns on initial investment contribution, but also as returns for the concession awarded.

Funding schemes, as defined in the BENEFIT project, both in the sense of revenue streams and remuneration (in case of private co-financing) are connected with the feasibility of infrastructure delivery. Even if, from a socio-economic cost-benefit point of view, projects are rendered viable and that should, in all reasoning, be developed, these are simply not possible to realize unless some sources of revenue are mobilized to pay for their costs and sustain a financing for their implementation, operation and maintenance.

What causes the possibility that a project would not generate sufficient funding, even though it provides more value than its costs, is the fact that such value is dispersed across several actors from which it may not be possible to obtain that funding, for several reasons. In the case of public funding, budget constraints, crescent public opposition to public spending and the costs of public funding present major barriers to gather the necessary funding for major infrastructure projects. Secondly, there is the problem of the free-rider, whereby each actor has an incentive to benefit from the project without paying for it.

Notably, funding schemes are connected with significant uncertainty with respect to the ability to materialize the potential streams of revenue for an infrastructure project. The issue is connected to the potential of securing financing and establishing funding schemes (revenue streams) sufficiently appealing (in terms of amount and risks) to investors. Appropriate institutional and business models are needed to make this availability and coordination of secure funding from different value recipients possible. Funding models “that rely on annual budget funding cycles to supplement user revenues rarely produce satisfactory outcomes; what counts is secure funding from multiple and diverse sources” (OECD, 2011). This is also the core concept in the BENEFIT project.

Following this brief introduction, the next section in the report reviews the various potential sources of revenue streams. This section also includes the discussion on the various charging and pricing issues connected to infrastructure for the various transport modes and respective regulation. EU policies are also an integral part of this section. The third section considers funding schemes as remuneration, the various forms that manifest and their appeal to potential financiers. How funding schemes relate to risk and incentives in support of remuneration schemes is the topic of fourth section. Conclusions end the report.

2. Funding Schemes as Infrastructure Revenue Streams

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2. 1 Sources of revenue

The **potential funding actors** of a project are mainly those that may benefit from such a project. They may aggregately be divided in three categories:

- **Users of the infrastructure**: final users directly receive value from using the infrastructure and are therefore willing to pay for being able to use it. Funding from final users is normally obtained by setting a price to use the infrastructure. They may also generate secondary funding income by using bundled services attached to the infrastructure.

- **The general public**: the general public may benefit from a transport infrastructure indirectly by for example the lowering of the costs of consumer goods or even economic growth and its general benefits, if it is promoted by the infrastructure. The way to obtain funding from the general public is through taxation, for which there may be strong acceptability barriers. Contrarily to the user-pays approach, taxation tends to be blind in relation to the relative benefits of different groups and may, in that way, be unfair.

- **Interested stakeholders**: some private stakeholders may have particular interests in a given infrastructure. This may for example be the case of businesses that strongly benefit from it due to their location, property owners who see their property value increase or even other transport infrastructures, or transport operators that increase their demand thanks to the new interconnected infrastructure. Obtaining funding from these actors tends to be more difficult due to their dispersion, strategic behaviour or the availability of institutional mechanisms to collect related income. More complex business models or institutional strategies may be required to extract such sources of funding.

There are several possible funding schemes originating from the agents above. They are distinctively applied in different modes of transport, although conceptually they are applicable to all modes and projects. The following types of funding schemes are described in some detail below:

- Public budget
- The user-pays approach
- Social marginal cost pricing
- Earmarked funds
- Value capture
- Bundled services or infrastructure

Public budget

Funding from public budget comes from the aggregate funding generated by State or regional taxation. It is, currently, highly constrained in European countries because of the existence of other pressing costs within the public budget related to increasing costs of the welfare state and the high level of public expenditure and debt. Public budget funding is also characterized by imposing tax deadweight losses and budget management costs on society (*marginal costs of public funding*). It is originated by tax payers who have a different exposure to the infrastructure and therefore benefit in distinct ways from it; on balance when money comes from the public budget supplied by all tax payers there will be clearly winners and losers.

The user-pays approach

The user-pays approach is a funding concept that relies on the users of the infrastructure to pay for its costs. The extent to which it is applied varies across modes of transport, mostly depending on three elements:

- The ability to cover the costs of the infrastructure through user payments;
- The transaction costs of collecting user based revenues;
- The public acceptance and equity concerns of restricting the access to the use of the infrastructure through charging.

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The user-pays approach may be applied in distinct ways depending on the type of mode, users (passengers, freight), regulatory approaches and general policy. It may be applied on a pay per use basis, or also in terms of right of access (without connection to the amount of use) to the infrastructure for a period of time. For example in the case of road infrastructure, there are cases of simple pay per use (e.g. a toll for a bridge), access rights (the vignette approach) or charging based on distance made (sectional tolls or even satellite based km charging). The pay per use option is more adequate from the perspective of covering marginal operational costs of utilization of the infrastructure and of adjusting the price to willingness to pay (eg. urban transit unified fares). The second option may be preferred for reasons of transaction costs or acceptability/equity. In both cases, distinct criteria may be applied to establish the applicable price, including Distance, Time, Size or weight or space occupied, Number of passengers or Cargo loaded.

The user-pays approach is comprehensible for the public opinion in the case of new infrastructures, but tends to be politically more difficult to implement in brownfield infrastructure, where it was not previously implemented. It requires specific infrastructure and services for collection of the revenues, which may be costly to implement (e.g. urban road charging) and because of that less than efficient pricing schemes may be implemented (the case of the vignette approach). The risks of revenue of the user-pays funding scheme are mostly related to the demand for the specific infrastructure.

Social marginal cost pricing

Social marginal cost pricing is not a funding approach, but it generates revenues. The objective of social marginal cost pricing is to obtain an efficient use of resources in transport activities. This efficiency depends on an efficient use of infrastructure capacity (bringing congestion to an economically optimal level), internalization of environmental costs (greenhouse gases, local air pollution and noise), internalization of safety costs and internalization of marginal infrastructure (wear & tear or other) costs.

The implementation of social marginal cost pricing has been a central objective of the European Commission (stated for example in the Transport White Paper of 2001) which found practical barriers to implementation, including the ability to conciliate it with the need to sufficiently fund infrastructure through pricing, which was only possible under specific conditions dependent on each project and mode of transport (ENACT, 2009). However, forms of social marginal cost pricing are present in some infrastructure in Europe, particularly in urban road congestion or environmental charges, or in airport environmental charges. In practice, whenever the price to use an infrastructure is being set on the basis of scarcity or congestion (e.g. in congested airports), a form of social marginal cost pricing is being applied.

Earmarked funds

Earmarked funds come from sources of revenue of the public authorities, which are specifically allocated to a given end. In the transport sector there are many cases of earmarking, most commonly in road and rail construction and public transport provision. From a theoretical point of view, where the public authorities would allocate revenues efficiently in investments and provision of services, earmarking is an inefficient measure because it constrains the ability to allocate funds efficiently. However, from a practical point of view, earmarking may be desirable due essentially to two aspects (REVENUE, 2006):

- It provides security of revenue for the initiative to which funds are allocated; with earmarking, the initiative's success is less dependent on funds that are subject to annual balance sheet variations or political changes;

- In some cases it promotes the acceptability by the public for the initiative and/or the collection of the revenue in cause; for example urban road charging initiatives tend to be more acceptable if revenues are allocated to improve the alternatives to car use.

Ubbels and Nijkamp (2002) provide an overview of existing or potential earmarked revenues:\

1. Charges for the use of road space: when road charging is used to manage traffic congestion and air pollution, the revenues could also be used to support public transport;

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2. Consumption taxes: consumption taxes can provide a dedicated funding source, and through their implementation, agencies can collect a substantial amount of revenue for operating and capital costs. This practice seems to be common in the United States where many counties or states have implemented such schemes after obtaining the required voter approval. More widely, it is applied by several countries to fund road construction and maintenance through the fuel consumption tax;

3. Local motoring taxes: motor tax is a tax levied on motorists and applied for local purposes (one of them being public transport). They might be collected in addition to state and federal motor fuel taxes;

4. Employer/employee taxes: in a few cities that these are hypothecated to pay for public transport in the US and in Europe;

5. Property-related taxes or development levies: this typically is applied on the rationale that the occupants of the properties served will benefit from the infrastructure or service, directly reflected on an increase in the real property value. Earmarked property taxes to fund public transport are common in North America. They have been subject to significant research in Europe as a way to fund transport are incorporated in the field of "value capture" funding approaches;

6. Parking charges and fines: parking charges are used throughout the world by local authorities to fund their activities;

7. Cross-utility financing: cross-utility financing is applied in parts of Europe, North America and elsewhere. Two methods of how cross-utility financing operates in practice can be identified. The first is via a levy on utility use, which operates in a similar way as sales and employer taxes, while the second is a system where a loss-making public transport department is cross-subsidised by a profitable utility.

The merits of earmarking in terms of economic efficiency, revenue stability and public acceptability vary widely according to the earmarking schemes applied and context (OECD, 2011). Acceptability and fairness depend on the extent that the revenue application is perceived to benefit the subjects from whom it is extracted, to compensate for external costs that they cause or simply that the revenue has some specific justification for the common good (PATS, 2002). The costs of securing such revenue vary also with the source of earmarking, but in general may be regarded as similar to the marginal costs of public funding, since they come from common sources of taxation or charging that supply the general budget. The risks of revenue also vary widely and depend on the indexation of the revenues. For example, vehicle ownership taxes tend to be more stable than fuel taxes and much more stable than vehicle purchase taxes.

Value capture

The value capture approach is an alternative way of funding in relation to the most common public budget or user-pays approaches. This funding scheme collects revenues by levying parties, which directly benefit from the infrastructure or services, not as users, but in the form of increasing property value. Accessibility is one of the major factors contributing to property value and the owners of property with increased accessibility benefit from higher property value. Part of this value obtained by property owners is thus shared to fund the project. In the extent to which this additional funding makes the project possible, it is a clear win-win situation. Value capture approaches may be more difficult to implement and require additional institutional and legal support to become possible in relation to traditional approaches, as they interfere with existing or new forms of taxation.

Martinez and Viegas (2012) present a systematization of a number of value capture funding schemes applied in the past: Land Value Taxation /Site Value Rating, Tax Incremental Financing /LRTP, Special Assessments (SA)/Business Improvement Districts, Transportation utility fees, Development impact fees,

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Joint development, Business rate levy, Greenfield development tax, Betterment levy / freehold levy, Planning gains/Tariffs.

The approaches differ in relation to the object of indexation of the revenue (type of tax), including the type of actor levied (citizens, businesses or other) and the method used to calculate of the levy. They have different implications in terms of their ability to differentiate the level of value capture per agents, which is a crucial aspect for the efficiency and fairness of the funding approach. The viability of undertaking each type of scheme depends on the type of project and benefited actors and must necessarily be adapted to the local institutional and legal context.

Revenues from bundled services or infrastructure

Bundled services or infrastructure of various types provide an additional source of revenue, particularly:

- Commercial activities within the infrastructure providing a monopolistic service which allows to extract additional rents for the entity with the exploitation rights (service stations in roads, commercial activities in rail stations and airports);
- Bundled cargo logistics services within the infrastructure space;
- Bundled infrastructure usable for other purposes (e.g. communication cables in road infrastructure)

In all sectors, bundled service or infrastructure revenues represent a small share of revenues. In some cases, by imposing monopolistic prices they imply a loss of surplus to consumers. Their revenue risks are essentially linked to the demand risk (in the case of infrastructure users/consumers) or to the economic environment.

2.2 Infrastructure Charging and Pricing EU Policies

2.2.1 Trends and Considerations

Over the last few years, there has been intensive discussion at EU level on the policies ruling funding of transport infrastructure. The European Commission, the European Parliament and the Council, all agree that mobility is key to quality of life and vital for EU's competitiveness, and accordingly, transport operations and transport infrastructure are the backbone of the economy, building the links between the different stages of production chains and allowing service industries to reach their clients, as well as being a significant employer in its own right. However, all three Institutions also recognize that mobility imposes costs on society, notably due to its related negative impacts. This, together with the fact that transport markets should also function according to the rules of the Treaties, has often been considered to be in conflict with policies that aim to incentivize and facilitate transport.

EU policies on funding of transport infrastructure have been clearly marked by this apparent contradiction. Two examples are provided below:

- According to the European Treaties, Europe's environmental policy shall be based on the polluter-pays principle (Article 191 of TFEU), under which the party responsible for producing pollution would be responsible for paying for the damage it may cause; however, due to the interest of the Community to facilitate transport several Directives limit Member States' ability to charge for all external costs of transport, including for example the European Directive on the charging of heavy goods vehicles for the use of certain infrastructures (the Eurovignette Directive);
- Article 107 of the Treaty on the Functioning of the EU establishes that *any aid granted by a Member State or through State resources in any form whatsoever which distorts or threatens*

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to distort competition by favouring certain undertakings or the production of certain goods shall, in so far as it affects trade between Member States, be incompatible with the internal market. There are several areas of transport infrastructure and operations where this rule is not fully applicable.

Adding to this, all EU activities on regulating transport funding schemes, charging and pricing models shall be governed by the principles of subsidiarity and proportionality. In this particular topic subsidiaritry is of extremely high relevance, as *the Union shall act only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States, either at central level or at regional and local level but can rather, by reason of the scale or effects of the proposed action, be better achieved at Union level*.

The above are evidence to the several layers of complexity of EU policy on funding schemes, charging and pricing models.. This section outlines the most important related policies in place (and those developed over time) that are considered to have set the basis and continue to shape the framework within which present funding schemes for transport infrastructure projects can be analysed. A particular emphasis is placed on transport user charging and pricing.

The development of EU transport pricing policy was essentially initiated with the publication of the Green Paper "Towards fair and efficient pricing in transport" in 1995, followed by the White Paper on "Fair payment for infrastructure use" in 1998. Both documents recognised the importance of pricing to reflect external costs.

The 2001 White Paper-"European transport policy for 2010: time to decide" cemented the fundamental principle of infrastructure charging, namely that the charge for using infrastructure must cover not only infrastructure costs but also external ones, and announced a directive on pricing targeted at setting out the principles to be followed in all transport modes. Most importantly, this policy document first foresaw the link between pricing and infrastructure funding, stipulating that new infrastructure projects should benefit from an "income" even before the first operating revenue is generated. It essentially introduces the basic principle to allocate part of the surplus income from charging for existing infrastructures to funding the completion of other infrastructure projects.

Following on the ground set by the 2001 White Paper, the latest 2011 White Paper-"Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system sets forth a clear strategy for "Modern infrastructure, smart pricing and funding", highlighting that a well-performing transport network requires substantial resources that must be now obtained from diversified sources of finance, including both public and private ones, supporting the creation of funds for public investment by making explicit reference to the potential for creating additional revenue streams. An example of such alternative schemes is the internalisation of external costs (such as noise, air pollution and congestion) through infrastructure use charges, particularly for the road sector. (In its Communication on the Strategy for the internalisation of external costs (SEC(2008)2207, accompanying COM(2008)435) the Commission has laid down a common methodology to charge all external costs across the entire transport sector).

The 2011 White Paper also reaffirmed EU's commitment to efficient pricing and the avoidance of distortion, whereby transport charges and taxes must be restructured in the direction of a wider application of the 'polluter-pays' and 'user-pays' principle, with correct and consistent monetary incentives given to users, operators and investors. In essence, a more wide-spread pricing of infrastructure use, including incentives for sustainability and the environment, could in parallel generate a stream of revenues able to secure funding of infrastructure, including both construction costs, and maintenance and operation.

With regard to taxation, the latest White Paper considers that several branches of transport are treated favourably in comparison to the rest of the economy, such as tax treatment of company cars and VAT and energy tax exemptions on international sea and air transport, and hence, the EC will endeavour to achieve greater consistency between the various elements of transport taxation and encourage the rapid introduction of clean vehicles.

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In light of the above, the White Paper presents a list of initiatives with regard to smart pricing and taxation that are expected to affect both travel demand and generation of revenue streams for project financing. At a first phase these include the restructuring of transport charges and taxes, the revision of motor fuel taxation, the evaluation of existing car road charging schemes, the internalisation of external costs for all modes of transport, as well as the issuing of guidelines for providing clarification concerning public funding to the different transport modes and infrastructure. Of particular importance for the BENEFIT funding schemes analysis, are the strategies for creating a framework for earmarking revenues from transport for the development of an integrated and efficient transport system. In the second phase, the White Paper foresees the full and mandatory internalisation of external costs for road and rail transport sector, together with the internalision of costs for local pollution and noise in ports and airports, as well as for air pollution at sea, and the examination of a mandatory application of internalisation charges on all inland waterways on EU territory.

Following its publication, there have been several responses to the 2011 White Paper from a variety of transport associations with regard to pricing and taxation. The present report indicatively cites that the International Road Transport Union (IRU) has expressed concerns of pricing discrimination with regard to the “user pays” and “polluter pays” principles to modes other than road, as well as taxation, stating that only earmarking of tax revenues at source to cover infrastructure costs, to support investment in affordable clean vehicles, clean fuels or eco-driving training would effectively reduce the impact of the commercial road transport sector on the environment. In addition, it is unacceptable to IRU that certain modes, like maritime, air and rail, still pay little or no tax for the energy they use. Another example is the view of the European Transport Safety Council (ETSC), which believes that if transport charges and taxes are to be restructured, they should also include road traffic accident costs.

On the concept of charging for the use of road infrastructure, key related European and international Associations have published their official position. As a general comment, they strongly support the generation of revenue streams for financing, however, targeted solely at the road sector, but with the requirement of the elimination of any additional taxation. Another key observation is that the European Union Road Federation partially objects the EC’s definition of externalities, and by association, the internalisation of these, with regard to CO_2, road accidents and congestion.

Three major international transport organizations: ASECAP (European Association of tolled road infrastructures operators), ERF (European Union Road Federation) and IRU (International Road-transport Union) issued in 2010 a Policy Statement on “FAIR CHARGING FOR GREENER, SMARTER AND SAFER ROAD INFRASTRUCTURE”. In their view, road charging should be based on the following fundamental pillars: road user charging should be seen as a means of a fair tolling scheme based on the pay-as-you-drive concept; the introduction of road user charging must be accompanied by the abolition of numerous current taxes (fuel and vehicle) in order to ensure that users do not pay twice; the revenue generated from road charging must be channeled back to the road sector in the form of additional investment and research funds aimed at developing cleaner vehicle and infrastructure technologies; and to date, the earmarking of collected revenues (e.g. concession tolling) has proven to be a successful method of developing greener, safer and smarter road infrastructure i.e. a high quality road network, from the design to the construction, operation and maintenance phases.

In 2013, ASECAP also signed a Joint Tolling Declaration with IBTTA, the worldwide Association for the owners and operators of toll facilities and the businesses that serve tolling. Based on their shared beliefs and strong commitment to implement a Memorandum of Understanding and Cooperation, the Declaration demonstrates the reasons why tolling supports mobility and economic growth in North America and in Europe, as well as in other regions of the world. According to the Declaration, tolling provides:

i. a reliable alternative to the lack of public funds for roads,
ii. a sustainable source of funding,
iii. governments with flexibility in the use of public funds,
iv. transparency and fairness for road users,
v. assistance to manage demand in congested areas , and
vi. support in foster economic growth around the world.

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In addition to the above, ERF published a Position Paper on the European Commission's Public Consultation on the Charging for the use of road infrastructure, outlining what the Union considers should be the main axis of any future EC proposal on road pricing: any future road pricing scheme that encompasses motorways must ensure that the revenues collected are channeled exclusively back into the road sector, and must be revenue neutral, excluding various flat taxes (registration tax, circulation tax etc.) to counterbalance the charges related to the use of the road. ERF also calls on the European Commission to adopt a fair definition of externalities, which acknowledges that road transport also has positive externalities, while CO_2, road accidents and congestion should not be considered as such. Finally, within the principle of proportionality, ERF considers the Pay-As-You-Drive (PAYD) principle the fairest way of charging for the use of the road.

2.2.2 Pricing Regulation

The above bring to the fore the need to regulate transport charging and pricing. European policies to regulate user charging vary across the different modes of transport, recognizing that the cost drivers, market rules and certain impacts— such as noise and congestion — vary in space, time and depend on the mode in question. The following sections summarize the existing rules for each mode of transport.

Road

According to the principle of subsidiarity, regions and/or Member States largely determine the rules governing road charging in Europe. The only exception is the charging of heavy duty vehicles in the Trans-European Network, where road charging schemes must comply with the so-called "Eurovignette Directive"[12]. This Directive aims to create a common framework for charging, which limits Member States from charging unfair amounts to heavy duty vehicles and discriminate them on the grounds of nationality of the haulier, country or place of establishment of the haulier or of vehicle registration, or the origin /destination of the transport operation.

The Eurovignette Directive does not impose road charging, i.e. it's up to the Member State to decide whether or not to implement a charging scheme for infrastructure financing. If the Member State decides to implement such a scheme it will be allowed to charge an amount based on the principle of the recovery of infrastructure costs only. Specifically, the weighted average tolls shall be related to the construction costs and the costs of operating, maintaining and developing the infrastructure network concerned. The weighted average tolls may also include a return on capital or profit margin based on market conditions. In addition to these costs, Member States may include in the user charges fees related to certain social costs of transport.

In accordance with the 2011 White Paper, the 'Eurovignette Directive' represents a first step towards a higher degree of internalisation of costs generated by heavy goods vehicles, but disparities in national road charging policies will remain. Further action will examine the gradual phasing of a mandatory harmonized internalisation system for commercial vehicles on the entire inter-urban network.

It is worth underlining that, according to the principle of subsidiarity, the EU does not regulate road user charges applicable to passenger cars and other light vehicles, nor does it impose any restriction on the activity of Member States outside the trans-European network (with the notable exception of not violating any Articles of the European Treaties).

Given, however, that the 2011 White Paper recognises that road charges for passenger cars are increasingly considered as an alternative way to generate revenue and influence traffic and travel behaviour, the Commission aims to develop guidelines for the application of internalisation charges to all vehicles and for all main externalities. The long-term goal is to apply user charges to all vehicles and on

[12] DIRECTIVE 1999/62/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 1999 on the charging of heavy goods vehicles for the use of certain infrastructures

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the entire network to reflect at least the maintenance cost of infrastructure, congestion, air and noise pollution.

Rail

Following the Commission's White Paper of 30 July 1996: "A strategy for revitalising the Community's railways", European rules on rail charging were defined by Directive 2001/14/EC. In sharp contrast with the Eurovignette Directive, this document regulates the process to calculate applicable charges to all infrastructure managers in the EU, effectively regulating the market. It should be noted that infrastructure charging in the railway sector is resulting from the separation of infrastructure from operations, and hence, a variety of approaches to charging has been adopted in the different Member States.

The Directive, which applies to railway infrastructure used for domestic or international rail services establishes that charges are set and collected by an independent charging body, generally the infrastructure manager provided it is not dependent on the railway undertakings. The directive defines the minimum access package and the mandatory access to services to which railway undertakings are entitled. The undertakings in turn are under an obligation to provide certain mandatory services, to which additional and ancillary services may be added. The directive lays down charging principles: charges must be paid to the infrastructure managers and used to finance their business. In principle, the charge for the use of railway infrastructure is equal to the cost directly incurred as a result of operating trains. The infrastructure charge may include a sum reflecting the scarcity of capacity and may be adjusted to take account of the cost of the environmental impact of train operation.

By way of exception to these charging principles, the directive allows infrastructure managers to levy mark-ups, if the market can bear this, on the basis of efficient, transparent and non-discriminatory principles, while guaranteeing optimum competitiveness, especially of international rail freight. Subject to certain conditions, railway undertakings may be granted discounts on charges.

Accordingly, for rail transport, charging for external costs is allowed under the condition that it is done in competing modes as well. Considering that there are effective restrictions for the charging of external costs of transport in other modes of transport (e.g. heavy duty vehicles in the trans-European network, fuel taxes on maritime transport or aviation) this provision entails a de facto limitation to wide external costs charging in rail transport. In this respect, the 2011 White Paper stipulates that before 2020, the Commission will develop a common approach for the internalisation of noise and local pollution costs on the entire rail network.

Maritime

Although currently outdated, the Green Paper on Sea Ports and Maritime Infrastructure of December 1997 remains an original milestone for the European Ports Policy. Among other, it focused on the financing of ports, highlighting that the way port charges were calculated varied widely among Member States, which was attributed to large differences in ownership and organisational structures, while it also raised the issue of lack of transparency in port accounts. Most importantly, though, it acknowledged the trend that ports were evolving into commercial entities that required new pricing and infrastructure funding mechanisms.

In the Port sector there has been a vast discussion on establishing a framework of transparent, fair and non-discriminatory provisions relating to financing and charging of port infrastructures and port services. In particular, the transparency of financial relations to allow a fair and effective control of State aid, preventing, thus, market distortion. A review of practices across Europe reflects remarkable differences regarding charging practices, cost recovery methods reaching from statements such as “full cost recovery” to “cost recovery is envisaged by revenues”.

The European Commission has proposed common rules on financial transparency and on port service and port infrastructure charges (COM/2013/0296 final). This Proposal would apply to all maritime ports of the trans-European transport network and establish that charges shall be set in a transparent, objective, and non-discriminatory way and shall be proportionate to the cost of the service provided. Also, in contrast with the provisions for road transport, Member States would be asked to ensure that a port infrastructure charge is levied, with the structure and the level of port infrastructure charges being determined according

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to national ports policy and/or the individual port's commercial strategy and investment plan and comply with competition rules, where applicable. Port infrastructure charges would be able to vary in accordance with the port's economic strategy and the port's spatial planning policy, related inter alia to certain categories of users, or in order to promote a more efficient use of the port infrastructure, short sea shipping or a high environmental performance, energy efficiency or carbon efficiency of transport operations. Finally, the 2011 White Paper stipulates EC's goal to internalise costs for local pollution and noise in ports, as well as for air pollution at sea,

Aviation

Airport charges are charged to airport users for the use of airport facilities. They include aircraft landing charges, charges for the processing of passengers and freight and other charges related to the use of airport infrastructure. Charges are applied in different ways, depending on the service they cover. Passenger charges are levied per passenger, whilst other charges are applied per aircraft landing or take-off.

While these are regulated at EU level by Directive 2009/12/EC, airport charging systems are in several cases imposed and governed by the national authorities. Even where the airports concerned are privately owned, the charges have to comply with regulatory parameters set by the authorities. Charging systems can also work as management tools. By varying certain charges, airports can try to increase the use of airport infrastructure or reduce the environmental impact of aviation.

The European Commission published in 2014 a report on the application of the Airport Charges Directive by the Member States. In this report, the Commission takes stock of the implementation of the Directive so far, noting that whilst some positive results can be identified in terms of increased consultation and transparency of airport charges, further work needs to be done to ensure consistent application in the EU. Similarly to seaports, one of the initiatives set out in the 2011 White Paper is the internalization of costs for local pollution and noise in airports.

Urban Transport

Due to the subsidiarity principle, the role of the EU in urban transport charging or funding has been less important than in other sectors. Apart from the attribution of structural funds with certain goals, its influence at urban level has been focused on setting the agenda of policy and innovation. Nonetheless, the general recommendations of the European Commission regarding efficient pricing do apply at urban level.

The *Green Paper – Towards a new culture of urban mobility* provides some recommendations on urban transport funding approaches. It presents urban road charging as allowing for optimised trip planning, better traffic management and easier demand management. It also presents car based fees (including parking charges) as a way to "contribute to urban transport financing, in particular by earmarking the revenues raised for the financing of urban transport measures". More generally, it calls for all stakeholders, at all levels (local, regional, national and EU) to contribute to the funding of urban mobility measures. Some stakeholders proposed that the Eurvignette system should be extended to cities so that road charging could apply to all types of vehicles and infrastructures.

In the 2000's the urban pricing agenda has been marked by several experiences on urban road charging in prominent cities, particularly London, Stockholm and Milan. It has not, nonetheless, been spread as expected throughout European cities throughout the 2010's. The most important barrier to urban road charging is public acceptability, but also the transaction costs of setting up the charging scheme, which may represent costs of 10 to 40 per cent of the collected revenues, a significant inefficiency. In this scope, the approximation of the expectation that it will soon be possible to implement urban charging on the basis of satellite-based vehicle tracking may be causing a strategic option to put off the implementation of charging systems.

In the scope of public transport, the funding agenda has been recently marked by the budget restrictions to keep the level of service of existing services or realize new investments. In this scope, there have been

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increasing calls at local and national level to carry out cross-subsidization of public transport from revenues generated in the road (car) sector.

3. Funding Schemes as Remuneration

The present section concerns the various schemes connected with remuneration of concessions and privately co-financed infrastructure delivery (construction, operation and maintenance). The traditional repayment model of a concession relies on the exploitation of the revenues directly generated by the project, particularly by its users. However, for essentially two reasons, this remuneration approach may not be (or may be only partially) applied:

a) The project exploitation does not generate (enough) revenues to pay for its costs and additional revenues are needed.
   Reasons for insufficiency of funds may include standardizing toll rates nationally for regional equity or public acceptance (ITFa, 2013) or the level of demand and willingness to pay may be simply insufficient to cover the costs.
b) The repayment of the concession through revenues generated by the project would deliver sub-optimal risk distribution and incentives to the concession.

In particular, when revenue risk is fundamentally related to demand risk, and where the concession has limited power to mitigate that risk (whereas the public party may have more power to influence demand), it becomes more rational to attribute such risk to the public party (ENACT, 2008b; Roumboutsos and Pantelias, 2015). Indeed the public party often has a significant influence on demand particularly when it is able to change the supply of alternative infrastructures or services. In order to protect from this risk, the private party tends to demand restrictions on the provision of alternative services which constrain the long-term freedom of the public party to realize changes in the local mobility system.

A qualitative assessment of revenue risk as a function of the charging regime and contextual aspects is given by the following table synthesized by Perkins (2013).

Table 1: Revenue risk assessment depending on charging regime (Source: Perkins, 2013)

	Less Risk	**More Risk**
Charging Regime	Availability payments	User tolls
	Tolls well established, data on actual use established	Toll roads absent or unusual
	Toll rates in line with tolls on existing facilities	Tolls higher than the norm
	Simple toll structure	Complex structure (local discounts, frequent users, variable pricing)
	Flexible toll rate - revision without government approval	All tariff rises require regulatory approval

The two types of causes above may also happen in the case that it is a policy objective to set infrastructure use prices as a function of social marginal cost prices, causing additional constraints on an appropriate level of remuneration and risk allocation. To solve this problem, a separation between revenue streams from pricing and payment of the private party is proposed (ENACT, 2009).

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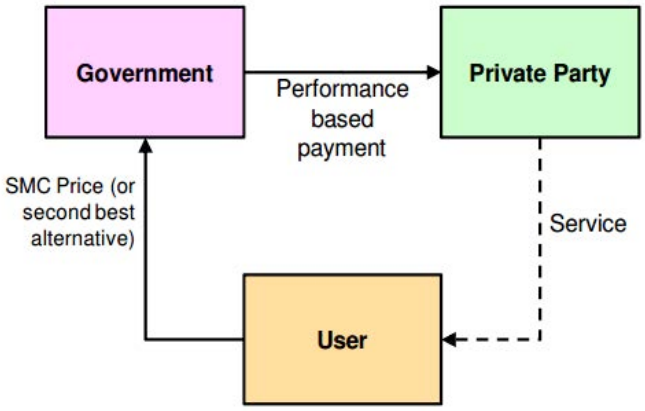

Figure 1: Separation of payment for provision and income from charges (Source: ENACT, 2008a)

When the payment is separated from the infrastructure revenue streams, there may be infinite methods of remunerating the concession, with different rules and goals. Broadly, the commonly used methods applied may be described under three types:

Demand based – Payments, which are proportional to the demand of the infrastructure. This is the case of "shadow tolls" in non tolled roads where the funds come from other sources but the concession gets paid as if there were tolls. To a more limited extent, this type of payment may be applied in smaller amounts with the only goal of covering the marginal maintenance costs (wear & tear) caused by the use of the infrastructure. The scheme protects against allocative risk and acceptability but sustains a level of demand risk for the operator who is incetivised to provide quality services to attract and sustain demand.

Availability - Availability payments are fixed payments, which are conditional on the fact that the infrastructure is available to users under the standard minimum quality. For example, in the case of roads, standards refer to road surface quality, lane availability or timing of maintenance works. Availability payments create strong incentive towards achieving minimum quality standards that demand based revenues do not necessarily achieve and have been in increasing use in PPP contracts, particularly in the road sector (Perkins, 2013). Availability payments have become more popular since the current economic crisis, since private investors have become more risk averse and in some cases demand became insufficient to supply enough funding to the projects.

Quality based – Even though availability refers to a minimum standard of quality, there may be payments (or penalties) conditioned on a wider spectrum of quality possibilities associated to Key Performance Indicators. Quality based payments put an incentive to go beyond minimum standards or to excel in additional performance factors (for example, depending on the mode of transport, relevant indicators may be the safety record, punctuality, or satisfaction surveys), including the realization of innovations.

In between demand based and availability payments, there are several options designed to share the traffic revenue risk, such as (EPEC, 2011):

- Revenue-sharing bands: lower and upper thresholds for sharing traffic revenue risk between the SPV (Special Purpose Vehicle - concessioner) and the Public Authority if traffic is outside the thresholds;
- Flexible-term contracts: the PPP contract will end when the concessioner has received a certain return on investment or equity;
- Financial re-balancing: provisions to change the financial elements of the PPP contract if traffic is much lower/higher than planned or at set regular intervals.

Remuneration schemes may also include other funding revenue sources not directly generated by the project. This may be the case of infrastructure cross-financing (through revenues generated in other pieces of infrastructure) or earmarking from other sources more or less related to the value generated by

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the infrastructure. In the simplest and most independent form, the private entity may be (partly) paid by fixed subventions from the general budget of the public entity not dependent on any internal (to the project) or external elements except for standard macroeconomic variables (e.g. inflation).

When the remuneration of the private agent is fully or partially split from the revenues generated by the project, in some cases there may be returns to the public sector. This remuneration of the public sector may occur under different rationales:

- Returns for co-financing: as participant in the investment, the public entity gets entitled to the correspondent returns;
- Sharing of upside risk: when the revenues from the project are higher than expected, the extra revenues may be shared between the public and private parties. This revenue risk sharing makes sense in the scope where both parties have some power to influence demand;
- Difference between project revenues and remuneration flows: this is the case where there is no particular public remuneration rationale and the public income is simply the result of the actual difference between the revenues generated by the project and the payments due to the private entity.

Finally, the public agent may be entitled to rents and fees for the right of use and development of infrastructure such as in the case of ports and, sometimes, airports.

4. Funding Scheme Performance

The first issue related to funding is the trivial question of whether the funding schemes (revenue streams and remuneration) available are sufficient covers the costs of the project such that the project is financially viable. The *cost recovery* ability has significant variations per mode of transport.

Beyond the ability of covering the costs of the transport infrastructure project (construction, operation and maintenance), the funding schemes that are used may have implications on performance aspects of the project itself (firstly, the ability to make the project happen, and secondly, the ability make it properly fulfill its objectives) or wider economic, social and environmental impacts.

The **internal performance factors** consist of two related issues: incentives and risks. The way the different actors of the Project are being funded may cause specific *incentives* in relation to their profit seeking behavior as long as they are able to influence through their actions the amount of income that they receive. On the risks side, different funding sources may imply different levels of uncertainty of the income that will be actually generated, influencing the *risk of revenue* of the actors that will finance the project and the related risk premium.

Funding, or revenue, risks and incentives directly affect **business cases** in their capacity to be at the same time appealing to investors and to provide the desired quality of the project.

External performance factors which are related to funding schemes cover essentially three aspects: economic efficiency of the usage of transport infrastructures (*allocative efficiency*), *fairness* and *acceptability* and *environmental cost internalization*. External performance factors reflect the extent to which the project is delivering desired **wellbeing** outcomes that are outside the framework of the business model.

An additional aspect, which may or not be relevant within the sphere of the business case is the costs of collecting the funding (revenues). These costs may be transaction costs related to the collection of the

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revenue, or economic efficiency costs related to the market inefficiencies that are potentially caused by price distortions (of which the above mentioned infrastructure allocative efficiency is a specific and particularly severe case). When the funds in question come from the public sphere (and are thus external to the business case), these costs are commonly known as *marginal costs of public funding*.

These performance factors are described in detail below.

Revenue risk
When revenues depend on pricing the infrastructure use, there is a risk of revenue that derives from demand risk. An accurate estimation of the future level and composition of traffic volumes is often difficult and overestimation of actual traffic levels is common (the "optimism bias"). Here, there is also the issue of pricing. As revenues depend on the pricing level, if there is some uncertainty regarding the future price level, this contributes to additional revenue risk. Price level uncertainty may be caused by general pricing policy changes, regulatory practice based on regulatory goals or even by changes in direct taxation like VAT. On the other hand, if the Agent has power over the price level, it may partly reduce the revenue risk by adapting the pricing to any demand fluctuations.

Other main sources of revenue also have risks. In the case of revenues from the public budget or earmarked revenues, the risk assessment by the private party will be influenced by the credit rating of the public party in question. The public party tends to be more risk neutral than private investors, but the increasing public budget restrictions have been probably increasing its risk aversion.

Incentives
Revenue streams induce incentives to the operating agent, which may influence its performance. This is particularly the case when revenues come from infrastructure pricing, featuring a potentially positive incentive to attract more demand through a high level of service, and a potentially negative incentive for pricing monopolistic behavior if price is not regulated. To deal and optimize incentive effects, the payments to the agent may be done through specific rules (related to performance indicators) complementarily or in replacement for pricing based revenues.

Allocative efficiency
In the case of transport infrastructure, allocative efficiency refers to an optimum use of the available infrastructure. According to economic theory, allocative efficiency is achieved when the users pay a price that corresponds to the marginal costs of their use. Deviations from marginal cost pricing, for example through prices based on the user-pays principle, which exceed the optimal price, translate into economic losses in the form of consumer surplus reduction. Losses of this kind take place for example when some users prefer to use poorer roads with free access to avoid paying high tolls of parallel motorways. In this case, the optimal economic return would occur if they used the best infrastructure. Allocative efficiency through correct pricing becomes particularly difficult to implement when there are several concurrent infrastructure with a different pricing policy. A first-best pricing policy in a given infrastructure only generates efficient outcomes if the concurrent infrastructures in the network also feature marginal cost pricing. When this is not the case and for some reason (like cost recovery) other pricing approaches must be kept, there may be second-best pricing solutions (Markup pricing, Multi-part Tariffs, etc) to approach the optimal allocation, which may be, again, difficult to compute and to implement (REVENUE, 2006).

Internalization of costs
Internalization of costs (eg. congestion, environmental or safety costs) is a specific case of the problem of allocative efficiency. Also here, efficient pricing would apply the (social) marginal cost pricing principle. Pricing may both contribute to internalize all types of external costs or to provide incentives in the opposite direction. When pricing is set based on other criteria (like the objective of financing an infrastructure project), it may be inconsistent with an efficient cost internalization. The ability to conciliate this type of conflict between cost recovery and price efficiency has been studied by a stream of literature. A theoretical point of departure is the Mohring and Harwitz's Cost Recovery Theorem, which establishes the conditions for the capital costs (building and maintenance) of an investment in a given infrastructure to be recovered with user charges based on marginal cost pricing. The theorem shows that the cost recovery will depend mainly on the characteristics of the operation and investment cost functions, with emphasis on the returns

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to scale of the type of infrastructure. Other assumptions given, infrastructure with decreasing (increasing) returns to scale does (not) achieve cost recovery. Rail could hardly achieve cost recovery, while roads, airports or ports may in some conditions be able to conciliate optimal pricing with cost recovery (ENACT, 2009).

Acceptability / equity

The benefits and costs of policies tend to fall unequally on the population, and those who perceive themselves to be losers may declare the policy to be unacceptable. Within a political process that is democratic and representative, only policies that are not opposed by a majority of relevant actors are likely to be implemented (REVENUE, 2006). In this scope, some funding schemes may simply not be feasible due to acceptability reasons, and this should not be forgotten in the scope of policy advisory. In respect to the elements concurring for the acceptability of a given funding scheme, the following are highlighted:

- Direct benefits of the Project to parties that fund the Project;
- Perception that infrastructure pricing revenue is applied towards a desired objective;
- Perceived equity of the funding scheme;
- Previous application of pricing in similar projects or the same (brownfield) infrastructure.

Marginal costs of funding

Funding mechanisms always imply costs in the collection of revenues, particularly transaction operational costs.. They also cause, to a different degree, price distortions in the respective markets. This is the case of *marginal costs of public funding*. This issue is also connected to distortions due to transport pricing (see *Allocative efficiency* above). These costs may have different levels of economic severity depending on the level of distortion imposed[13] or operational costs of revenue collection.

Many of the considerations in this section have been considerations and outcomes of EU funded research (see Appendix).

The qualitative relation between funding schemes and performance factors is presented in tables 2i and 2ii below.

Table 2i – Relation between types of funding schemes and performance factors (I)

	Cost recovery	Revenue risk	Incentives
Public budget	Due to increasing budget constraints in Europe, the ability to fund projects based on public budget is diminishing and alternatives must be found	Depends on the sovereign credit rates attributed to the State in question. In the last years this rate diminshed for several countries, making risk premiums for projects higher.	The incentives on the Agent from public budget funds depend strictly on the related remuneration scheme.
User-pays	The willingness to pay for the use of the infrastructure and the level of demand on the infrastructure determine whether the funds are sufficient to cover the costs. Cost recovery from user-pays pricing is possible to achieve in airport, port and road projects with sufficient demand, but not in rail.	Indexed to demand risk and pricing (the later only if pricing not fixed by contract or controlled by the Agent).	If demand is sufficiently elastic to level of service, user prices cause a positive incentive for a high level service and for innovation.

[13] A Portuguese study estimated 45% of economic losses in relation to revenues collected in motorways (Gama Glória, 2014).

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	Cost recovery	Revenue risk	Incentives
Social marginal cost pricing	Not possible in infrastructure with increasing returns to scale. Tends to require that infrastructure is to some extent congested / scarce. Never applies to rail. In all modes it potentially generates less revenues than user-pays charges.	Higher than user-pays pricing. It depends not only on demand risk, but also on a highly non-linear congestion/scarcity curve and on risks related to the future uncertainty of other specific environmental costs.	Like user-pays pricing, may feature positive incentives for level of service. May cause perverse incentives towards capacity extension, innovation or no reduction of external costs, depending on the contractual arrangement and (second-best) pricing scheme.
Earmarked funds	Depends on type and amount of earmarking.	Depend on the object of indexation of the revenues (type of tax, etc). From a policy and stakeholder perspective, earmarking may provide higher security of funding in the medium to long term.	Depend on the object of indexation or on the related remuneration scheme.
Value capture	Depends on level of property value increased.	Similar framework as earmarked funds	Similar framework as earmarked funds
Bundled services	Normally low share of contribution to cost recovery in all modes.	Indexed to demand risk and/or economic environment.	Typically features monopolistic behaviour on the provision of the services. Positive incentive to attract demand through high level of service.

Table 2ii – Relation between types of funding schemes and performance factors (II)

	Allocative efficiency (infrastructure use)	Environmental externalities	Acceptability / fairness	Marginal costs of funding
Public budget	Neutral effects.	Neutral effects.	Public acceptability for public budget spending on major projects has been in a negative trend. Benefits from the infrastructure will accrue in an unequal way througout its funders (all taxpayers). Contribution is progressive according to the region's tax structure.	Equivalent to marginal costs of public funding

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	Allocative efficiency (infrastructure use)	Environmental externalities	Acceptability / fairness	Marginal costs of funding
User-pays	Inefficiency. User-pays pricing only by chance practices efficient pricing, which also depends on the pricing on other infrastructure.	May be both in the direction of properly internalizing externalities or not, depending on mode, existence of competing modes and related pricing.	Tends to be acceptable in greenfield infrastructure (because the funders directly benefit from the infrastructure) and less acceptable in brownfield infrastructure previously with no pricing. Regressive equity effects within (potential) users.	ICT contributing to a reduction of costs in all modes. In some cases (e.g. Road charging) collection costs represent a significant part of operational costs.
Social marginal cost pricing	Efficient, but is often difficult to implement due to consistency with pricing in competing infrastructure.	Efficient.	May face difficult acceptance in brownfield infrastructure (e.g. Urban road charging); benefits if revenues are earmarked to alternative options. Regressive equity effects within (potential) users.	Similar to user-pays
Earmarked funds	Neutral effects.	Neutral effects.	Depends mostly on if the revenue application is perceived to benefit the subjects from whom it is extracted. Progressivity depends directly on object of indexation.	Dependent on object of indexation
Value capture	Neutral effects.	Neutral effects.	May rate well on acceptability considering that the funding is provided by the agents who benefit. Neutral equity effects: funding proportional to accrued value.	Dependent on object of indexation
Bundled services	Neutral effects.	Neutral effects.	Opposition to monopolistic pricing in bundled services not common.	No net costs: value added activities

5. Conclusions

This analysis reviewed the state-of-the-art in terms of funding practices and policy in the scope of the BENEFIT funding schemes definition and its implications on factors of performance of the transport infrastructure project and socio-economic issues at large.

A particular emphasis was put considering the relevant impacts on these two levels. The elements identified as being specifically influenced by revenue streams were: project Cost recovery, Revenue risk, Incentives, Allocative efficiency, Internalization of environmental costs, Public acceptability and equity and Marginal costs of funding.

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As a way to overcome some of the drawbacks of the remunerating the private entity in charge by the typical revenue streams generated by the project, independent remuneration approaches and their effects on the above elements (particularly revenue risk and incentives) were also discussed.

This review and analysis provided the basis of knowledge applied in the analyses conducted fpr the elaboration of the funding scheme typology.

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APPENDIX: Previous EU Funded Research

The funding of transport infrastructure and its implications on internal and external performance factors has been covered in previous EU studies. They focus on specific funding schemes and/or specific performance factors. The table below presents an overview on their scope, objectives and performance factors covered. BENEFIT gives an additional step by focusing simultaneously on all possible sources and schemes of funding and by studying in particular their relation to business models.

Table A.1– Previous EU studies related to transport funding and pricing

Study	Main topics	Objectives
ENACT – Design Appropriate Contractual Relationships (2007-09)	- Pricing (social marginal cost) - PPPs	1) To study the constraints and provide recommendations for the conciliation of Social Marginal Cost Pricing (SMCP) and the development of Public-Private Partnerships in the transport sector.

Key findings

1) SMCP principles: highly differentiated pricing systems; users' perception, transparency and acceptability constraints; imperfect pricing of substitute/complementary goods; existence of transaction costs; public deficit and debt; equity issues.
2) SMCP (welfare goal) vs. Cost recovery (private goal): second best solutions (for cost recovery) more appropriate when private funds are required; need to deal with social cost components in a transparent and effective way; SMCP basis for more suitable pricing principles to attract private investors without disregarding transport's social component.
3) Contractual design for better PPP performance: application of PPPs in transport sector not much affected when SMCP or second best alternatives are introduced; direct payment by users preferable when users are better able than the government to observe performance and have alternatives available
4) Risk evaluation: financial impact of SMCP application depends on level of sunk costs considered in contract; unreliable for private partners due to many ways of calculating SMCP, greater uncertainty and higher risk premium leading to tension for renegotiation and increased contractual and transaction costs; performance enhancement mechanisms to be used to ensure agents behave towards efficiency
5) Requirements for SMCP implementation: PPPs in transport can be fully compatible with SMCP when they are performance-based, rather than based on direct user charges; performance-based PPP arrangements require reform of accountancy system to create institutional capability for monitoring infrastructure business and avoid market bias; need for harmonised framework for charging, state aids, and definition of port and airport infrastructure; for public transport services SMCP to be integrated in PPP contract, as well as supplementing revenues with subsidies in case cost recovery is not achieved; accounting framework based on systematic Activity Based Cost rationale would permit to identify with greater detail functional costs and make charging equal or above marginal external costs and below total costs, clarifying the drivers for each cost category; current EU policies and associated legal frameworks offer no barriers to implementing the practice of bridging cost accounting and charging for transport infrastructure services

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Study	Main topics	Objectives
DIFFERENT – User Reaction and Efficient Differentiation of Charges and Tolls (2006-08)	- Pricing economics - Behaviour	To improve understanding of user reactions to differentiated prices, design approaches to determine efficient differentiation of infrastructure cost based charging schemes. Analyse and demonstrate the benefits and effectiveness of differentiated charging and taxation schemes as a means to manage mobility, externalities, equity aspects and to obtain revenues and recover infrastructure costs.

Key findings

1) Pricing-schemes were rarely implemented in pure textbook forms, but rather reflected a compromise between various aspects and approaches
2) Optimal degree of differentiation beyond which further differentiation was counter-productive
3) Political influence on pricing structures was always discernible and therefore should not be disregarded in the design of pricing-structures
4) Normative economic theory identified 3 main dimensions to be taken into account: Aims of pricing; Cost structure; and Demand of infrastructure user
5) Price changes/differentiation affect travel behaviour and mode choice leads to changes in transport demand, but depend very much on examined mode and particular circumstances

RAILCALC - Calculation of charges for the Use of Railway Infrastructure (2006-08)	- Railway charging - Social marginal cost pricing	To develop a best practice guide to verify compliance of rail infrastructure charges within the rules of Directive 2001/14 and to analyse the way infrastructure charges are calculated in Member States and to harmonise accounting practices in this domain.

Key findings

1) Basic charges (CUA) recovering marginal operation, maintenance and renewal costs, incorporating significant cost drivers able to reflect the contribution of different types of rolling stock in different types of infrastructure
2) Mark-ups allocated to railway services after having explored the WTP of operators, taking into consideration intermodal competition effects
3) Reservation charges increasing as departure time approaching
4) Performance schemes applied to all services, based on measurement of delay minutes caused or suffered by every stakeholder
5) Scarcity charges applied only to sections declared congested, sufficiently differentiated per time band
6) Environmental charges reflecting external marginal costs and differentiated according to cost causation-related variables
7) Discounts intended to stimulate the use of new network links
8) Need for detailed cost allocation to physical & organisational accounting units

FUNDING - Funding infrastructure: guidelines for Europe (2005-07)	- EU transport funding - Efficient pricing	Developing a scientifically sound approach to the funding of large transport infrastructure investments in the EU, exploring two possibilities: 1) the creation of an EU transport infrastructure fund financed by mark-ups on transport activities; 2) the use of mark-ups on the users' costs charged by the infrastructure suppliers that make the investment.

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Study	Main topics	Objectives
Key findings 1) Development of scenarios to address problems of current funding framework for large European transport infrastructures and range from heavy reliance on European funds and low mark-ups on user prices for new infrastructure to small reliance on European fund and important role of internal funding of investments via mark-ups, 2) Computation of revenues and financial gaps, per mode and per country: more tax revenues can be raised in the transport sector at a limited welfare cost, 3) Testing of EU-wide equity and efficiency effects of alternative pricing and revenue use scenarios with and without EU subsidies: a) not all projects have significant benefit spill-overs, b) rate of return of many projects is low, c) when there are benefit spill-overs (so that the project receives EU funding), the rate of return increases significantly but this is often insufficient to adopt the project, d) the proposed EU subsidy scheme does not appear to systematically hurt poorer countries, 4) Taxes and marginal external costs: when taxes are low relative to marginal external costs, then it is economically efficient to increase taxation; similarly, high subsidies relative to marginal external costs are inefficient and peak-period taxes are economically efficient.		
REVENUE - Revenue Use from Transport Pricing (2003-06)	- Pricing - Earmarking	To study the implications and produce guidelines on the application of revenues from social marginal cost pricing in the transport sector.
Key findings 1) The merits of earmarking: ○ rests on pragmatic grounds ○ enhances acceptability ○ increases efficiency if it deters politicians from making self-interested, socially wasteful decisions ○ can harm efficiency by preventing money from going to the most economically worthwhile uses ○ channels revenues to both economically efficient and publicly acceptable uses ○ well-targeted earmarking schemes will be undermined if funds from other sources are reduced in an offsetting way 2) Acceptability of charging and revenue use policies: ○ a condicio sine qua non of transport policy reform and a major consideration in the design of pricing and revenue use policy packages ○ earmarking may help achieve acceptability, as long as all stakeholders are convinced that charges are imposed fairly and evolve as promised 3) Institutional arrangements and assignment of responsibilities for charging and revenue allocation: ○ the merits of alternative infrastructure investments favour assignment of responsibility to local governments, ○ spill-over problems between regions related to interregional traffic, pollution etc. call either for centralised government control or coordination between neighbouring regional governments ○ dangers of delegating decision-making to an authority below the level at which the impacts will be felt, need to develop proposals on a consensus basis between authorities 4) Transport infrastructure financing and operation delegate to the private sector because of its lower costs and association with earmarking of revenues		
CURACAO - Coordination of Urban Road User Charging Organisational Issues (2006-09)	- Urban road charging	To research and monitor the results of the implementation of road user charging as a demand management tool in urban areas. ▪ The strategic objectives of the project were: ▪ to co-ordinate the synthesis, appraisal, and reporting of research activities, case studies and other initiatives in the field of urban road user charging; ▪ to compare and contrast different approaches to urban road user

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Study	Main topics	Objectives
		charging such as tolling, distance-based pricing and charges for infrastructure and parking; ▪ to facilitate the exchange of information, raise awareness and disseminate and promote research results and best practice at a European, national, regional and local level; ▪ to maintain the sound knowledge base, established by the CUPID, PRoGRESS and EUROPRICE projects to support decision-making and integration of research results into policies; ▪ to ensure that the work undertaken to achieve these objectives is responsive to the needs of potential end-users, notably city decision-makers ▪ The main result of CURACAO is the development of a generic urban blueprint that can serve as a catalyst and enabler for the implementation of road pricing in European cities.

Key findings

The policy recommendations developed on the basis of the evidence collected in the State of the Art Report and the Case Studies are addressed to City and Regional Authorities, National Governments, and the European Commission.

1) Recommendations to City and Regional Authorities
   - P1: Before considering RUC as a sustainable urban transport strategy, City and Regional Authorities should clearly specify their objectives and stick to them consistently.
   - P2: A RUC scheme should be designed considering the full range of complementary policies that will support it.
   - P3: City and Regional Authorities designing a RUC scheme should allocate resources for continuous monitoring of performance after its implementation.
   - P4: Acceptability should be addressed at the outset of the RUC scheme design process in all its different aspects. A persistent dialogue with the public, pressure groups, politicians and the media is needed.
2) Recommendations to National Governments
   - P5: National Governments are recommended to develop a clear national transport strategy. This strategy should also highlight the potential benefits of RUC as a tool for demand management at both local and national levels.
   - P6: The application of RUC schemes should also be considered as part of a wider strategy involving the internalisation of external costs and the adjustment of road and vehicle taxation systems.
   - P7: National Governments are recommended to ensure the provision of appropriate legislation which will enable city, local, and regional authorities to implement both RUC and the policy instruments which will complement it.
3) Recommendations to the European Commission.
   - P8: The Commission is recommended to publish guidance for authorities interested in considering RUC as a policy tool.
   - P9:The commission is also recommended to provide financial support to:
   - cities to carry out feasibility studies addressing ways to reduce congestion and environmental impacts including RUC options, and to support research and demonstration projects that specifically address key issues (e.g. acceptability, requirements for effective implementation, economic and equity impacts); educational campaigns, training schemes and toolkits explaining the rationale behind RUC as one valid option in the range of measures available to transport planners, and encouraging citizens' and stakeholders' participation in finding out approaches to tackling sustainable mobility issues; research on standardisation and interoperability of RUC systems and technologies.
   - P10: The Commission should also bear in mind the need for governance structures which enable city authorities both to implement RUC (and the policy instruments which complement it), and to collect and use scheme revenues in accordance with policy objectives.

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Study	Main topics	Objectives
IMPRINT EUROPE - Implementing Pricing Reform in Transport - Effective Use of Research on Pricing in Europe (2001-04)	- Efficient pricing	▪ To draw together the results of research in the field of pricing and to make them accessible to stakeholders; To identify, through comparative work, the prerequisites for the development of an integrated approach to implementing the European pricing reforms.

Key findings

1) Measurement of marginal social cost:
   - infrastructure cost is best measured by an allocation process informed by econometric studies
   - established approach to measuring congestion costs – concerns on data availability and lack of studies on modes other than road
   - extent to which pricing reform can contribute to efficient allocation of scarce capacity in rail and air remains uncertain due to the complexity of cost measurement and implementation in pricing policies,
   - identifying external component of accident cost is uncertain
   - progress on measurement and valuation of environmental cost, in particular noise and air pollution; disagreements remain regarding the treatment of global warming,
   - seek consensus on a lower limit of costs that should be reflected in price
2) Impacts, acceptability and phasing of pricing reform:
   - the biggest responses to pricing reform tend to involve re-organisation of travel whilst continuing to use the same mode although there is also good evidence of some transfer between modes
   - distributional impacts will vary both with the design of schemes and the use of revenues
   - land-use impacts vary with the detailed design of schemes; with appropriate design and use of revenue the limited evidence is that these can be positive
   - broader economic impacts are uncertain, might be negative, but could be offset by appropriate use of revenue
   - acceptability is higher where problems are particularly acute and demonstrable, where there is an identified package of complementary measures and where revenue use is transparent and/or earmarked - also where initial price changes are simple and modest
   - revenue use is key, need of transparent and acceptable arrangements that do not constrain revenue use in an efficient way
   - making simple and modest reforms first, progressing towards more sophisticated charging systems, can address concerns about reform
   - implementation steps identified to serve as a guideline for policy-makers.
3) Key Issues for Newly Associated States:
   - strong link with financing: financing needs are more acute, and other sources of finance more limited,
   - congestion is not so much of a problem, so it is more difficult to demonstrate to public that there is a problem worth addressing via pricing
   - issues concern transit traffic and peripherality; risk that NAS countries incur substantial costs to improve infrastructure for transit traffic but cannot recover this in price because of low congestion
4) Importance of sharing experiences of existing member states with NAS and identifying good practices.

TIPMAC - Transport Infrastructure and Policy: a macroeconomic analysis for the EU (2001-03)	- Macro-economic impacts - Investment - Pricing	Combine transport modelling with macroeconomic modelling to study the indirect macroeconomic impacts of transport infrastructure investment and transport pricing policies in the EU.

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Study	Main topics	Objectives
Key findings		
1) All scenarios were revenue neutral, with the SMCP charges in 2 scenarios (SMCP & SMCP+TEN-T) being offset by reductions in personal income tax. 2) The 2 model systems (ASTRA & E3ME/ SCENES) showed considerable dynamic macroeconomic impacts in the SMCP scenarios, with significant increases in GDP and employment from the "Business as Usual" (BAU) in the SMCP scenarios. 3) Fuel Tax+TEN-T scenario has relatively small macroeconomic impacts. 4) Medium to long-term impact of more rapid completion of TEN-T projects is small in comparison to the BAU case; macro-economic impacts are hence dominated by revenue recycling. 5) Results for changes in employment by country from the BAU are very similar to those for GDP, with small or no employment change from BAU in all scenarios and most countries. 6) Overall change in CO_2 emissions from the BAU across the EU is very small for all scenarios considered. 7) Overall pattern of results across industrial sectors reflects the average across EU countries within both models. 8) Low aggregate effect on industrial activity from the more rapid construction of TEN-T infrastructure projects. 9) Overall transport results have similar patterns to the macroeconomic results when the 3 scenarios are compared; considerable differences between the two models.		
PATS – Pricing Acceptability in the Transport Sector (1999-2001)	- Pricing - Acceptability	▪ To identify the reasons for acceptance/ non-acceptance of new forms of transport pricing, to find ways of increasing their acceptability, and to identify the legal and political barriers to the implementation of new pricing schemes.
Key findings		
1) Objectives of pricing measures must be clear and reasonable to those affected by them; new types of measures to be preceded by awareness raising campaigns, 2) Price should be seen to relate to real costs of transport, in order to make new or higher charges acceptable, 3) Transparent use of revenues raised by pricing measures is essential in securing acceptability, 4) Privacy protection is necessary precondition for an acceptable pricing scheme, 5) Introduction of pricing measures in a stepwise way, avoiding price shocks; compensation measures for disadvantaged groups. 6) Widespread suspicions of governments' motives for increasing prices and belief that transport is already too heavily taxed, 7) Selected authority to run pricing scheme should be capable, trustworthy and accountable, with the power to integrate pricing with other policies to tackle transport problems.		
FISCUS – Cost Evaluation and Financing Schemes for Urban Transport Systems	- Urban mobility costs - Urban public transport financing	Evaluation of internal and external urban transport costs to enable cost comparisons between public transport and private car; financing of urban mobility.

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Study	Main topics	Objectives

Key findings

1) New mechanisms such as private finance, value capture and cross funding,
2) Three financing packages identified, combining various pricing mechanisms and finance sources, based on:
   - electronic road pricing, parking/cordon charges and public transport tariffs all being differentiated by time of day, with public budgets providing subsidies and capital as necessary
   - differentiated charges, but with private finance and value capture,
   - making each mode commercially viable, with no subsidies or cross financing.
3) First two packages are given preference, with the choice depending primarily on the adequacy of funds for investing in the transport system.

PRIMA – Ways and Means to Increase the Acceptance of Urban Road Pricing	- Urban road pricing - Accepta-bility	▪ To analyse the reasons behind the acceptance/ non-acceptance of urban road pricing schemes and to find measures to increase its acceptability.

Key findings

1) Acceptance depends on stakeholders perceiving that there are severe and urgent traffic problems and that pricing is an effective part of the solution,
2) Acceptance requires alternative modes of transport to be available,
3) Charges should start low, and compensating measures for disadvantaged social groups,
4) Introduction of road pricing in a stepwise manner to allow gradual adjustment.
5) Adjustment of national legislation and financial support from government may be needed to ease the change in costs for car users,
6) Acceptance requires public participation in the decision making process, open discussion of traffic problems and urban transport policy objectives.
7) Success of earlier road pricing schemes influences acceptance,
8) Increased use of IT and electronic payment systems in other applications is expected to improve acceptance of technologies needed for efficient road pricing,
9) Acceptance from a majority of citizens cannot be expected from the outset; it tends to increase after the implementation.

EUROTOLL - European Research Project for Toll Effects and Pricing Strategies (1996-99)	- Road pricing	▪ Assess the road pricing and tolling mechanisms, including the usage of tolls as a financial leverage tool.

Key findings

1) Less traffic congestion: a) car drivers re-schedule departure times if tariffs vary throughout the day according to demand, b) if tariff systems reward re-routing, a significant number of car drivers will do so,
2) Road pricing has not been observed to lead to significant modal shift,
3) It takes time for users to change their behaviour in response to price signals,
4) Strategies to integrate pricing measures and transport information applications, are able to reinforce the positive effects of both.

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