Planning, choices and assessment.

Defining an integrated framework to create robust, sustainable infrastructures [1]

Presented at the MIMS seminar on 21/01/2021:
Public works: planning, policy choices and assessment criteria.
Defining an integrated model for sustainable development

1. Introduction

Our country faces various challenges on the road to defining a more robust, inclusive and sustainable development model. In this light, the process for infrastructure planning and selecting policy options needs to be supplemented by innovative aspects that provide public decision-makers with more complex information than in the past. Such complexity lies in the multidimensional nature and integration that is inherent in the concept of sustainability (as is clear in the framework set by Agenda 2030 and the 17 Sustainable Development Goals - SDGs). It also forces policy makers to adopt systemic thinking in defining its so-called objective function. The new name of the Ministry of Sustainable Infrastructures and Mobility (MIMS) clearly highlights such change and makes its irreversible, but at the same time it shows the fundamental importance of creating an orderly process for planning and selecting works, as well as for defining the characteristics they should have. Such a process will be essential for ensuring the new policy direction is consistent and resilient, while also allowing structured engagement with stakeholders using a robust methodological and procedural approach. Throughout 2021, the Ministry made decisions on the basis of this new conceptual and policy framework and in line with the principles and conditionality of the *Next Generation EU* fund, defining the goals, reforms and investments in infrastructure and mobility to be included in the new National Recovery and Resilience Plan (NRRP). The so-called Infrastructure Annex to the 2021 Economic and Financial Document makes clear the choice to foster sustainability, especially through the inclusion, *inter alia*, of an assessment of the NRRP in the light of the SDGs. In parallel, the new guidelines on drafting the Technical and Economic Feasibility Project (TEFP) issued by the Higher Council for Public Works and the guidelines for public debate have both given central importance to the various aspects of sustainability in the decision-making processes involved in public works.

The focus on sustainability in selecting public investments has gained even greater traction because of the recent changes to the rules that define the role of the Inter-ministerial Committee for Economic Planning and Sustainable Development.[2] The new rules require that this Inter-ministerial Committee's procedures and investigations include assessments as to the pursuit of sustainable

[1] This document has been drafted by a MIMS working group coordinated by Davide Ciferri and consisting of: Flavia Melchiorri Terribile, Sauro Mocetti, Michele Torsello, Andrea Tardiola. A special thanks to the various MIMS offices for their ideas and suggestions while creating this document.
[2] The reform set out by Law no. 141 of 12 December 2019 ratifying the so-called "climate decree", which sets out the Inter-ministerial committee for Economic Planning becoming the Inter-ministerial Committee for Economic Planning and Sustainable Development, directs public investments towards national sustainable development goals.

development goals that are consistent with Agenda 2030, the National Sustainable Development Strategy and the Fair and Sustainable Well-being indicators.

In addition, as part of the commitments for the NRRP, the Government recently adopted a draft implementing act with the guiding principles and criteria for the reform of the Italian Public Contract Code. This includes, among other aspects: pursuing goals that are strictly linked to European directives by introducing or maintaining the minimum levels of rules and regulations required by the self-same directives; better defining the contracting authorities; reducing the times for tender processes, signing contracts and creating public works, and making these times more certain, partly through the use of digitalisation; fostering stable employment, equal opportunities across generations and genders, and workplace inclusion for people with disabilities; setting out specific forms of simplification to encourage investments in green and digital technologies, and in innovation and research, to achieve the sustainable development goals in the UN 2030 Agenda.

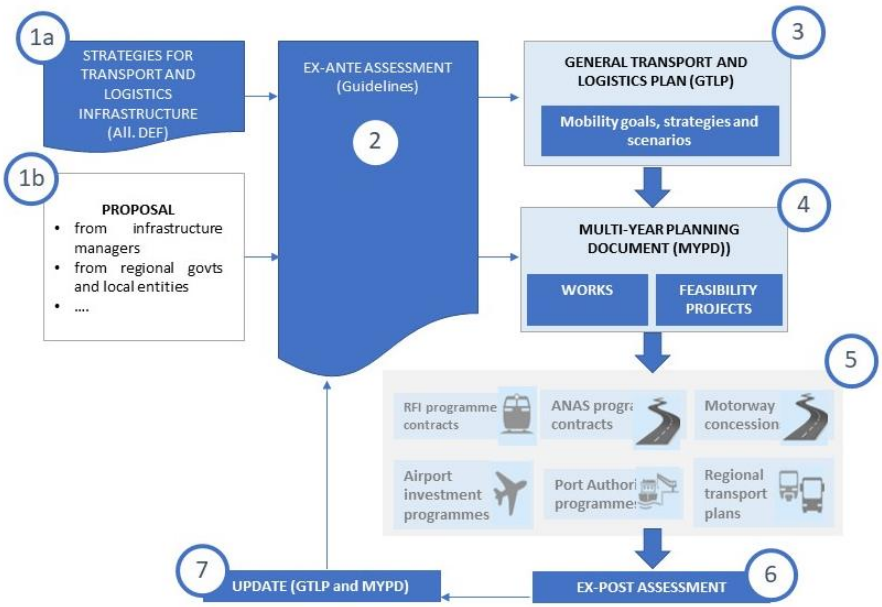
Against such a backdrop, this document sets out a proposal for reforming the infrastructure programming and planning process. It envisages introducing new methodological tools to make economic, environmental and social sustainability more central to the Ministry's decision-making process. However, this is done with full awareness that no algorithm based on the data available at a specific moment in time - even if such an algorithm is superbly designed and methodologically sound - can ever fully capture the complexity of policy decisions, as these relate to dimensions that are tricky to categorise and order, and require some degree of freedom to be maintained. At the same time, the optimal and balanced management of such flexibility could require a clear conceptual scheme that can actually guide the Ministry's own policy-making function so as to guarantee increased accountability for the individual decisions made and to reduce the number of decisions that are inefficient as they do not match the underlying general policy principles.

This document is arranged as follows. The second section describes the planning and scheduling processes according to "current legislation", while the third section describes the current weaknesses in relation to implementation and the consistency with the conceptual framework underlying Agenda 2030 and *Next Generation EU*. The fourth section sets out a proposal for how a new decision-making and planning processes could be, and the fifth describes the main methodological tools supporting this new approach.

2. Planning framework and policy choices: the model under current legislation

The current Italian Public Contract Code (Legislative Decree no. 50 of 2016) sets out how to move beyond Law no. 431/2001 (also known as the "Objective Law") and, in doing this, lays the groundwork for a new infrastructure planning and scheduling process. More specifically, article 200 and following describe the planning approach for identifying infrastructure (and priority settlements), while article 23 and following describe the new levels and related hierarchy for the project documents for the individual stages. This planning process is shown in Figure 1.

Figure 1 - Infrastructure planning process



The process starts by determining the strategic work required. This is done by analysing those projects already included in previous planning documents (point 1a in the graphic) or those based on proposals (1b) from a range of proposing bodies (central or regional administrations, local entities and so on) and infrastructure managers (RFI, Anas and so on). Additionally, article 200, subsection 3, of the Code, in relation to the identification of infrastructure, assigns the Ministry the role of selecting, from all the proposals received, those to be included in the Multi-Year Planning Document (MYPD), which then becomes the main planning document for Ministry action.

The Ministry then conducts a series of *ex-ante* analyses of the individual works (point 2 in the graphic) as part of its strategic guidance role. These analyses are conducted using the information and document sets provided by the proposing bodies in accordance with the Guidelines for the Assessment of Public Works (Legislative Decree no. 228/2011). The Code specifically sets out that - for the purposes of inclusion in the MYPD - **regional governments, the administrations of the autonomous provinces and metropolitan cities and other competent bodies can submit proposals for work of significant national interest to the MIMS, along with a feasibility project.** Once MIMS has assessed whether the work is consistent with the methods and criteria set out in the Guidelines, it includes it in the MYPD, setting the priority level. In this approach, in accordance with article 8 of Legislative Decree no. 228/2011, the *Guidelines* describe the essential aspects in the feasibility project that are the competence of the MIMS, with any additional technical and methodological aspects set out in sectoral documents ("Operational Guidelines") that identify and present the most appropriate assessment methodologies for each area (railways, roads, water infrastructure, building, etc.).

For this stage, the legislation also envisages an additional planning tool, namely the General Transport and Logistics Plan (GTLP), which sets out the strategic guidelines for the mobility policies for people and freight on the basis of the forecast national and international demand and supply of transport. This plan also plays a part in identifying the strategic goals for the integrated national transport and logistics system (point 3 in the graphic). The GTLP is adopted every three years.

The results from this assessment stage (which are closely linked for the transport and logistics industries) are set out in the MYPD, which is the consolidated three-year planning tool for resources for public investments. This document (see Table 1) contains a list of the actions that are the competence of the Ministry that are to be financed and a list of the works where the feasibility project was determined to be worth funding (article 201, subsection 3). Thus, the MYPD is effectively a summary of all the financial planning and should include details of any additional resources, especially any resources from the Cohesion and Development Fund, National Operational Programmes and - with a view to the NRRP- those based on *Next Generation EU* resources.

Table 1 - Contents of the MYPD

Sections	**Content**
Infrastructure needs analysis	▪ A list of the infrastructure needs based on the analysis and information in the ascendant phase (indication of the priorities from the various levels of government and the main promoting bodies) and the descendant phase (centralised guidelines from the GTLP and national and European strategies)
Ex-ante analysis and selection of works	▪ Results of the *ex-ante* analyses of works ▪ List of the work that is the competence of the MIMS that need to be funded ▪ List of the works with a feasibility project that were deemed worthy of funding ▪ Prioritisation of works
Ex-post assessments	▪ List of the works to be submitted to ex-post assessment ▪ Results of the ex-post assessments and monitoring of the work that has been completed or is being done

The subsequent stage (5 in the graphic in Figure 1) is about the creation of the works, for which article 23 of the Code classifies the project documents for contracting based on three successive levels of increasingly in-depth technical analysis:

1. Technical and Economic Feasibility Project (TEFP)
2. Final Project
3. Executive Project

For the purposes of this document, it is worth noting that the Code sets out - for any work equal to or exceeding the threshold indicated in article 35 (€5.3 million for public works and concessions), for projects where public debate is required (article 22) or for projects chosen through competitions for planning and ideas (article 152) - that the TEFP is preceded by a Feasibility Document for Project Alternatives (Feasibility Document, article 3, subsection 1, letter ggggg-*quater*). The Feasibility Document indicates and analyses possible alternative project solutions and provides qualitative (especially in environmental terms), technical and economic details of the assessments of each one. Unlike other planning levels, the Feasibility Document is not "governed" by specific rules, especially on the minimum required details. The aforesaid *Guidelines* try to partially close this gap by specifically requiring that analyses are produced on the alternative project solutions.

Table 1 - Content of the three planning levels

Document	Content
Technical and Economic Feasibility Project - TEFP (article 23, subsection 5)	The TEFP indicates, from among the various solutions, the one with the best cost-benefit ratio for the community given the specific needs to be met and services to provide. In the TEFP, the designer produces the graphics used to identify the size, volume, type and functional and technological characteristics of the works to be built, along with the related economic forecasts.
Final Project (article 23, subsection 7)	The Final Project comprehensively indicates the work to be done in accordance with the needs, criteria, restrictions, guidelines and indications set by the contracting authority, coherently with the TEFP. The Final Project also contains all the aspects needed for the issuing of the required authorisations and approvals, and for the definitive determination of the spending limit for the work and the related timetable.
Executive Project (article 23, subsection 8)	The Executive Project, drafted in compliance with the Final Project, sets out all of the work to be done in detail, the forecast cost and the timetable in accordance with the Final Project. The detail must be such that there is information about the form, type, quality, size and price of each element. The Executive Project must also contain a specific maintenance plan for the work and all the various parts, based on its life cycle.

The actual work done during the creation phase (point 5) varies according to project sector and area. "Programme contracts" are used for railway and road works (except for motorways run on a concession basis), while "specific investment programmes" are the tool used in other areas (airports, ports, water infrastructure, local public transport and so on).

The ex-post impact assessments (point 6) conclude the assessment cycle for work. In general, ex-post assessment focuses on specific works, although where useful and pertinent, as envisaged by Legislative Decree no. 228/2011, an ex-post evaluation can also cover a series of works with a functional, sectoral or territorial connection. The Code requires that the MYPD expressly indicates the list of the works to be submitted to ex-post assessment and the results of such an assessment on:

- Works included in previous MYPDs that have already been tested and can be used
- Any works that have already been tested/approved and can be used, but that are not included in previous MYPDs
- Public works that are incomplete or still being created.[3]

The *Guidelines* require that the MYPD includes the following for any works that are already in use:

- The result indicators and the impact indicators
- An analysis and an explanation of any discrepancies compared to the *ex-ante* assessment, focusing specifically on any variables that changed and impacted the costs, revenues and benefits
- A comparison of the ex-post results against national benchmarks
- An analysis of the implementation process, examining the procedures and methods used for project implementation, and determining and analysing all the problems that had an impact on the planned project progression.

[3] Since the ex-post assessment of works that are incomplete or in the process of being created involves monitoring the work underway and so provides an analysis of the degree of completion of such work, creation times and costs (i.e. implementation process efficiency), only those works of strategic importance and a cost exceeding €10 million can be included in the selection.

- The results from repeating the cost-benefit analysis or the cost-effectiveness analysis.

Ministries are required to transpose the content of the MYPD into any contracts they enter into with supervised companies that systematically perform ex-post assessments so as to measure the impact of the works created and determine any discrepancies compared to the goals and indicators set during the planning and scheduling stage. The MYPD can be updated annually (point 7) to increase the efficiency of the planning cycle and to bolster efficacy in the light of the evidence arising from the analyses or from changes in the reference scenario.

3. Weaknesses of the current planning framework

Over the years, the planning framework envisaged by the Code has proven to have a series of weaknesses that have undermined its implementation, especially for work by the MIMS. While these weaknesses are diverse, they are strongly correlated and can be grouped under three macro-categories: problems with application; functional inconsistencies and a lack of clarity for some defining aspects; aspects of methodology and expertise.

3.1 Problems with application

First, the failure to update the GTLP has meant any scenario and policy assessments (especially for the transport and logistics sectors) lack the necessary quantitative aspects and forecasts. Such problems are also found in other areas. The fragmentation of decision-making processes combined with the need to move ahead with certain initiatives regardless has greatly reduced the capacity over the years to create reference planning documents that provide a genuine framework within which to decide on which projects to finance.

So, the selection process was only partially structured into definitive steps, particularly because of organisational shortcomings (e.g. the Planning Department is only a recent creation). The knock-on effect of this is that those documents that both legislation and internal procedures require have not been updated with the necessary regularity to ensure an effective planning process.

Even during the "ascendant" stage when needs are being determined various problems are evident. The various Ministry offices do periodically collect the needs expressed by the various key stakeholders (central and regional administrations, local entities, primary contracting authorities), but this tends to lack structure, especially when it comes to the actual information provided. This is definitely influenced by the diverse nature of the proposing bodies and contracting authorities, making it difficult for them to produce proposals that match the criteria set out in the Guidelines, as required for the *ex-ante* analysis of any work. As a result, the legislative requirements for such analyses have largely been disregarded, with the sole exception really being specific major projects, and there has been no guarantee of the necessary transparency in the preliminary documentation (especially the Feasibility Document and cost-benefit and cost-effectiveness analyses) required by the regulations.

The combined effect of a bottom-up system (due to the lack of or shortcomings in a national plan) and the different abilities of stakeholders to plan and execute work has produced two undesirable effects (that are partly connected):

- Non-optimal resource allocation: a different allocation would have produced a better overall effect
- Widening of geographical gaps: projects are undertaken based on the ability of the proposing bodies to plan projects rather than the effective needs of an area.

The difficulties in linking choices to scenarios that are updated periodically are evident in the lack of explicit priorities and the consequent "order of merit" for works that are financed. More specifically, the Infrastructure Annex to the Economic and Financial Document, which effectively replaces many of the steps indicated above (particularly the drafting of the MYPD) pending the full adoption of the design envisaged by the Code, is rather "neutral" in how it presents the priority works.

The combined effect of these shortcomings is that decisions have tended to be influenced by what can be termed "inertia dynamics" such that the most "mature" projects tend to receive priority, meaning that the "basket" of potential policy choices contains, over time, options that might have lost their strategic importance because the economic, social and technological context has changed.

3.2 Functional inconsistencies and a lack of clarity for some defining aspects

The second category of weaknesses relates to the functional inconsistencies that remain in the Code-defined process and to the lack of clarity in some defining aspects for the identified tools. In particular, as noted previously, the planning process envisaged by the law provides no clear reference to the definition of the strategic framework for policy decisions. The needs analysis is based largely on the ascendant or descendant collection of requests and projects at local and central level, without any calibration of these in relation to general strategies. As a consequence, despite the express effort found in the Infrastructure Annex to the 2021 Economic and Financial Document, any sectoral survey of the main planning documents that do exist has found no specific reference to policy consistency.

This discrepancy is especially evident when focusing on the position of the GTLP within the process. Indeed, this plan "follows" the identification of needs and the *ex-ante* assessment of works, but in logical terms it should be the main tool used to define a data-driven needs framework (in the transport and logistics sectors) to supplement what has been identified by the relevant stakeholders.

At the same time, there are some inconsistencies in the definition of various tools. More specifically, the content and "positioning" of the Feasibility Document in the process are neither unambiguously defined nor is there sufficient clarity as to the difference between the "feasibility project" for the *ex-ante* assessment phase and the technical and economic feasibility project for the downstream decision-making stage.[4] In all likelihood, this problem has only been amplified by the changes made by the Higher Council for Public Works to the TEFP guidelines for NRRP project. The changes made, especially in pursuit of the goal of speeding up the authorisation process, meant that much of the TEFP was pushed into the Final Project (although useful changes about the sustainability of the work were introduced) and this significantly reduced the part on project alternatives (also relevant for the public debate procedure). While this is consistent with what happens in the NRRP (where the

[4] In purely legal terms, in the Code the terms "feasibility project" should be understood as the "Technical and Economic Feasibility Project".

selection and decision-making process happened while drafting the plan), it might not be as effective for other MIMS planning.

3.3 Aspects of methodology and availability of expertise

The final category of shortcomings groups together methodological aspects and the availability of expertise at the Ministry. To ensure sufficient "depth" for the planning process, over time MIMS needed to have developed a host to expertise and methodological tools that it could use for providing quantitative support for decision-making, as per legislative requirements. First, the *Guidelines* themselves recall the importance of appropriate modelling to analyse transport matters. However, the ups and downs of the so-called Information System for Transport Monitoring and Planning or *SIMPT Model*[5] (which even indirectly impacted the required updates of the GTLP) have long hindered any attempts to develop in-house skills and know-how that could be usefully adopted in making transport policy decisions. The result of this has been twofold: on the one side, the Ministry's decision-making process has had to deal with information asymmetry between itself and the proposing bodies (which, in some cases such as the railways and motorways, have tools able to analyse traffic flow demand); on the other side, it has had to manage observations from external stakeholders that, in some cases, highlighted the lack of robust transport and economic scenarios for the selected works (as also seen in some of the comments for the NRRP).

Significant structural shortcomings can also be found in economic, social and environmental analyses, and not only for transport. Indeed, given current and future analysis requirements, there is a lack of models able to estimate the economic side of investments (in the short and long-term, incorporating the effects the infrastructure could have on reducing transport costs and the competitiveness/appeal of a specific area, within a balanced economic outlook) and the social and environmental implications, as done, for example, by the European Investment Bank or even the Commission, with the support of the JRC.

A third area of methodological weakness can be found in the tools used for priority analysis. As described previously, the decision-making process envisioned by the Code includes an *ex-ante* analysis phase that should produce the order of strategic priorities used to draft the MYPD. At present, there is no selection methodology for this stage (e.g. scoring models for the works) and there is little definition of the qualitative criteria that describe or structure the Ministry's objective

[5] SIMPT is a multi-modal simulation model developed, using an outsourcing approach, in the early 2000s for the Ministry. It can examine both passenger and goods transport and it has a functional architecture that incorporates a series of different models/modules:

- Demand models (passengers and freight) that can be used to simulate the main features of mobility demand
- Supply models (passengers and freight) that can be used to show the main characteristics of (multi-modal) transport infrastructure and services
- Allocation models that simulate the interaction between supply and demand, thus making it possible to estimate the use of infrastructure and services for both passenger and freight transportation
- Models to analyse impact and performance
- Models to generate long-term socio-economic scenarios.

Despite various efforts over the years to update and improve the modelling (the most recent was in 2018), the model has never been fully functional. The reason for this failure to fully implement this model despite substantial investment can be traced back to the lack of flexibility of the tool given the Ministry's requirements and the lack of in-house expertise to manage and maintain (or update) the tool.

function. So, the choices in planning documents (especially the Annex to the Economic and Financial Document and the 2021-2027 Cohesion and Development Fund general document) lack structured details explaining the decisions made about works deserving funding.

Moreover, the data available to the Ministry also has shortcomings. Such shortcoming relate both to structural aspects used to identify needs (e.g. the dynamics of people and freight transport, efficient and inefficient aspects of the water infrastructure, characteristics of the public buildings that are MIMS's competence and so on) and to the current situation (e.g. surveys of the transport decisions of individuals and companies). The quantitative information about the individual works is not uniform, it is hard to access and it lacks some essential aspects (e.g. carbon footprint).

Finally, as a consequence and/or cause of the aforesaid methodological issues, significant gaps in internal expertise persist in a number of areas, such as quantitative economic analysis, complex data management, and social, environmental and climate sustainability analysis.

4. Towards the definition of a new process for planning works

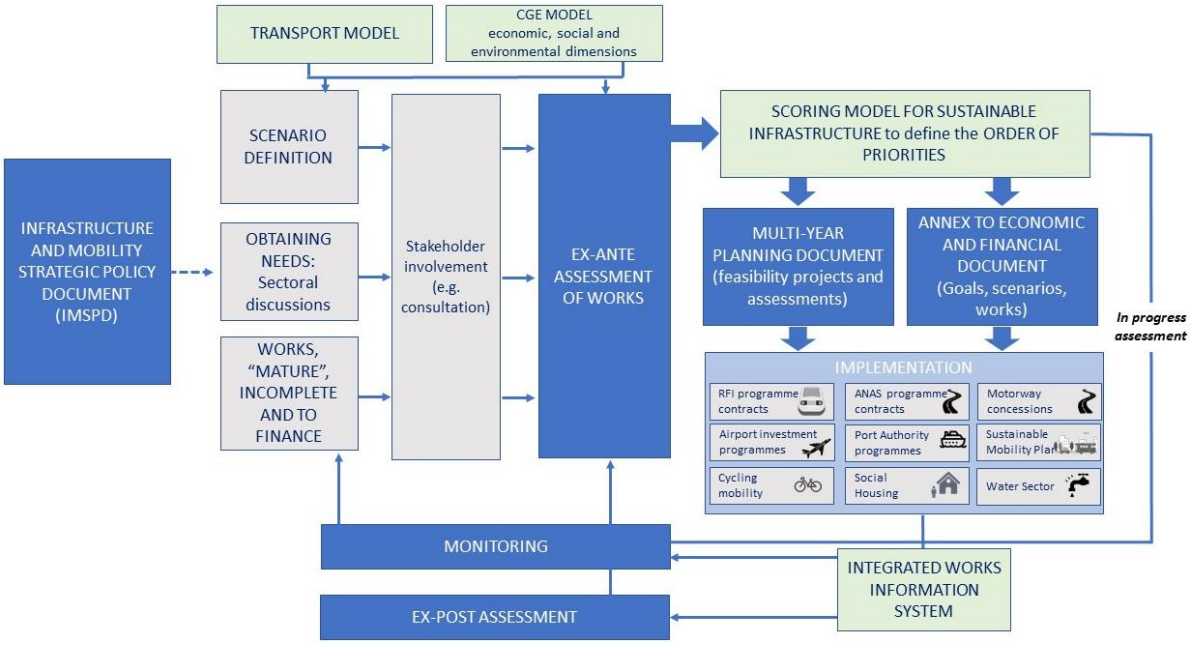
Over five years from the approval of the Italian Public Contract Code, which redefined, as noted, the entire planning and scheduling process for infrastructure, it has become necessary to revise the existing framework given the problems with its implementation and the new needs that have arisen (including those of an analytical nature) because of constantly changing policy priorities, due to the growing importance placed on environmental and social sustainability. In general terms, the process of identifying, selecting and assessing the infrastructure to finance should be in line with the following principles:

- **Consistency**: the layering of planning documents (both for "Europe-Italy" and for "national strategy-sectoral strategy") requires an enhanced governance process to ensure the consistency and synergy of any actions taken.
- **Efficiency and effectiveness**: the process must ensure the timeframe is suitable and calibrated to the identified needs and requirements (efficiency), while also ensuring it is possible to identify the targets that can be pursued with the assigned tools (effectiveness).
- **Flexibility**: defining criteria and scenarios must take into account the uncertainty related to technological developments, as these could, in certain areas (above all, for energy transitioning), have a significant influence on the ability to select the best solutions across different time periods.
- **Proportionality**: various aspects need to be analysed using a proportionality principle that sets out a growing level of detail and robustness for the analyses, in accordance with the value of the work and/or its impact on the local context.
- **Transparency**: the decision-making process must be in a clear and structured format so as to ensure necessary discussions and dialogue with stakeholders (political debate, public debate and so on). At the same time, the figures about the works financed must be organised so as to ensure access, including by external parties, to any information needed for *ex-ante* and, especially, ex-post analyses of works.

Drawing on experience gained, the aforesaid principles and additional international experience, this section sets out a new planning process that moves beyond the limitations of the current model by adding innovative aspects that ensure consistent flows and the structured qualitative and qualitative

background needed for making choices. The graphic in Figure 2 provides a linear depiction of the process. However, it really needs to be envisaged through a dynamic lens as each stage can be followed by autonomous refinement and updating processes to ensure the process is consistent, at all times, with any changes in the reference scenarios.

Figure 2- Proposal for new process for resilient and sustainable infrastructure planning



The linear representation shows the process starts with an **initial stage in which the orientations and guidelines in national and European strategic documents** (e.g. the National Sustainable Development Strategy, the Ecological Transition Plan, Next Generation EU, Fit for 55, etc.) and sectoral documents are determined, to ensure policy consistency and synergy of targets. **These orientations and guidelines are used to draw up a document (Infrastructure and Mobility Strategic Policy Document - IMSPD), updated annually,** that summarises the key targets, quantifying the distance between the current infrastructure situation in the country and the targets. The IMSPD includes the Government's and the Minister's main strategic guidelines and it defines, in programmatic terms, the Ministry's guidelines, thus guiding scenario analyses and potential projects to assess following the reported needs received from central and local levels of government. In such a paradigm, the IMSPD also becomes a "pre-filter" for the list of potential projects as any potential projects that are not consistent with the overall strategies and targets are discarded from the subsequent assessment process (for example, any works or tools that are not consistent with the carbon reduction targets in the transport industry would be discarded).

Using the strategic goals in the **IMSPD**, **the MIMS identifies all the needs and works that could be financed.** In accordance with what the Code already envisages, this stage includes, on the one hand, reporting on any works that are "mature", incomplete and/or have already been funded but not yet built and, on the other hand, collecting the needs expressed by other proposing bodies (e.g. infrastructure operators, local entities and so on). This stage is also when the reference scenarios are defined (and not only for transport) using specific modelling (see section 5 for more on this side) so as to create a quantitative framework within which to analyse the choices as to which projects to fund.

The next stage is the ***ex-ante* analysis of the works**, for which it is necessary to update, extend and (in some cases) amend the aforementioned Guidelines for the Assessment of Public Works. The *Guidelines* and the related sectoral "Operational Guidelines" need to ensure uniform preliminary analyses and provide information that could be used subsequently to conduct a project review, if required, and to determine the order of priorities. The *Guidelines* should make clear what is required in a new "Feasibility Project" (which should be separate from the TEFP, following an amendment of the Code) in which it is possible to assess, separately from the sectoral nature of the proposal, the following:

- Economic and financial dimension
- Social dimension
- Environmental dimension
- Institutional and governance dimension
- Sectoral analyses.

The new Feasibility Project should also include analyses of alternative projects, in accordance with what is envisaged (but not in a structured form) by the Code in the description of the content of the Feasibility Document, which could be "absorbed" in a sense by this new project level. In theory, the decision-making process for any project documentation submitted should be divided into a decision on what needs to be planned (*"what?"*) and on how to do the related work (*"how?"*). In such a perspective, the Feasibility Project is the primary tool for doing the first part, while the TEFP (as defined in the Higher Council for Public Work's Guidelines for NRRP projects) would be the tool used for the second part. The analysis and information in the Feasibility Project are then used **during screening as part of a scoring methodology used to determine, annually, the order of priorities for works to be funded.**

The *ex-ante* assessment process, project review and scoring are then used for the two main Ministry planning documents, namely the MYPD and the Infrastructure Annex to the Economic and Financial Document. At present, the latter document effectively makes up for the failure to draft the former document, until such time as the process set out in the Code is fully implemented. However, unlike this current situation, the two separate but complementary documents should "serve" two distinct purposes. The MYPD presents a multi-year perspective of all priority work in accordance with the scenarios for and needs of the country, setting out the results of the *ex-ante* analyses for each work and the aspects that mean such works match the MIMS's priorities. The MYPD also contains details of the monitoring of any work underway and the ex-post assessment of finished work. By contrast, the Annex to the Economic and Financial Document is a summary of the planning (scenarios, goals, priority work) with a quantification of the financial resources for such work to be included in the planning documents for the use of public funds. As such, this document would become - and this is also consistent with its legislative positioning - a tool for infrastructure funding.

Following the creation stage, which is done using the Ministry's traditional tools (programme contracts, concessions, sector tenders and so on), there is a monitoring and ex-post assessment stage for works. Both of these stages are fed by the creation of an open, integrated information system that collects and orders the information and indicators used for both internal and external analyses. More specifically, this monitoring phase must both involve monitoring project progress (partly to update the list of any incomplete or pending work) and produce periodic assessments, along the way, using the scoring system. In such a perspective, the scoring system adds key dimensions in the creation of a work to both the *ex-ante* (pre-assessment) stage and the in-progress

assessment. On this basis, it can potentially lead to alerts that need to be sent to the proposing bodies, the contracting authorities and the parties involved in the actual creation (e.g. a constantly updated project score could be used to determine a failure to meet certain commitments made during the proposal stage - perhaps the use and recycling of materials, checks on the use of subcontractors, impact on employment, stakeholder engagement).

On the other side, the ex-post assessment, which by definition requires a longer period to be done properly, will provide information about the results of commissioning such work, their effectiveness, and additional or corrective measures required to improve the planning process for future projects to be funded. In this light, it becomes fundamental for the information system to also allow parties outside of the administration and the proposing parties (especially researchers and staff) access to all the information needed to conduct a robust assessment of all completed work.

5. Necessary analysis and methodological tools

Infrastructure is essential for ensuring the mobility of people, the movement of goods, the supply of water and energy, the transmission of information and communication between geographically distant parties. Such infrastructure is the backbone of the economic and social development of an area, impacting productivity, fostering trade with other areas and markets, and bolstering economic and social inclusion.

However, such positive effects cannot be generalised for all infrastructure investment, as they only relate to infrastructure that is economically, social and environmentally sustainable. Certain investments can actually have net negative impacts because:

- Assessment mistakes could have over-estimated the demand for mobility, in relation to substantial resources used to improve the infrastructure.
- Poor governance of the process can increase costs compared to forecasts, cause delays in realisation, produce lower quality than planned and, last but not least, increase corruption.
- The impact on the landscape might be negative, and exposure to climate and environmental risks might not have been properly factored in.
- Poor investment might actually worsen the quality of life in a community and reduce confidence in the government and the institutions.

Despite the costs and benefits of an individual project - which can be measured in a more or less stringent manner and in greater or smaller dimensions - it could also be possible to table broader considerations about the efficient use of resources. For example, the usefulness of investment could also be assessed in terms of the alternative use of resources. Decision as to what infrastructure investments to make cannot be separated from carefully and balanced assessments of the impacts of such investments.

It is well known that debate about the importance of assessing policy choices is always very lively, especially in Italy, where too little has been done on this front in the past. Traditionally, assessments evaluating the tools of economic and industrial policy (especially those microeconomic ones based on identifying counterfactual scenarios) focused on what is added to one-dimensional measurements (e.g. additional effect of action on the level of investment of the company, on the number of employees, on R&D expenditure). Nonetheless, **the goal of sustainable development makes it**

necessary to adopt a multidimensional approach to the impacts generated, looking at both the positive and negative sides, while also foregrounding any trade-offs between the various individual dimensions included in the analysis. Moreover, in traditional approaches the focus is on measuring output (take, for example, the estimates of the impact on GDP in a discussion about the Budget Law or the European Commission's forecasts), but it has become essential to develop and use models able to quantify outcomes, especially in relation to those processes that change the lives of people and companies, which often require medium to long-term frameworks to be fully apparent.[6] Placing suitable attention on all such aspects enables policy makers to target their selection processes more precisely, and this ensures the results will be more in line with the shared overall strategic framework.

At present, at least in methodological terms, the Ministry (and the world of research, in a broader sense) is only partially equipped to tackle this challenge. **Significant investment is required in complementary assessment models**, fostering a cross-fertilisation approach (micro exercises, micro-simulation models, 'traditional' macro autoregressive models, general economic equilibrium models, environmental economy models, etc.) so the results obtained can be systematically analysed. **The new Centre for Innovation and Sustainability in Infrastructure and Mobility, which is part of the Ministry, will play a fundamental role in developing such tools**, working with the other ministries and Italian and international researchers and research bodies.

5.1 Methodological tools for the different stages of planning and assessment

A variety of types of impact assessment exist, using different methodologies, time frames and dimensions (see Table 3). For example, assessments can be divided into *ex-ante* and ex-post, with the former focusing more directly on forecast scenarios and the latter comparing actual results with what the situation would have been in the absence of the infrastructure investment. While the *ex-ante* approaches are the only ones that can actually be used during the decision-making stage, the ex-post methods can be used to "inform" the *ex-ante* models. In terms of the time used in an assessment, the chosen time horizon is a key consideration, depending on whether the effects are to be analysed in the short or medium/long term.

For example, models that examine the expansionary effects of public spending using an input-output matrix incorporate the short term (direct and indirect) effects, while macroeconomic or spatial models can also look at the long-term effects by factoring in the supply-side effects. The various approaches can also be differentiated on the basis of the variables that are given the greatest importance during the assessment. Most models focus on economic variables (added value or employment), but some approaches can be used to assess other dimensions, such as the environment. More specifically, the input-output matrices can be used to estimate climate-changing emissions in relation to the creation of infrastructure, while those exercises that estimate changes in mobility demand (per level and means of transport) can be used to assess the climate-changing emissions of such changes.

The final key dimension is the geographic level at which the effects of infrastructure are estimated. Such effects can be local (meaning limited to the geographic area directly impacted by the public works) or aggregate (e.g. if non-local companies are used in building the infrastructure or,

[6] The classic example in these terms is the impact of investments on climate-altering gas emissions. The expectation might be that building transport infrastructure (such as a high-speed rail line) might increase CO_2 emissions during construction. Yet, the medium-term impact of the same project might actually have climate mitigation benefits because of people switching to a lower emission form of transport.

alternatively in the medium/long-term if the increase in infrastructure in a specific area might have positive - such as production complementarity - or negative effects - displacement - on other areas). Only models that incorporate spatial aspects can produce local forecasts (such as quantitative spatial models or those that analyse transport supply and demand).

The lack of uniformity of such methods means infrastructure investment opportunities cannot simply be assessed from a single perspective, but require a holistic approach. Differing forms of assessment might lead to concordant or conflicting results, with the latter case requiring compromises or, ideally, a decision-making model that can blend aspects.

Given the multi-faceted decision-making process outlined above, it is necessary to underscore that the MIMS's "evaluation and analysis" requirements cover differing dimensions and require tools that can provide progressively more detail to match the planning, selecting, designing and creating cycle for projects. Figure 3 shows the suitable modelling or analysis tools for the information required in each stage, although this must be seen as a theoretical representation that is not necessarily directly or easily implementable at MIMS.

Table 3 - A (partial) taxonomy of assessment methods

Model	Description	*Ex-ante* vs. ex-post	Timeframe	Subject of analysis	Geographic area	Institution
IO Matrices	Models that estimate the aggregate effects of a demand shock for various products or sectors. These are based on input-output tables that show the sectoral and external interdependencies (via imports and exports) and attributes (e.g. productivity, employment composition, climate-changing gas emissions) that characterise the various productive sectors.	*Ex-ante*	Short term	Added value, employment environmental (costs)	Whole economy	ISTAT - Italian National Statistics Institute MIMS
Macro models	Dynamic stochastic general equilibrium (DSGE) models that factor in supply-side effects (public capital is a productive factor for production) and complementarities between public and private capital.	*Ex-ante*	Short and long-term	Added value, employment, environmental variables	Whole economy, regional dimension	IFM, EC ISTAT Ministry of Economy and Finance EIB Bank of Italy
Spatial models	Spatial quantitative models (SQMs) of general economic equilibrium, with firms, workers, and territories (mixed in terms of geography, sectoral composition, productivity, etc.). Creating infrastructure is a "shock" (e.g. reducing freight transport costs) that has both local and aggregate effects (e.g. spill over into other markets, as well as production relocation).	*Ex-ante*	Long-term	Added value	Whole economy and local effects	Bank of Italy
Transport demand and impact models	These modes can be used to predict the development of demand, the adequacy of the mobility system (infrastructure and degree of use) and variations in demand (in terms of level and	*Ex-ante*	Short and long-term	Demand and type of mobility, polluting emissions, etc.	Whole economy and local effects	EC

	mode shift) given changes in mobility systems.					
Counterfactual analysis	Impact assessment based on comparing observed impact and what would have been the case if the work had not been done. For example, this could be assessing GDP trends for an area before and after new infrastructure is built, or comparing the area of the work with a "similar" area (using methods such as difference-in-differences - dif-in-dif -, synthetic control method etc.)	Ex-post	Short and long-term	Added value employment environment	Local effects	OPEN (but access to data creates a privileged position)

During the macro-stage of choosing "*what*", primarily two approaches can identify the needs and the related infrastructure solutions:

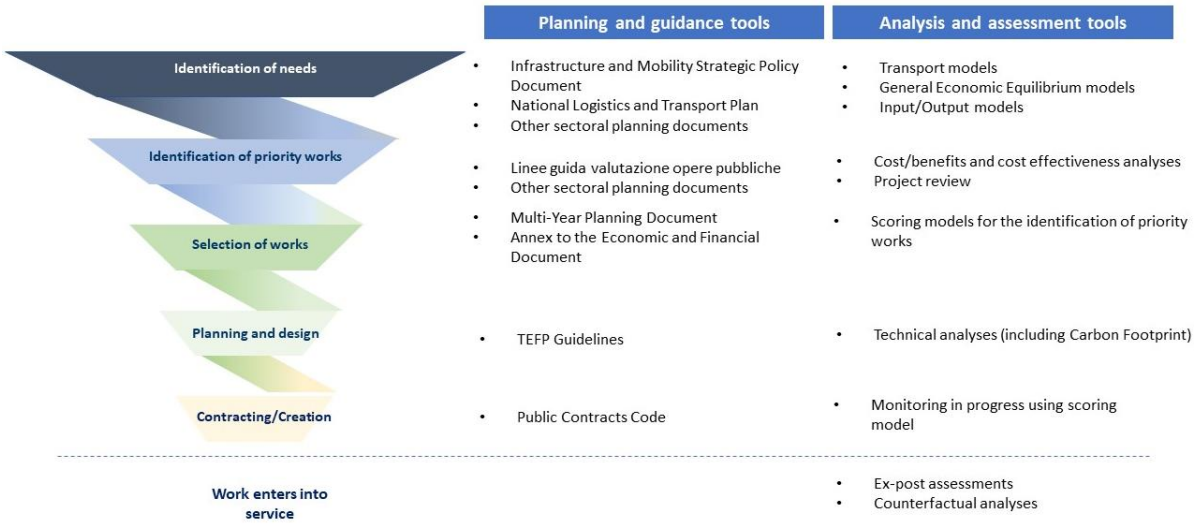
- **Transport models analysing supply and demand**
- **Macroeconomic models of computable general equilibrium** - CGE (see more below)

The former are, specifically, useful as insofar as they guarantee forecast scenarios for traffic demand (passenger and freight) and impact analyses on the level and composition of mobility demand deriving from infrastructure investment (or on the service offer of existing infrastructure). Such analyses are more suited to the Ministry's institutional needs of infrastructure planning and management. Moreover, for such analyses the MIMS has access to the necessary skills and data.

Although the two classes of models (transport and CGE) belong to different "families", their joint use (through bridging mechanisms that allow the bi-directional use of results) in the *ex-ante* phase does ensure the main aspects are factored into determining the reference scenarios, especially transport dynamics, the macroeconomic and employment impacts, reducing territorial inequality, and the climate and environmental impacts.

When it comes to identifying the priority works, MIMS's needs are slightly different, at least in methodological terms. During this stage, the Ministry receives a series of project analyses from a variety of proposing bodies and, to ensure the information set is suitable for the subsequent phases, such information needs to be standardised using uniform measurements. This is done by drawing up the Guidelines for Assessing Public Works (and the related "Operational Guidelines", which are broken down by sector) that set out the standards and minimum essential requirements that any proposals sent to the Ministry must meet. During this stage, the analysis that MIMS needs to do largely extends to "validating" the cost-benefit and cost-effectiveness analyses produced by the proposing parties and possibly identifying project review actions (at present, both these aspects are performed by the so-called Technical Mission Structure.)

Figure 3 - Analysis and assessment tools along the works planning chain



In order to guarantee a structured and "defensible" process for selecting priority works to be included in programme documents (MYPD and the Annex to the Economic and Financial Document), MIMS should invest in creating a synthetic qualitative and quantitative model to assess infrastructure investments (see the section with more details on the scoring model). Such a model needs to include both the quantitative results based on the precise analyses submitted with project presentations (following what is required in the Guidelines and the related documents) and additional qualitative information that is inherently less measurable but also significant in defining sustainable infrastructure.

The benefits of such a synthetic approach are twofold. In first place, it makes it possible to incorporate all aspects needed to determine the sustainability of an investment (and that cannot be estimated using theoretical and/or statistical-econometric techniques), including the degree of involvement of local communities in the creation of the work, the distribution effects (both within a specific territory across territories), the quality of public governance and so on. In second place, a suitable reasoned summary scheme gives the proper order and weighting to the totality of analyses and approaches that might be used to assess the creation of public works.

In the macro-stage about determining the "*how*" of a project, the assessment incorporates more technical aspects. In such a perspective, a general review of the contents of the TEFP (as per what was done for NRRP projects assessed by the Higher Council for Public Works) would ensure a better balance between the engineering sides and those related to the sustainability of the infrastructure.

Finally, the scoring model used in the selection stage could also be useful for monitoring during the creation stage, by precisely reporting the typical aspects of this stage (e.g. the impact on employment, circularity in the use of materials, commencement of dialogue with stakeholders etc.), which would also help a process of continuous improvement and the assessment of the expected results.

5.2 Need for an integrated data set

Data is a necessary, but not sufficient condition for making the best decisions. Data is not a sufficient condition because: it is necessary to be able to interpret the data (for example, using statistical-econometric analyses); not all the information needed to make decisions can be observed (and hence

transformed into data); decisions must be made taking into account what is known and what is not known (sometimes known as the lamppost paradox) and considering future scenarios that cannot always be predicted merely on the basis of past events. However, data does remain a necessary condition because it can be used to make informed decisions and to measure the degree to which different opinions and/or descriptions of an event match reality.

The importance of data (and how data is managed) has grown substantially over the years. The use of new technologies has made it far easier to measure aspects that were once hard to measure and they have allowed the digitalisation of information obtained by public and private bodies (and so increased the options for using such information).

For the Ministry, focusing solely on the collection of data - and thus leaving aside the related topic of the ability to manage and interpret the data - it is clear there is significant room for improvement. In simple terms, the information requirements can be classified into two, partially overlapping groups: data that can be used to determine infrastructure needs and so select and plan public investment; data that can be used to analyse problems related to the creation of public works. These two groups will be discussed separately below.

a) **Data to identify what works to build.** Firstly, for this purpose, it is necessary to understand the current situation, that is, the current infrastructure, access and the quality of services using the infrastructure and the demand for mobility (for passengers and goods). This provides the details needed to determine areas of congestion (and, as such, where mobility demand outstrips supply) and/or areas where access is lacking. Moreover, such data is essential for feeding transport models (and so to determine what the impacts on mobility might be and the modal change for new infrastructure) and economic models (to determine what the impact might be on development). In more concrete terms, the necessary data concern:

   - *The "physical" supply of network (roads and railway lines) and nodal infrastructure (ports and airports).* For every item of infrastructure, it is necessary to have geo-referenced data - so as to physically locate the infrastructure and so assess the modal connection - and the technical details - to know, for example, how many lanes a road has, how many tracks a railway line has, the depth of a port and so on.

   - *Supply and quality of "services" using infrastructure.* While the road network can be accessed by any user at any time,[7] using other infrastructure is heavily dependent on the quantity and quality of services offered on it. For the railway network, for example, it is not only necessary to have kilometres of track, but also an ability to use the infrastructure, the frequency with which trains run, the scheduled timetable, prices, traveller comfort and so on.

   - *Mobility demand.* Here, it is important to distinguish between what is observed and the potential. The term "observed demand" refers to the flow of passengers and goods actually observed, broken down into the various dimensions. For example, it is not sufficient to say that in one year a certain number of passengers travelled and a certain amount of goods were transported. It is necessary to know, for example, the origin-destination matrix for such flows, the type of goods being transported (in relation to other forms of transport that

[7] Although even in this case some aspects might influence a user's choices, such as having to pay a toll on a motorway, or worries about the maintenance and safety of infrastructure (e.g. landslides or mudslides) and any areas of congestion.

could be used across different types of infrastructure) and so on. The term "potential demand" refers to what is likely to be generated thanks to the new infrastructure, as estimated using forecasting models, which are typically fed by parameters that are, in turn, based on data analysis and investigations.

b) **Data on the creation of works.** To assess the optimal composition for infrastructure (in economic, environmental and social terms), data is needed on the functioning of the system used to create infrastructure and this depends on good planning skills, the assessment of an effective contracting system and the proper execution of the required work. To a crucial degree, these stages all depend, directly and indirectly, on good public governance, with both an effective system of laws and regulations, and good quality contracting authorities or a high degree of "qualification", as the Public Contract Code envisages. Measuring the functioning of the system used to create public works is crucial for: identifying obstacles, understanding whether problems are largely procedural and/or can be ascribed to the various offices involved having different levels of efficiency, and verifying the effectiveness of specific regulatory actions intended to improve how the system functions.

   At present, the available data is insufficient to monitor the various stages in creating infrastructure, from planning until its actual launch or the progress of any work being done - with the option to assess any discrepancies between the forecast timeframe (and costs) and the actual ones. Plus, there is an effective lack of indicators that can measure the quality of the work done. Moreover, the available information is highly fragmented, both in terms of the information sources, and the institutional bodies involved in the monitoring process. For example, two fundamental parts of the Public Contract Code from 2016 have never been adopted: calculating a company's rating and the qualification of the contracting authorities.[8]

5.3 Transport analysis models

The need to build new infrastructure comes from a necessity to reduce imbalances between the (current and future) demand and supply of passenger and freight mobility. Identifying and quantifying such imbalances requires a series of models that can forecast trends in demand and factor in the endogenous relationship between supply and demand. The first step is to measure the current infrastructure, its degree of usage (that is, the quantity of services offered, for example in terms of the number of trains that run) and last - but this is definitely not least - possible indicators as to the quantity and quality of ancillary services that might influence consumers and companies to favour one type of transport over another.

The second step is to measure the current mobility demand. As such, data about origin-destination mobility matrices (for passengers and freight) is required, with as much disaggregation as possible (for example, down to the level of the individual municipality, although for some areas with lower population density, larger aggregations would be possible; on the flip side, in metropolitan areas, it

[8] The term "company's rating" referse to some form of reward (or punitive) mechanism that, as is clear, rewards (or punishes) a company that has won a past contract in future public tenders on the basis of that past performance. The term "qualification of the contracting authority" refers to various criteria that determine whether a contracting authority is sufficiently qualified, or not, for awarding work for a certain amount. These criteria, which vary in accordance with the amount for the work, relate to the size (how many people work there) and composition (type and qualification of those people) of the contracting authority. At present, no dataset exists that can be used to see these aspects.

might even be useful for data to be broken down below municipal level). Such matrices also need to have disaggregated data about modes of transport (road, railway, air, sea).

Comparing current supply and demand can uncover any sections and/or nodes in a network that are characterised by an imbalance. In cases where demand outstrips supply, it is necessary to assess whether the increase in supply must come from the creation of new infrastructure, the extension or modernisation (for example, by making a section of railway line ready for high-speed trains) of existing infrastructure or changes in the services on existing infrastructure (for example, having trains run more regularly, changes in prices and so on). However, since infrastructure is a long-term investment, such analyses cannot have only a static dimension. They must also include dynamic aspects, especially demand forecasts that factor in future scenarios for that demographic and socioeconomic context. Clearly, demand can also be influenced by changes in mobility systems.

Analysing the functioning of supply and demand also makes it possible to conduct environmental impact assessments and analyses of other dimensions where the costs are not as easy to quantify in monetary terms. These include road congestion, accidents, pollutant and climate-altering emissions, noise pollution, etc.

In the past, the Ministry adopted the SIMPT model (an Information System for Transport Monitoring and Planning). This simulated how a transport system functioned across all its modal components, making it possible to forecast mobility demand and estimate traffic flows across a multi-modal network, in different potential demographic, macroeconomic and transport supply scenarios. Returning to such a tool will require a decision as to whether to upgrade the SIMPT model or acquire an entirely new model. The context has changed radically from when the Ministry chose to create the SIMPT model. Today, it would seem, companies in the market can offer such models that, obviously, would be adapted to Italy factoring in how our system of supply and mobility works. The initial contact with Ministry consultants suggests such models would be cheaper than the investments in the past to create the SIMPT model and they would be more user-friendly.

5.4 Scoring models for ex-ante analysis and monitoring of works

The growing importance of sustainable development has fostered the creation over recent years of methodological approaches for the multidimensional and multi-criteria assessment of infrastructure projects. More specifically, multi-lateral development institutions were the first to integrate models based on scoring mechanisms into their decision-making processes (examples can be found with the World Bank, the Inter-American Development Bank, the African Development Bank, the EIB and even Cassa Depositi e Prestiti). In more recent times, even private rating firms have developed similar certification systems in order to help bodies proposing major infrastructure projects internationally (for examples, see the Envision, STAR, IS, Invest rating/scoring models).[9]

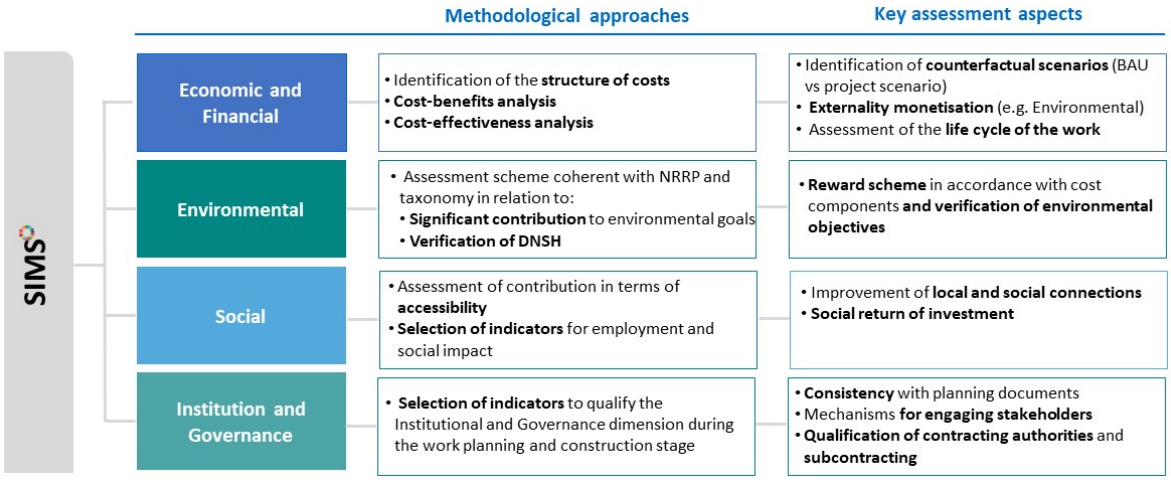
The launch of InvestEU, the facility specifically for funding private sector projects in NGEU, saw the European Commission defining a similar mechanism for assessing projects (called sustainability proofing). This is one of the first attempts to adopt a multi-criteria scoring model for sustainability issues in public policy decisions. **A similar approach could be adopted at MIMS to guarantee a methodological and conceptual framework to prioritise the works to finance and to monitor the forecast impacts during creation.** Such an approach can also be used for structured debate and

[9] For a complete overview of the existing models, see Inter-American Development Bank (2018), "Framework for Planning, Preparing, and Financing Sustainable Infrastructure Projects".

discussion with proposing bodies such that, during the project review stage, it is possible to identify the aspects requiring greater attention to achieve continual improvement in the quality of potential projects.

When it comes to supporting and guiding the decision-making process as to which works to construct - and, thus, the "*what*" rather than the "*how*" - the scoring model has the advantage of being able to specifically identify the works that should not be built (as they do not match the Ministry's overall strategy and they have economic/financial, environmental, social and institutional issues) and to prioritise others.

Figure 4 - Analysis dimensions for Sustainable Infrastructure and Mobility Score (SIMS)



The Sustainable Infrastructure Mobility Score (SIMS) is a model based on four dimensions (see Figure 4) that, in turn have sub-dimensions with specific analysis components, indicators and qualitative information. The scoring system is fed by information from the proposing body in accordance with what is envisaged by the Guidelines for Assessing Public Works and the related sectoral documentation (for the railway industry, the Operational Guidelines have already been drafted taking into account the possible need for information in the *ex-ante* and in-progress assessments of the works).

A. Economic and financial dimension

The following aspects are required:

A.1. **Cost-benefit and cost-effectiveness analysis**. The following must be provided, using the transport analysis and the demand forecasts, for the entire life cycle of the infrastructure:

- Investment and operational costs
- The economic benefits, including a monetary assessment of these, and relating to: the time that will be saved by users and the reduction in congestion, accidents, polluting emissions for passenger and freight transport, noise pollution, and climate-altering gas emissions from passenger and freight transport that contribute to global warming.

A.2. **An analysis of the impact of the project on the economic development of the area**, which must be assessed using qualitative and quantitative models that show:

- The effects on the growth and spatial distribution of productive activities linked to the **reduction in transport costs** (e.g. done using quantitative spatial models).
- The effects on economic growth linked to a **structural increase in the productivity and competitiveness of the area involved** (for example, done using a meta-analysis and a review of the ex-post impacts estimated for similar works and territories).

B. *Environmental dimension*

The following analyses are required:

B.1) An **assessment of the significant contribution of the work to the six priority environmental objectives set by the EU** (mitigation, adaptation, circular economy, water resources, pollution, biodiversity and ecosystems). In all cases, this includes estimating the carbon footprint for the work during construction (using a certification system) and estimating the emissions balance for the infrastructure over its life cycle. This includes factoring in the effects from the infrastructure operating compared to other alternative scenarios, including "do nothing" (for example, the reduction in climate-altering gases due to a shift to another form of transport due to the new infrastructure).

B.2.) An **assessment of the Do No Significant Harm (DNSH) principle** for each of the six environmental goals.

C. *Social dimension*[10]

The following aspects must be assessed:

C.1. **Impact on accessibility for the areas in question** (for example, reducing the time needed to reach other destinations, for the railway industry) and **on existing territories discrepancies/gaps** (for example, reducing water loss in areas that are hardest hit by climate change).

C.2. **Potential effects on employment** (and socio-demographic characteristics) of the work in both the short- and long-term.

C.3. **Quantification of the potential beneficiaries from the construction of the infrastructure, measured in terms of that population** (and socio-demographic composition) potentially involved.

D. *Institutional and governance dimension*

The following factors need to be taken into account:

D.1. **Degree to which the work is consistent with European and Italian strategic directions**, both in terms of general goals and in relation to the specific sector (railways, roads, ports and so on).

[10] All of the dimensions evaluated (from 3.1 to 3.4) must be viewed in relation to the overall cost of the work, across its entire life cycle, so as to make it possible to compare the social benefits of works costing different amounts.

D.2. **Mechanisms for involving stakeholders and citizens** during the planning and construction stages, and the tools that will be used to keep the local community updated as to progress with the work, to manage any disputes, mitigate any disservices and/or negative externalities related to the construction.

D.3. **Level of qualification of the contracting authority that can be measured,** *inter alia*, using the total number of employees at the contracting authority/proposing body and the composition of these employees in terms of professional expertise, the experience of the contracting authority/proposing body in terms of work for similar amounts and with an equivalent level of technical complexity, and the other requirements envisaged by the Code (for example, a positive assessment from the Italian National Anti-Corruption Authority as to the corruption risk, litigation losses, standard compliant quality management systems).

D.4. **Existence of mechanisms that can be used to monitor the chain of subcontractors and/or other governance quality indicators** in relation to the following at the contracting authority: corruption monitoring tools (along the supply chain, including subcontractors); reward mechanisms for selecting subcontractors factoring in ESG criteria; policies for inclusion and ensuring a gender balance in project governance; quality management systems meeting the UNI EN ISO 9001 standards for the offices and tender procedures, certified by accredited bodies; use of online technologies for tender procedures; the number of losses in legal disputes (definitive rulings) over the last five years for reasons linked to tenders and how tenders are conducted; management plans and monitoring of environmental and social impacts during the construction phase of the work.

The assessment of each SIMS sub-domain[11] is done using a discrete scale divided into four consecutive levels [1 min; 4 max] of linear progression (see Table 4). The choice to have an even number of levels influences the possible outcomes, ensuring the results are polarised and avoiding "neutral" options. At the same time, the linear nature of the scale tends to give uniform weighting to the assessment categories.[12] Finally, by restricting the scale to four assessment levels, the process is streamlined and easy to adopt, especially in those cases where a large number of cases might need to be analysed.[13]

Table 4 - The SIMS Model Domain Rating Scale

Points	Score
1	Minimum
2	Sufficient
3	Good
4	Excellent

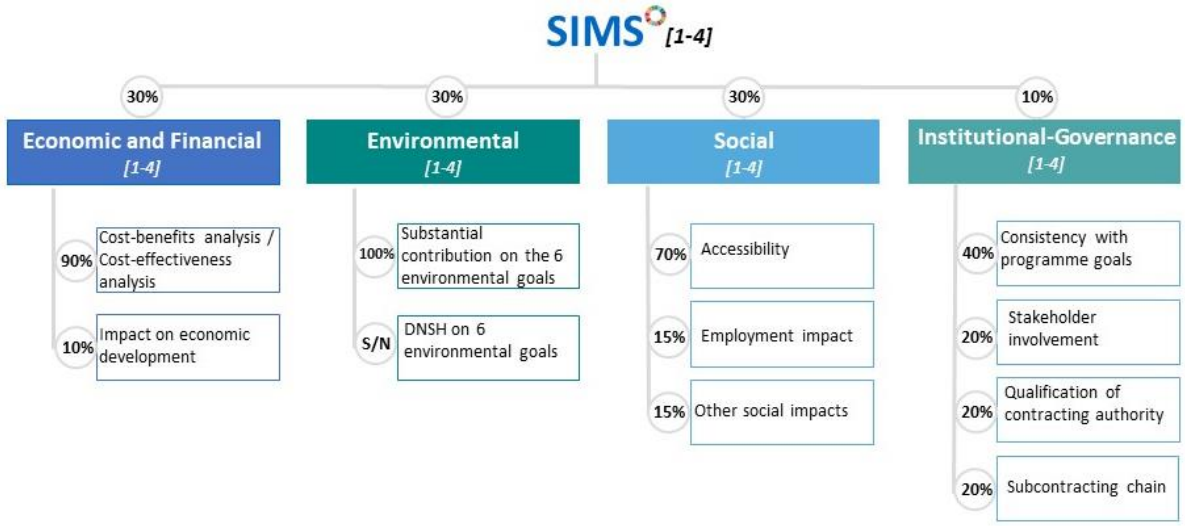
[11] Importantly, in this scheme a few items might be counted twice because, for example, some environmental or social costs or benefits have been "monetised" and so also included in the costs-benefits analysis (point 1.1). Yet, they are included separately to ensure a comprehensive picture of the individual dimensions assessed.

[12] In other scoring models, such as those used by the Inter-American Development Bank (IDB) or Cassa Depositi e Prestiti (CDP), the discrete scale uses an increasing, non-linear progression. Such an option tends to reward better performing projects more.

[13] The World Bank's Anticipated Impact Measurement and Monitoring (AIMM) model uses a scale of 0-100, the IDB and CDP models use a scale of 0-10 and the InvestEU scoreboard uses a scale of 1-4.

The final project score is calculated on the weighted average of the scores from the four dimensions that, in turn, are calculated using the assessments in the individual sub-domains/dimensions. The structuring of the weighting in the scoring is decisive in determining the decision-maker's preferences. It can be calibrated using robustness exercises based on project data and information or through the specific involvement of qualified stakeholders (at MIMS, for example, it is possible to interview the Minister, the Department Heads, the Director Generals and so on). At the same time, the structure of this weighting can be flexible to ensure the Ministry's objective function can vary in accordance with the political leadership and the reference context. In this initial proposal, the weighting is uniform for the four main dimensions, but partially differentiated in the sub-domains (see Figure 5).

Figure 5 - The domains and structure of the weighting for the SIMS model



Grids defining the criteria to be used in scoring projects were drawn up to standardise the qualitative and quantitative assessment criteria (see Table 5). This ensures maximum uniformity for the results, which is critical in removing the subjective element of any assessment, but also makes it possible to compare works for different sectors.

Table 5 - The SIMS Model Assessment Grid

Dimension	Domain	Minimum [1]	Sufficient [2]	Good [3]	Excellent [4]
Economic-Financial	a.1 Cost-Benefit/Cost-Effectiveness Analysis	ERR<5%[14]	5%<ERR<7%	7%<ERR<10%	ERR>10%
	a.2 Impact on economic development	*Marginal impact*	*Significant impact on one development dimension*	*Significant and widespread impacts on several development dimensions*	*Transformative impact in terms of outcome*
Environmental	b.1-2 Significant contribution and DNSH on the 6 EU Environmental Goals	Failure to ensure DNSH for one or more goals	DNSH achieved for all goals	Contribution on at least one goal (climate&env tracking EU criterion) and DNSH on the remaining	Substantial contribution on at least one of the goals (taxonomy criterion) and DNSH on the remaining

[14] ERR - Economic Rate of Return. Thresholds consistent with those in the InvestEU rules.

Social	c.1 Accessibility	No improvement[15]	Marginal increase	Positive increase	Significant increase
	c.2 Impact on Employment	Construction and implementation phase[16] FTE/mln €<3	Construction and implementation phase FTE/mln €<3-6	Construction and Implementation Phase FTE/mln € 6-7	Construction and Implementation Phase FTE/mln€ >8
	c.3 Other social impacts	*0<ERR-FRR<1%*	*1%<ERR-FRR<3%*	*3%<ERR-FRR<5%*	*ERR-FRR>5%*
Institutional and Governance	d.1 Consistency with programme goals	No consistency	The project makes a marginal contribution to a goal	The project makes a positive contribution to a goal	The project makes a significant contribution to a goal.
	d.2 Stakeholder Engagement	No mechanism	Involvement during the design stage	Involvement in all stages	Involvement in all stages and mechanisms for handling complaints
	d.3 Contracting authority qualification	*See Table 6 for details:* non-compliance with both criteria	*See Table 6 for details:* complies with only one criterion	*See Table 6 for details:* complies with both criteria	*See Table 6 for details:* complies with both criteria, and the total number of people and works is 50% higher (rounded down) than the minimum
	d.4 Subcontracting chain	No mechanism to check on subcontracting	Verification of key quality certification for subcontractors	Verification and conditionality of compliance with ESG criteria in selecting suppliers	Reward mechanisms for ESG criteria in selecting suppliers

Table 6 - Assessment grid for the qualification of contracting authorities based on the complexity of the work

Level of complexity of the work	Size and composition	Experience
Base Level: from €150 thousand to €1 million	▪ 1 administrative employee ▪ 2 technical staff with skills for the job	5 base or higher level works
Middle Level: from €1 million to the EU threshold (art. 35, Code)	▪ 2 administrative employees with diplomas ▪ 3 technical employees with degrees relative to the job ▪ 4 technical employees with diplomas ▪ 2 graduates in legal and economic subjects or 2 staff with diplomas, in senior positions and at least five years' experience at contracting authorities	3 middle or higher level works
High level: from the EU threshold to €20 million, excluding complex works (art. 3, subsection 1, letter oo, Code)	▪ 3 administrative employees with diplomas ▪ 6 technical employees with degrees relative to the job ▪ 7 technical employees with diplomas ▪ 2 graduates in legal and economic subjects or 2 staff with diplomas, in senior positions and at least 10 years' experience at contracting authorities	2 high or superior level works

[15] Accessibility calculated based on the standardised index in the Operational Guidelines for the railway industry. Thresholds being defined

[16] Direct Employment.

Superior level: over €20 million or complex works (art. 3, subsection 1, letter oo, Code)	▪ 4 administrative employees with diplomas ▪ 8 technical employees with degrees relative to the job ▪ 10 technical employees with diplomas ▪ 3 graduates in legal and economic subjects or 3 staff with diplomas, in senior positions and at least 10 years' experience at contracting authorities	2 superior level works

Box 1: A use of the SIMS scoring systems for a high-speed railway project

The investment is for a section of high-speed, high capacity railway in the TEN-T corridors, costing a total of about €3.5 billion.
For the economic and financial dimension, the cost-benefit analysis (CBA) only shows moderate results, in terms of the Economic Rate of Return (ERR), for all the main scenarios analysed. The analyses conducted by the proposing body quantify the various positive impacts on local development based on the completion of a key railway line for the local and national economy.
For the environmental dimension, high-speed lines are tagged as 100% for the climate under European regulations and the aspects analysed (including the environmental impact assessment), suggesting substantial alignment between the investment and DNSH principles for all six priority environmental goals in the Taxonomy.
For the social dimension, the estimated contribution to accessibility is limited, taking into account that the area is already pretty well interconnected. However, the impact on employment is significant given the sector and volume of investment.
Finally, for the institutional and governance dimension, the project is substantially in line with the national and European strategic priorities for the sector and the contracting authority is adequately qualified.

The SIMS model calculates a score of 3.5 The individual dimensions are assessed as follows.

Dimensions	Sub-Dimensions	Analysis Aspects	Assessment
Economic/Financial	Cost-benefits analysis	▪ ERR=3% in the project review scenario	Minimum
	Impact on economic development	▪ The studies and analysis found the shortcomings in the railway infrastructure are only partially satisfied in the project scenario	Sufficient
Environmental	Significant contribution Climate change mitigation DNSH compliance	▪ Compliance with taxonomy criteria on the substantial contribution to the mitigation goal. *100% EU climate tagging*	Very good
		▪ Verification of compliance with DNSH principle	Very good
Social	Accessibility	▪ Travel time reduction of 11 minutes. Nonetheless, in the case of limited growth, the capacity of the historical line in the reference scenario is never (delay reduction effect), penalising the flow of goods due to lack of capacity	Minimum
	Employment impact	▪ FTE/€mln=13.3 (about 40,00 AWU created or maintained)	Very good
	Other social impacts	▪ Marginal accident reduction	Minimum
Institutional/Governance	Consistency with programme goals	▪ Work falls entirely within TEN_T network programme	Good
	Stakeholder engagement	▪ The project review contains instances from the region and local communities	Good
	Contracting authority qualification	▪ RFI: composition level: above average; experience level: above average	Very good
	Subcontracting	▪ RFI: adoption of quality standards and certification for the subcontracting network	Very good

The question of the distribution of weighting is essential in the proposed assessment scheme. Changing the weighting of the dimensions could actually produce different final results, formulate the objective function of the decision-maker differently and, so, create an *ex-ante* differentiation in the order of the priorities to obtain using the model.
By way of example, the graphic below shows the results from the SIMS model, using the same project assessment data, but with different possible weightings for the dimensions in the scoring mechanism. The results using the model proposed in the scheme in Figure 5 ("SIMS 1.0 Approach")

- where the economic, environmental and social dimensions are assigned an equal weighting of 30% and the institutional and governance dimension, 10% - are compared to alternative models. More specifically, the "NRRP approach" uses a uniform structure for the weighting of the four dimensions (25% each), the "traditional approach" tends to place greater importance on the economic component, especially the CBA (70% for this dimension, 10% for the other three) and the "incremental approach", where it is possible for the overall score to exceed the maximum total from simple addition (4) by allowing the over-weighting of the individual dimensions. The latter case favours investment options that, in the *ex-ante* stage, show a significant impact in at least one (but not necessarily all) of the dimensions considered. The three preceding approaches are based on simply adding the components together and, implicitly, only allow the maximum absolute score to be achieved if the project is examined very positively in all four dimensions considered.
Considering the robustness analysis shown in the following diagram, it is clear that the first, second and fourth approaches produce quite similar final scores, but the traditional approach is more heavily influenced by the economic and financial assessment, which did not achieve particularly good results in the case study analysed.

Calibration type	Weighting structure	Total score
«SIMS 1.0 Approach»	Uniform weighting for economic, environmental and social dimensions. Reduced weighting for institutional and governance dimension	**SIMS° =3,5**
«NRRP Approach»	Unform weighting for all four dimensions	**SIMS° =3,4**
«Traditional Approach»	The CBA is weighted the most (75%)	**SIMS° =2,3**
«Incremental Approach»	The economic, social and environmental dimensions are "over weighted" and a *cap* is placed on the maximum score	**SIMS° =3,6**

Finally, it is necessary to note how the application of the model is impacted, in this stage, by the lack of some information and indicators that can be used to feed the scoring process. Given the absence of such information, ad hoc assumptions were made to simulate possible results. Once fully operational, the new *ex-ante* analysis tools that have already been defined (Operational Guidelines for the railway industry) or are to be defined guarantee a complete information set that can be used for the SIMS model.