

OECD Working Papers on Public Governance

OECD Infrastructure Governance Indicators

Conceptual framework, design,
methodology and preliminary results

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OECD Infrastructure Governance Indicators: Conceptual framework, design, methodology and preliminary results

By Ana Maria Ruiz Rivadeneira, Tenzin Dekyi, and Lorena Cruz,
OECD Public Governance Directorate

The governance of infrastructure can affect how and whether infrastructure projects achieve desired outcomes and contribute to wider policy goals. This paper presents the conceptual framework, design and methodology of the OECD Infrastructure Governance Indicators (IGIs). The IGIs support the implementation and monitoring of the OECD Recommendation on the Governance of Infrastructure. This paper also describes the key findings from the first set of IGIs, which cover three areas: long-term strategic vision for infrastructure; fiscal sustainability, affordability and value for money; and efficient and effective public procurement. It identifies the governance dimensions that are well developed across OECD countries and those that require improvements under each of the three areas.

Keywords: infrastructure governance, composite indicators, value for money, public procurement, strategic planning.

JEL Codes: C1, C43, H54, O18.

Table of contents

1 Introduction	6
2 Rationale	8
3 Objectives	10
4 Conceptual framework	11
5 Composite Indicators Methodology	13
5.1. Structure of the Composite Indicators	13
5.2. Implementation of the IGIs by phase	13
5.3. Data collection and validation	14
5.4. Selection of variables and re-coding	15
5.5. Missing data	17
5.6. Weighting and aggregation	17
5.7. Multivariate analysis	18
5.8. Sensitivity analysis	19
5.9. Measuring balance in sub-pillar scores	21
5.10. Limitations of composite indicators	22
6 Results	23
6.1. Key findings across OECD countries on long-term strategic vision for infrastructure	24
6.2. Key findings across OECD countries on fiscal sustainability, affordability, and value for money	26
6.3. Key findings across OECD countries on efficient and effective public procurement	28
7 Conclusion	31
References	33
Annex A. List of sub-pillars, variables and answer options	34
Annex B. Results from factor analysis	45

FIGURES

Figure 4.1. Overview of the Recommendation on the Governance of Infrastructure (2020)	11
Figure 4.2. A governance framework for infrastructure policy and implementation	12

Figure 5.1. Structure of the IGIs	13
Figure 5.2. Data collection by phase	14
Figure 5.3. Overview of the three pillars and their corresponding sub-pillars developed in Phase 1	17
Figure 5.4. Results from sensitivity analysis by pillar	20
Figure 6.1. OECD average composite indicators for pillars in Phase 1	24
Figure 6.2. Composite indicator for long-term strategic vision by country	25
Figure 6.3. OECD average sub-pillar scores under long-term strategic vision	26
Figure 6.4. Composite indicator for fiscal sustainability, affordability, and value for money by country	27
Figure 6.5. OECD average sub-pillar scores under fiscal sustainability, affordability, and value for money	28
Figure 6.6. Composite indicator for efficient and effective public procurement by country	29
Figure 6.7. OECD average sub-pillar scores under efficient and effective public procurement	30

TABLES

Table 5.1. Cronbach coefficient alpha for the three pillars	18
Table 6.1. Summary statistics for the three pillars	23

1 Introduction

Governments today count on infrastructure investments to deliver multiple policy objectives: recovery from the economic effects of COVID-19, sustainable growth, generating employment, mitigating and adapting to climate change, delivering public services, linking to global value chains, and ensuring resilience, social inclusion, and gender equality. Effective governance is required to achieve these multiple objectives by providing a well-articulated, whole-of-government approach that explicitly links them back to infrastructure planning, investment, and delivery. Yet, infrastructure investment is complex, getting from conception to construction and operation is a long road fraught with obstacles and pitfalls. Poor governance is a major reason why infrastructure projects often fail to meet their timeframe, budget, and service delivery objectives. Since its first meeting in 2006, the OECD Network of Senior Infrastructure and PPP Officials (SIP Network) has worked on the issue of infrastructure governance, developing substantive evidence-based analysis and policy recommendations on infrastructure governance and public private partnership (PPPs). Similarly, the OECD Regional Development Policy Committee (RDPC) has been advancing the discussion on the need to strengthen the governance of public investment across levels of government.

As highlighted in the last two meetings of the SIP Network, there is a need to better assess and monitor infrastructure governance frameworks, allowing countries to identify and measure their' capabilities, strengths and key areas for improvement. In order to provide accurate and comparable data for self-assessment and evaluation, the OECD has been working on the development of Infrastructure Governance Indicators (IGIs). The indicators aim to support countries in the assessment of processes, tools, norms of interaction, decision-making processes and monitoring strategies for infrastructure investment and delivery. The purpose of this scoping paper is to: i) describe the design, content, methodology, structure and scoring tables of the OECD IGIs; ii) outline the data collection and verification processes; iii) present preliminary results from the first phase of implementation; and iv) discuss next steps and future avenues of work.

The [OECD Recommendation on the Governance of Infrastructure \(2020\)](#) and the [Recommendation on Effective Public Investment Across Levels of Government \(2014\)](#) provide the conceptual framework for the construction of the OECD IGIs. The *Recommendation on the Governance of Infrastructure* was developed based on the long-standing evidence-based work that has been carried out by the OECD on infrastructure governance. The contents of the Recommendation were developed with the support and expertise of infrastructure and budgeting public officials from SIP Network, the OECD Working Party of Leading Practitioners on Public Procurement (LPP), as well as the wider OECD policy community. The two bodies support the OECD Public Governance Committee, with the SIP Network also supporting the OECD Senior Budget Officials. The best practices and standards found in the Recommendation have been widely recognised by national governments and other international organisations as a comprehensive framework for infrastructure governance. This tool has also been used as a reference to provide tailored policy recommendations in both OECD members and non-members alike. The *Recommendation on Effective Public Investment Across Levels of Government* is reflected in pillar 5 (co-ordinate infrastructure policy across levels of government) of the *Recommendation on the Governance of Infrastructure*. The former, developed by the RDPC, is an actionable instrument to guide countries in the multi-level governance of public investment, which is supported by the [Effective Public Investment Toolkit](#).

The *Recommendation on the Governance of Infrastructure* equips governments with policy tools to invest in infrastructure through a well-articulated, whole-of-government approach that explicitly links the achievement of economic, social, and environmental policy goals back to infrastructure planning, investment and delivery. The overarching nature of the Recommendation's pillars allows for an exhaustive analysis of the multiple governance dimensions that are at play in infrastructure investment and delivery.

The OECD IGIs resonate with a general call for evidence in the infrastructure governance field. More data are needed to inform capacity building, policy and decision-making in infrastructure. In this sense, the IGIs aim to provide a synthesised overview of countries' performance in infrastructure governance against the pillars outlined in the Recommendation and on cross-cutting pillars such as environmentally sustainable and climate-resilient infrastructure, which in turn enables the identification of trends across OECD countries and draws attention to particular issues that require additional intervention. While providing cross-country comparison, the IGIs are not context-specific nor can fully capture the complex realities of the quality of infrastructure governance frameworks and practices. Therefore, these composite indicators should be seen as a means for initiating discussion and learning from each other, rather than drawing simplistic policy conclusions.

The development of the IGIs is being carried out in three phases. The first phase covers the construction of indicators for three of the ten pillars of the *Recommendation on the Governance of Infrastructure*, as follows: development of a long-term vision for infrastructure; fiscal sustainability, affordability, and value for money; and efficient and effective public procurement. Pillars in Phase 1 were prioritised due to their strategic importance in driving infrastructure investments towards a sustainable rebound in a COVID-19 context. The second phase will cover the construction of five indicators for four of the remaining pillars of the Recommendation and the cross-cutting pillar on environmentally sustainable and climate-resilient infrastructure. In the third and final phase, indicators for the remaining three pillars of the Recommendation will be developed. Upon implementation of the final phase, results for the full set of indicators will provide an overview of countries' performance across all dimensions of the *OECD Recommendation on the Governance of Infrastructure* and on the cross-cutting pillar on environmentally sustainable and climate-resilient infrastructure. Results from the first phase are presented and discussed in this paper.

Results from the first phase of the IGIs signal the need to strengthen long-term strategic planning for infrastructure. This is particularly important in context of the climate crisis as long-term planning is the principal means by which governments will be able to ensure that infrastructure investments are aligned with climate action plans. Equally important is the effective and efficient delivery of infrastructure projects to ensure that these projects actively contribute to policy goals such as environmental protection, climate action, inclusion, gender mainstreaming, etc. This will require consequential improvements in infrastructure risk management and professionalisation of the procurement workforce.

2 Rationale

One of the main challenges faced by OECD countries in implementing infrastructure projects has been the quality of public governance (OECD, 2016^[1]). Infrastructure governance can be understood as the policies, frameworks, norms, processes, and tools used by public bodies to plan, make decisions, implement and monitor the entire life cycle of public infrastructure (OECD, 2020^[2]). The goal of good infrastructure governance is to ensure that the right projects are selected, and that they are delivered in a way that is fiscally sustainable, cost-efficient, affordable with respect to life cycle costs, transparent, and, most importantly, that represents value for money to the public sector and end-users. Governance deficiencies are an important factor explaining the large differences in perceived infrastructure quality across countries that display a similar public capital stock (Demmou and Franco, 2020^[3]). Without robust institutional capacities, appropriate processes and appraisal methods, it is highly likely that strategic choices regarding infrastructure investments will be suboptimal and fail to deliver their expected outcomes.

There is evidence to suggest that stronger infrastructure governance results in better macroeconomic outcomes of public investment. According to a study recently conducted by the OECD, both sound governance of infrastructure investment and procompetitive regulation in network industries are associated with stronger productivity growth in firms operating downstream. The study shows that productivity growth over ten years for the average firm in an average infrastructure dependent sector is 0.24 percentage points higher for countries with relatively high governance quality compared to countries with relatively low governance quality (Demmou and Franco, 2020^[3]). Similarly, the IMF (2015) found a larger growth dividend of public investment for countries with high public investment efficiency than for those with low public investment efficiency. According to this report, a GDP increase in public investment of 1 percentage point leads to an increase in output by 0.3% for countries in the lowest efficiency quartile compared to an increase in output by 0.6% for countries in the highest efficiency quartile (IMF, 2015^[4]).

Particularly in the context of the post-COVID-19 crisis, many OECD countries have recognised infrastructure investment to be at the core of the response to achieve a sustainable and inclusive long-term recovery. Countries like Chile, Costa Rica, Hungary, Ireland, New Zealand and Slovenia have reported that at least 30% of their recovery plans' budget has been allocated to investments in infrastructure (OECD, 2021^[5]). A widespread trend responding to the COVID crisis has been to accelerate infrastructure projects that can provide immediate boosts in employment such as those in construction and R&D. Countries are exploiting green investments to create jobs in green electricity, green water and sanitation, and environmentally friendly buildings such as schools and hospitals (IMF, 2020^[6]). At the same time, countries have made clear their objectives of achieving a sustainable recovery and higher long-term growth through infrastructure development whilst also pledging to invest in projects that are conducive to a resilient, inclusive, and green recovery. These projects support innovation (France), training (Australia, France), green growth (France, Germany, Italy, Japan, Korea, United Kingdom), and expanding digital infrastructure (Germany, Korea, Japan) (IMF, 2020^[6]).

Some countries like Ireland, are planning to maintain high capital investment levels and accelerate project delivery as a response to the fallout from COVID-19. Learning from past recessions, the Irish government conducted a review of the country's National Development Plan (NDP) to optimise project implementation and improve the capability of different public agencies to deliver infrastructure projects over the long-term

(OECD, 2020^[7]). Similarly, with a new approach to identifying priority areas for investment, the Canada Infrastructure Bank (CIB) has adopted the Growth Plan with a focus on investing in green infrastructure. Through the plan, the CIB also aims to accelerate delivery of projects in which it is investing.

Under those economic conditions, the [*OECD Recommendation on the Governance of Infrastructure*](#) provides a useful framework to supporting the economic and social recovery effort from the COVID-19 crisis, as well as sustainable economic growth in the long run. The IGIs can provide valuable inputs for countries that are looking to enhance infrastructure governance frameworks and ensure that infrastructure planning, decision-making and delivery are aligned with sustainable recovery objectives. The IGIs aim to provide countries with the ability to monitor their own policies and practices (as well as those of other countries), and thus the potential for countries to improve areas of infrastructure governance that are less developed. The importance of the indicators also lies in their ability to cement the economic, social and environmental importance of infrastructure governance, engaging and influencing countries to adapt their policies and practices to achieve strategic government long-term policy objectives. The indicators can inform and put reform agendas into action and will raise new questions for research on infrastructure governance.

The added value of the proposed composite indicators lies in its in-depth analysis of multiple dimensions of infrastructure governance. For complex phenomena that lack a unique definition and direct measurement such as infrastructure governance, composite indicators serve as useful tools for assessing the performance of countries, monitoring policies and practices, and communicating results to the public (Becker et al., 2017^[8]). The variables are designed to measure not only the adoption of governance frameworks and tools, but also their adequacy in supporting quality infrastructure investments. The need for a plurality of variables in the evaluation of infrastructure governance calls for the use of composite indicators. The OECD has employed composite indicators to measure country performance in various areas of governance that are otherwise difficult to assess. For example, the OECD Indicators of Regulatory Policy and Governance (iREG) monitor countries' regulatory policy and governance practices advocated in the 2012 Recommendation of the Council on Regulatory Policy and Governance, measuring three key principles – Stakeholder engagement, Regulatory impact analysis (RIA) and Ex post evaluation. The OECD Digital Government Index benchmarks digital government policies across OECD member and partner countries based on the six dimensions: digital by design, government as a platform, data-driven public sector, open by default, user-driven, and proactiveness (OECD, 2020^[9]). Similarly, the OECD Open, useful, and Re-usable data (OURdata) Index assesses country efforts in developing and implementing open government data policies across three pillars - data availability, data accessibility, and support for data reuse (OECD, 2020^[10]).

Finally, the IGIs will be regularly updated using data collected every five years through an OECD survey instrument. Other non-OECD indicators currently available mostly rely on external sources of data that might be updated at irregular points in time or may even cease to be collected. Considering that the IGIs are aimed at supporting and monitoring the implementation of the *OECD Recommendation on the Governance of Infrastructure*, the regular collection of data and update of the IGIs will ensure that the Recommendation remains relevant in a rapidly changing investment environment while being reflective of governance innovations and sector trends. Measuring progress regularly will be key to enable countries to monitor their performance and ensure that infrastructure governance improves overtime to deliver better quality infrastructure.

3 Objectives

The main objective of the IGIs is to support and monitor the implementation of the *OECD Recommendation on the Governance of Infrastructure*. The indicators will serve as a diagnostic tool to help countries assess their current stage of development and identify the dimensions that may require more attention. In particular, the indicators will aim to achieve the following goals:

- map OECD countries' state of play regarding infrastructure governance, identifying strengths and weaknesses
- provide tools for countries to self-assess their performance in each of the infrastructure governance pillars highlighted in the Recommendation
- provide a comprehensive view and deeper understanding of the different pillars that compose the infrastructure governance framework
- allow countries to identify changes in their performance on infrastructure governance through time
- draw attention to how much data are available and needed to measure infrastructure governance, as well as the benefits of building a comprehensive database in the field
- contribute to the discussion on the relationship between infrastructure governance and infrastructure outcomes.

In addition to a general assessment, the IGIs also serve to pinpoint specific areas within each pillar that may require further development from each government. Results at a more granular level (i.e. performance on the sub-components of each dimension) will allow a more in-depth assessment.

4 Conceptual framework

The [OECD Recommendation on the Governance of Infrastructure](#) provides the basis for the selection and combination of variables to form the proposed composite indicators. For the pillar on coordination across levels of government, the selection and grouping of variables will be based on the [Recommendation on Effective Public Investment Across Levels of Government](#). The *Recommendation on the Governance of Infrastructure* is based on ten pillars that relate to how governments prioritise, plan, co-ordinate, budget, deliver, regulate and evaluate infrastructure investment, covering the entire life cycle of infrastructure projects (See Figure 4.1). The Recommendation presents a whole-of-government approach, covering the entire life cycle of infrastructure projects and placing special emphasis on regional, social, gender, resilience and environmental perspectives. The overarching nature of the Recommendation's pillars allows for exhaustive analysis of the multiple governance dimensions that are at play in infrastructure planning, decision-making, and delivery. They therefore provide a robust conceptual framework for the development of composite indicators. The pillars represent both conceptual categories and functional areas of work. As such, the pillars are not stand-alone and interact with one another to support a comprehensive overview of infrastructure governance.

Figure 4.1. Overview of the Recommendation on the Governance of Infrastructure (2020)



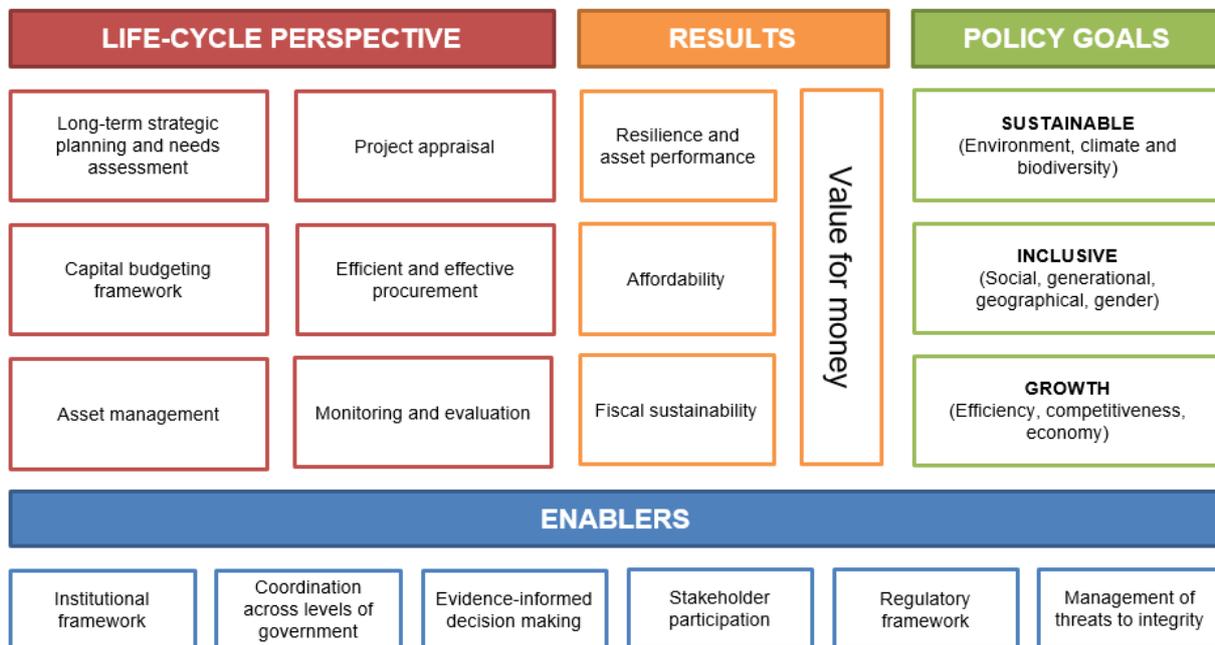
The Recommendation is built on a robust conceptual framework on the governance of infrastructure policy and implementation, which provides a better understanding of the different elements at play across the asset life cycle (see Figure 4.2). First, infrastructure policymaking and implementation need an environment conducive to good public governance, which generates transparency, credibility and trust around the investment and delivery process. Enablers for good governance of infrastructure policy and

implementation highlighted in the Recommendation include the following: a stable institutional framework, coordination across levels of government, evidence-based decision-making, an adequate regulatory framework, management of threats to integrity and continuous stakeholder participation.

In addition to the enabling environment, good governance of infrastructure policymaking and implementation should adopt a life-cycle perspective. The Recommendation provides relevant governance tools and practices that cover each stage of the investment and delivery process, namely long-term strategic planning, project appraisal, capital budgeting, public procurement, asset management (i.e. maintenance, upgrade, and decommissioning), and monitoring and evaluation. Despite the multiplicity of organisational and institutional contexts across countries, a life-cycle perspective is key to ensure public investments’ quality starting from the strategic planning stage all the way through to the assets’ decommissioning.

The end-goal of infrastructure governance is twofold. Firstly, good governance ensures that investments are delivered in a way that is fiscally sustainable, affordable, that ensures assets’ resilience and performance across the life cycle, and overall, that represents value for money. Secondly, good governance of infrastructure policymaking and implementation can support governments’ goals for sustainable and inclusive growth at both a national and subnational level. Robust governance frameworks provide governments with tools to align infrastructure planning, decision-making and implementation with key policy objectives, notably: environmental protection and climate action; resilience to climate-related hazards; gender mainstreaming; eradication of poverty and income inequalities; regional disparities; and inclusive access to vulnerable populations (e.g. youth, elderly, people with disabilities, minorities). Getting infrastructure right means that public investments actively contribute to achieving social, economic, and environmental policy goals.

Figure 4.2. A governance framework for infrastructure policy and implementation



5 Composite Indicators Methodology

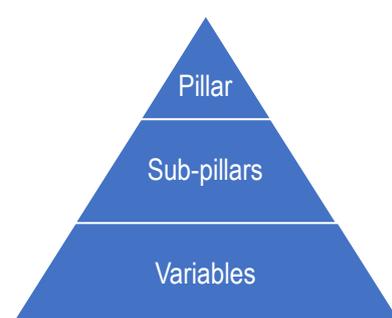
The Methodology used for building the OECD Infrastructure Governance Composite Indicators is based on the Handbook on Constructing Composite Indicators (OECD/European Union/EC-JRC, 2008^[11]). It has also been shared and discussed with experts and public officials from the SIP Network and the LPP Working Party.

5.1. Structure of the Composite Indicators

The IGIs are measured and presented in composite indicators, one for each of the pillars set in the [OECD Recommendation on the Governance of Infrastructure](#), plus the cross-cutting pillar on environmentally sustainable and climate-resilient infrastructure. The goal of the IGIs is not to build one composite indicator for the whole of the Recommendation. The risk of building a single composite indicator is that it may mask underlying dimensions, invite simplistic policy conclusions and make identification of proper remedial action more difficult. As noted earlier, the objective of the IGIs is to provide countries with an actionable diagnosis. Therefore, composite indicators were developed to measure different aspects involved in infrastructure governance.

As shown in Figure 5.1, each pillar can be disaggregated into groups of variables, called *sub-pillars*. These sub-pillars reflect countries' performance at a more granular level. The nested structure will help countries understand the driving forces behind each of the composite indicators.

Figure 5.1. Structure of the IGIs



5.2. Implementation of the IGIs by phase

The implementation of the IGIs is being carried out in three phases (See Figure 5.2). In phase 1, three composite indicators were built in order to measure the following three pillars of the Recommendation: 1) long-term strategic vision for infrastructure; 2) fiscal sustainability, affordability, and value for money; and 3) efficient and effective public procurement. In the second phase, the composite indicators for four of the remaining pillars of the Recommendation, plus the cross-cutting pillar on environmentally sustainable

and climate-resilient infrastructure were developed. In the third and final phase, the composite indicators for the remaining pillars of the Recommendation will be developed. Results for the full set of indicators will provide an overarching analysis of countries' performance across all dimensions of the *OECD Recommendation on the Governance of Infrastructure* and on the cross-cutting pillar on environmentally sustainable and climate-resilient infrastructure. Results from the first phase are presented and discussed in this paper. They are also presented in the [OECD Infrastructure Toolkit](#). The toolkit is an online resource to guide policymakers in the implementation of the *OECD Recommendation on the Governance of Infrastructure*. It explores each of the ten pillars of the Recommendation as well as cross-cutting themes relevant for infrastructure (e.g. green gender and resilience), providing policy tools, indicators and illustrative case studies. It provides a repository of good practices to help countries design their own policy strategies and implement the Recommendation according to their specific national circumstances.

Figure 5.2. Data collection by phase



5.3. Data collection and validation

The IGIs were built using data collected via OECD survey instruments, namely the Survey on the Governance of Infrastructure and other relevant data collected from OECD policy communities. The data collection process is being carried out in three phases (See Figure 5.2). The first phase of data collection was completed with the implementation of the 2020 Survey on the Governance of Infrastructure in January 2021 and covers three of the ten pillars of the *Recommendation on the Governance of Infrastructure*, as follows: development of a long-term vision for infrastructure; fiscal sustainability, affordability, and value for money; and efficient and effective public procurement.

The 2020 Survey was designed based on inputs from the relevant divisions in the Governance Directorate and in consultation with the SIP Network and the LPP. The survey measures countries' performance for the first three pillars of the Recommendation and is composed of 51 questions. Invitations to participate in the survey were sent to all OECD countries, including delegates from the SIP Network and main contact

points in country delegations. Responses to the 2020 survey encompass 32 OECD country responses¹. The survey monitors practices at the national/federal level and does not cover specific practices at subnational levels. Respondents were predominantly senior officials in the central/federal ministries of infrastructure, public works and finance, as well as in infrastructure agencies and other line ministries. Data for Czech Republic were not used in this phase as they did not respond to all the questions in the survey. Data for Denmark, France, Israel, the Netherlands, Poland and Sweden are not available as these countries did not respond to this round of the survey.

OECD qualitative surveys rely on the expertise of its policy networks in order to ensure the ownership and contextual understanding of the responses, which in turn are verified through an OECD methodology of quality control and response validation. The discussion and review of both the methodology and preliminary findings, along with data interpretation, through OECD policy networks such as the SIP, is thus an essential component of ensuring relevant and actionable indicators.

The process included various steps to ensure the highest standards in data quality and accuracy. Before the survey was launched, the questionnaire and the glossary of key terms were discussed with the delegates of the SIP Network at the 2020 Annual Meeting. The draft survey was then circulated for comments by written procedure. After the data were collected, a data cleaning process took place from January to April 2021. The process checked for internal and external consistency in the survey responses, comparing the answers to previous answers provided in related questionnaires, and verifying that supporting evidence was systematically provided before validating the responses.

The second phase of data collection was implemented in the course of 2022, where a new survey was prepared and implemented for data collection on four of the remaining pillars of the Recommendation and on the cross-cutting pillar on environmentally sustainable and climate-resilient infrastructure. In the third phase, data on the remaining three pillars will be collected through a new survey. The implementation of the final phase will provide a full set of indicators on the governance of infrastructure.

5.4. Selection of variables and re-coding

The sub-pillars were constructed from a set of variables that aim to measure the adoption and adequacy of governance practices in line with the [OECD Recommendation on the Governance of Infrastructure](#). The variables were selected in order to measure countries' performance in infrastructure governance in terms of inputs and processes (e.g. policy tools, norms of interaction, decision-making methodologies and monitoring strategies). The proposed composite indicators did not include variables related to outputs or outcomes (e.g. levels of investment, quality of infrastructure services, amounts of capital stock, achievement of policy objectives). It is important to note that the selection of variables and re-coding, and thus the structure of the composite indicators, could be subject to change in future editions of the IGIs to account for changes in institutional, political, and economic settings across OECD countries. An overview of the sub-pillars under each of the three pillars in Phase 1 is shown below in Figure 5.3.

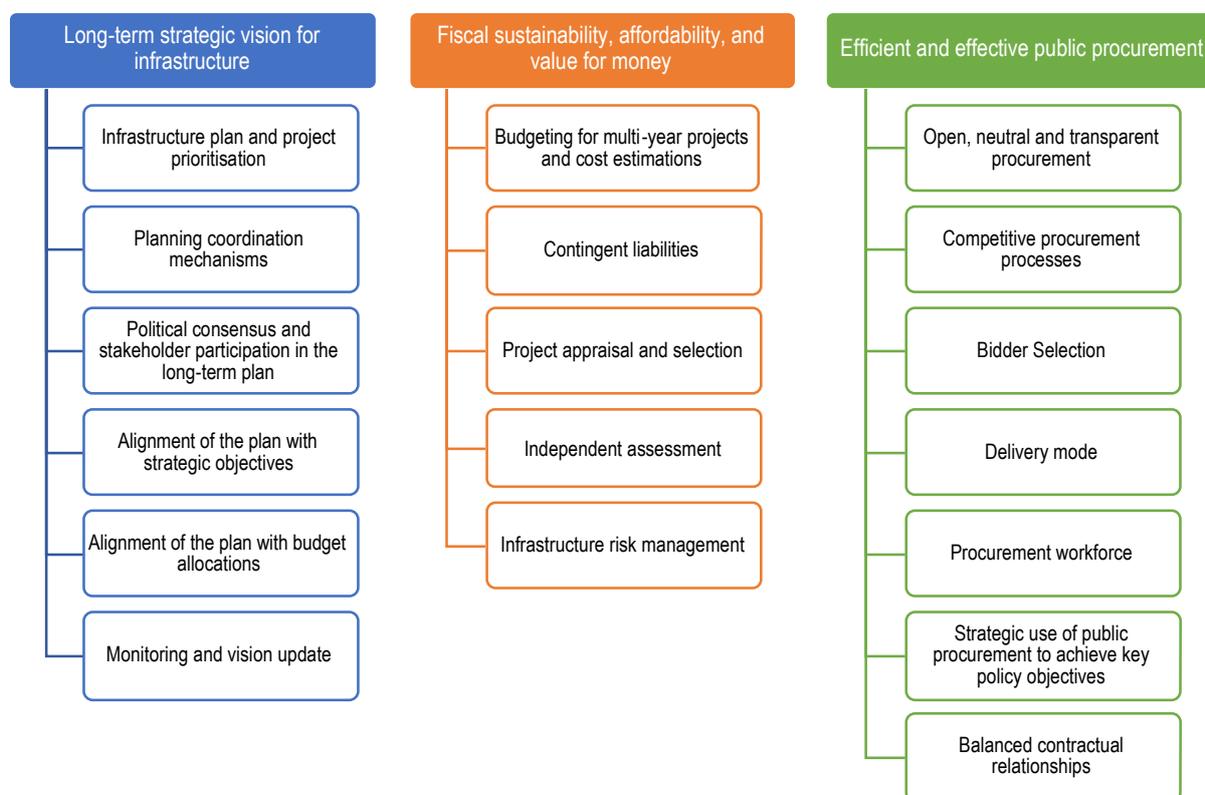
The 2020 OECD Survey on the Governance of Infrastructure was designed to collect qualitative data. Therefore, the responses to the survey questions were re-coded using numerical values between 0 and 1, where 1 is the maximum value and indicates complete alignment with the best practices highlighted in the *OECD Recommendation on the Governance of Infrastructure*, and 0 is the minimum value indicating the absence of such practices in the country. The full list of variables and their corresponding scores is provided in Annex A. Variables were re-coded as follows:

¹ At the time of conducting the survey, Costa Rica's data was collected since it was an accession country. Costa Rica became a member country during the process of the construction of the indicators.

- *Variables on formal requirements:* For the large majority of the questions, a value of 1 was awarded for the existence of requirements that apply to all infrastructure sectors, all types of projects or, all public entities at the central level. A value of 0.5 was awarded for the existence of requirements adopted only for some sectors, for some types of projects or, by some public entities. A value of 0 was awarded for the absence of formal requirements.
- *Frequency type variables:* A value of 1 was awarded for always, a value of 0.75 for most/sometimes (more than 50% of the time), a value of 0.25 for some/rarely (less than 50% of the time) and a value of 0 for never.
- *Binary type variables (Yes/No):* For this type of variables, a value of 1 was awarded for “Yes” and a value of 0 for “No”.
- *Multiple-answer variables:* For variables measuring the adoption of more than one tool or mechanism available, all available options are given equal fraction of the score, which adds up to 1. Respondents were able to choose more than one option. The score for this type of variable will be the sum of all the options chosen by the respondent.
- *Single-answer variables measuring adequacy:* A score between 0 and 1 is given depending on the level of adequacy of the tool or mechanism adopted. A value of 1 was awarded to the answer that reflects the most adequate and comprehensive tool, a value between 0.25 and 0.75 to answers that reflect different levels of adequacy, and a value of 0 for the absence of tools and mechanisms. As opposed to the multiple-answer variables, respondents were only able to choose one option.

It should be noted that in the first phase, the responses to the answer option “Other” in the survey were not taken into account in developing the indicators due to the variability in these responses which makes evaluation and comparisons across countries difficult.

Figure 5.3. Overview of the three pillars and their corresponding sub-pillars developed in Phase 1



5.5. Missing data

Due to the cross-cutting nature of the concept of infrastructure governance, the 2020 Survey on the Governance of Infrastructure required respondents from different institutions to provide information on the infrastructure governance frameworks and practices in a country. The Czech Republic reported lacking the institutional capacity to provide the necessary information to complete all the questions provided in the survey. Therefore, there are reasons to assume that the data for this country are missing in a not random fashion. To overcome this, the complete case analysis approach was used and the country with missing records was omitted entirely from the analysis. As the data used to build the composite indicators are qualitative, data imputation was avoided to deal with missing data.

5.6. Weighting and aggregation

The IGIs present composite indicators reflecting countries' performance in the pillars in the [OECD Recommendation on the Governance of Infrastructure](#) and on environmentally sustainable and climate-resilient infrastructure. To build the composite indicators, all the sub-pillars within each pillar were given equal weights. However, the variables within a sub-pillar were weighted differently depending on: i) the number of variables that make up each sub-pillar, as the larger the number of variables within a sub-pillar the lower the weight each variable will have; and ii) the relevance of each variable, where a greater weight was given to variables that are more relevant in measuring a specific sub-pillar. The weights assigned to the variables in each sub-pillar add up to 1. The weighted scores of all the variables were totalled to arrive

at a sub-pillar score that ranges from 0 to 1. Given the number of sub-pillars for each pillar, the final weights of the sub-pillars are: 17% each under pillar 1, 20% each under pillar 2, and 14% each under pillar 3. The linear aggregation method was used to first aggregate the variables into a sub-pillar (i.e. weighted arithmetic mean), and then the sub-pillars into a composite indicator (i.e. arithmetic mean). Experts and public officials from the SIP Network and the LPP were consulted over the assignment of weights and the aggregation type before the final set of weights was confirmed. The weights for each variable in a sub-pillar are shown in Annex A.

Results from composite indicators should be interpreted with caution. Linear aggregation allows for constant compensability, meaning that the deficit in one variable or sub-pillar can be offset (compensated) by a surplus in another. Consequently, countries with equal or closely similar composite indicators can display very different profiles (i.e. a country can have a large variability across its sub-pillar scores, while the other can have more balanced scores). In line with the *OECD Recommendation on the Governance of Infrastructure*, countries are encouraged to carefully examine the results at the sub-pillar level, in order to identify the areas that require further improvements. This concerns countries with significantly low scores on a sub-pillar who may seek to improve their overall composite indicator.

5.7. Multivariate analysis

Multivariate analysis was employed to study the overall structure of the data collected. The analysis was used to further help guide methodological choices with respect to variable grouping and aggregation. The techniques used in the multivariate analysis are detailed below.

5.7.1. Cronbach coefficient alpha

The Cronbach coefficient alpha (c-alpha) was used as a measure of internal consistency and scale reliability. The coefficient shows how related the variables are as a group and to what extent they measure the same underlying concept. It ranges from 0 to 1, with a coefficient of 0 indicating independent variables and as the coefficient approaches 1, the more correlated the variables are and measure the same underlying concept, i.e. they are consistent. A c-alpha of 0.7 is usually recommended as an acceptable reliability threshold (Lafortune and Ubaldi, 2018^[12]). The c-alpha test was used to measure internal consistency at the pillar level (i.e. long-term strategic vision for infrastructure; fiscal sustainability, affordability, and value for money; and effective and efficient public procurement).

Table 5.1. Cronbach coefficient alpha for the three pillars

Pillar	Number of variables	Cronbach Coefficient Alpha
Long-term strategic vision for infrastructure	26	0.76
Fiscal sustainability, affordability, and value for money	21	0.71
Efficient and effective public procurement	37	0.85

As shown in Table 5.1, the c-alpha for the three pillars were over the threshold of 0.7. The c-alpha for pillar 3 on efficient and effective public procurement was 0.85, suggesting that the variables used in this pillar have relatively high internal consistency. Similarly, a c-alpha of 0.76 for pillar 1 on long-term strategic vision for infrastructure suggests that the variables used in this pillar are measuring well the same underlying construct. The c-alpha for pillar 2 on fiscal sustainability, affordability, and value for money

was 0.71, the lowest among the three pillars. Pillar 2 looks at different processes and practices involved in the decision-making and budgeting stages of infrastructure projects, which could explain why the variables may have relatively low internal consistency compared to the variables used in the other two pillars.

5.7.2. Factor analysis

Factor analysis was used to check the structure of the data along the variable dimension, to help identify groups of variables that are statistically similar and that could be regrouped under a sub-pillar where such grouping is conceptually relevant. High correlations between variables from different sub-pillars may indicate that the sub-pillars are measuring the same underlying concept, in which case the variables would have to be grouped to prevent the double counting of the sub-pillar in the composite indicator. However, factor analysis alone should not determine double counting. The analysis of a variable vis-à-vis others and the phenomena they jointly aim to measure should also determine whether highly correlated variables measure separate underlying concepts. It should be noted that factor analysis was used as a searchlight to help identify any unexpected trends (Arndt et al., 2015^[13]). It was used to assess the way variables are grouped at the sub-pillar level, providing more insight into how the proposed model explains common variance amongst variables within each one of the pillars.

The factor analysis was run separately for each pillar. The principal component factor analysis, the preferred methodology in the development of composite indicators, was used to extract the principal components and consider them as factors (groups of variables). The Kaiser criterion was used to determine the number of factors to be retained, which means dropping all factors with eigenvalues (variance of the factor) below 1. The factors retained explain above 75% cumulative variance in each pillar. On its own, the factors resulting from this analysis lack a meaningful interpretation. The groups of variables offered by the factors analysis were interpreted together with the conceptual framework underpinning the composite indicators exercise.

The results were carefully reviewed to look for any set of variables that measure the same underlying dimension and that could be grouped to avoid double-counting. The results offered several cases where the factors matched well the conceptual groupings (sub-pillars). In the case of variables with high levels of covariance but initially placed in different sub-pillars, the results were discussed with experts to determine if the variables needed to be regrouped. Following the consultation with experts, some sub-pillars were re-adjusted. These include infrastructure plan and project prioritisation under pillar 1, budgeting for multi-year projects and cost estimations, independent assessment and infrastructure risk management under pillar 2, and delivery mode and competitive procurement processes under pillar 3. In most of these cases, two initial sub-pillars that measure similar or highly related concepts were combined to form one sub-pillar to retain as many variables as possible under that sub-pillar. In the case of variables that aim to measure conceptually different phenomena, no changes were introduced to the structure as these variables provide valuable information for the construction of the composite indicators. This draft paper presents only the final structure of the composite indicators. More detailed information on the results from the factor analysis can be found in Annex B.

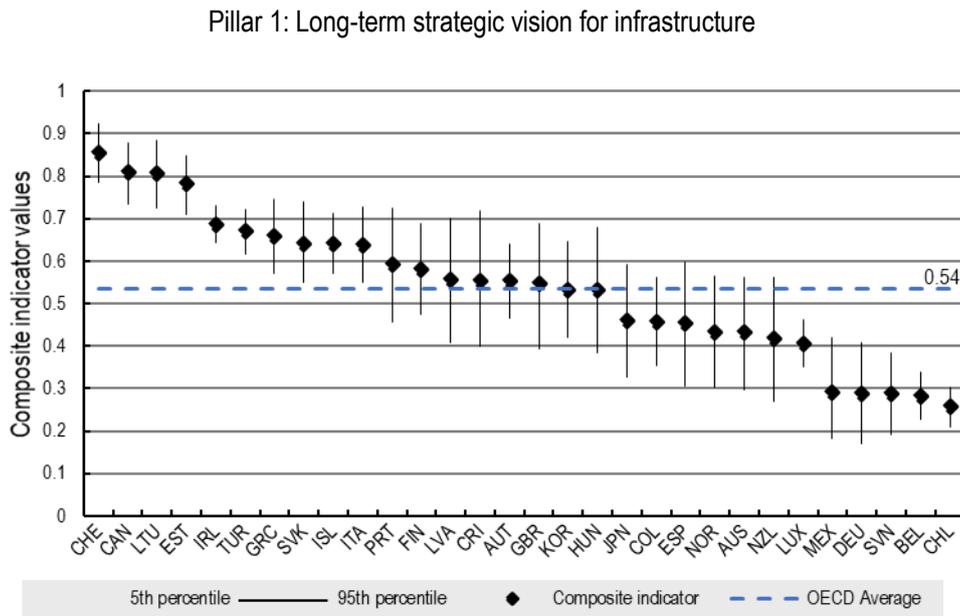
5.8. Sensitivity analysis

To assess the robustness of the composite indicators, Monte Carlo simulations were used to study how uncertainty in the weighting schemes affects the composite indicator values. This technique uses 1 000 sets of randomly generated simulated weights to calculate possible composite indicator scores for each country under different weighting schemes. It is important to note that not all the combinations of weights used to create these intervals can be viewed as realistic outcomes (Arndt et al., 2015^[13]).

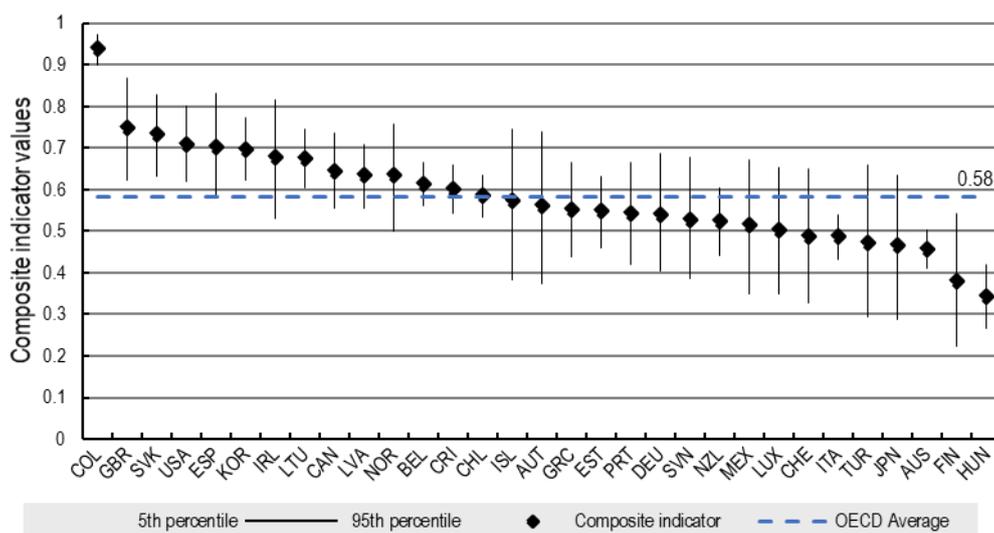
The size of the interval of possible composite indicator values varies depending on the country profile. Countries with a balanced profile (i.e. similar sub-pillar values under a determined pillar) will have a narrow interval. This indicates that the composite indicator values for these countries are not very sensitive to the choice of weights given to the sub-pillars. On the other hand, countries with a mixed profile will have a broader interval indicating that their composite indicator values are relatively more sensitive to the choice of weights for the sub-pillars. Figure 5.4 presents the results from sensitivity analysis for the three pillars.

Results obtained show that all the country scores lie within the 90% confidence intervals. For most countries, the composite indicator values are not very sensitive to the choice of weights given to the sub-pillars. For pillar 1, the composite indicator values of Costa Rica, Hungary, Latvia, New Zealand, Spain and the United Kingdom appear to be more sensitive to the weight values. For pillar 2, the composite indicator values of Austria, Finland, Iceland, Japan, Luxembourg, Mexico, Switzerland and Turkey appear to be more sensitive to the weight values. For pillar 3, the composite indicator values of Colombia, Germany, Japan, Slovenia and Switzerland appear to be more sensitive to the weight values. These are the countries that have large variability in their sub-pillar scores under the pillar. The composite indicator values for pillar 2 appear to be more sensitive to the weight values than those for pillars 1 and 3. The higher degree of sensitivity for pillar 2 owes to the fewer number of sub-pillars under this pillar.

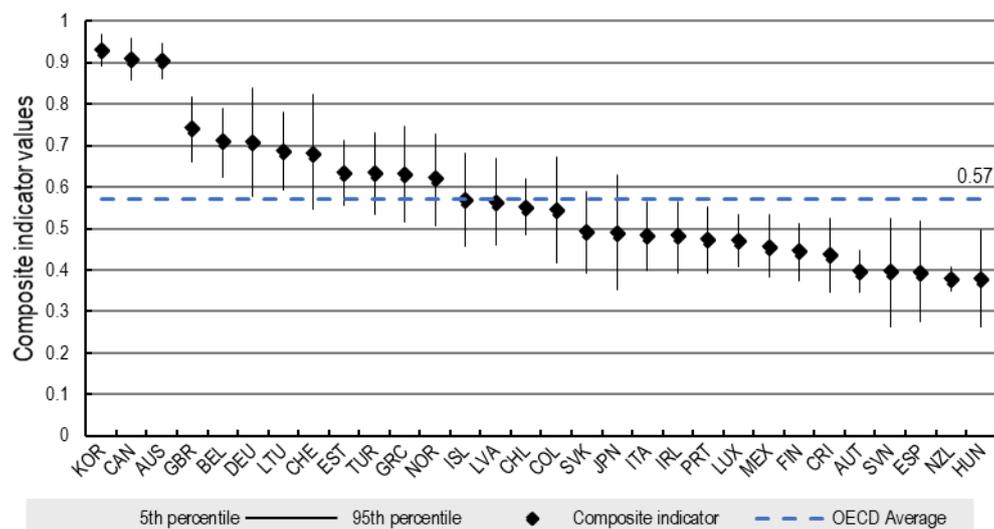
Figure 5.4. Results from sensitivity analysis by pillar



Pillar 2: Fiscal sustainability, affordability, and value for money



Pillar 3: Efficient and effective public procurement



Note: Figures present the sensitivity of the composite indicator values to various weighting assumptions (results from the Monte Carlo simulation where 1 000 different weights were assigned). Diamonds represent the indicator values and vertical lines represent the 90% confidence intervals derived from the random weights analysis.

5.9. Measuring balance in sub-pillar scores

Good infrastructure governance requires improvements across multiple dimensions. Ideally, countries should make progress in all sub-pillars, and low scores in some should not be compensated with high scores in others (i.e. sub-pillars for a country should not show a wide range of values). For each pillar, a rating scale based on the coefficient of variation was used to rate country profiles from balanced (low variability in country sub-pillar scores under a pillar) to unbalanced (high variability in country sub-pillar

scores under a pillar). For each pillar, this analysis shows how balanced country profiles are with respect to sub-pillar scores and help identify country indicators that could have a good average value but with great variability in their sub-pillars. The analysis for each country is presented in the [OECD Infrastructure Toolkit](#).

5.10. Limitations of composite indicators

Composite indicators are useful in conveying large amounts of information through an easily understood index. Nevertheless, composite indicators should be interpreted with caution. The IGIs, while providing cross-country comparison, are not context-specific, nor can they fully capture the complex realities of the quality of infrastructure governance frameworks and practices. Although country responses to the 2020 Survey on the Governance of Infrastructure were supported with evidence and examples where possible, the data do not provide an in-depth assessment of the quality of country practices. It should be noted that the IGIs are aimed at monitoring practices at the national/federal level and do not cover specific practices at subnational levels.

The IGIs should be complemented with in-depth qualitative country reviews to help countries interpret the findings and provide a more detailed analysis of the content. The strengths and shortcomings of countries' infrastructure governance frameworks and practices should also be verified in this way. In order to provide context-specific recommendations for improvement, it is important to take into consideration diverse governance structures, multi-level governance systems, administrative cultures, institutional and constitutional settings, allocation of responsibilities across levels of government, fiscal health and physical asset needs, intergovernmental fiscal frameworks, as well as understand infrastructure priorities through the lens of a country's political agenda. For example, achieving a carbon-neutral transition or the use of infrastructure to generate employment or overcome regional inequalities. Due to heterogeneity in institutional frameworks, implementation quality and infrastructure governance practices across the OECD countries, results from countries with similar scores should be interpreted with caution. Furthermore, contextual analyses can aid in identifying corrective action and how to mobilise relevant actors and stakeholders.

6 Results

Results from the first phase of the IGIs provide an overview of countries' performance in three different dimensions: 1) long-term strategic vision for infrastructure; 2) fiscal sustainability, affordability, and value for money; and 3) efficient and effective public procurement. Table 6.1 and Figure 6.1 below present some summary statistics and the OECD average values for the three composite indicators. Two key findings are worth highlighting from the preliminary results:

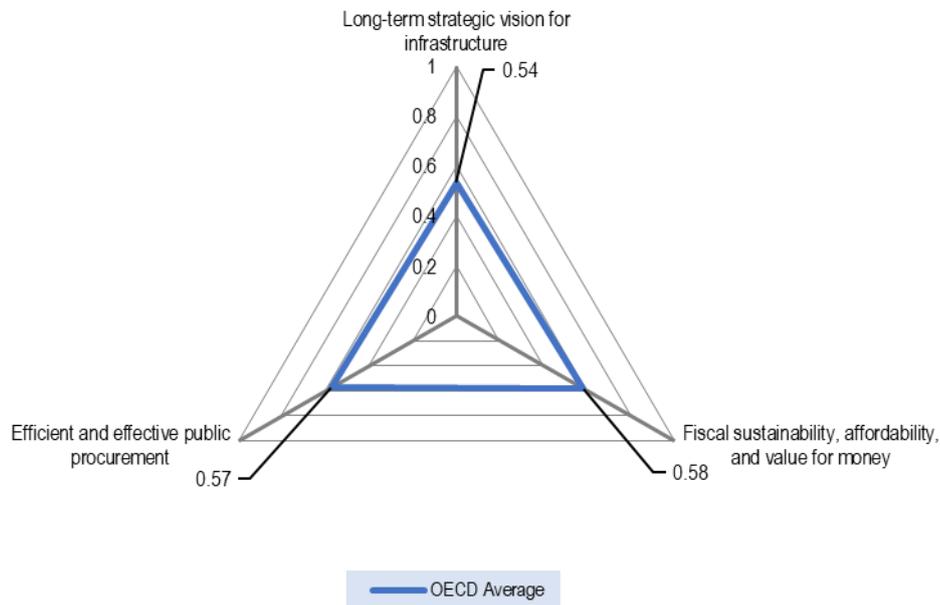
- With OECD averages ranging between 0.5 and 0.6, all pillars require substantive efforts to promote better alignment with the *OECD Recommendation on the Governance of Infrastructure*. Considering that full alignment will be equivalent to a composite indicator value of 1, more efforts are needed to enhance strategic planning, fiscal sustainability, affordability, value for money, and public procurement practices in OECD countries.
- There is a large variability in composite indicator values across OECD countries. This is particularly relevant for the pillars of long-term strategic vision for infrastructure, and efficient and effective public procurement (see Table 6.1). Countries with relatively low composite indicator values are strongly encouraged to look at the results on a more granular level to determine the areas that need improvements within each pillar.

The OECD average and detailed country values for sub-pillars under each of the pillars and key trends across OECD countries are shown below. Comparisons of composite indicators against the OECD average values and across countries should be made with caution, as countries' profiles largely differ even if they present similar composite indicator values.

Table 6.1. Summary statistics for the three pillars

Pillar	OECD mean	Standard deviation	Minimum value	Maximum value
Long-term strategic vision for infrastructure	0.54	0.17	0.3	0.86
Fiscal sustainability, affordability, and value for money	0.58	0.12	0.34	0.94
Efficient and effective public procurement	0.57	0.16	0.38	0.93

Figure 6.1. OECD average composite indicators for pillars in Phase 1



6.1. Key findings across OECD countries on long-term strategic vision for infrastructure

Results for long-term strategic vision for infrastructure show that there is widespread adoption of infrastructure plans and project prioritisation practices across OECD countries. The OECD average value for infrastructure plan and project prioritisation is 0.68 (see Figure 6.3), the highest average value across all sub-pillars under pillar 1. However, long-term cross-sectoral infrastructure plans are not widely adopted. Only 43% of the countries (13 countries out of 30) have cross-sectoral infrastructure plans that exceed 10 years.

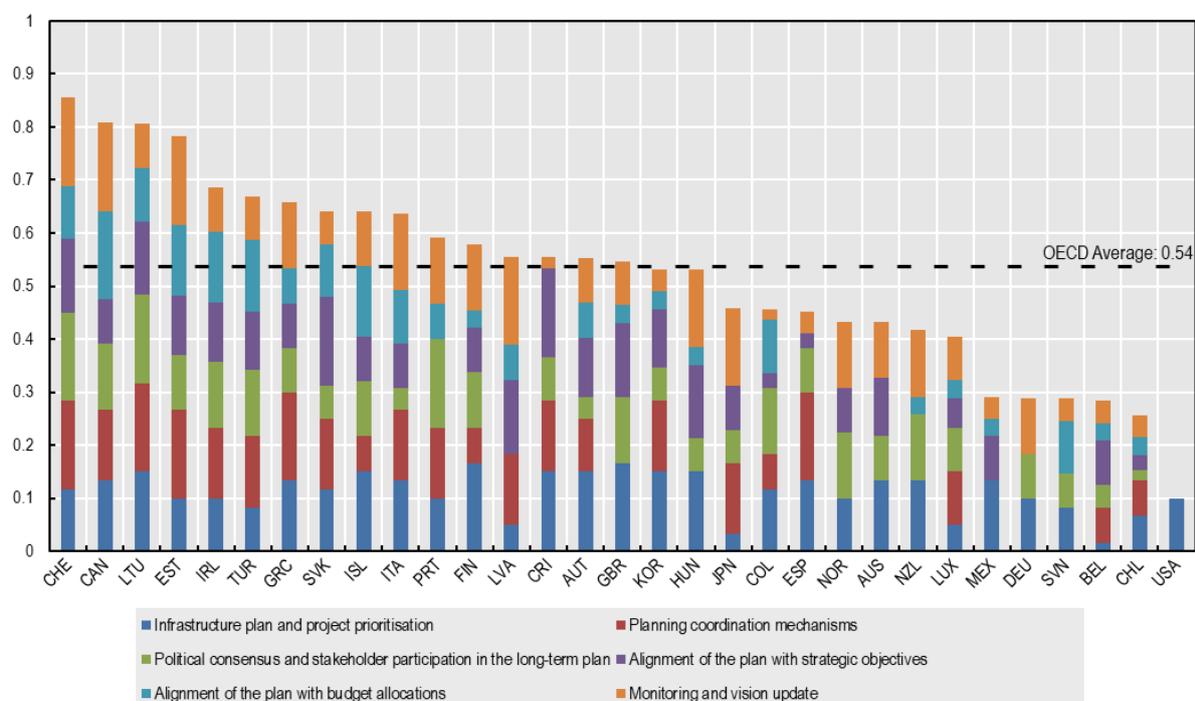
Most OECD countries have adopted mechanisms to promote stakeholder participation in the formulation of national infrastructure long-term plans, but few have mechanisms to ensure political consensus and open public debate. The OECD average value for political consensus and stakeholder participation in the long-term plan is 0.53. Less than half of the countries (13 countries) make available a draft of the infrastructure strategy for parliament discussions with the central government to promote political consensus.

OECD countries have made efforts in aligning long-term infrastructure plans with green objectives, but other key policy objectives are less commonly integrated. The OECD average value for alignment of the plan with strategic objectives is 0.52. While more than two-thirds of the countries (24 countries) have aligned their long-term infrastructure plan with environmental and climate action policies, fewer countries ensure alignment with land use and spatial planning instruments and regional development plans (17 countries each), inclusion and gender mainstreaming (10 countries), and human rights commitments (6 countries).

More efforts are also needed when it comes to aligning national long-term infrastructure plans with budget allocations. The OECD average value for alignment of the plan with budget allocations is 0.37, making it the lowest average value under pillar 1. Under this sub-pillar, 53% of the countries (16 countries) have discussions at the ministerial Cabinet/Council level to ensure alignment between the long-term national infrastructure plans and budget allocations. Other less commonly used tools to promote alignment between

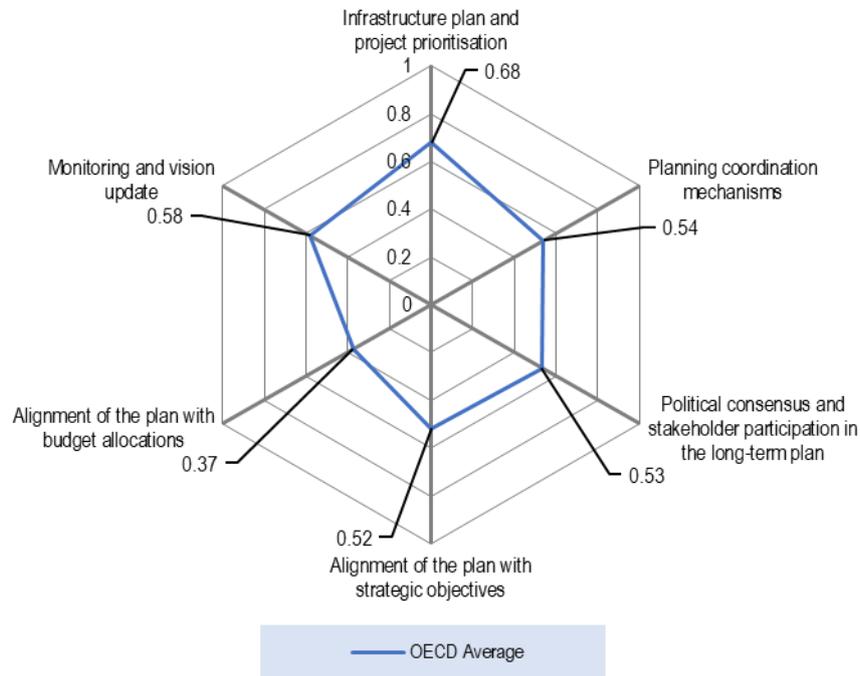
the plan and budget allocations include the role of the central budget authority (13 countries), annual milestones and resourcing indications (10 countries), medium-term expenditure framework (9 countries), and informal and/or ad hoc coordination mechanisms (8 countries).

Figure 6.2. Composite indicator for long-term strategic vision by country



Note: i) Good long-term planning requires improvements across different dimensions. Ideally, countries should make progress in all sub-pillars, and low scores should not be compensated with high scores in some of the sub-pillars (i.e. sub-pillars values should not show large dispersion). ii) Australia's data on long-term strategic vision for infrastructure are based on the 2021 Australian Infrastructure Plan. The 2021 Australian Infrastructure Plan is a practical and actionable roadmap for infrastructure reform, developed by Infrastructure Australia, an independent advisory agency. The plan is not a politically sanctioned document. iii) The OECD average value does not include data for the United States as it does not have a long-term national cross-sectoral infrastructure plan (as of the implementation of the 2020 OECD Survey on the Governance of Infrastructure). Complete data for the United States are only available for the sub-pillar on infrastructure plan and project prioritisation.

Figure 6.3. OECD average sub-pillar scores under long-term strategic vision



6.2. Key findings across OECD countries on fiscal sustainability, affordability, and value for money

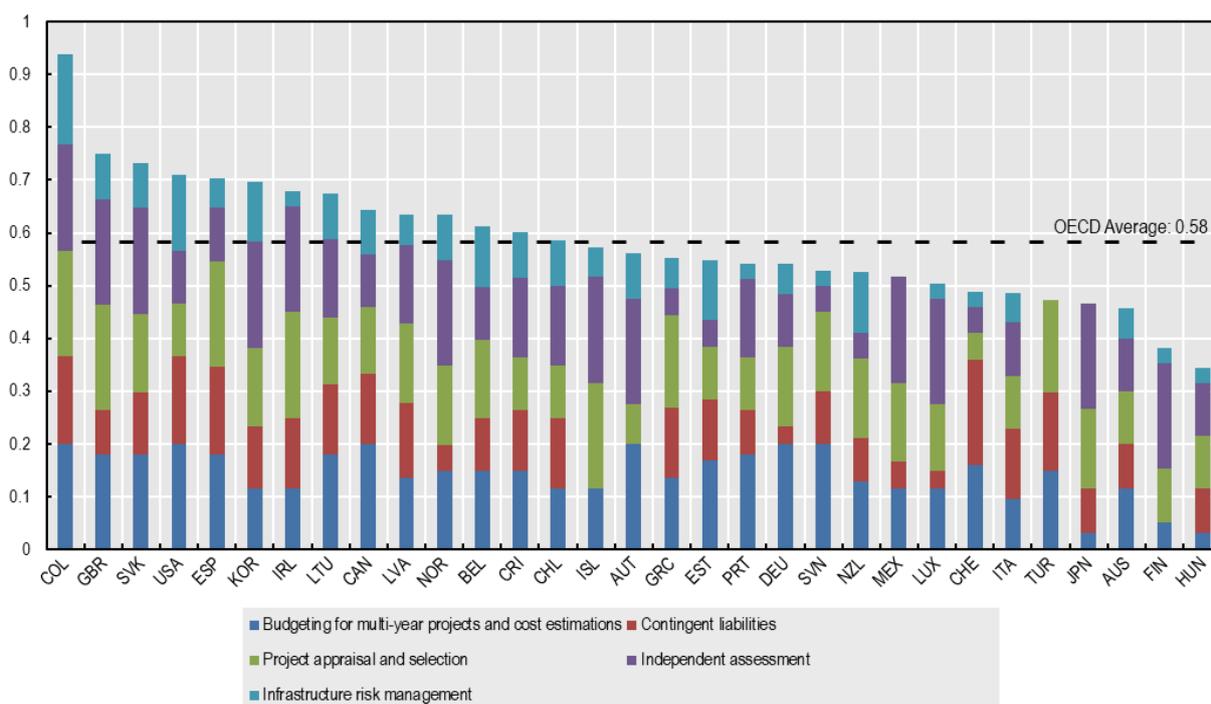
OECD countries use methodologies for project appraisal and selection to provide an independent and impartial expert assessment of infrastructure projects. The OECD average value for project appraisal and selection is 0.69 and for independent assessment, 0.68. More than 85% of the countries use at least one methodology to assess PPPs (28 out of 31 countries) and other infrastructure projects (30 countries). Likewise, more than half of the countries use a formal process to evaluate value for money in all or some PPPs (20 countries), and in other types of infrastructure projects (17 countries). More than two-thirds of the countries provide an independent and impartial expert assessment of all or some projects (24 countries) and have a gatekeeping role by the Ministry of Finance (23 countries). It is important to note that these results do not describe the quality or adequacy of the methods used by countries to appraise and prioritise projects.

Most OECD countries also estimate different types of costs to assess affordability and have practices in place to budget for multi-year projects. The OECD average value for budgeting for multi-year projects and cost estimations is 0.72, the highest average value under pillar 2. More than 85% of the countries estimate construction, operation and maintenance costs (27 countries) when assessing the affordability of new infrastructure projects. However, fewer countries estimate adaptation (18 countries) and decommissioning costs (13 countries). In 84% of the countries (26 countries), funding is either requested for the entire cost of a multi-year project up-front or requested incrementally each year until the project is completed.

Finally, substantive efforts are needed to promote an adequate allocation of risks related to infrastructure projects. The OECD average value for infrastructure risk management is 0.33, the lowest average value under pillar 2. 58% of the countries (18 countries) use central guidelines and methodologies to identify, measure and allocate risks in new infrastructure projects. However, other relevant tools to support an adequate allocation of risks are less commonly used. Less than one-third of the countries use tools to

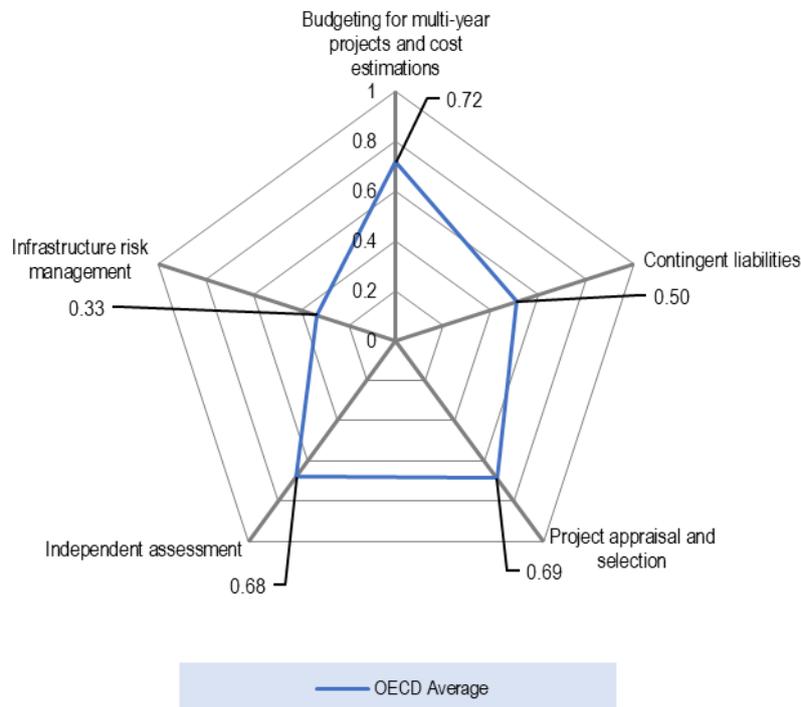
monitor risk allocation (8 countries), special functions or units for risk analysis and management (7 countries), guarantee funds that limit liabilities for government support to the value of its capitalisation (2 countries), and national strategy for risk management (1 country). Only half of the countries undertake mandatory risk management of risks associated with public procurement (16 countries). Two-thirds (20 countries) conduct risk management activities covering the entire infrastructure procurement life cycle.

Figure 6.4. Composite indicator for fiscal sustainability, affordability, and value for money by country



Note: Ensuring fiscal sustainability, affordability and value for money requires improvements across different dimensions. Ideally, countries should make progress in all sub-pillars, and low scores should not be compensated with high scores in some of the sub-pillars (i.e. sub-pillars values should not show large dispersion).

Figure 6.5. OECD average sub-pillar scores under fiscal sustainability, affordability, and value for money



6.3. Key findings across OECD countries on efficient and effective public procurement

OECD countries widely use mechanisms to ensure open, neutral and transparent procurement processes, and identify proposals offering the best value for money. The OECD average value for open, neutral and transparent procurement is 0.72, the highest average value under pillar 3, followed by bidder selection with an average value of 0.71. Although there are mechanisms used by more than two-thirds of the countries to ensure open, neutral and transparent procurement processes, some mechanisms are less commonly used such as platforms for regular dialogues with suppliers on public procurement strategies (15 out of 30 countries), and mandatory market analysis (11 countries). All 30 countries employ a combination of financial and qualitative criteria to select proposals offering the best value for money. Most countries have mechanisms to manage abnormally low or high tenders (21 countries). However, only 43% of the countries (13 countries) take into consideration life cycle costs when awarding contracts, which could decrease their ability to reduce inefficiencies and costs over the long term.

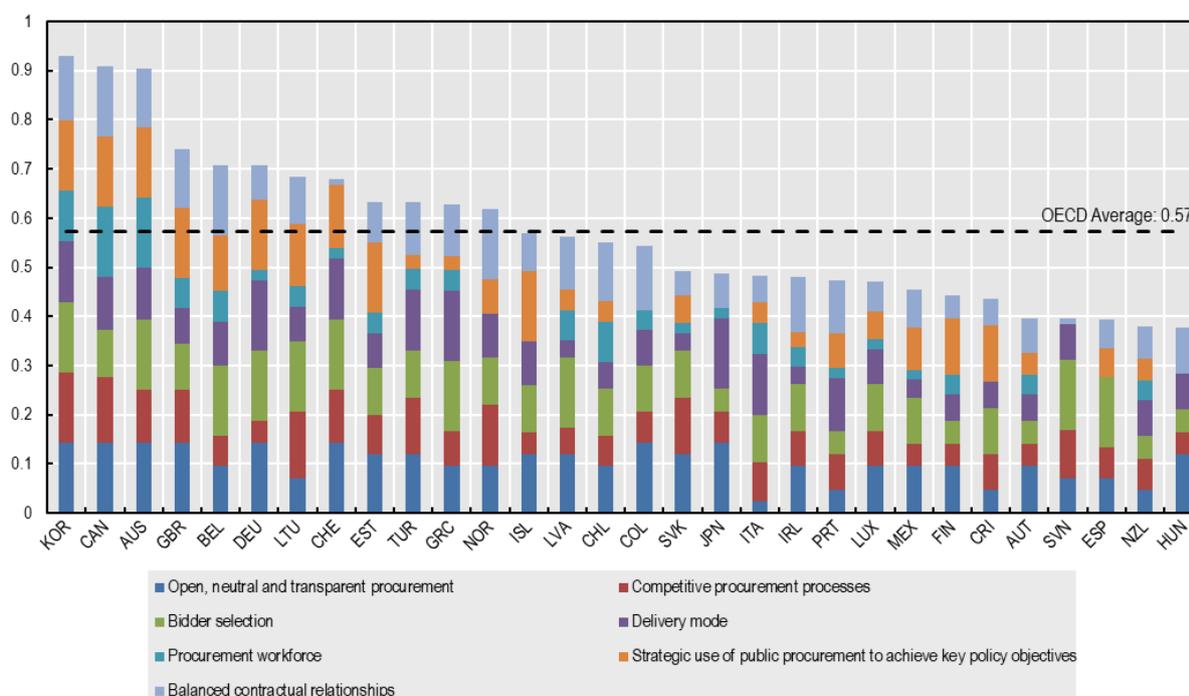
Across OECD countries, there is a need to adopt better practices in terms of choosing projects' delivery modes. The OECD average value for delivery mode is 0.57. In 30% of the countries (9 countries), no methodologies and guidelines are available for choosing the delivery mode of infrastructure projects. In 20% of the countries (6 countries), the decision on the procurement of an asset never precedes decision on the mode of delivery.

OECD countries have made efforts in promoting strategic objectives in public procurement. However, they are falling short when it comes to adopting frameworks to measure success against these objectives. The OECD average value for strategic use of public procurement to achieve key policy objectives is 0.54. Most countries promote environmental protection (22 countries), innovation (21 countries), responsible business

conduct (20 countries), and social policy objectives (19 countries). Only 43% of the countries (13 countries) have standardised frameworks to measure success against these policy objectives.

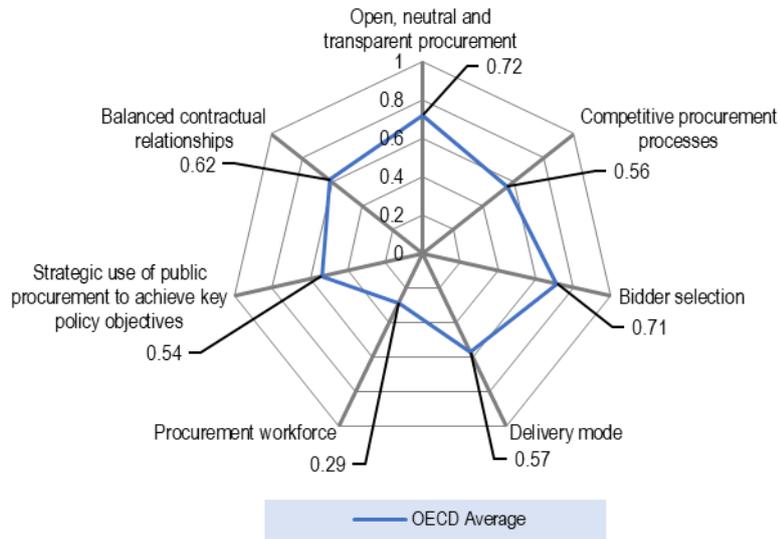
More efforts are needed across OECD countries in adopting mechanisms to ensure that the procurement workforce continuously delivers value for money. Investing in the professionalisation of the procurement workforce responsible for the delivery of infrastructure projects can contribute to quality infrastructure. The OECD average value for procurement workforce is 0.29, the lowest under pillar 3. 67% of the countries (20 countries) provide resources, advice and/or training to support the development of professional skills of procurement officials. However, other mechanisms are less commonly used. 40% of the countries integrate procurement officials within the project management team (12 countries), provide dedicated external support units (11 countries), competency frameworks (6 countries), attractive, competitive and merit-based career options (5 countries), performance-based frameworks (4 countries), and cost-benefit assessment of the size and skills of the procurement workforce (2 countries).

Figure 6.6. Composite indicator for efficient and effective public procurement by country



Note: i) Efficient and effective public procurement of infrastructure requires improvements across different dimensions. Ideally, countries should make progress in all sub-pillars, and low scores should not be compensated with high scores in some of the sub-pillars (i.e. sub-pillars values should not show large dispersion). ii) Complete data for the United States are not available as the country does not traditionally rely on public procurement of infrastructure at the Federal level.

Figure 6.7. OECD average sub-pillar scores under efficient and effective public procurement



7 Conclusion

Infrastructure is playing an increasingly important role in governments' economic, social and environmental agendas. Recent OECD data show that most countries will leverage infrastructure investments to recover from the COVID-19 crisis. Good infrastructure governance is key to ensuring that infrastructure investments contribute to a sustainable recovery and higher long-term growth. The IGIs resonate with a general call for evidence in the infrastructure governance field. More data are needed to inform capacity building, policy and decision-making in infrastructure. They will help countries improve infrastructure governance through rigorous assessment of government's capabilities, strengths and key areas for improvement. Countries will be able to understand how they perform in each of the pillars included in the *OECD Recommendation on the Governance of Infrastructure* and on environmentally sustainable and climate-resilient infrastructure and highlight the areas which require more attention.

Results from the first phase of the IGIs show large variability in country performances in the three pillars: development of a long-term vision for infrastructure; fiscal sustainability, affordability, and value for money; and efficient and effective public procurement. On average, countries performed better in guarding fiscal sustainability, affordability, and value for money compared to the other two pillars. On the other hand, long-term strategic vision for infrastructure is a pillar that requires more attention, as it is the principal means by which governments will be able to ensure that infrastructure policies are aligned with political commitments such as climate change objectives. Within each pillar, some sub-pillars require more improvements on average. Under pillar 1, improvements are required in alignment of infrastructure plan with budget allocations. Under pillar 2, countries need to pay more attention to infrastructure risk management. Under pillar 3, it is procurement workforce that requires more attention.

The results should be interpreted bearing in mind the limitations of composite indicators. The IGIs are not context-specific nor fully capture the complex realities of the quality of infrastructure governance frameworks and practices. The IGIs should be seen as a means for initiating discussion rather than drawing simplistic policy conclusions. Countries are strongly encouraged to look at the results at a more granular level to determine the areas that need improvements within each pillar.

The next steps for the development of the IGIs include the collection of data (see Section 5) and the corresponding construction of the remaining composite indicators. Additional research could also be conducted to explore the possibility of summarising or aggregating the composite indicators into a number of overall indexes to facilitate their analysis and interpretation. Increasing interest in understanding the impacts of infrastructure on environmental sustainability, inclusivity and diversity could also provide opportunities for extending the breadth and depth of the IGIs. For instance, the construction of additional composite indicators that focus specifically on gender and social aspects in infrastructure governance could potentially be explored.

Likewise, future avenues for work include interpreting the initial results presented in this report to support countries in the implementation of the *OECD Recommendation on the Governance of Infrastructure*. This could involve the development of tailored policy tools and advice on areas that require more attention based on the results shown by the IGIs. These potential areas for future work could include:

- Alignment of long-term strategic plans with broader policy objectives, such as gender, diversity, inclusiveness, regional development, amongst others;
- Political consensus and open public debate during the strategic planning phase;
- Alignment of long-term strategic plans with budget allocations;
- Tools to support an adequate allocation of risks related to infrastructure projects;
- Good practices in terms of choosing projects' delivery modes;
- Professionalisation of the infrastructure procurement workforce; and
- Promotion of strategic objectives in public procurement.

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Annex A. List of sub-pillars, variables and answer options

Pillar	Weight	Sub-pillars	Weight	Variable	Answer option	Score	Questions
Long-term strategic vision for infrastructure	1	Infrastructure plan and project prioritisation	0.1	Existence of cross-sectoral infrastructure plan	Yes	1	Q1. Does your country have a long-term infrastructure plan (more than 10 years)?
					No	0	
			0.1	Existence of sectoral plans	Yes	1	
					No	0	
			0.1	Length of overall plan	More than 10 years	1	
					Less than 10 years	0	
			0.1	Length of sectoral plans	More than 10 years	1	
					Less than 10 years	0	
			0.2	Primary institution for needs assessment	Yes	1	
					Each line ministry or agency carries their own assessments	0.5	
					No	0	
			0.2	Existence of a shortlist of priority projects	Yes, within and across sectors	1	
					Yes, only within a specific sector	0.5	
					No	0	
0.2	Use of common criteria to prioritise projects in the long-term vision	Yes	1				
		No	0				
							Q2. Is there a primary institution responsible for assessing the country's long-term infrastructure needs?
							Q8. Is there a short list of priority projects at the national level?
							Q9. Which is the primary institution responsible for setting the criteria to prioritise infrastructure projects?

	1	Planning coordination mechanisms	0.4	Coordination between sectors	Yes	1	Q5. Did you use a specific co-ordination mechanism during the formulation (or revision) of the most recent long-term national infrastructure plan for considering the strategic vision across sectors and levels of government?	
					No	0		
			0.4	Coordination across levels of government	Yes	1		
					No	0		
			0.2	Transboundary coordination	Yes	1		
					No	0		
	1	Political consensus and stakeholder participation in the long-term plan	0.5	Level of stakeholder participation	Drafts disseminated with identified stakeholders	0.25	Q10. What is the level of participation of stakeholders during the formulation of the long-term national infrastructure plan?	
					Draft available online	0.25		
					Drafts available to the public for comments	0.5		
					Platforms for open debate and consultation	1		
			0.25	Plan subject to parliament discussions	Yes	1	Q11. Which tools are used to promote political consensus during the formulation of the infrastructure strategy?	
					No	0		
0.25			Plan discussed and approved by the cabinet	Yes	1			
				No	0			
1			Alignment of the plan with strategic objectives	0.17	Alignment with national strategic document	Yes	1	Q3. Does the long-term national infrastructure plan explicitly consider how to align the infrastructure strategic vision with the following policies?
						No	0	
	0.17	Alignment with land use and spatial planning		Yes	1			
				No	0			
	0.17	Alignment with environmental plans		Yes	1			
				No	0			
	0.17	Alignment with human rights		Yes	1			

			commitments	No	0				
		0.17	Alignment with inclusion and gender mainstreaming	Yes	1				
				No	0				
		0.17	Alignment with regional development plans	Yes	1				
				No	0				
1	Alignment of the plan with budget allocations	0.2	Alignment with medium-term expenditure framework	Yes	1	Q12. What tools are in place to promote alignment between the long-term national infrastructure plan and budget allocations?			
				No	0				
		0.2	Plan has annual milestones and resourcing indications	Yes	1				
				No	0				
		0.2	Alignment promoted by the central budget authority	Yes	1				
				No	0				
		0.2	Alignment handled via discussions at Cabinet / Council of ministers	Yes	1				
				No	0				
		0.2	Informal and/or ad hoc coordination mechanisms	Yes	1				
				No	0				
		1	Monitoring and vision update	0.5	Benchmarks to monitor implementation		Project timeline	0.25	Q13. Which benchmarks are included in the current long-term national infrastructure plan to facilitate the monitoring of its implementation?
							Cost estimations	0.25	
Other non-project related objectives	0.25								
Achievement of defined policy outcomes	0.25								
0.5	Mechanisms for updating/revising the plan			Regular review process	1	Q7. Are there mechanisms in place to update/revise the infrastructure vision?			
				Revision based on political demand/economic or social need	0.5				

					Vision not regularly updated	0		
Fiscal sustainability, affordability, and value for money	1	Budgeting for multi-year projects and cost estimations	0.2	Budgeting for multi-year projects	Funding requested for the entire cost up-front	1	Q23. How are multi-year infrastructure projects budgeted for?	
					Funding requested incrementally each year	0.5		
					Other funds outside of the budget	0		
					Case by case basis	0		
				0.16	Estimation of construction costs	Yes	1	Q33. What costs are generally estimated to assess affordability of new infrastructure projects?
		No	0					
			Estimation of operation costs		Yes	1		
		No			0			
			Estimation of maintenance costs		Yes	1		
		No			0			
			Estimation of adaptation costs		Yes	1		
		No			0			
			0.16	Estimation of decommissioning costs	Yes	1		
		No			0			

	1	Contingent liabilities	0.5	Identification of contingent liabilities	Contingent liabilities are identified	0.5	Q25. Is there a formal requirement to identify contingent liabilities associated with new infrastructure projects?		
					Government's exposure to fiscal risks is measured	0.75			
					Costs of bearing contingent liabilities are estimated	1			
					No formal requirement	0			
			0.5	Management of contingent liabilities	Disclosure in accrual and accounting analysis	0.33	Q26. How are contingent liabilities associated with new infrastructure projects managed?		
					Disclosure in budget documentation	0.33			
					Regularly monitored	0.33			
					No specific mechanism	0			
			1	Project appraisal and selection	0.25	Formal process to evaluate value for money in PPPs	For all projects	1	Q28A. Is there a formal process to evaluate value for money in PPPs?
							For projects above a certain threshold / specific sectors	0.5	
Not used	0								
0.25	Formal process to evaluate value for money in other projects	For all projects			1	Q28B. Is there a formal process to evaluate value for money in other infrastructure projects?			
		For projects above a certain threshold / specific sectors			0.5				
		Not used			0				
0.25	Assessment of PPPs	Yes			1	Q31A. What methodologies are used to assess PPPs?			
		No			0				
0.25	Assessment of other infrastructure projects	Yes			1	Q31B. What methodologies are used to assess other infrastructure projects?			

				No	0		
1	Independent assessment	0.5	Independent assessment	All projects / projects above a certain threshold	1	Q30. Are Infrastructure projects subject to an independent and impartial expert assessment?	
				Projects identified of special relevance / ad hoc bases	0.5		
				No	0		
		0.5	Ministry of Finance's gatekeeping role	For all projects / projects above a certain threshold	1		Q27. Does the Ministry of Finance have a formal gatekeeping role with respect to the approval of infrastructure projects?
				For projects of specific sectors / only PPPs	0.5		
				No	0		
1	Infrastructure risk management	0.14	National strategy for risk management	Yes	1	Q35. Which type of tools the government uses to support an adequate allocation of risks related to infrastructure projects?	
				No	0		
		0.14	Central guidelines for risk allocation	Yes	1		
				No	0		
		0.14	Special functions or units for risk analysis and management	Yes	1		
				No	0		
		0.14	Guarantee funds that limit liabilities for government support	Yes	1		
				No	0		
		0.14	Tools to monitor risk allocation	Yes	1		
				No	0		
		0.14	Mandatory risk management in public	Yes	1		Q47. Is it mandatory to undertake risk management of

				procurement	No	0	risks associated to the public procurement of infrastructure projects?	
			0.14	Risk management covers entire procurement life cycle	Yes	1	Q48. Are risk management activities covering the entire infrastructure procurement life cycle?	
					No	0		
Efficient and effective public procurement	1	Open, neutral and transparent procurement	0.17	Support tools for the design of tender documents	Yes	1	Q37. What mechanisms are in place to ensure open, neutral and transparent procurement processes for infrastructure?	
					No	0		
			0.17	Platforms for regular dialogues with suppliers on public procurement strategies	Yes	1		
					No	0		
			0.17	Mandatory market analysis	Yes	1		
					No	0		
			0.17	E-procurement systems spanning the full procurement cycle	Yes	1		
					No	0		
			0.17	Publication of future procurement opportunities	Yes	1		
					No	0		
			0.17	Allowing firms from other countries to participate	Yes	1		
					No	0		
	1	Competitive procurement processes	0.25	Competitive tendering use as standard method	Yes, for all infrastructure projects	1		Q36. Is competitive tendering the standard method for the procurement of infrastructure projects?
					Yes, for some contracting agencies / depending on the delivery mode	0.5		
Not standard method					0			

			0.25	Requirements for the use of single-source procurement	Single-source procurement must be justified and publicly disclosed	0.5	Q39. What requirements are in place to formally approve the use of single-source procurement for infrastructure projects?		
					Independent body should be responsible for approval of single-source procurement	0.5			
					There are no specific requirements for infrastructure projects	0			
			0.25	Mechanisms to facilitate access to competitors of all sizes	Favouring subcontracting and joint bidding arrangements	0.25	Q40. What mechanisms are in place to facilitate access to procurement opportunities to competitors of all sizes?		
					Simplification of administrative processes	0.25			
					Reduced use of bonds	0.25			
					Allowing smaller firms to participate by awarding by lots	0.25			
			0.25	Incentives for procurement officials to prevent bid-rigging	Yes	1	Q37. What mechanisms are in place to ensure open, neutral and transparent procurement processes for infrastructure?		
					No	0			
			1	Bidder Selection	0.3	Combination of financial and qualitative criteria	Yes	1	Q41. What mechanisms are in place to help identify proposals offering the best value for money?
							No	0	
					0.3	Assessment on life cycle perspective	Yes	1	
							No	0	
0.3	Management of abnormally low or high tenders	Yes			1				

				No	0			
1	Delivery mode	0.5	Decision of investment precedes decision on delivery mode	Always (100% of the time)	1	Q34. Does the government first decide on the procurement of an asset before it chooses the mode of delivery?		
				More than 50% of the time	0.75			
				Around 50% of the time	0.5			
				Less than 50% of the time	0.25			
				Never (0% of the time)	0			
		0.5	Methodologies for choosing delivery mode	Yes, applicable to all infrastructure projects	1	Q42. Are there methodologies and guidelines for choosing the delivery mode of infrastructure projects?		
				Yes, for projects above a certain threshold / specific sectors	0.5			
				No	0			
		1	Procurement workforce	0.14	Attractive career options	Yes	1	Q50. What mechanisms are in place to ensure that the procurement workforce continuously delivers value for money in infrastructure procurement processes?
						No	0	
0.14	Competency frameworks			Yes	1			
				No	0			
0.14	Dedicated external support units			Yes	1			
				No	0			
0.14	Integration within the project management team			Yes	1			
				No	0			
0.14	Resources and training			Yes	1			
				No	0			
0.14	Cost-benefit assessment of the size and skills of the procurement workforce			Yes	1			
				No	0			
0.14	Performance-based frameworks			Yes	1			
				No	0			

	1	Strategic use of public procurement to achieve key policy objectives	0.1	Promotion of innovation	Yes	1	Q44. Does your country provide support to procurement officers on how to harness infrastructure procurement to achieve the following objectives?
				No	0		
			0.1	Promotion of responsible business conduct	Yes	1	
					No	0	
			0.1	Promotion of gender equality	Yes	1	
					No	0	
			0.1	Promotion of environmental protection	Yes	1	
	No	0					
	0.1	Promotion of social policy objectives	Yes	1			
			No	0			
	0.5	Measurement of strategic objectives	Yes	1	Q46. Are standardised frameworks to measure success against the objectives in the question above in place?		
			No	0			
			No	0			
	1	Balanced contractual relationships	0.13	Periodical assessment of contractors' performance	Yes	1	
No					0		
0.13			Dedicated on-site supervision	Yes	1		
				No	0		
0.13			Delivery-based payments	Yes	1		
				No	0		
0.13			Enforcement of contractual clauses	Yes	1		
				No	0		
0.08			Approval and disclosure required for amendments of contract	Yes	1	Q51. What formal tools are in place for infrastructure contract re-negotiation?	
				No	0		

			0.08	Contract re-negotiation restrictions	Yes	1
					No	0
			0.08	Publication requirements for contract re-negotiation	Yes	1
					No	0
			0.08	Escalation procedures for contract re-negotiation	Yes	1
					No	0
			0.08	Open-book practices for contract re-negotiation	Yes	1
					No	0
			0.08	Standard contract clauses for contract re-negotiation	Yes	1
					No	0

Annex B. Results from factor analysis

Tables 1, 2 and 3 below show the variables that have high correlations with a factor, i.e. the factor loadings were greater than 0.5 within the same identified factors.

Table 1. Results from factor analysis for pillar 1 on long-term strategic vision for infrastructure

Factors	Variables
Factor 1	Existence of cross-sectoral infrastructure vision
	Length of overall plan (more than 10 years)
	Use of common criteria to prioritise projects in the long-term vision
Factor 2	Alignment with land use and spatial planning
	Alignment with environmental plans
	Alignment with regional development plans
Factor 3	Existence of a shortlist of priority projects
	Alignment with human rights commitments
Factor 4	Alignment with national strategic document
	Alignment with medium-term expenditure framework
Factor 5	Plan subject to parliament discussions
	Benchmarks to monitor implementation
	Mechanisms for updating/revising the plan
Factor 6	Primary institution for needs assessment
	Level of stakeholder participation
Factor 7	Existence of sectoral plans
	Length of sectoral plans (more than 10 years)
	Plan discussed and approved by the cabinet
Factor 8	Coordination across levels of government
	Transboundary coordination
Factor 9	Coordination between sectors
	Alignment promoted by the central budget authority
	Informal and/or ad hoc coordination mechanisms

Note: Variables that were not well-represented by any of the factors include alignment with inclusion and gender mainstreaming, plan has annual milestones and resourcing indications, and alignment handled via discussions at Cabinet / Council of ministers.

For pillar 1 on long-term strategic vision for infrastructure, factor 3 groups together variables that measure alignment of the infrastructure plan with policy objectives with one that measures project prioritisation. After a careful review, it was determined that although related these variables measure different processes in infrastructure strategic planning and thus should not be grouped. In factor 4, a variable that measures alignment of the infrastructure plan with policy objectives and one that measures alignment with budget allocations are grouped. Factor 5 groups variables that measure tools used to promote political consensus during the formulation of the infrastructure plan and mechanisms for monitoring and updating the plan. Although related, these variables measure different processes in infrastructure strategic planning. Similarly, factor 6 groups variables that measure the assessment of infrastructure needs and the level of stakeholder participation during the formulation of the infrastructure plan. Factor 7 groups variables that measure the existence of an infrastructure plan and tools used to promote political consensus during the formulation of the plan. Factor 9 groups variables measuring the use of mechanisms to promote coordination between sectors during the formulation of the infrastructure plan and alignment of the plan with budget allocations. With these variables measuring different processes and practices in infrastructure strategic planning, it was concluded that these groupings were not conceptually apt.

Table 2. Results from factor analysis for pillar 2 on fiscal sustainability, affordability, and value for money

Factors	Variables
Factor 1	Estimation of adaptation costs
	Estimation of decommissioning costs
	Assessment of PPPs
Factor 2	National strategy for risk management
	Guarantee funds that limit liabilities for government support
Factor 3	Estimation of operation costs
	Estimation of maintenance costs
Factor 4	Mandatory risk management in public procurement
	Risk management covers entire procurement life cycle
Factor 5	Estimation of construction costs
	Formal process to evaluate value for money in PPPs
	Formal process to evaluate value for money in other projects
	Ministry of Finance's gatekeeping role
Factor 6	Identification of contingent liabilities
	Independent assessment
Factor 7	Special functions or units for risk analysis and management
Factor 8	Management of contingent liabilities
	Central guidelines for risk allocation

Note: Variables that were not well-represented by any of the factors include budgeting for multi-year projects, assessment of other infrastructure projects, and tools to monitor risk allocation.

For pillar 2 on fiscal sustainability, affordability, and value for money, factor 1 groups together variables that measure cost estimations and methodologies for project assessment. Similarly, factor 5 groups a variable measuring cost estimations with variables on processes for evaluating value for money and one measuring the Ministry of Finance's gatekeeping role. These variables, although related, measure different practices for promoting value for money and thus should not be grouped. Factor 6 groups together variables measuring identification of contingent liabilities and independent assessment of projects. Similarly, factor 8 groups together variables measuring the management of contingent liabilities and tools for risk allocation. These cases were examined carefully, and it was determined that these groupings were not conceptually apt.

Table 3. Results from factor analysis for pillar 3 on efficient and effective public procurement

Factors	Variables
Factor 1	Periodical assessment of contractors' performance
	Dedicated on-site supervision
	Delivery-based payments
	Enforcement of contractual clauses
Factor 2	Platforms for regular dialogues with suppliers on public procurement strategies
	Publication of future procurement opportunities
	Allowing firms from other countries to participate
	Standard contract clauses for contract re-negotiation
Factor 3	Assessment on life cycle perspective
	Competency frameworks
	Integration within the project management team
	Performance-based frameworks
Factor 4	Mechanisms to facilitate access to competitors of all sizes
	Incentives for procurement officials to prevent bid-rigging
	Contract re-negotiation restriction
Factor 5	Approval and disclosure required for amendments of contract
	Publication requirements for contract re-negotiation
Factor 6	Resources and training
	Promotion of innovation
Factor 7	Promotion of gender equality
	Measurement of strategic objectives
Factor 8	Attractive career options
	Cost-benefit assessment of the size and skills of the procurement workforce
Factor 9	Mandatory market analysis

	Methodologies for choosing delivery mode
	Dedicated external support units
Factor 10	Support tools for the design of tender documents
	Competitive tendering used as standard method
Factor 11	E-procurement systems spanning the full procurement cycle
	Decision of investment precedes decision on delivery mode
Factor 12	Promotion of responsible business conduct
Factor 13	Management of abnormally low or high tenders

Note: Variables that were not well-represented by any of the factors include requirements for the use of single-source procurement, promotion of environmental protection, promotion of social policy objectives, escalation procedures for contract re-negotiation, and open-book practices for contract re-negotiation.

For pillar 3 on efficient and effective public procurement, many of the factors match well the sub-pillars built under this pillar. One case was reviewed carefully. In factor 9, variables measuring mechanisms for open, neutral and transparent procurement, delivery mode, and capacity building for procurement workforce are grouped together. These variables relate to different processes that contribute differently to ensuring efficient and effective public procurement and thus should not be grouped.