OECD Implementation Handbook for Quality Infrastructure Investment

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Supporting a Sustainable Recovery from the COVID-19 Crisis

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Foreword

The COVID-19 crisis has underlined the central role played by economic and social infrastructure – such as energy, water and sanitation, transport, communications, and hospitals and related services – in our economies and societies. Meanwhile, COVID-19 has brought with it a realisation of the need to do things differently in the future, to innovate, to build-back-better. In this context, given its wide-ranging and potentially transformative impacts, infrastructure investment provides a key instrument to bring about many desired changes, and deliver on ambitious economic, social, and environmental objectives.

The 2020 OECD Ministerial Council Statement highlighted the crucial role infrastructure investment will play in ensuring a strong, resilient, sustainable and inclusive recovery from the COVID-19 crisis. Quality infrastructure investment consistent with the voluntary *G20 Principles for Quality Infrastructure Investment* is vital in order to maximise the economic, social, environmental, and development impacts of infrastructure. The *OECD Implementation Handbook for Quality Infrastructure Investment* serves as a practical tool for governments to support quality infrastructure investment as they consider new infrastructure investments as part of their COVID-19 response and also for their long-term development goals.

The Handbook provides a forward-looking view on how quality infrastructure investment can be implemented to deliver on key policy priorities, notably catalysing the low-carbon transition, safeguarding biodiversity, building resilience, addressing regional disparities, and underpinning sustainable development. The Handbook assesses some of the infrastructure investment needs required to deliver on these priorities, identifies challenges and bottlenecks, and proposes solutions. It highlights effective infrastructure governance, the mobilisation of financial resources, and the subnational dimension of infrastructure governance and investment as key means for delivering quality infrastructure investment.

The Handbook complements the *OECD Compendium of Policy Good Practices for Quality Infrastructure Investment* (2020). While the Compendium is a policy guidance tool, the Handbook is an analytical and operational tool, focussing on selected major issues and challenges that are relevant in the context of the current crisis as well as for long-term sustainability, with concrete examples and case studies to illustrate the suggested solutions. Given the continued challenges in delivering quality infrastructure investment, the Handbook usefully lays out a potential future work agenda for the OECD.

The Handbook is a contribution to the OECD Horizontal Project on "Strategic Policies for Sustainable Infrastructure". The preparation and drafting of the Handbook was undertaken by several OECD Directorates with extensive input from the International Energy Agency and International Transport Forum, ensuring substantive coherence and true horizontality of the work. The Handbook was also developed on the basis of directions provided by the Steering Committee for the Horizontal Project, the Friends of Sustainable Infrastructure Group, the OECD's Executive Committee and the OECD Council.

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Executive summary

Quality infrastructure investment can support a sustainable recovery and deliver key policy priorities, made more critical in a post-COVID-19 context

Infrastructure is the backbone of well-functioning economies, providing connectivity by enabling the flow of goods, people and information, and supplying the necessary inputs in the form of energy and water that constitute the foundation for human well-being and most economic activity. The COVID-19 crisis has further underlined the essential nature of infrastructure and its contribution to the resilience of economies and societies.

While the crisis represents an overwhelming health, economic and social tragedy, it has also brought with it a realisation of the need to do things differently in the future, to innovate, to build-back-better. This implies major transformations in the infrastructure that is to be built in the coming years, as governments reconsider policy priorities and the role of infrastructure in their achievement.

As highlighted by the 2020 OECD Ministerial Council Statement, infrastructure investment has a crucial role to play in ensuring a strong, resilient, sustainable and inclusive recovery from the COVID-19 crisis. Quality infrastructure investment, as framed by the *G20 Principles for Quality Infrastructure Investment*, plays a key role in delivering the needed economic, social, and environmental outcomes that governments are increasingly seeking in the recovery phase and also for the long-term.

The OECD Horizontal Project "Strategic Policies for Sustainable Infrastructure" has contributed to developing guidance on implementing quality infrastructure investment. The *OECD Compendium of Policy Good Practices for Quality Infrastructure Investment* offers comprehensive policy guidance for policymakers and practitioners in developed and developing countries on how best to ensure quality infrastructure investment (QII) at every stage of a project (OECD, 2020[1]). This *Implementation Handbook for Quality Infrastructure Investment* complements the Compendium by providing solutions buttressed by concrete examples for implementing QII that supports a sustainable recovery from the COVID-19 crisis and helps to deliver key policy priorities; in particular:

- Quality infrastructure investment is crucial for ***averting dangerous climate change through supporting the low-carbon transition***, and ***safeguarding biodiversity***.
- Quality infrastructure can contribute to ***building more resilient economies and societies*** by reducing the vulnerability of infrastructure systems to future natural and human-made threats.
- Quality infrastructure investment can improve access and affordability to infrastructure in rural and remote regions, and deprived areas, and ***redress regional disparities***, made more apparent by the COVID-19 crisis.
- Quality infrastructure investment is central to ***advancing the 2030 Agenda for Sustainable Development***, the progress of which COVID-19 has threatened, by enabling economic

transformation in developing economies while safeguarding the environment and reducing poverty and inequality.

However, as governments reconsider their priorities and infrastructure needs, they face key challenges:

- Governments will continue to be under ***intense fiscal pressure***, as they rebuild their finances, which will severely constrain future resources for public infrastructure investment.
- COVID-19 has added to the ***deep uncertainty*** in which infrastructure investment must take place, resulting from powerful driving forces such as climate change and biodiversity loss, accelerating technological change, and demographic and social changes.
- Infrastructure investment is subject to ***increasing levels of complexity*** as it is being called upon to meet multiple objectives and deliver multiple benefits in the short and long-term, in a context of increasing interconnectedness and interdependence of infrastructure systems across geographies, sectors, and levels of government.

Implementing quality infrastructure investment for the post-COVID-19 recovery

In order to overcome these challenges and ensure that infrastructure investment contributes to long-term development goals and policy priorities, delivering quality infrastructure requires:

- **Adopting the necessary policy and regulatory frameworks** that provide the enabling conditions, incentives, and standards that promote sustainable infrastructure investment.
- **Ensuring strong governance mechanisms** so that the right infrastructure gets built in a manner that is cost effective, affordable with respect to life cycle costs and trusted by stakeholders.
- **Identifying innovative solutions to mobilise financing**, to complement public financing, given the scale and urgency of the investment needed to build new types of infrastructure.
- **Enhancing the capacity of subnational governments to invest in quality infrastructure**, given their critical role in delivering a significant proportion of infrastructure.

1. Policy and regulatory frameworks

Ensuring infrastructure investment at the necessary scale in order to support the low-carbon transition, protect biodiversity, and promote resilience requires appropriate policy frameworks and regulations in these fields, notably:

- ***Policy commitments to long-term climate goals, international biodiversity targets, and other environmental objectives*** need to be credible in order to provide a stable framework for long-term investment decisions. Carbon pricing can play an enabling role if set at a sufficiently high level and if concerns over distributional aspects are addressed. Economic instruments internalising the negative impacts of infrastructure on biodiversity can incentivise better choices.
- ***Regulatory frameworks*** should be supportive of deployment of low-carbon infrastructure systems.
- Resilience standards and regulations need to be reviewed and updated to reflect evolving knowledge of hazards and their implementation needs to be continuously monitored.

2. Effective governance as a foundation for implementing quality infrastructure in a COVID-19 context

Good infrastructure governance, as reflected in the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], is key to implementing quality, sustainable, affordable, reliable and resilient infrastructure, and to improving the returns on public and private investment. It is particularly critical in a post-COVID-19 context for navigating the increasing complexity and uncertainty, addressing dilemmas and trade-offs, and ensuring that infrastructure investments are supportive of a sustainable recovery.

Key governance solutions for implementing quality infrastructure investment include:

- A ***strategic long-term vision for infrastructure*** that is informed by a thorough needs assessment and stakeholder engagement process, to help ensure that investment decisions respond to the needs of the entire population in an inclusive and sustainable way. Strategic plans also need to accommodate the heightened uncertainty and complexity resulting from the crisis and other drivers such as technological and environmental change.
- ***Clear, transparent and comprehensive prioritisation processes*** are crucial for ensuring investment in infrastructure delivers the expected social and economic benefits, while contributing to long-term policy objectives. A ***rigorous project appraisal and selection process*** should take into account economic, social, fiscal, environmental and climate-related costs and benefits and account for the full life cycle of the asset. Furthermore, ***decision-making frameworks*** should integrate impacts that are difficult to monetise, such as biodiversity, and address trade-offs and synergies between different objectives.
- ***Ensuring that long-term infrastructure plans are fiscally sustainable*** can be achieved by linking the plans with budget allocations and aligning them with medium-term expenditure frameworks. A robust, transparent and accountable capital budgeting framework should support the implementation of the plan, in order to meet national development needs in a sustainable, cost-effective, and coherent manner. Measuring, disclosing, and monitoring multi-year spending commitments, liabilities, and contingent liabilities resulting from infrastructure projects can help understand associated fiscal risks and better inform decision-makers during the planning and budgeting stages.
- ***Promoting systematic and effective stakeholder participation*** and defining strategies to ***manage threats to integrity*** are key to increase trust and ownership of infrastructure planning and delivery. The current crisis scenario calls for additional efforts to ensure transparency, openness, and access to relevant information, and to foster stakeholder participation during the strategic planning process and throughout the entire life cycle of the infrastructure asset.
- ***Effective procurement strategies*** to deliver and operate public infrastructure projects are essential to ensure infrastructure investments contribute to policy objectives and support economic and social recovery. To achieve this, procurement strategies can be better aligned with national level policy priorities and long-term development goals, address the quality of implementation of infrastructure projects, promote innovation and take into account the management of ongoing infrastructure contracts. Governments can benefit, in particular, from procurement processes that are competitive and transparent in nature.
- Effective infrastructure governance requires looking beyond the planning and prioritisation process and ensuring that ***infrastructure is fiscally sustainable and performs over the asset life cycle***. This requires monitoring strategies, paying due consideration to the operation,

maintenance and upgrade of infrastructure assets, fostering investments to reinforce resilience of infrastructure systems, and monitoring and managing fiscal risks related to infrastructure.

- ***Strengthening the governance and performance of economic regulators*** will be key to support market efficiency, quality, reliability and affordability of private infrastructure services, and ensure the provision of critical infrastructure services following the COVID-19 crisis.

Ensuring infrastructure investment at the necessary scale in order to support the low-carbon transition and protect biodiversity will require, in terms of infrastructure governance:

- ***National investment strategies, infrastructure plans and pipelines*** that are aligned with long-term climate and development objectives, and are linked to the strategic long-term vision.
- ***Procurement processes*** that support deployment of low-carbon infrastructure systems.

Promoting infrastructure that is resilient in the face of new and evolving physical hazards in a context of heightened uncertainty will require:

- ***Clarification of the roles and responsibilities for investing in resilience*** and disaster recovery in order to ensure sufficient upfront investment in resilience.
- More ***flexible and adaptive infrastructure planning approaches*** that can accommodate uncertainty, and take a ***dynamic approach to infrastructure investments***.
- The ***systematic collection of data*** on the resilience levels of infrastructure assets.
- ***Provision of dedicated ex ante financial support*** to incentivise private sector resilience investments.

Uneven access to infrastructure is a key contributor to regional disparities which risk being exacerbated by the COVID-19 crisis:

- Governments can seek to redress regional imbalances through their recovery programmes by ***developing national infrastructure strategies that have a focus on regional disparities***, and ***strengthening the capacities of regions and municipalities to manage infrastructure investment***.

For developing countries, in spite of their continued efforts, lack of capacity remains a key constraint which will require:

- An ***ongoing enhancement of both institutional and individual capacities for project planning, preparation, and implementation*** and the ***institutionalisation of rules and processes***.

3. Mobilising financing for quality infrastructure investment

Financing for quality and sustainable infrastructure will need to be significantly scaled-up to deliver key policy priorities and contribute to a strong, inclusive and green recovery from the COVID-19 crisis. Given the pressures facing government budgets, sources of private financing will need to be mobilised. Infrastructure projects with long-term and stable cash flows can be particularly attractive investments for long-term investors such as pension funds and insurance companies seeking to match liabilities.

Key solutions for mobilising financing for quality infrastructure investment include:

- Broadening the investor base by ensuring the ***availability of appropriate capital market instruments and vehicles*** for channelling financing for infrastructure projects, in which institutional investors can invest, ***without undue regulatory constraints*** and while ensuring ***adequate investor protection***.

- Carefully ***calibrated government intervention can influence the risk profile of infrastructure investments*** by influencing the overall level of risk, managing environmental and social risks, and promoting diversified risk mitigation instruments and incentives. Government liabilities associated with any public guarantees should be ***adequately disclosed***.
- ***Strengthened incentives and disclosure*** can enhance consideration of sustainability factors, and help to guide infrastructure investment toward key policy priorities. Infrastructure regulation, alongside the promotion of transparency in financial markets, including through the use of sustainability definitions and taxonomies, can provide incentives for private sector investment.
- The public sector has an essential role to play in driving change and opening a path for private investment through providing ***early-stage financing for technology development and demonstration projects***, ***collaborating with private investors*** in rolling-out new infrastructure, and ***adapting regulation and market design*** to incentivise innovation.
- A ***strategic and coordinated approach*** is required that identifies barriers and bottlenecks and develops financing solutions that match investments with investor profiles and risk appetites.

Risk management incentives can help to mobilise financing in support of the low-carbon transition and biodiversity:

- Supporting the shift in financing toward to low-carbon infrastructure requires the ***pricing and management of climate-related risks*** across the financial system and ***related disclosures***.

In developing countries, a lack of viable projects and imbalances between perceived risks and the level of financial returns are often cited as reasons for the low-levels of private investment in infrastructure:

- Enhancing the ***capacity to prepare bankable projects*** is critical. Project preparation facilities can help but their effectiveness may need to be increased. Along with ***enhanced fiscal transparency***, ***public debt management capacity*** also needs to be strengthened to ensure large infrastructure investments do not result in unsustainable debt levels.
- ***Blended finance*** approaches that involve mixing development finance with commercial finance, and are adapted to project risk-return profiles, offer a potential pathway to address imbalances. ***National development banks*** are well placed to catalyse private financing for infrastructure by serving as intermediaries between governments and private investors.

4. Strengthening capacity of subnational governments to invest in quality infrastructure

Subnational governments – regions, cities, municipalities – play a determining role in quality infrastructure investment. They are responsible for a significant proportion of infrastructure investment (57% on average in the OECD and 40% worldwide).

To make the most of their contribution to infrastructure investment, key solutions for strengthening the ability of subnational governments to deliver quality infrastructure investment include:

- ***National level support for subnational infrastructure investment***. Subnational governments play a critical role in investing in sustainable and resilient infrastructure which is essential for post-pandemic rebuilding. To achieve a successful COVID-19 recovery, subnational public investment, including in infrastructure, should not be sacrificed.
- Investment recovery strategies designed and implemented by municipalities, regions and national governments ***need to align short-term recovery needs with long-term objectives*** to make sure countries are better prepared to address future shocks, whatever their nature. Regions (states and provinces) and municipalities should focus on green and digital priorities,

but also on building more resilient health systems and investing in social housing to reduce well-being disparities across and within regions.

- There should be ***coordination among all levels of government*** to ensure timely investment to support the recovery, while ensuring quality of infrastructure investments. While many public investment projects can be launched in the short-term, care must be taken not to focus on speed as the only criteria, and to avoid spreading investment funding across a myriad of small projects. Intermediate levels of government – regions, states, provinces – should be included in national investment recovery strategies.
- ***Integrating infrastructure investment into regional or local development strategies*** Further, infrastructure investment needs to be part of a broader strategic approach, complementing policy measures and other investments designed to advance regional and local needs, for instance in education, labour market and skills, R&D and innovation, industrial transition, etc.
- Subnational governments should ***optimise and diversify financial resources for infrastructure investment***. They should optimise the use of public funding (e.g. national grants, taxes and fees), and explore innovative funding instruments such as land-value capture mechanisms. Subnational governments with sufficient, large-scale capacities also need to mobilise capital markets and institutional investors for relevant infrastructure projects through appropriate funding and external financing mechanisms.

Summary of solutions

Implementation Handbook for Quality Infrastructure Investment		
Chapter 1: Role of sustainable quality infrastructure investment in implementing key policy priorities in a COVID-19 context		
1. Low-carbon transition and biodiversity	*Policy and regulation*	• Demonstrate clear policy commitment to long-term climate goals, international biodiversity targets, and other environmental objectives • Apply effective carbon pricing combined with targeted compensatory measures to address concerns over distributional aspects • Ensure that regulatory frameworks are supportive of the deployment of low-carbon infrastructure systems
	Governance: infrastructure planning and decision-making	• Establish national strategies, infrastructure plans and pipelines that are aligned with long-term climate and development objectives • Apply adapted cost-benefit analysis to guide infrastructure investments • Ensure that trade-offs and synergies with broader well-being outcomes are appropriately reflected in decision-making frameworks for infrastructure investment • Integrate biodiversity considerations into infrastructure planning and decision-making processes
	Financing	• Pursue measures that promote the appropriate pricing and management of climate-related risks across the financial system • Adopt economic instruments that help internalise the negative impacts of infrastructure on biodiversity
	Technology and innovation	• Provide targeted support for new technologies needed for the low-carbon transition • Make effective use of public procurement to incentivise innovative low-emission infrastructure solutions
2. Resilience	*Governance*	• Clarify roles and responsibilities for investing in resilience and recovery
	Regulation	• Review and update resilience standards and regulations to reflect evolving knowledge about hazards, and continuously monitor their implementation
	Planning and decision-making	• Explore more flexible and adaptive infrastructure planning approaches that can accommodate uncertainty, and take a dynamic approach to infrastructure investments to ensure alignment with policy objectives over time • Gather data and monitor the resilience levels of infrastructure assets
	Financing	• Use government financing mechanisms to incentivise private infrastructure actor resilience investments

3. Regional inclusiveness and access		• Strengthen the capacities of regions and municipalities to manage infrastructure investment • Implement national infrastructure strategies with a focus on regional disparities
4. Sustainable development	*Governance*	• Strengthen institutional and individual capacity for project planning, preparation, and implementation through collaboration with external actors • Institutionalise standards, rules and processes, and strengthen regulatory frameworks • Establish anti-corruption measures including explicit policies and rules with adequate enforcement mechanisms
	Financing	• Strengthening capacity to prepare bankable projects through improving the effectiveness of project preparation facilities and risk mitigation instruments • Enhance fiscal transparency and improve capacity for debt management with required technical and financial expertise
Chapter 2: Effective governance as a foundation for implementing quality infrastructure in a COVID-19 context		
1. What are the main policy and institutional enablers of sound long-term infrastructure planning?		• Align the long-term strategic vision with strategic policy objectives and adapt to uncertain and complex conditions • Undertake needs assessment to support decision making and investment • Develop robust annual and multiannual capital budgeting to support sustainable investment • Strengthen capacities for public investment management and ensure coordination across sectors and levels of government
2. How can evidence-based project selection and prioritisation processes be embedded in government decision-making?		• Ensure that the political decision-making process is informed by robust, independent evidence-based analysis • Supplement CBA with other methodological tools to accommodate multiple objectives and uses • Integrate wider economic impacts in project decision-making for non-marginal or transformative projects • Use robust, independent evidence-based analysis to guide the decision on the delivery mode
3. How can governments increase trust and ownership of infrastructure planning and delivery?		• Promote systematic and effective stakeholder participation • Manage threats to integrity
4. What procurement strategies support quality infrastructure investment?		• Accelerate infrastructure investments by developing public procurement competencies • Align procurement strategies for infrastructure with national long-term priorities • Ensure transparent and effective management of procurement operations, including contract management
5. What strategies can be implemented to ensure fiscal sustainability and infrastructure performance over the asset life-cycle?		• Monitor the implementation and operation of infrastructure assets • Monitor and manage fiscal risks related to infrastructure • Pay adequate attention to operation and maintenance • Reinforce resilience of critical infrastructure systems and services • Promote good governance of economic regulators

Chapter 3: Mobilising finance for quality infrastructure investment		
1. Scaling-up financing for quality and sustainable infrastructure	*Deepening capital markets, mobilising alternative sources of finance, and ensuring proper financial regulatory frameworks*	• Review and where appropriate reform capital market regulation to ensure the availability of appropriate capital market instruments and vehicles for channelling financing for infrastructure, while ensuring adequate investor protection • Enable the development and pooling of infrastructure expertise and collaborative investments • Identify and where appropriate address unnecessary regulatory barriers, while ensuring protections for beneficiaries and fulfilling prudential and market integrity objectives • Establish mechanisms to promote greater transparency with regard to public sector financial liabilities
	Shaping the risk profile of projects through risk mitigation and incentives	• Ensure stable and appropriate legal and regulatory frameworks, along with supportive governance and investment environments that can attract quality infrastructure investment • Ensure stable, reliable and diverse sources of funding • Seek to minimise environmental and social risks during the project preparation phase, and provide full transparency regarding these risks to investors • Promote diversified risk mitigation instruments and incentives that can support a variety of different investor types and financing modalities (equity, bank loans, debt), based on an assessment of financing needs and market capacity, and contingent liabilities • Where appropriate, consider the targeted use of incentives that can enhance the risk-return profile of investments
	New forms of public-private collaboration	• Consider innovative collaborative models beyond PPPs that involve a long-term vision and a sharing of risks and rewards over time
	Incentives and disclosure for improved sustainability	• Adopt regulatory frameworks for regulated infrastructure networks that align incentives with policy goals • Promote disclosure of sustainability strategies and ESG risks • Facilitate consensus over definitions and standards for sustainable infrastructure
2. Financing the next generation of infrastructure technologies		• Provide early- stage financing for technology development and demonstration projects • Collaborate with private sector investors in scaling-up and rolling-out new infrastructure systems. • Adapt regulation and market design in order to incentivise innovation
3. Financing infrastructure that promotes sustainable development	*Blended finance as an effective approach to catalyse commercial investment for infrastructure in developing countries*	• Adopt and promote a common framework on blended finance, enhancing coordination and increasing transparency • Deploy blended finance instruments and mechanisms that best fit risks, investment attributes and development objectives of infrastructure projects • Promote an effective use of different types of guarantees to mitigate risks and mobilise private capital for infrastructure • Pool capital through blended finance funds and facilities to mobilise investment from different sources at scale • Provide technical assistance to develop bankable infrastructure projects and build local capacity
	A key role for development banks in	• Strengthen mandates, incentives, and capacity • Mobilise new sources of finance and catalyse change in markets • Use concessional finance strategically

	facilitating quality infrastructure financing	• Promote collaboration within the ecosystem of development banks
4. Infrastructure financing strategies: a systemic and coordinated approach		• Establish and promote infrastructure plans and project pipelines that are aligned with long-term objectives. • Consider developing infrastructure financing strategies that assess financing needs, and systematically identify and address the various barriers to mobilising financing. • Adopt a strategic and coordinated approach to mobilising private financing • Consider empowering public financial institutions to address barriers and catalyse private financing
Chapter 4. Subnational governance and investment in infrastructure		
1. Addressing subnational governance obstacles for effective infrastructure investment		• Integrate long-term objectives into recovery strategies in regions and cities • Coordinate infrastructure investment among levels of government to align priorities • Adopt a place-based and integrated approach across sectors for infrastructure investment • Facilitate cross-jurisdiction cooperation for infrastructure to achieve economies of scale
2. Addressing larger financing gaps for infrastructure investment in local and regional governments		• Use appropriate measures to support lower-level governments to maintain or boost their infrastructure investments for the recovery • Optimise and diversify subnational resources to finance investments, using public and private sources: budgetary resources, new sources of revenue, and capital markets and private sector resources

Background

Infrastructure provides the backbone of modern well-functioning economies, providing connectivity by enabling the flow of goods, people and information, and supplying the necessary inputs in the form of energy and water that constitute the foundation for most commercial and industrial activity. Infrastructure is also critical for delivering many services, such as electricity, water and sanitation, communication, public transport, health care and education, and flood protection that are essential for health and quality of life, and for providing protection against natural elements.[1]

The COVID-19 crisis has further highlighted the importance of infrastructure in both enabling economic activity and protecting the well-being of citizens, and the disastrous consequences that it can have when it fails. In some respects, infrastructure systems have coped remarkably well during the crisis. In most OECD countries, for example, communication infrastructure, while being under stress, has enabled a massive shift to teleworking which has sustained many parts of the economy. Moreover, transport and logistics systems have ensured that supplies of food and other essential goods have been maintained even during the strictest lockdowns. However, we have also witnessed the terrible human consequences of health care systems that become overwhelmed under a surge of patients. In emerging and developing economies, the appropriate infrastructure policies and investments will be critical for counteracting the impacts of the crisis and maintaining momentum on the Sustainable Development Goals (SDGs).

Infrastructure has not only been a key determinant of the ability of economies, societies and communities to cope during the crisis, but it is also a major component of many recovery packages announced by governments given its expected economic multiplier effects and its potential to boost employment. For example, according to the International Energy Agency (IEA), each USD 1 million invested in clean energy, urban transport infrastructure, and efficient buildings creates an estimated 10-15 jobs (IEA, 2020[2]). As highlighted by the 2020 OECD Ministerial Council Statement, infrastructure investment has a crucial role to play in ensuring a strong, resilient, sustainable and inclusive recovery from COVID-19.

One of the keys to a successful and sustainable recovery is ensuring that infrastructure investment not only supports the immediate response to the crisis, but creates a solid foundation for future economic growth and for addressing long-term challenges, whether it be the climate crisis or inequality, and helps to build more resilient and inclusive societies going forward given heightened risks.

While the crisis represents an overwhelming health, economic and social tragedy, it has also brought with it the realisation of the need to do things differently in the future, to innovate, to build-back-better. As governments transition from the immediate crisis response phase to the longer-term recovery phase, this will require new solutions and out-of-the-box thinking in order to balance and prioritise among multiple objectives, ensure long-term plans are flexible and adapt decision-making to conditions of heightened uncertainty, maximise both the efficiency and impact of public investment, and catalyse private investment into priority areas.

The role of quality infrastructure investment in supporting sustainable recoveries

Quality infrastructure investment can play a central role in supporting a sustainable recovery. The concept of quality infrastructure investment recognises the essential role of infrastructure for economic growth, productivity enhancement, sustainable development and improvements to human well-being.[2] It also acknowledges that achieving positive economic, social and environmental outcomes is contingent on the active engagement of governments and other stakeholders in setting the appropriate policy and governance frameworks to ensure effective planning, delivery, financing, and oversight of infrastructure investments.

The *G20 Principles for Quality Infrastructure Investment*[3], developed under the Japanese G20 Presidency in 2019, provide a voluntary framework to assist countries in pursuing investments that maximise the economic, social, environmental and development impact of infrastructure. The *OECD Compendium of Policy Good Practices for Quality Infrastructure Investment* (2020) offers comprehensive policy guidance for policymakers and practitioners in both developed and developing countries on how best to ensure quality infrastructure investment at every stage of a project (OECD, 2020[1]).

Figure 1. Overview of the G20 Principles for Quality Infrastructure Investment

This Implementation Handbook complements the Compendium by focusing on areas that are particularly relevant in the context of the COVID-19 crisis and providing forward-looking solutions, accompanied by concrete examples and case studies that support the implementation of quality infrastructure investment. Given the importance of financing for implementing quality infrastructure investment, the Compendium and the Handbook include sections on mobilising financing to supplement the guidance on the dimensions addressed by the G20 Principles. Both the Compendium and Handbook have been developed within the OECD Horizontal Project "Strategic Policies for Sustainable Infrastructure" which represents a cross-cutting and multidisciplinary OECD response to the issue of sustainable infrastructure. Finally, both documents support the priorities of the Italian G20 Presidency in 2021 as they relate to infrastructure, including a focus on resilience and maintenance, and sustainability.

Quality infrastructure investment must contribute to delivering key policy priorities in a challenging context

In order for infrastructure investment to support a sustainable recovery from the crisis and generate long-term benefits for society in terms of inclusive economic growth and improvements to well-being, it should contribute to a number of key policy priorities. Infrastructure investments that fail to align with policy priorities are unlikely to generate the desired impacts, and run the risk of early obsolescence or locking-in of unsustainable technologies and practices. **Chapter 1** examines how quality infrastructure investment can support a number of key policy priorities such as catalysing the low-carbon transition, safeguarding biodiversity, promoting resilient infrastructure, addressing regional disparities, and underpinning sustainable development. It assesses some of the infrastructure investment needs required to deliver these priorities, identifies challenges that could inhibit or reduce the impact of infrastructure investment, and proposes a range of solutions to guide infrastructure investment into these areas and enhance its effectiveness.

Governments face a range of challenges in providing quality infrastructure investment at the required scale in order to deliver these policy priorities. First, governments all around the world are under intense fiscal pressure, which is only likely to grow the longer the crisis drags-on. Future resources available for public investment will therefore be heavily constrained in the wake of the crisis as governments' fiscal stances shift from selective structural short-term support measures to an eventual fiscal consolidation. In such a context, infrastructure investment must therefore deliver the greatest possible positive impact at the lowest economic, financial, environmental and social cost.

Secondly, infrastructure investments are being planned in a context of unprecedented uncertainty. Some of this uncertainty is a direct the result of the COVID-19 crisis. For instance, demand for certain infrastructure services and assets, particularly public transport and aviation, has plummeted. On the other hand, demand for communication infrastructure has increased dramatically as a result of the rise of teleworking, and the increased use of digital tools for communications and entertainment. While future behaviour is difficult to predict, the effects of the crisis are likely to linger for a considerable period. Even before the crisis, however, deep uncertainty resulting from powerful driving forces such as climate change, the accelerating pace of technological development, and urbanisation had created a particularly unstable foundation for making long-term decisions for large capital-intensive long-lived infrastructure investments.

Third, infrastructure investment is subject to increasing levels of complexity. This stems in part from the fact that quality infrastructure investment is being called upon to meet multiple objectives and deliver multiple benefits beyond simply addressing user needs, such as preserving biodiversity, reducing pollution, or regenerating deprived areas. The COVID-19 crisis has also highlighted the need to balance economic efficiency with resilience considerations as the pursuit of efficiency at all costs can result in brittle systems that are unable to cope with shocks. At the same time, infrastructure investment must continue to deliver value for money on a life cycle basis. Rising complexity is also a consequence of the increasing interconnectedness and interdependence of infrastructure systems both across geographies and across sectors. For example, the deployment of electric and autonomous vehicles will drive convergence across the electricity, transport and communications sectors. The COVID-19 crisis has demonstrated the extent to which transport and communication infrastructure are substitutes.

Implementing quality infrastructure investment requires good infrastructure governance and scaling-up of financing, including at the subnational level

Implementing quality infrastructure that overcomes these challenges and contributes to long-term development goals and policy priorities will require action on three key fronts. Good infrastructure

governance is required to promote coherence across multiple policy areas and thus facilitate the implementation of infrastructure investments that support the achievement of multiple objectives, such as resilience, social inclusion, sustainable growth and gender equality. It also ensures that the right infrastructure projects get built in a manner that is cost effective, affordable with respect to life cycle costs,[4] and trusted by stakeholders. It is particularly critical in a post-COVID-19 context for navigating the pervasive complexity and uncertainty, addressing dilemmas and trade-offs, and ensuring that infrastructure investments are supportive of a sustainable recovery. **Chapter 2** outlines key challenges impeding effective governance and a number of solutions for ensuring sound long-term infrastructure planning, evidence-based project selection and prioritisation, increased trust and ownership of infrastructure planning and delivery, effective procurement strategies, and good infrastructure performance over the asset life cycle.

Secondly, financing for quality infrastructure will need to be significantly scaled-up to deliver key policy priorities and contribute to a strong, inclusive and green recovery from the COVID-19 crisis. Given the pressures facing government budgets, alternative sources of private financing will need to be mobilised, particularly institutional investors such as pension funds and insurance companies. For infrastructure owned and operated by regulated utilities, changes to incentives will be required to shape their investment behaviour. The need for new types of infrastructure (such as hydrogen production, storage and networks, and grid-scale battery storage), combined with the scale and the urgency of this investment, will require innovative solutions to scale-up existing sources and mobilise new sources of financing. **Chapter 3** discusses key challenges impeding the financing of quality infrastructure and examines solutions for mobilising private financing through deepening capital markets, shaping the risk profile of projects through risk mitigation and incentives, and steering private investment towards policy priorities, including in the context of developing countries. It also highlights the systemic nature of infrastructure financing and the need to adopt a strategic and coordinated approach for mobilising private investment.

Third, subnational governments – regions, cities, municipalities – play a determining role in quality infrastructure investment. While they are responsible for a significant proportion of infrastructure investment (57% on average in the OECD), their capacity to invest is hindered by a fragmentation in responsibilities and resources, as well as significant financing gaps. **Chapter 4** examines approaches for improving the effectiveness of subnational investments through strengthening governance and coordination mechanisms, and reducing infrastructure financing gaps at the subnational level.

1 Role of quality infrastructure investment in implementing key policy priorities following COVID-19

Key policy objectives and the role of infrastructure

Infrastructure investment is a means, not an end. For infrastructure investment to generate long-term benefits to society in terms of inclusive economic growth and improvements to well-being, it should contribute to key policy priorities, such as supporting the low-carbon transition and protecting biodiversity, making societies more resilient, addressing disparities across regions and cities, and promoting sustainable development. Infrastructure that fails to align with policy priorities is unlikely to generate the desired outcomes, and runs the risk of early obsolescence or locking-in of unsustainable technologies. This is all the more important in a COVID-19 context where public finances are being stretched and a poorly planned or executed investment will divert scarce resources from other, more impactful, uses.

The COVID-19 crisis is building increased awareness of the longer-term role of infrastructure in creating more resilient, inclusive, green, and sustainable economies and societies. This section explores selected key policy objectives – the low-carbon transition and biodiversity, resilience, regional inclusiveness and access, and sustainable development – and how infrastructure investment can serve to address them. This section is followed by a review of infrastructure trends and needs in these areas and a discussion of key challenges and solutions, some of which are further developed in subsequent chapters. The chapter concludes with key messages for policymakers.

1. Low-carbon transition and biodiversity

Climate change and the loss of biodiversity and ecosystem services upon which we depend represent two of the greatest immediate threats to human well-being. Climate commitments in countries' current Nationally Determined Contributions to the Paris Agreement will not, however, put the world on a credible path to a 2°C, let alone a more stringent, target. Global CO_2 emissions need to fall rapidly: by about 45% from 2010 levels by 2030, reaching "net zero" around 2050 for a 1.5°C; and by about 25% below 2010 levels by 2030 for a well-below 2°C goal, reaching net zero around 2070 (IPCC, 2018[3]).

Choices made on infrastructure systems in the next decade will be critical for achieving global and national climate goals, and halting the dramatic loss in biodiversity. Achieving climate objectives will require far-reaching transitions in energy and mobility infrastructure that will depend on a rapid scaling-up of investment in low-carbon electricity generation, significant improvements in energy efficiency, and the deployment of new energy and transport technologies such as grid-scale storage and hydrogen. The wrong types of investments could lock the world into an unsustainable path.

Biodiversity underpins essential inputs to human life, including food, safe water, climate regulation, and protection against water-related hazards. Poorly planned and managed infrastructure can have direct and indirect impacts on biodiversity and ecosystem services, with the type, scale, and duration of these impacts varying across infrastructure types and depending on the environment in which they are located (CBD, 2018[4]). New roads, for example, can directly damage habitats, while also fragmenting ecosystems that can exacerbate other pressures on biodiversity, for example by providing access for hunting, logging and agricultural expansion. Low-carbon infrastructure may have harmful biodiversity impacts, on land or freshwater (e.g. wind turbines, dams) or in marine environments (e.g. tidal barrages), and its roll out is increasing demand for minerals whose mining poses a threat to biodiversity (Rehbein et al., 2020[5]).

While, globally, certain types of infrastructure are cited as placing a major pressure on biodiversity (Venter et al., 2016[6]), quality infrastructure can reduce these impacts through a number of intervention points, including through better strategic planning and impact assessments, the adoption of strategic procurement and green finance, and more efficient construction and operations. In various cases, ecosystems can also substitute for, or complement, traditional infrastructures (e.g. for flood protection or water purification).

2. Resilience

The COVID-19 crisis has demonstrated how critical system-wide infrastructure resilience is to sustaining human well-being and economic activity during adverse shocks. At the same time, the crisis has laid bare the vulnerabilities created by inadequate investments, especially in the resilience of some countries' health and communication infrastructures, and demonstrated the cascading effects they can have on economies.

Decisions on the location, design, operation and maintenance, but also on the governance and financing of infrastructure, need to be assessed in relation to the exposure and vulnerability of infrastructure to a whole range of risks. These risks emanate from different natural or human-induced sources of hazard[5] and have caused major damage to infrastructure assets in the past, and interrupted critical services, resulting in considerable direct and indirect social and economic rippling effects, given the interdependence of economies and the infrastructure assets, networks and operations on which they rely.

Early action on resilience measures can avoid undesirable lock-in effects, premature obsolescence, or expensive maintenance. Resilience will protect infrastructure assets and ensure continuity of services, thereby allowing communities to better absorb adverse shocks and recover from them more rapidly. Resilience measures include making room for slack and building-in redundancies.

When infrastructure owners, concessionaires, and operators fail to address risks in the planning, design, and maintenance of their assets and services, they may face disaster costs that threaten their solvency. For instance, the Californian utility provider, Pacific Gas and Electric, was made liable for wildfire damages in 2018 that forced it into bankruptcy. When governments step in to shoulder the costs of infrastructure damage to avoid negative economic spillovers or to address societal needs, major budgetary imbalances may arise. More than half of government spending in response to disasters consists of payments for infrastructure damages (OECD/The World Bank, 2019[7]).

The COVID-19 pandemic illustrates how essential resilient infrastructure is for absorbing the impacts of adverse shocks, but also creates a unique opportunity for countries to boost infrastructure resilience against future risks as part of their recovery efforts. For example, commitments to expand renewable energy as part of recovery packages in a number of countries will not only create new jobs and stimulate growth, but also strengthen the resilience of infrastructure networks against future shocks by diversifying and decentralising energy generation (IEA, 2020[2]).

3. Regional inclusiveness and access

Disparities among regions within countries represent a significant source of inequality and have added to the currents of political disaffection in a number of countries. For instance, since the 2008 global financial crisis, within-country regional economic gaps[6] increased in 50% of OECD countries, even though the gaps have narrowed in the OECD area. In 2018, the top 20% of OECD regions represented twice the level of the bottom 20% of regions in terms of GDP per capita. In particular, the 2008 crisis brought to a halt the convergence between metropolitan areas and remote areas.[7]

A decisive driver of regional disparities is the ongoing concentration of population and economic activity in metropolitan areas. Most people's perceptions of their prosperity and quality of life depends not only on the productivity of the region in which they live and work but also on their awareness of the experiences of other regions. The resulting 'geography of discontent' associated with large interregional inequalities in productivity have profound, and often dangerous, political economy implications for national governance and institutional systems. Whether the COVID-19 pandemic will exacerbate these regional economic disparities remains to be seen (OECD, 2020[8]; OECD, 2020[9]).

Lack of access to infrastructure is typically a significant contributor to regional disparities. For example, many people in rural places already face greater difficulties in accessing health and social care services compared to residents of metropolitan or other urban areas. Geographic distances and less developed transport services amplify the challenges in access to public infrastructure and services. The COVID-19 crisis has shed further light on the gaps in critical infrastructure areas linked to health care, communication infrastructure, environmental protection, social housing, and safe transport, as well as disparities within countries in access to infrastructure. In certain cases, these disparities could be reinforced or even magnified if strong policy action is not taken.

Well-planned and well-governed infrastructure investment can help reverse the decline in rural and marginalised areas by improving access to job opportunities and public services. However, financing infrastructure investment in low-density regions can be a challenge under existing appraisal and financing models that privilege economic and financial returns on investment.

4. Sustainable development

Quality infrastructure investment is central to advancing the 2030 Agenda for Sustainable Development, and pursuing economic transformation in developing economies, while safeguarding the environment and reducing poverty and inequality. Investments in low-carbon electricity, water and sanitation, communication infrastructure, health, and education are critical for achieving the Sustainable Development Goals (SDGs).

The COVID-19 crisis, in addition to its human toll, represents a major setback for many developing countries as it lowers growth prospects and risks negating recent progress toward the SDGs. The magnitude of the repercussions for developing countries is more severe as the impacts added to pre-existing weaknesses and vulnerabilities, particularly for the most vulnerable and marginalised groups. A recent World Bank estimate projected that the pandemic would push an additional 71 to 100 million people into extreme poverty in 2020, compared to 2019 (World Bank Group, June 2020[10]).

While governments have had to take urgent actions that have involved diverting public financing towards providing immediate economic support and health care in response to the COVID-19 crisis, the critical importance of infrastructure in addressing today's development challenges should not be neglected. The appropriate infrastructure policies and investments will be vital for counteracting the impacts of the crisis and maintaining momentum on the SDGs. In developing and emerging economies, enhanced connectivity with quality infrastructure improves people's well-being by providing better access to jobs and markets, improving labour productivity and competitiveness, and reducing poverty, income and gender inequality, and exclusion. To this end, particular emphasis should be placed on the needs of vulnerable or

marginalised groups, including women. However, constraints related to capacity and public finances (made worse by the pandemic) of many developing countries will reduce their ability to respond in a timely and effective manner to these multiple challenges.

Trends, challenges, and solutions

1. Low-carbon transition and biodiversity

Infrastructure trends and needs

Energy accounts for two-thirds of total greenhouse gas emissions (IPCC, 2014[11]). To achieve a 1.5°C goal with no or limited overshoot of the global CO_2 budget, renewables will need to supply some 70–85% of electricity globally in 2050 (IEA, 2020[12]). Decarbonisation of electricity generation will also enable the decarbonisation of end-use sectors such as transport and buildings. Some renewable technologies have seen rapid cost reductions. Since 2010, the capital cost of solar PV has fallen by almost 80%, with smaller but significant reductions in both on-shore and offshore wind (IEA, 2020[13]).

Large-scale innovation will be critical in developing new fuels and technologies needed to decarbonise some of the more challenging sectors such as heavy industry, freight and air transport. Furthermore, smart grids, appliances, and energy management systems will be needed to increase flexibility in matching electricity supply and demand. Electrification, different forms of bioenergy, hydrogen, and carbon capture use and storage (CCUS) are likely to make major contributions to achieving stringent climate mitigation goals but, for the time being, most of these technologies are not mature enough to be deployed at the commercial scale needed to bring us to a net zero pathway, particularly in heavy industry and long-distance transport (IEA, 2020[13]).

The urgent need to reduce GHG emissions to meet climate goals suggests that new infrastructure investments undertaken as part of the recovery from the COVID-19 crisis should be aligned with the transformations needed to achieve these objectives (IEA, 2020[2]). The mitigation investment needed for a transition to a well-below 2°C goal are assessed at around 0.36% (between 0.2–1%) of global GDP over 2015–2035 (IPCC, 2018[3]), which corresponds to approximately 1.5% (between 0.8–4.2%) of projected total world investments. This includes a significant increase in required investment in power generation, electricity transmission and distribution networks, and energy demand technologies, with an offsetting reduction in primary energy investment.

Failure to integrate climate mitigation objectives in recovery plans from the COVID-19-crisis, including infrastructure investments, could have a number of damaging effects, depending on the precise measures implemented. It could significantly increase the lock-in of carbon intensive infrastructure assets for decades to come (OECD, 2017[14]), thus making it more difficult to achieve stringent mitigation targets. It could also hamper efforts to reduce air pollution and improve human health at a time when adverse air quality is known to exacerbate the impacts of COVID-19 (OECD, 2020[15]).

Given that the major trend in the infrastructure sector is one of growth, with implications for further land use change, this is also likely to have an adverse impact on biodiversity. By 2030, for example, cities are expected to cover three times as much land as they did in 2000, with many of the expansions occurring in key biodiversity hotspots (Seto, Guneralp and Hutyra, 2012[16]). It will therefore be increasingly important to mainstream biodiversity considerations into infrastructure development planning over time.

Challenges and solutions

Policy and regulation

Challenges

Policy and regulation critically guide public and private infrastructure investments. Uncertainty in the direction, pace, and stability of strategies to support a low-emissions transition limits the deployment of related investments and can result in the lock-in of infrastructures that may not be consistent with national and international climate mitigation targets, nor with national and international commitments on biodiversity under the Convention on Biological Diversity. Similarly, a lack of a clear trajectory for long-term carbon prices, a lack of long-term emissions trading system policy certainty, or a lack of stability of allowance prices within such systems, can reduce the effectiveness of carbon pricing schemes as a mechanism for incentivising investment in low-carbon systems.

The transformation of energy systems lies at the heart of the low-carbon transition. However, regulatory frameworks and market design, which set the rules for who can transact in energy markets, how they can invest, as well as how different actors are remunerated, can often be unclear, inadequate, or overly restrictive, thus inhibiting private investment in energy infrastructure. More specifically, the structure of network regulation has failed to keep up with technological transformations, including the rising penetration of variable renewable energy sources, more decentralised networks, and the application of digital technology, particularly on the demand side. Major new infrastructure-related areas, including the aggregated use of batteries, electric vehicle charging, and smart devices for grid services, face regulatory uncertainty and business model challenges. For sectors that are difficult to fully electrify, such as heavy industry, new infrastructure that is still in an early stage of development, such as hydrogen and CO_2 pipelines, will be needed.

On the production side, developers can often be hampered by restrictions associated with permitting and land acquisition. Project remuneration for clean-energy related assets, such as renewable power, most often depends on long-term contracts (e.g. power purchase agreements) awarded through competitive auctions, but in some countries, a combination of inadequate system planning, unclear rules for procuring new capacity, and payment risks (stemming from the financial weakness of the state-owned utility buyer) can inhibit investment.

In advanced economies, competitive energy markets and private-led investment are more prevalent, though regulatory bottlenecks (e.g. permitting) and market pricing uncertainties can inhibit investment. These markets face the challenge of balancing the use of short-term markets to promote system-friendly and affordable deployment, while simultaneously providing long-term price signals to promote investment in capital intensive clean power (e.g. renewables) as well as flexibility (e.g. storage). Stronger policy signals and system planning are needed to support investment in low-carbon hydrogen production, which is still at a very early stage.

Solutions

Demonstrate clear policy commitment to long-term climate goals, international biodiversity targets, and other environmental objectives

Long-term low emissions strategies and complementary medium-term action plans that set out the climate targets of a given jurisdiction can play an important role in steering investment decisions (Aguilar Jaberi et al., 2020[17]). Similarly, National Biodiversity Strategies and Action Plans (NBSAPs) provide a starting point for national commitments to mainstream biodiversity across sectors, including infrastructure. Commitment can be signalled by enshrining long-term climate goals in law and by creating an independent advisory body that provides policy recommendations.

The long-term perspective provided by such commitments is particularly important in the case of infrastructure investments given their long life span. Investments in the transport or electricity sectors, for example, cannot be easily replaced or retrofitted. The long-term targets included in such strategies can also be effective in highlighting the nature and scale of the transformation required. A focus on broader well-being and sustainable development goals in these strategies will increase their political acceptability. Mainstreaming biodiversity in infrastructure development, via strategic spatial planning and other approaches, can also help to mitigate biodiversity loss, while providing opportunities for the use of nature-based solutions to restore biodiversity (OECD, 2018[18]). The European Commission, for example, has developed a Green Infrastructure Strategy, and has linked this to the EU Biodiversity Strategy (Target 2).

Box 1.1. The role of long-term climate strategies in guiding infrastructure investments

Singapore's long-term low-emissions development strategy (LEDS) published in 2020 aims to guide the transition to a low-carbon and climate resilient future. Singapore's long-term target is to "halve emissions from its peak to 33 $MtCO_2e$ by 2050, with a view to achieving net-zero emissions as soon as viable in the second half of the century" (p. 4). The strategy highlights the role of infrastructure investments in both mitigating emissions and building resilience. Examples include:

- Investments in active mobility infrastructure so that nine in ten of peak period journeys are made using Walk-Cycle-Ride (WCR) transport mode by 2040;
- Make electric vehicles (EVs) more accessible and promote their adoption by expanding the public charging infrastructure for EVs;
- Restoring nature in urban areas by for example increasing the skyrise greenery footprint in buildings and infrastructure (e.g. vertical green walls, green roofs, and rooftop gardens);
- The development of infrastructure to support hydrogen production, transportation, storage, and use.

Source: (NCCS, 2020[19])

Apply effective carbon pricing combined with targeted compensatory measures to address concerns over distributional aspects

Carbon pricing of fossil-fuel emissions is a key policy lever for driving emissions reductions, but also for providing incentives to shift investments towards low-carbon alternatives when available. However, effective carbon prices, i.e. the sum of carbon prices in emissions trading schemes, direct carbon taxes, or energy taxes, remain too low to drive change at a sufficient pace, and are uneven both across sectors within a given country and also across countries (OECD, 2018[20]). Determining the socially optimal level of carbon pricing is, however, challenging, though methodologies exist (e.g. integrated assessment models).

To increase the carbon pricing signal and reduce policy risks for investors in clean technology, international co-operation and co-ordination on carbon pricing and reform of inefficient fossil fuel subsidies are needed (Ellis, Nachtigall and Venmans, 2019[21]). A credible commitment to a clear long-term trajectory for carbon prices can help provide a firmer signal for investment in low-carbon technologies.

Carbon pricing offers the potential to drive decarbonisation in the power sector by reducing electricity demand, changing the merit order of electricity dispatch to favour low-carbon sources, and providing investment incentives for less carbon-intensive power supply. Investments in sustainable infrastructure such as renewables are key for the provision of global public goods such as climate mitigation. In practice,

however, power market structures and regulation can reduce the effectiveness of the carbon pricing signal. For example, if retail electricity prices are highly regulated, the carbon price signal will not be visible to electricity consumers, thus limiting or removing the incentive for electricity consumers to save electricity or to choose low-carbon electricity suppliers.

Several options can be used to reflect and strengthen the carbon price effect, depending on institutional arrangements within jurisdictions. These include consignment auctions, covering indirect emissions, consumption charges, climate-oriented dispatch rules, carbon investment boards and pricing committees (IEA, 2020[22]). The city of Tokyo in **Japan**, for example, includes indirect emissions in its emissions trading system to cover the emissions from electricity consumption in commercial buildings (Box 1.2).

The effectiveness of carbon pricing depends on a number of country-specific factors, including energy costs, industrial composition, and abatement costs. The effectiveness may also be constrained by an inelastic response to pricing in some sectors due to the inadequate supply of alternatives (e.g. for conventional vehicle use). In such circumstances, different approaches to managing the supply and demand for services can be important in addressing these challenges, for example by shifting from a focus on mobility to accessibility (the combination of mobility and proximity to opportunities) in the ground transport sector (OECD, 2019[23]).

The adoption of carbon pricing may be impacted in some sectors by concerns over competiveness and distributional aspects. So far, however, carbon pricing does not seem to have had significant effects on international competitiveness (Ellis, Nachtigall and Venmans, 2019[21]; IEA, 2020[22]), in part due to measures put in place in some emissions trading schemes to reduce the impact of the carbon price on competitiveness such as free allocation of allowances. For example, the European Union emissions trading scheme, launched in 2005 and up to now the largest carbon market of the world, allocates allowances free of charge for installations in energy-intensive trade-exposed industries. Concerns relating to distributional aspects can be addressed through targeted compensatory measures.

Box 1.2. Covering indirect emissions: Tokyo's emissions trading system

The Tokyo municipal emissions trading system covers both direct and indirect emissions. Indirect emissions are included in the emissions trading system specifically to cover emissions from electricity consumption in commercial buildings. In Tokyo, electricity represents 40% of energy consumed, but 90% of this electricity is produced outside of the geographic boundaries of the city. A fixed emissions factor is therefore used to calculate CO_2 emissions from electricity use, to separate out efforts made to reduce electricity demand from fluctuations in the CO_2 emission factor on the supply side. Since 2006, facilities have been required to calculate and report their emissions to the national government, including CO_2 emissions related to fuel usage, and the use of electricity and heat. This mandatory data collection in the years before the emissions trading system is recognised as a key to the success of the programme, allowing facility-level understanding of indirect emissions through electricity and heat use.

Source: (IEA, 2020[22])

Ensure that regulatory frameworks are supportive of the deployment of low-carbon infrastructure systems

Regulators need to maintain a transparent, robust framework for energy network tariffs that is supportive for accelerated investment. The economic structure of network regulation needs to be adjusted to accommodate a rising proportion of variable renewable energy sources, as well as the emergence of new

distributed technologies that change the role of the network from one that is top-down into a multidirectional platform. For example, to support the secure integration of renewables into the grid and manage risks stemming from the retirement of baseload generation and lower utilisation of other plants, the **United States** Federal Energy Regulatory Commission has required, since 2018, that all new generators (regardless of size or technology) be capable of providing primary frequency response – a specific ancillary service used to cope with sudden changes in supply and demand – as a precondition for grid interconnection (IEA, 2020[24]).

New regulatory models are required to trigger additional investment into digitalising networks and hardening them to extreme climate events (refer to section 2 below for a solution on financing investments in resilience). In addition, location signals in network regulation and the procurement processes of grid services need to create appropriate incentives, and reduce barriers for new entrants and new technologies such as storage and demand response.

For the emerging direct current transmission technology, project-financed point-to-point transmission models can be encouraged. Better engagement with local communities and streamlined licencing procedures should address non-financial investment barriers. For the new infrastructure systems of electric vehicle charging, hydrogen and CO_2 pipelines, government infrastructure programs in the context of green recovery efforts and the activities of development banks could prioritise investments in these areas (see Chapter 3 for a more detailed discussion of financing solutions for new infrastructure systems).

For the competitive production areas with auction systems, policymakers have a straightforward way of scaling-up the investment ambition. At high renewable shares, the auction design might have to incorporate production profiles of different renewable technologies and locations. Such a long-term contract model might be suitable for scaling up low-carbon hydrogen production as well. On the other hand, for batteries, demand response aggregation and other flexibility solutions, a combination of technology neutral competitive procurement plus pricing signals that better reward capacity and flexibility, would help to support the increasing flexibility needs of the grid.

Governance: Infrastructure planning and decision-making

Challenges

Increased investment levels needed for climate mitigation are not high relative to broader investment needs, but achieving stringent mitigation goals requires transformational – and not incremental – change. A lack of detailed infrastructure investment planning and poor integration of these plans into national policy contexts, could lead to investments that should not be made and could even hinder the flow of infrastructure investment (OECD, 2018[25]).

A review of government infrastructure planning practices in G20 countries conducted several years ago showed that infrastructure project planning was characterised by a lack of detail and inadequate links to climate policy and broader development goals (OECD, 2017[26]). Focusing on infrastructure that contributes to mitigation outcomes without consideration of other environmental goals may cause significant harm, including to biodiversity.

However, traditional planning and decision-making frameworks for infrastructure investment are ill-adapted for accommodating multiple objectives, particularly when these extend beyond the direct benefits for users to encompass broader outcomes relating to human well-being and the environment, such as climate change mitigation, cleaner air, and biodiversity preservation.

This situation is partly due to the fact that understanding the economic impacts of climate change is an evolving field of research and policy recommendations depend on key assumptions (Auffhammer, 2018[27]). Since climate change is a global problem and climate impacts vary across regions and over time, calculating the social cost of carbon for use in cost-benefit analysis is a complex challenge (OECD,

2018[28]). Decision-making frameworks for infrastructure investments in support of a low-carbon transition based on cost-benefit analysis may use values of discount rates and make assumptions about the nature, scope and scale of future climate damages to be considered that reduce their present value relative to the costs of investment in low-carbon solutions. By aggregating costs and benefits into a single number, cost-benefit analysis might also hide important trade-offs and synergies between policy goals, where one set of costs is compensated by benefits in another policy dimension.

Solutions

Establish national strategies, infrastructure plans and pipelines that are aligned with long-term climate and development objectives

The creation of national strategies, interim goals, and bankable pipelines of low-carbon infrastructure projects is a key element for increased investment in low-carbon infrastructure (Aguilar Jaberi et al., 2020[17]; OECD, 2018[25]). Policy coherence across governments and coherence across different levels of government is also important to facilitate the transition (OECD, 2015[29]; OECD, 2017[14]). Aligning infrastructure pipelines and plans with long-term climate and development objectives is critical to avoiding further lock-in of emissions-intensive infrastructure.

This points to the importance of fast-tracking infrastructure project investment that prioritises the deployment of "high-value" and strategically important projects and sectors (OECD, 2018[25]). In the **United Kingdom**, for example, the government kick-started the offshore wind energy market by establishing dedicated public institutions, policy incentives to target investment barriers, and capacity auctions to indicate future opportunities (OECD, 2018[25]). Box 1.3 highlights how the European Union has accelerated the development of strategically important infrastructure projects.

Box 1.3. Prioritisation for building robust project pipelines: Infrastructure investment in the European Union

The members of the European Union face diverse country infrastructure capacity and gaps. To expedite and prioritise investment in low-carbon technologies and network infrastructure, the European Union provides institutional access and public guarantees and funds. Lessons emerging from this prioritisation process include:

- Incorporate infrastructure priorities into national and regional strategic planning that is aligned with long-term climate objectives and promote suitable investments;
- Overcome non-financial barriers by placing prioritisation mechanisms within existing regulatory and institutional arrangements rather than separate from or in conflict with them;
- Employ experienced institutions with high capacity and expertise to assess project eligibility, determine strategic value, and bridge investment gaps by allocating funding and other policy tools;
- Use prioritisation as a means to feed into policy processes and align project pipeline development to changing investment requirements.

Source: (OECD, 2018[25])

Apply adapted cost-benefit analysis to guide infrastructure investments

Some governments, including the **United Kingdom, New Zealand** and **France** are moving towards adapted cost-benefit analysis that complements traditional cost-benefit analysis (CBA) with tools that provide additional information on climate and other well-being benefits (see Chapter 2 for a discussion on how CBA can be complemented by multi-criteria analyses). For example, the Department of Transport in the UK includes impacts that are categorised as monetised, evolving monetised, indicative monetised, and non-monetised. In the case of elements related to accessibility, for instance, some are monetised (e.g. agglomeration effects), while others are presented by using different tools (e.g. mapping, qualitative assessment). Indicative elements, such as shifts towards more productive jobs due to improvements in the transport network and other non-monetised impacts (i.e. improved security, landscape, and facilities for those with physical and hidden impairments), guide investment decisions by influencing Value for Money assessments at different stages of the decision-making process. Assessment results are presented to decision makers in an Appraisal Summary table that includes non-monetised and monetised costs and benefits, indicating compatibility with key policy objectives (ITF, 2019[30]). In France, guidance on cost-benefit analysis requires that effects that are non-monetisable (including, for example, on biodiversity and quality of life) are presented alongside monetised effects (Direction Générale du Trésor/France Stratégie, 2017[31]).

Ensure that trade-offs and synergies with broader well-being outcomes are appropriately reflected in decision-making frameworks for infrastructure investment

The impact of investments on emissions and their contribution to climate change are typically captured in cost-benefit analysis through an estimation of the social cost of carbon (OECD, 2018[28]).[8] Independent of these detailed assumptions, synergies between GHG emission reductions and broader well-being objectives (such as cleaner air) mean that the short-term benefits of taking mitigation action may be greater than if the mitigation benefits alone are taken into account. For example, including the benefits from improved health due to reductions in air pollution, can increase the case for early mitigation action (OECD, 2019[23]). On the other hand, trade-offs – perceived or real – between climate policies and, for example, energy affordability, may be regressive and exacerbate political economy barriers to action.

Potential synergies and trade-offs need to be understood to allow decision-makers to increase the former and anticipate and manage the latter (OECD, 2019[23]). One approach in the context of the transport sector is the use of vulnerability indices to identify spatial vulnerability to changes in fuel prices by taking into account exposure or the cost burden of travel, sensitivity and adaptive capacity, where adaptive capacity refers to accessibility through alternatives to car use, which in addition to being an important component for measuring equity, is key to understanding the potential modal shift (OECD, 2019[23]).

Integrate biodiversity considerations into infrastructure planning and decision-making processes

Tools such as spatial planning and Strategic Environmental Assessments (SEA) can serve to integrate biodiversity considerations into the early stages of infrastructure planning and decision-making. Such assessments help ensure full compliance with laws pertaining to protected areas and buffer zones. In addition, infrastructure planning processes and regulation such as performance codes should be evaluated and revised to ensure that they allow or support the use of nature-based solutions. In **South Africa**, for example, mainstreaming biodiversity in infrastructure has been undertaken by fostering partnerships to ensure better collaboration and co-ordination of ecological infrastructure investments aimed at improving water security via ecosystem restoration (Manuel et al., 2016[32]). The recent **European Union** taxonomy of sustainable activities (see Chapter 3, Box 3.6) identifies not only the positive impact that an activity can

have on one of the six environmental outcomes sought, but also requires that that activity do no significant harm to any of the other outcomes, including protection and restoration of biodiversity and ecosystems.

Financing

Challenges

The mispricing of climate-related risks – physical or transition risks – may lead to serious misallocations of capital resulting in infrastructure that locks in long-term emissions or becomes obsolete prematurely. For physical risks, this may reflect investment decision-making that fails to consider uncertainties relating to the future evolution of the climate. Transition risks related to carbon-intensive infrastructure are more likely to arise in the absence of credible climate policies, investor short-termism, or misaligned incentives for executives within firms (OECD, 2017[14]). They relate to a reassessment of asset values, which could result from adjustments toward a low-carbon economy through changes in policy, law, technology, or markets.

Existing incentives are insufficient to ensure that negative externalities of infrastructure on biodiversity are internalised. While effective regulatory frameworks, including strategic land use planning, Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) are critical to help foster green infrastructure investments, economic instruments should also be applied, as these can provide additional incentives for green infrastructure, while also generating revenue that can be invested for this purpose.

Solutions

Pursue measures that promote the appropriate pricing and management of climate-related risks across the financial system

Mobilising public and private resources across the financial spectrum is an essential part of generating the trillions of dollars needed for sustainable infrastructure. Public finance institutions, banks, institutional investors, corporations and capital markets all have a crucial role to play, both in their own right and as part of the broader financial ecosystem (refer to Chapter 3 for a detailed discussion of the challenges and solutions for scaling-up financing for quality infrastructure investment).

Unlocking private investment in low-carbon, resilient infrastructure requires investors, issuers and other financial stakeholders to better understand and manage climate change-related risks and impacts generated by their investment decisions and portfolios, including in terms of financial performance (i.e. from a *financial materiality* perspective).and, depending on investment objectives and mandates, with respect to society and the environment (i.e. from a *social and environmental materiality* perspective).

Tackling this bottleneck involves addressing the pricing and management of climate risks through a set of complementary approaches. These include: pricing climate-related externalities to bring the returns to low-carbon, resilient infrastructure closer to the socially efficient level; reducing the policy risk premium by increasing the credibility of the strategic direction of climate policy (see above); fixing biased or short-term incentives for decision-makers, capability gaps in financial firms, and inadequate climate risk disclosure and pricing that may be hindering the allocation of finance to low-emission, resilient infrastructure; and encouraging forward-looking climate scenario analysis to better manage climate risks.

Adopt economic instruments that help internalise the negative impacts of infrastructure on biodiversity

Economic instruments such as taxes, fees and charges, and biodiversity offsets can be applied to help internalise the negative externalities of infrastructure on biodiversity, thereby also helping to make green infrastructure more cost-effective. Such instruments can also generate revenue, which can be used to

further support green infrastructure or other habitat restoration activities. Biodiversity-relevant fees on infrastructure include, for example, stormwater fees which, as in the case of Philadelphia in the **United States**, are based on impervious areas. Revenue generated from these fees is used to finance the management of stormwater impacts such as flooding and poor water quality arising from built-infrastructure.

Biodiversity offsets are measurable conservation outcomes designed to compensate for adverse and unavoidable impacts of development activities, and are often required in association with Environmental Impact Assessments. Biodiversity offsets are applied to the infrastructure sector in a number of countries including programmes in Hessen, Germany; British Colombia, Canada; and the United States and Mexico (OECD, 2016[33]). In the **United States**, infrastructure projects that may be required to undertake biodiversity offsets include roads, bridges and tunnels, real estate developments or mining and energy projects. Biodiversity offsets help to promote strict adherence to the biodiversity mitigation hierarchy for impacts: avoid, minimise, restore/rehabilitate on site, and offset.

Technology and innovation

Challenges

Significant innovation and technological development, demonstration, and large-scale deployment are needed to ensure there is an adequate portfolio of low-emissions technologies to achieve stringent mitigation goals (IEA, 2020[13]). Social acceptance, commercial feasibility, as well as risk sharing will be determining factors on whether some such technologies (e.g. CCUS) can be deployed sufficiently quickly at an appropriate scale.

Solutions

Provide targeted support for new technologies needed for the low-carbon transition

To develop, demonstrate and deploy the new technologies needed to achieve climate goals, a range of measures will be needed, including targeted innovation policies, support for early-stage technologies and commercialisation of technologies, infrastructure investment (e.g., converting natural gas pipelines to hydrogen), as well as clarity in sharing risks (e.g., liability over leaked CO2 over time). Priority actions identified for scaling up climate solutions, some of which may also relate to the context of infrastructure investments in support of climate action, include (OECD/The World Bank/UN Environment, 2018[34]):

- Deploy targeted innovation policies to create and shape markets for climate innovations;
- Scale up public investment in research and development (R&D);
- Overcome financial barriers to demonstration and early-stage commercialisation to bring existing technologies to scale (see also Chapter 3);
- Promote international technology diffusion to ensure that innovation benefits all.

Make effective use of public procurement to incentivise innovative low-emission infrastructure solutions

Public procurement at central and local government levels plays a key role in the economy as a whole (averaging 13% of GDP in advanced countries, and sometimes more in emerging economies). Public procurement can also create lead markets for innovative, low-GHG industrial materials and infrastructure choices. One approach is to include life-cycle CO_2 emissions in procurement criteria, thereby encouraging a competition to lower emissions. However, for this potential to be materialised, the capacity of public procurement organisations much be strengthened (OECD, 2017[14]).

2. Resilience

Infrastructure trends and needs

The supply of and demand for infrastructure services is susceptible to damage and disruption from a range of disasters. These include natural hazards and man-made threats such as macro-political crises and conflicts, health crises, industrial accidents, and malicious acts. Health crises, such as the COVID-19 pandemic, have demonstrated their capacity to not only overwhelm health systems, but also affect almost all other infrastructures (such as electricity demand, transport and communication infrastructure) as a result of governments' responses to contain outbreaks, and the behaviour of businesses and households.

Most of the past increase in infrastructure damages has come from greater risk exposure. Past observed infrastructure damages and disruptions have been driven less by an increase in tail intensities, but rather by a number of socio-economic, technological and environmental factors that change the way hazard events occur, are transmitted, and generate reactions (OECD, 2014[35]). These include population growth and growing urbanisation rates in risk-prone areas. Technological developments and growing mobility have facilitated inter-connectedness, thereby increasing the systemic nature of risks (OECD, 2014[35]).

In the future, environmental degradation, coupled with the effects of climate change, will increase the vulnerability[9] of infrastructure to certain types of disasters. The continued expansion and intensity of land use will accelerate land degradation and pollution which, coupled with climate change, is set to undermine nature's and humans' resilience to risks. As a consequence of rising global temperatures and global atmospheric changes, hydrometeorological hazards are expected to become more intense and to shift in their geographical patterns, affecting areas previously spared from certain hazard types (IPCC, 2018[3]). Understanding such driving forces is indispensable for making decisions about infrastructure resilience.

Future socio-economic development will determine both the vulnerability and exposure[10] of infrastructure to risks. The world's population is expected to grow to 9.7 billion by 2050 and to close to 11 billion by 2100, with its medium age raising from 31 today to 42 by 2100 (United Nations Department of Economic and Social Affairs, Population Division, 2019[36]). Urban expansion will continue, especially in developing countries, but also in high-income contexts, including in regions already subject to the impacts of climate change. For example, Miami, a low-lying city prone to a range of coastal hazards, is expected to see a growth in economic assets from USD 416 billion in 2005 to USD 3.5 trillion by 2070 (OECD, 2014[35]).

Making infrastructure resilient can reduce repair costs and maintenance needs over the life cycle, and limit the direct and indirect costs associated with extended service disruptions. The net benefit of building more resilient infrastructure in low- and middle-income countries has been estimated at USD 4.2 trillion, with a USD 4 in return for each USD 1 invested (Hallegatte, Rentschler and Rozenberg, 2019[37]). Adapting to the impacts of climate change by investing USD 1.8 trillion globally[11] from 2020 to 2030 could generate USD 7.1 trillion in total net benefits (Global Commission on Adaptation, 2019[38]). The type of investment needed to make infrastructure resilient includes investments in new infrastructure and their services, investments in protective infrastructure (e.g. grey protection measures such as seawalls and levees or "green" such as mangrove or forest restoration), as well as investments in upgrading and retrofitting existing infrastructure.

Challenges and solutions

There are a number of challenges related to governance, regulation, and financing that have inhibited progress towards strengthening resilient infrastructure. This section highlights solutions that have been found to address them.

Governance

Challenges

As highlighted in the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], effective governance mechanisms that take into account the large number of stakeholders involved in the planning, design, investment, construction, operations or regulation of infrastructure and their services across different sectors are critical for ensuring that infrastructure is resilient against a wide range of threats. Governance mechanisms also need to acknowledge the often shared nature of ownership and operation between public and private stakeholders (see Chapter 2). In addition, they need to consider the interdependencies of infrastructure assets and operations across sectors as well as across geographic areas so as to ensure that systemic risks are addressed effectively through resilience measures undertaken at the asset level (OECD, 2019[39]).

One important governance challenge arises from the "ownership" of risk. If it is not clear who "owns" a risk or who shares the responsibility for and management of a risk, which includes determining who is accountable and liable for damages to third parties, a significant underinvestment in resilience will be the likely result (OECD/The World Bank, 2019[7]; Fisher and Gamper, 2017[40]; OECD, 2019[39]). In addition, a track record of governments stepping in to cover damages reinforces moral hazard dynamics and reduces private sector incentives for investing in resilience. A lack of competition and monopolistic market conditions can discourage service providers, such as energy sector utilities and system operators, from investing in resilience measures in spite of having a responsibility to protect their assets and provide reliable services to their customers (IEA, 2020[24]).

Solutions

Clarify roles and responsibilities for investing in resilience and recovery

Establishing clear roles and responsibilities for resilience investments and liability as well as for reconstruction and rehabilitation costs is key for creating the right incentive structure. **Australia** has established a framework that sets out clearly the responsibilities of post disaster financial assistance (Box 1.4).

Box 1.4. Responsibilities for post-disaster financial assistance in Australia

Disaster response is the main responsibility of subnational (state and territory) governments, but central government assistance following a disaster is provided based on shared responsibilities between levels of government and other stakeholders. Subnational governments finance post-disaster assistance through a Disaster Relief Account, whose annual allocation is based on an estimated annual average need for ex post disaster financing (Australian Productivity Commission, 2014). It was in recognition of the significant cost of disasters that the central government established the Natural Disaster Relief and Recovery Arrangements (NDRRA) to provide disaster assistance to subnational governments.

Subnational governments determine the areas and stakeholders eligible for compensation as well as the level of assistance that will be provided to individuals and communities, without having to seek central government approval. In the event of a disaster that activates the NDRRA, the central government provides the subnational governments with up to 75% of what the latter have determined to be eligible expenditure on relief and recovery assistance. The NDRRA provides relief and recovery support for individuals, owners and operators of public infrastructure or other public assets, as well as

to a more limited extent to business owners. The NDRRA have detailed cost-sharing arrangements for each individual category of costs eligible for funding.

NDRRA generally provides funds to return assets to their pre-disaster state. State and territory governments are expected to consider any need to relocate assets or build in additional resilience during reconstruction, although the Commonwealth government currently has few (if any) tools to encourage state and territorial governments to build back better. The states and territories are able to seek reimbursement for some costs related to investments that improve resilience, although such requests are not very frequent. There is some discussion of increasing NDRRA funding support for such investments.

Source: (OECD/The World Bank, 2019[7])

Regulation

Challenge

Regulations on risk assessment, land use, or infrastructure and operational resilience are indispensable in directing infrastructure stakeholders toward assessing risk exposure and building resilience. The regulatory design can take various forms and depends on the policy objective. Regulations can either prescribe detailed technical regulations and standards for resilience, or specify outcomes linked to the duration of service disruption or minimum service requirements. Regulations can also serve to guide investment choices in order to privilege resilience, such as in the case of **Fiji** where climate risk reporting became mandatory. In **Norway,** municipalities are required to prioritise the conservation or restoration of ecosystems to manage natural hazards and need to provide a rationale if they chose a different measure (OECD, 2020[41]).

The task for regulators is becoming increasingly complex, however, as demonstrated by the Great East Japan Earthquake. Although **Japan** had the most advanced nuclear safety standards in the world in terms of seismic risk management, regulations did not consider the cascading impacts that could be triggered by the flooding caused by an ensuing tsunami. The water that breached the sea walls shut down the back-up diesel generator as well as the second battery-powered back-up, which should have ensured the continued cooling of the nuclear power reactors. The power disruption ultimately caused reactors to melt down (Fisher and Gamper, 2017[40]).

The evolving nature of hazards further complicates the task of setting resilience standards. The increasing frequency and intensity of many climate-related events means standards can easily become out-of-date. Further, the uncertainty surrounding the future level of threats may make it difficult to set realistic standards with a high degree of confidence. A similar uncertainty exists regarding other hazards such as cyber-threats and future pandemics.

Failure to enforce regulations constitutes an additional challenge. For example, dikes and other protective infrastructure succumbed to intensive floods in Germany and Austria in 2013. Had the regulations that had been updated after similar floods in 2003 been properly implemented, the infrastructure should have been able to withstand the flood levels (OECD, 2014[35]).

Solution

Review and update resilience standards and regulations to reflect evolving knowledge about hazards, and continuously monitor their implementation

The fluid nature of many hazards and the elevated degree of uncertainty regarding both their timing and magnitude, means that regulators need to regularly review the prevailing standards based on the latest scientific knowledge of threats and, where warranted, to update them to reflect recent data and analysis. However, it is not sufficient to ensure that regulations and standards are kept up-to-date. It is equally important that regulations on infrastructure construction and operations are properly implemented. Regulators should therefore continuously monitor the implementation of regulations in order to drive early adoption of resilience measures.

The **United Kingdom**'s National Infrastructure Commission, through its resilience strategy, has recommended that regulators not only develop resilience standards and cost them, but carry out regular monitoring of their implementation by operators. The purpose of monitoring is to evaluate the compliance of infrastructure operators with resilience standards as well as with the conduct of stress tests. It also seeks to track the implementation of resilience measures that address the vulnerabilities revealed through stress tests. To further strengthen enforcement of resilience standards, regulators can issue fines, such as in the case of the water and communication infrastructure sectors (National Infrastructure Commission, 2020[42]).

Governance: Infrastructure planning and decision-making

Challenge

Infrastructure is a typically a long-lived, capital-intensive investment. Decisions made today about the nature, location, and design of infrastructure will have long-lasting effects that influence the extent to which investments deliver anticipated benefits over time and align with broader policy objectives. Infrastructure systems must be capable of coping with a range of operating conditions that they are likely to encounter over their lifetime.

Policymakers and infrastructure providers need to build resilience taking into consideration the inherent uncertainty in understanding risks. Uncertainty relates to the limits to or even absence of scientific knowledge (data, information) that makes it difficult to assess the probability and possible outcomes of risks. While information on past risks and potential existing vulnerabilities is not enough to predict the future, it is indispensable to inform resilience building (OECD, 2014[35]; OECD, 2015[43]).

For many infrastructure systems exposed to or dependent on the environment, such as, for example, water supply, flood protection, nuclear power plants, and ports, climate change is generating deep uncertainty over future operating conditions in terms of, for instance, temperatures, rainfall, extreme weather events, and sea level rise.

As a result of climate change, data on past conditions no longer serve as a guide for what can reasonably be expected in the future. This uncertainty is due, on the one hand, to the existence of multiple possible climate scenarios (which themselves are contingent on mitigation pathways) and, on the other hand, to the inaccuracy of climate models and long-term projections of climate impacts. Traditional decision-making tools used by infrastructure planners, such as cost-benefit analysis, which depend on being able to assign probabilistic values to different outcomes, are ill-equipped for handling such deep uncertainty.

Solutions

Explore more flexible and adaptive infrastructure planning approaches that can accommodate uncertainty, and take a dynamic approach to infrastructure investments to ensure alignment with policy objectives over time

Ensuring that infrastructure systems can cope with highly uncertain future operating conditions requires planning and decision-making approaches that can accommodate uncertainty, allow for a greater degree of flexibility, and enable adjustments over time to reflect changing conditions or new information. A number

of alternative decision-making approaches have been developed, using scenario planning as their basis, that offer greater flexibility (e.g. real options analysis, robust-decision making, adaptive planning). These different techniques share a common understanding that planning must accommodate a range of future outcomes.

In adaptive planning approaches, planners envisage multiple actions and a range of alternative policy or investment pathways. As circumstances evolve, and on the basis of pre-determined trigger points, they switch options and reorient to an alternate pathway. The **Netherlands**, for example, has adopted adaptive water management as the basis for its long-term planning for its water resources (Box 1.5).

The use of scenarios and more flexible planning approaches have yet to gain wide application in infrastructure planning. However, given the heightened levels of uncertainty to which many infrastructure systems are exposed, incorporating these techniques into existing planning processes would be beneficial for policymakers and planners.

Box 1.5. Adaptive water management in the Netherlands

The Netherlands has a long and robust tradition of living with water. Located in a delta, more than half of the country's territory and population and two-thirds of its economic activity are flood-prone. Safety against flooding and the management of excess rain have long been the foundation of water management in the Netherlands. Centuries of concerted action and investment helped build and maintain the country's extensive system of primary and regional flood defences.

A new paradigm towards adaptive water management has put thinking about the future and long-term sustainability at the heart of Dutch water policy. This shift began with the programme "Room for the River" and culminated with the adoption of the Delta Act in 2012. The act established the Delta Programme, the Delta Commissioner, and the Delta Fund to advance an adaptive water management approach that places primacy on a long-term perspective (up to 2100) and flexible strategies to cope with future challenges related to water safety and freshwater supplies.

Adaptive management is seen as a structured, iterative, learning-based process involving the fundamental features of learning and adaptation leading to both improved understanding of the (resource) system and to improved management based on that understanding. This entails integrating a long-term perspective into water management planning with iterative decision making, considering how decisions in the short term potentially enable or foreclose future options, and the use of nature-based solutions, which can avoid or delay lock-in to capital-intensive, conventional "grey" infrastructure.

Source: (OECD, 2018[25]; Zevenbergena, Rijkeb and van Herkb, 2015[44])

Gather data and monitor the resilience levels of infrastructure assets

Data is key to support resilience decision-making**.** Better data and information about past risks and potential threats based on scientific evidence are indispensable to inform resilience building. Systematic data collection on the resilience levels of infrastructure assets is key to understanding a system's continued capacity to withstand shocks.

In an attempt to understand the resilience levels of flood protection measures, several OECD countries have established central repositories that gather information on the level and adequacy of resilience measures. In **Austria**, a central database was established by the Ministry of Agriculture, Forestry, Environment and Water Management that contains information on 270,000 protective infrastructures, with

information on their physical dimensions, an assessment of their condition, documentation on monitoring and inspections, attendance, corrective maintenance, and rebuilding measures. In **France**, local level initiatives, such as the SIRS-dike database created by the Syndicat Mixte Interrégional d'aménagement des Digues du Delta du Rhône à la Mer, catalogues existing protective infrastructure along the Rhône downstream of Beaucaire which includes inspection observations. In **Switzerland**, a database (ProtectMe) monitors the aging process and vulnerabilities of existing protective infrastructure, with comprehensive information on the status of maintenance and protection capacity. In the **United States**, the Army Corps of Engineers created the National Levee Database, containing up-to-date and publicly available information on the location, condition, and maintenance of the majority of dikes and dams built across the United States. The information can be illustrated with a mapping tool (OECD, 2017[45]).

Financing

Challenge

Underinvestment in resilient infrastructure is a key challenge. To avoid governments shouldering the entire burden of resilience investments, it is important to leverage contributions from private infrastructure owners or operators. However, infrastructure owners or operators may not invest in resilience if the business case is hard to make, or if regulations impede them from recovering costs through their pricing mechanisms. Uncertainty about whether or not the benefits of resilience investments may materialise, may serve as a disincentive to resilience investments. Last, but not least, a track record of government funding for damages incurred reinforces issues regarding moral hazard.

Solution

Use government financing mechanisms to incentivise private infrastructure actor resilience investments

Ex ante government financing mechanisms can go a long way to encouraging infrastructure owners and operators to invest in resilience measures. They can take the form of grants or loans, and can finance all or part of the necessary costs. For example, in response to Hurricane Sandy in the **United States**, the state government in New Jersey chose to create a facility that co-finances energy resilience measures in critical infrastructure assets and services so as to enhance their reliability during future hurricanes (Box 1.6).

Box 1.6. Co-financing energy resilience measures - New Jersey's Energy Resilience Bank (ERB)

Following the critical infrastructure failures during Superstorm Sandy, the New Jersey government implemented financing mechanisms to encourage the strengthening of energy network resilience. A New Jersey Energy Resilience Bank was created with USD 200 million in federal Community Development Block Grant-Disaster Recovery funds to support the development of distributed energy resources at critical facilities throughout the state to ensure operational capacity during future outages.

Financing options available through the ERB consisted of grants and loans to address unmet funding needs. Grants and forgivable loans were offered to address up to 40 percent of unmet funding needs, while low-interest, amortising loans were available for the remaining 60 percent of unmet funding needs. Grants and loans required equity contributions, and any principal forgiveness component required evidence of meeting minimum performance requirements. Eligible technologies had to include islanding (ability to operate isolated from the electric utility grid) and blackstart (ability to start up without a direct connection to the electric grid) capabilities, with the capability to operate at critical load. The programme

included a sliding scale of matching funds based on the characteristics (i.e., profit, not-for-profit) of the applicants and an assessment of the project needs, feasibility, and return on investment

Source: (Fisher and Gamper, 2017[40])

3. Regional inclusiveness and access

Infrastructure trends and needs

The crisis has shed light on the gaps in infrastructure linked to health care, digitalisation, social housing, and safe transport, as well as within-country disparities in access to infrastructure. In some cases, these disparities also exist among cross-border regions. There is a risk that the COVID-19 crisis will amplify some of these pre-existing regional disparities (see also Chapter 4) due to the tight fiscal context arising from the pandemic. This section focuses primarily on two areas strongly affected by the COVID-19 crisis: health and communication infrastructure.

Since 2000, territorial disparities in access to health infrastructure have increased. A widening rural-urban divide in access to health infrastructure is observed among OECD countries. Since 2008, remote rural regions have lost an average of 22% of hospital beds, compared to an overall average of 6% for all types of regions. By 2018, regions with access to metropolitan areas were equipped with almost twice as many hospital beds per 1 000 inhabitants than remote rural regions. The largest gaps are observed in countries badly hit by the 2008 global financial crisis (e.g. Ireland and Portugal) (OECD, Forthcoming[46]).

The COVID-19 crisis also highlighted the importance of *high-quality* broadband (i.e. connections that are fast enough to support high-quality video calls or simultaneous connections, fundamental to remote working). The quality of connections matters beyond the access to basic internet when it comes to seizing the opportunities of digitalisation. Across OECD countries, there are significant disparities in access to high-quality broadband (e.g. connections with speeds >30Mbit/s), in particular between rural and urban areas. Since 2010, the gap in broadband access between rural and urban areas has decreased by half in almost all OECD countries. Yet, by 2017, in the 14 OECD countries with available data, the region with the highest access to communication infrastructure had, on average, a 23-percentage point higher share of people with access to fast (>30 Mbit/s) internet networks, than the region with the least widespread access (OECD, 2020[8]; OECD, Forthcoming[47]).

The rural-urban digital divide is evident. According to the information provided from regulators in 26 OECD countries, on average, one in three households in rural areas does not have access to high-speed broadband. In countries like Finland, while the share of total households with internet connection is almost 75%, just 9.3% of households in rural areas had a connection to high-quality broadband. Overall only 7 out of 26 countries have succeeded in ensuring access to a high-speed connection to over 80% of households in rural regions (OECD, 2020[8]). In India, only 14.9% of rural households have internet access (compared to 42% urban households), according to a national survey conducted in 2017-18 (Government of India, 2019[48]). A similar situation exists in Mexico, with a 39.2% internet adoption rate in rural areas in contrast to 71.2% in urban areas (INEGI, 2017[49]). Slow or intermittent broadband connection reduces the opportunities for people to participate and benefit from economic gains and quality of life in the digital age. Advances in technology and broadband infrastructure are particularly relevant for low-density regions as improvements in broadband connectivity can overcome some of their core challenges including isolation, high transport costs, high service-delivery cost, and distance to markets (OECD, 2020[9]; OECD, 2018[50]; OECD, 2019[51]).

Broadband access is particularly important for remote working, which is critical to mitigate the economic impact of the pandemic. During the COVID-19 crisis, regions and cities that adopted remote working on a

large scale have been better able to mitigate economic disruptions due to lockdowns (OECD, 2020[52]; OECD, 2020[8]; OECD, 2020[53]). Remote working can contribute to reshaping urban and rural development and achieve a greater balance across regions. In the medium- and long-term, post-COVID-19, remote working may facilitate operating cost-reductions by reducing office space and equipment needs, or by reducing labour costs through enlarging the pool of workers from which firms can choose (OECD, 2020[54]). For these reasons, it is critical to invest in high-quality infrastructure in rural regions.

Challenges and solutions

Challenges

Post-COVID-19, the territorial divides in access to health care could be amplified due to various short- and long-term risks. First, the crisis will deeply affect the availability of public resources for social spending and investment. Second, lockdown measures generate short-and medium-term financial shocks for some regional and local hospitals. For instance, many financially challenged rural hospitals were forced to close during the crisis as the volume of patients decreased due to mobility restrictions and people choosing to delay or forego care. Third, the health care effects of COVID-19, added to ageing challenges, may lead to increased demand for certain types of infrastructure and services, such as long-term care (OECD, Forthcoming[46]).

In the case of communication infrastructure, there is a risk of a widening digital divide in the medium-term. This could arise where national and subnational governments are constrained in their ability to invest in remote regions due to reduced fiscal space, coupled with reluctance by private actors to invest in low-density, remote rural areas. So far, the potential of remote working, measured by the share of employed people that can potentially telework[12], varies greatly among different types of regions, especially between capitals and other regions, as well as between cities and rural areas. In Europe, for instance, cities have a 13-percentage point higher share of jobs amenable to remote working than their rural counterparts (OECD, 2020[8]; OECD, 2020[52]). In addition, the forced shift to online learning in response to the pandemic has further highlighted inequalities faced by rural communities in accessing digital services. For some children, for example, this meant being unable to continue lessons during lock-down periods, widening pre-existing inequalities with peers in better-serviced regions (OECD, Forthcoming[46]). This highlights a need for policymakers to pursue communication infrastructure investment in rural or remote areas in tandem with other regional development policies, such as investing in education and labour skills, and upgrading regional industries.

While disparities across metropolitan and other regions are increasing, disparities within metropolitan areas are also significant. Large cities have their own internal divisions at a smaller, yet often quite intense, scale. In the wake of the COVID-19 crisis, local governments may face higher financial constraints limiting their capacity to maintain and operate their urban public transport systems. Many local governments are confronted with a fall in user fees for public transport, and the medium- to long-term impact of enhanced teleworking and social distancing on urban public transportation could be substantial.

Solutions

Implement national infrastructure strategies with a focus on regional disparities

National governments can play a large role in enabling a balanced approach to infrastructure development, and ensuring that infrastructure contributes to broader objectives, such as reducing regional disparities. **Brazil's** National Strategy for Economic and Social Development and the recently announced New Deal in **Korea** are two examples (Box 1.7). National governments can also incorporate a territorial dimension into their national investment strategies. In a 2016 survey conducted on the Governance of Infrastructure,

12 of the 25 responding OECD countries reported that imbalances in regional development were among the key drivers for their infrastructure strategic plans (OECD, 2016[55]).

Sufficient data at the subnational level is a key element in designing and implementing national investment strategies with a territorial focus. It is necessary to have a robust statistical system with socio-demographic, economic, and governmental activity indicators that help capture investment needs, which are disaggregated geographically for regions and even cities. This would allow policymakers to, firstly, identify those regions in which the need to develop quality infrastructure is most pressing; secondly, to monitor the progress of regional convergence in access to infrastructure and public services, as well as measure the social, economic, and environmental impact of infrastructure investment in different regions; and third, to make better forecasts in terms of investment needs and trends. In this regard, subnational governments are well-placed to collect these data. This is further elaborated in Chapter 4 regarding developing a place-based approach for infrastructure investment in regions and cities.

Box 1.7. Incorporating the territorial dimension in national investment strategies

Infrastructure investment in Brazil's National Strategy for Economic and Social Development

In 2018, Brazil published the National Strategy for Economic and Social Development (*Estratégia Nacional de Desenvolvimento Econômico e Social*, ENDES) 2020-2031, which is organised along five axes: economic, institutional, infrastructure, environmental, and social. The axes aggregate the problems that the Brazilian state must solve and represent the major fields of public policies that are structured around these problems. For each of these axes, megatrends, challenges, guidelines, key indices, and targets are identified.

For the Infrastructure Axis, one particular challenge is to ensure greater well-being, which is tackled by improving urban and rural infrastructure. This includes:

- Planning urban infrastructure considering the complementarities and synergies of public and private investments in urban infrastructure (e.g. sanitation, mobility and housing);
- Expanding the satisfactory condition of well-being of households in rural areas, respecting local characteristics;
- Increasing the capacity of federal entities in planning and regulating public services, and providing greater security for the expansion of private initiatives in service provision.

In addition, the strategy highlights inter-regional transport and modernising communication infrastructure, with a clear territorial dimension, as priorities. For the former, it aims to develop various modes of regional passenger and cargo transportation, in such a way as to promote territorial integration and the intensification of spatial interactions. For the latter, the strategy specifies that the country needs to ensure rules and instruments for the expansion and access of broadband infrastructure in needy/remote regions and in those with the highest population density, as well as incorporate new technologies (e.g. Internet of Things) in urban planning, to make smart city projects viable.

Korea's regionally balanced New Deal

In July 2020, Korea adopted the New Deal to combat the economic setbacks caused by COVID-19, with a distinctive territorial approach. According to the government's plan, KRW 75.3 trillion will be invested in projects that are conducted outside of Greater Seoul. The majority of the spending will be funded by the central government, which will cover KRW 42.6 trillion, or 57%, while local governments will match those funds with a total of KRW 16.9 trillion. The remainder will be in the form of private sector investments.

The government will assign major projects, such as installing green technology in outdated government-leased apartments, or installing artificial intelligence technology in traffic systems, after categorising the 299 local governments according to their development status. The local governments will be divided into the top 25%, middle 50% and bottom 25%.

Some of the planned projects will be led by local governments rather than by the central government, including the expansion of a robotics factory in Daegu, the establishment of an autonomous vehicle testing site in Sejong, and the development of a publicly-backed delivery platform in Gyeonggi.

The plan will also create special economic zones by providing fiscal and tax support while lifting regulations. This includes a KRW 35 billion regulation-free zone fund. The central government said it will speed up regional participation in New Deal projects by cutting regulatory red-tape, including feasibility evaluation requirements and local government fiscal situation reviews.

Source: (Ministry of Planning, 2018[56]) (Korea JoongAng Daily, 2020[57])

National governments can significantly contribute to mobilising public investment in low-density or remote regions with potential for development or catching-up but with limited ability for attracting private investment. In sectors with a particular territorial focus (e.g. transport, energy, communication infrastructure), national policies that clearly set out a long-term policy orientations can encourage subnational governments and local/regional private investors to invest. Support from the national level is particularly crucial post-COVID-19, when both subnational governments and private investors operate in a highly uncertain environment. Private investment tends to fall in times of uncertainty as private investors may be even more risk-averse than usual. Investors might be particularly reluctant to invest in remote areas even if there are growth potential and investment opportunities. The multiplier effect of public investment is higher in times of uncertainty as private investment falls during this time. Expectations are key and private investors adjust their expectations when there is more public investment, in turn affecting the fiscal multiplier for public investment (IMF, 2020[58]).

Deployment of information and communication technology (ICT) and communication infrastructure can play a key role in bringing rural regions closer to markets and also to public services such as health and education. For example, **Brazil** has included the modernisation of communication infrastructure in its national development strategy (Box 1.7). The **United States** Coronavirus Aid, Relief and Economic Security (CARES) Act allocates more than USD 500 million to help rural communities connect to broadband internet, including enhancing telemedicine in rural hospitals (Box 1.8). **Korea**'s Ministry of Education implemented a plan to improve wireless internet infrastructure in some rural schools, with projected funding of KRW 1.5 billion (USD 1.2 million). In order to prepare rural schools for the future and close the territorial gaps, investments should also be made in the training of teachers to ensure they have the digital skills necessary to facilitate online learning for students and to provide them with the competencies to manage other new learning environments (OECD, Forthcoming[46]). Facilitating teleworking and enhancing widespread availability of high-speed broadband in rural areas can also contribute to support behavioural changes, limit commuting, and help with the low-carbon transition.

However, investing in physical infrastructure alone is far from sufficient to support local economies and reduce regional disparities. Even if investments flow to regions that are more impoverished in terms of physical infrastructure, skilled human capital may migrate to more prosperous regions. This holds particularly true for lagging regions with relatively weak growth factors, where investing in physical infrastructure alone, such as building roads and railways, may appear to have a limited contribution to reviving the local economy. In a worst-case scenario, physical infrastructure undertaken in isolation can even produce unintended negative consequences, such as "leaking by linking" – road and motorway

building, for example, while having a short-term positive impact, may lead to a brain drain and a concentration of private investment in the main urban centres of the state.

Governments should therefore consider mechanisms that ensure that physical infrastructure, education, skills, regional attractiveness, firm productivity, innovation policies, and local public services, etc. are coordinated at the regional and local level in order to connect to new markets and overcome isolation (OECD, 2020[59]). This means policymakers at all levels need to undertake comprehensive needs assessment for regional development, and adopt place-based and integrated policy packages for infrastructure investment (see Chapter 4).

Box 1.8. The United States' CARES Act supports enhanced communication infrastructure and services in rural areas

Signed into law March 27, 2020, the United States Coronavirus Aid, Relief and Economic Security (CARES) Act allocates over USD 500 million to several programmes and initiatives to help rural communities connect to broadband internet. For example, the CARES Act allocates an additional USD 100 million to the RUS Rural Connect Pilot Program ("ReConnect").This Program furnishes loans and grants to provide funds to entities seeking to deploy broadband (e.g. construction, improvement, or acquisition of facilities) in eligible rural areas. In particular, the proposed funded service area must be in an area where 90% of the households do not have sufficient access to broadband. The CARES Act also increases RUS' Distance Learning, Telemedicine, and Broadband Program funding by USD 25 million, allowing the USDA to provide additional grants to support rural communities' access to telecommunications-enabled information, audio and video equipment.

To support the growing need for telehealth services due to the COVID-19-19 emergency, the Act also provides the Federal Communications Commission with USD 200 million for its COVID-19-19 Telehealth Program. The program supports eligible health care providers responding to COVID-19-19 by providing telecommunications services, information services, and the devices necessary to enable telehealth services. In addition, the Act increase funding to the Public Health and Social Services Emergency Fund, within which USD 180 million has been set aside for the Department of Health and Human Services to expand services and capacity for rural hospitals, including telehealth.

Source: (OECD, 2020[60]; U.S. Department of Agriculture, 2020[61]; The American Farm Bureau Federation, 2020[62]).

Strengthen the capacities of regions and municipalities to manage infrastructure investment

Regional disparities in access to health, communication, and transport infrastructure are connected with how national and subnational governments finance and prioritise investment needs, and coordinate their actions to ensure no region is left behind. Given that almost 60% of public investment is managed by subnational governments in OECD countries – and 40% around the world – their role in ensuring a balanced and equitable approach to infrastructure is essential (see Chapter 4). Subnational governments are also well placed to identify local needs and complementarities across sectors for infrastructure investment.

The question of scale for subnational infrastructure investment is critical. In some cases, enabling the design and implementation of infrastructure investment at the regional level can be effective in overcoming inter-regional and intra-regional disparities. The key to this approach is that regions have the capacities and policy tools to carve-out priorities, mobilise regional/local information and knowledge (e.g. consult local authorities, regional enterprises and social partners, etc.), coordinate with national and local authorities,

and invest accordingly (OECD, Forthcoming[63]). This also applies to metropolitan areas, in some cases. Enhancing co-operation and coordination for infrastructure investment at the metropolitan scale could help address the disparities among municipalities within the metropolitan area.

Subnational governments – be they at the state, regional, or local level – need to have the necessary administrative, financing and strategic capacities in order to properly perform their role in driving infrastructure investment. National governments can support the subnational level in acquiring these capabilities, focusing in particular on lagging regions, and providing incentives to invest at the right scale. Subnational governments, where relevant, could also explore the opportunities offered by international organisations and initiatives, such as the SOURCE platform (described in Box 1.8) and the Public-Private Infrastructure Advisory Facility's (PPIAF) Sub-National Technical Assistance program, that help subnational governments build capacities in preparing and managing infrastructure investments.

The solutions for strengthening subnational government capacities in infrastructure investments are discussed in Chapter 4, with concrete examples from countries, regions, and cities. These solutions cover how to coordinate infrastructure investment among levels of government, how to facilitate cross-jurisdiction cooperation for infrastructure, appropriate measures to support subnational investment, and how subnational governments can optimise their resources to finance different infrastructure investments. These solutions should not be viewed in isolation. Rather, they should be adopted as a suite of complementary approaches in order to achieve regional inclusiveness and improve access to infrastructure.

4. Sustainable development

Infrastructure trends and needs

Over the 2016-2040 period, infrastructure investment needs for electricity and water are estimated at USD 94 trillion (representing a 19% investment gap compared to current investment trends), and a further USD 3.5 trillion is required to achieve the SDGs (representing a 23% investment gap compared to current investment trends) (Oxford Economics/Global Infrastructure Hub, 2017[64]). At the global level, electricity and roads are the most important sectors accounting for 65% of global infrastructure investment needs until 2040 based on the current trends. The greatest investment gap is for roads. Globally, the proportion of GDP for infrastructure investment needs to increase to 3.5% from 3.0% at current trends in order to bridge the investment gap (Oxford Economics/Global Infrastructure Hub, 2017[64]).

The investment gap over the 2016-2040 period (i.e. the difference between the estimated investment need and investment expected under the current trends) is largest in the Americas (47%), followed by Africa (39%), Europe (16%), Oceania (10%) and Asia (10%) (Oxford Economics/Global Infrastructure Hub, 2017[64]). Developing Asia's largest investment needs through 2030 are for energy followed by transport. A significant amount of future investment is required for maintenance and rehabilitation (ADB, 2017[65]). In Africa, the investment needs are greatest for water, followed by transport and energy (ICA, 2018[66]). In the Americas, the largest investment gap is for the transport sector, in particular road and rail (Oxford Economics/Global Infrastructure Hub, 2017[64]).

In addition to the investment gap, gaps in the quality of infrastructure services also matter significantly for developing regions. Countries need to ensure efficient public expenditure by targeting scarce resources on economic, social, and environmental priorities (Rozenberg and Fay, 2019[67]). A further challenge lies in urban-rural disparities in access to infrastructure services. For instance, only 25% of the rural population in sub-Saharan Africa has access to electricity while 75% of citizens in urban areas do (IEA, 2019[68]). Similarly, a basic source of drinking water is available for 84% of the urban population in sub-Saharan Africa while only 45% of the rural population have access to it (UNICEF/WHO, 2019[69]).

Since infrastructure assets play a vital role in economic development over several decades, it is critical that infrastructure investment decisions are aligned with low-carbon and resilient development to avoid further lock-in of emissions. Developing and emerging economies can seize the opportunity presented by rapid urbanisation to plan and build new infrastructure that is both low-carbon and resilient. African countries, for instance, can reap large benefits by leap-frogging to a green economy. Since two-thirds of urban investments are to be made between now and 2050, technology can contribute to new service delivery models for sustainable cities in Africa (AfDB/OECD/UNDP, 2016[70]).

The role of infrastructure in intermediary cities in developing regions is also crucial for sustainable urbanisation, urban-rural linkages, providing markets for rural products, developing agricultural value chains as well as expanding access to services. However, intermediary cities are increasingly challenged by fast population growth, unplanned built-up expansion, and climate change risks, which will lead to an unprecedented demand for infrastructure and public services over the next decades. This will put significant pressure on local governments suffering from both limited capacity and capital, and which usually operate below the radar of national development plans and international development partners. Local governments and policymakers need to strengthen engagement with experts and development partners in order to fill the knowledge and capacity gap to design strategies that tap the assets and comparative advantages of intermediary cities (OECD/PSI, 2020[71]).

Strengthening regional and continental connectivity through quality infrastructure investment is also fundamental. Integrated regional approaches for planning and investment strategies could enhance regional cohesion through cross-border infrastructure for stronger regional connectivity, based on an economic corridor approach (OECD/ACET, 2020[72]). Regional pacts and initiatives thus contribute to strengthening unity among countries, and to creating integrated regional economic corridors that attract investment and generate economic activity by linking countries together with lower logistic costs and higher quality of infrastructure (OECD/ACET, 2020[72]). For instance, the African Union (AU) facilitates the implementation of the Agenda 2063, Africa's master plan for economic transformation, which includes the promotion of infrastructure development through the Programme for Infrastructure Development in Africa (PIDA) which provides a common framework for facilitating African integration and connectivity through prioritisation of cross-border infrastructure (OECD/ACET, 2020[72]; AU, 2020[73]).[13]

The spread of COVID-19 has also reinforced the significance of accessible, affordable, and inclusive digital connectivity. Digitalisation can promote the efficient use of logistics, productivity, commercial competitiveness and responsiveness as well as human capital development. However, only 54% of the global population has access to the Internet, and only 19% of the population in Least Developed Countries (LDCs) use the Internet, compared with 87% in developed countries. Key barriers underlying this gap include the cost of Internet access and insufficient skills (UN, 2020[74]). Reaping the full benefit of the digital transformation requires appropriate policy choices and the development of associated complementary factors such as communication infrastructure along with capability and skills. A stable and predictable regulatory framework is necessary to foster long-term investment in broadband infrastructure and digital innovation (OECD et al, 2020[75]).

While increasing the quantity of infrastructure is vital, ensuring the quality of assets and services is equally essential for sustainable growth. At the same time, finding ways to accelerate and speed up the infrastructure development process is critical, in particular for accommodating rapid population growth and urbanisation in developing and emerging economies (OECD/ACET, 2020[72]).

Challenges and solutions

Well-planned and successfully delivered infrastructure investments require appropriate policies and regulatory frameworks with accountable public institutions. Reaping economic, environmental, social, and development gains needs effective early-stage planning, feasibility assessments, and stakeholder

engagement (OECD/ACET, 2020[72]). However, developing and emerging economies face challenges in promoting quality infrastructure investment notably because of the lack of institutional/individual capacity and technical and financial expertise, difficulties in co-ordinating across different levels of government, regulatory weaknesses, corruption, the lack of bankable projects, and financing constraints. These bottlenecks often result in the inefficient use of financial resources, significant delays, increased costs, and limited benefits. In addition, it should be recognised that developing countries often face broader challenges including economic and fiscal constraints, or conflicts which can inhibit their ability to engage in the transformational changes required to promote and accelerate infrastructure development. The design of reforms and their pace of implementation therefore need to take into account the specific circumstances of each country (OECD, 2020[76]; OECD/ACET, 2020[72]; OECD, 2018[77]; OECD/CAF/ECLAC, 2018[78]; Ashiagbor D. et al., 2018[79]).

Governance

Challenges

Capacity constraints of individuals and institutions, and the lack of experience in developing and emerging economies, hamper infrastructure development (OECD, 2017[26]). In particular, achieving expected service delivery requires capacity for project preparation (feasibility assessments, design evaluation, compliance with legal regulations, financial viability assessments, cost-benefit analysis, social and environmental impact assessments and stakeholder engagement) (GIH, 2020[80]). Ineffective preparation causes delays in meeting the timeframe, budget, and service quality and delivery objectives, leading to a deterioration in the local environment and in people's well-being (OECD, 2018[77]). In addition to project preparation capacity, capacity constraints hinder other stages of infrastructure development. For instance, technical capacity gaps result in poor quality construction.

Regrettably, standards, rules, and processes that ensure quality, value for money and efficiency of the infrastructure investment are often perceived as impediments to accelerating project development (OECD/ACET, 2020[72]). In addition, the lack of adherence to transparent regulatory processes leads to poor cost recovery, insufficient investments in maintenance and new projects, and limited access to basic infrastructure services (Sundararajan and Ahmed, 2015[81]).

Due to the elevated political interests in infrastructure projects, the sector is highly exposed to corruption risks in both developing and advanced economies. In addition, collusive behaviour in public procurement distorts fair competition, resulting in paying higher prices for low-quality goods or services, and failing to deliver the best value for long-term investment (OECD/CAF/ECLAC, 2018[78]). Corruption also leads to ineffective public investment with unnecessary projects and the loss of trust in the public sector, lowering the government's capacity to mobilise domestic revenues and discouraging private investment (IMF, 2016[82]; OECD/ACET, 2020[72]; OECD/CAF/ECLAC, 2018[78]).

Solutions

Strengthen institutional and individual capacity for project planning, preparation, and implementation through collaboration with external actors

Building required capacity and technical knowledge is necessary for all phases of infrastructure development, from project planning and preparation through to monitoring and evaluation during the implementation phase (OECD/ACET, 2020[72]). Governments can compensate for capacity shortfalls through collaborating with appropriate external actors, such as development partners, academia, the private sector, and training institutions among others, in order to access better training, skills development, and advisory support.

For instance, **Japan** supports capacity building in partner countries through the Japan International Co-operation Agency (JICA). JICA provided financial and technical support to the Delhi Mass Rapid Transport System's project in India, which aimed at addressing rapid urbanisation, traffic congestion problems, and air pollution. With a view to improving its institutional capacity, the Indian government worked with JICA to draw-up a development plan and funding mechanisms. This resulted in higher economic efficiency, and technology and expertise transfer from JICA, which introduced a new technology for a braking system that generates renewable energy for the operation, leading to the reduction of greenhouse gas (GHG) emissions. This project also incorporated a gender perspective in the planning and operation phases of the Delhi Metro, and contributed to creating a better enabling environment for women by creating local jobs with better working conditions (The Japan Journal, 2020[83]; MOF Japan/JBIC, 2019[84]; OECD, 2018[77]).

While numerous capacity-building programmes exist, improving the effectiveness of such programmes also requires performance-based incentive structures to translate gained expertise and capacity into practical applications, thereby effectively contributing to improving and sustaining organisational knowledge (OECD/ACET, 2020[72]).

The lack of institutionalised procedures for co-ordination leads to ineffective communication among relevant ministries, agencies, and institutions. Ensuring the consistency of national or regional mandates and priorities across various ministries is also crucial (OECD/ACET, 2020[72]; OECD, n.d.[85]). Formalising and institutionalising communication processes, for instance via an online project platform, can contribute to smooth and effective co-ordination. A key resource in this respect is SOURCE, an online platform supported by the multilateral development banks (MDBs) which facilitates project preparation for quality infrastructure investment through enhancing data collection, promoting data sharing, and institutionalising key processes (Box 1.9).

Box 1.9. The SOURCE platform

SOURCE is the multilateral infrastructure project platform implemented by the Sustainable Infrastructure Foundation (SIF). Several MDBs, including ADB, IADB, EIB, World Bank, and EBRD, provide key inputs into SOURCE, and since 2018, the strategic and financial management of SOURCE is under the supervision of the SOURCE Council, which is composed of representatives from MDBs. SOURCE provides a structured approach to the investment cycle through sectoral templates, thereby enabling:

(i) The provision of a standardised and comprehensive map of all aspects to take into account the development of high quality, sustainable infrastructure ;

(ii) Delivery of MDB tools, reference notes, and best practices to project managers at the right juncture in the decision-making process ;

(iii) Monitoring whether projects meet their intended outcomes and benefits during the implementation period;

(iv) Collection of structured and standardised project data at a global scale to assess performance of projects against standards, and generate analytics and benchmarks (for example, unit costs).

SOURCE has been designed as a public good, to be used by government agencies and MDBs.

Source: (EBRD, 2019[86])

Infrastructure development may also be streamlined through the establishment of a specific committee or institution to centralise and oversee co-ordination (OECD, 2018[77]). The OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402] (OECD, n.d.[85]) provides guidance on strengthening coordination across levels of government. The PPP Centre in the **Philippines** provides a good example of establishing a central point for co-ordinating and monitoring PPP projects in the country (Box 1.10).

Box 1.10. The PPP Centre in the Philippines

The 1991 Local Government Code (Republic Act No. 7160) in the Philippines devolved the provision of local infrastructure to local governments, stipulating the institutional mechanisms for formulating and implementing local plans. The PPP Centre in the Philippines is the central co-ordinating and monitoring agency for PPP projects within the country, and primarily responsible for monitoring and evaluating local governments' PPP projects. The main objective of the Centre is to assist local governments in preparing projects, clarifying procedures, and evaluating PPP projects as well as providing training and capacity building programmes, and financing for pre-investment process for potential PPP projects. The Centre launched a PPP strategy for local governments including the preparation and dissemination of a PPP manual for local governments. The PPP subcommittee assisted the local development council in drawing action plans and strategies for the implementation of PPP projects at local levels. In addition, local governments have access to the Local Government Unit Guarantee Corporation (LGUGC), which offers guarantees for municipal bonds as a private risk guarantor for PPP projects in the Philippines. The country has been proactive in streamlining the business environment for PPPs over the last decade.

Source: (OECD, 2018[77])

Institutionalise standards, rules and processes, and strengthen regulatory frameworks

Streamlining and institutionalising the infrastructure development process, in particular for project appraisal, fair and competitive procurement, and social and environmental impact assessment could ensure that investments achieve their delivery objectives more efficiently (OECD, 2017[87]). In the case of cross-border projects, co-operation should be enhanced, and, where relevant and appropriate, harmonisation of regulations and standards could be considered (OECD/ACET, 2020[72]; OECD, 2016[88]).

In addition, as highlighted in the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], stable and predictable regulatory frameworks and standardised procedures are necessary for ensuring efficient, affordable, reliable and high quality of infrastructure service provision as well as the financial viability of projects. Good economic regulation of infrastructure services is vital for improving sector performance by ensuring efficient price setting, service quality, and appropriate investment levels (BoKIR, 2019[89]). For example, Rwanda implemented regulatory reforms to its energy sector that have supported private investment in the sector (Box 1.11).

Box 1.11. Rwanda's energy sector reforms

In 2000, the government established strategies and policies for an efficient and reliable energy supply to support the development of the energy sector including renewables. The government launched initiatives and reforms in legal frameworks and private sector development for improving governance, accountability, transparency, and efficiency in the sector. An independent institution, the Rwanda Utility Regulatory Authority (RURA), was established and made responsible for promoting competition, ensuring consumer protection, issuing licenses, and monitoring performance. Reforms made by the

RURA resulted in an improved business environment as well as a transparent and comprehensive institutional framework. This supported foreign investments in infrastructure projects including Gigawatt Global's solar power plant. Business facilitation measures, the transparency of the legislative framework, and the rules and regulation for the entry and operations of foreign investors contributed to increasing investors' confidence in the project and led to its rapid success.

Source: (Abrams, 2016[90])

In Latin America, improving the performance of logistics with lower transport costs and efficient custom procedures is key for increasing the region's competitiveness and diversifying its productive structure. However, the regulatory and institutional weakness of concessions has led to repeated renegotiations of infrastructure contracts, contributing to raising logistic costs. Minimising the possibility of future renegotiations requires regulatory reforms and the transformation of institutional aspects that include administrative quality and independence of regulators (OECD/UNECLAC/CAF, 2013[91]). The planning and prioritisation phase of infrastructure projects requires further improvements with rigorous cost-benefit and value-for money analysis. There is also a need to improve the institutional and regulatory framework for transport infrastructure including a more transparent and thorough assessment of PPPs and better specification of projects before tendering. Regulations that specify clear requirements and procedures for environmental and social assessments are required to safeguard the health and well-being of affected populations (OECD/UNECLAC/CAF, 2013[91]). Chile has demonstrated how strong institutions, processes, and regulatory frameworks can provide a foundation for developing infrastructure efficiently at scale (Box 1.12).

Box 1.12. Chile: Strong institutions and processes underpin successful infrastructure investment

Since the early 1990s, **Chile** has successfully deployed infrastructure on a significant scale that has supported rapid economic growth largely by strengthening its institutions and the quality of public administration. The Chilean National Investment System (SNI) has established a number of well-institutionalised processes that ensure value for money and transparency in the use of public investment. One of them is the social cost-benefit analysis (CBA) process that is a core element of project evaluation. Key components of the social cost-benefit analysis process include a simple and clear target rate of return, well-documented methodologies for conducting CBA, and a clear institutional division of roles between project development, evaluation, and approval. In addition, the country has a long history of inter-ministerial committees that bring together government institutions, civil society, experts and others to develop policies with supports from various actors, promoting dialogues between central and local actors.

Chile has also adopted reforms that address the challenge of repeated renegotiations. In 2010, Chile reformed its PPP law in order to make it mandatory to bid out any additional work on a project and prohibit the concessionaire from participating in the new contract. In addition, the law established an independent board, the Panel Técnico de Concesiones (Technical Panel for Concessions), to review renegotiations and resolve conflicts between the contracting authority and the private party. This reform has resulted in a significant reduction in renegotiated cases during the construction phase.

Source: (OECD, 2017[87]) (Engel, Fischer and Galetovic, 2020[92])

Establish anti-corruption measures including explicit policies and rules with adequate enforcement mechanisms

Preventing corruption requires explicit policy objectives, rules, and regulation for anti-corruption with clear policy guidance and training. Governments could assign a clear leadership for integrity within the accountability structure of institutions. Adequate enforcement mechanisms need to be combined with robust risk assessments of corruption, risk mitigation strategies, internal controls, independent external audits, secure whistle-blowing procedures, and appropriate sanction processes (OECD, 2020[93]; OECD, 2017[94]). Public participation in rule-making processes could enhance the transparency and the credibility of anti-corruption countermeasures (OECD, 2017[94]). These solutions are further elaborated in Chapter 2 addressing the governance of quality infrastructure investment.

The National Treasury in **South Africa** discloses a database of restricted suppliers on its website in accordance with the OECD Recommendation for Further Combating Bribery of Foreign Public Officials in International Business Transactions [OECD/LEGAL/0378] (OECD, 2009[95]). The database lists companies and individuals that are restricted from doing business in the public sector due to poor performance in previous contracts, corruption, fraud, and tender irregularities. Procurement officers are required to check the database prior to awarding any contract (National Treasury, Republic of South Africa, n.d.[96]).

Transparency and disclosure of data on infrastructure projects can promote scrutiny by external stakeholders and thus serve to inhibit corrupt practices and waste. For example, through adopting a standard on data transparency, **Thailand** has improved competition in the bidding process for infrastructure projects (Box 1.13).

Box 1.13. Thailand: Improved transparency results in cost savings

Since 2015, Thailand has adopted CoST (The Infrastructure Transparency Initiative) Infrastructure Data Standard, which promotes data transparency and disclosure in infrastructure projects. CoST is a cross-government platform that involves other actors including the private sector and civil society in promoting transparency in infrastructure development. It is global initiative with 15 participating countries spanning four continents that aims to improve transparency and accountability in public infrastructure. CoST's approach features four elements: multi-stakeholder working, disclosure, assurance (i.e. review of disclosed data), and social accountability (CoST, n.d.[97]). CoST's multi-level approach limits corruption, inefficiency and mismanagement across the project cycle and increases the benefits arising from infrastructure investment. In 2020, the Ministry of Finance Thailand confirmed a USD 360 million in cos savings between 2015 and 2020 as a result of the deterrent effect of the CoST approach. This has led to lower contract prices and a more efficient use of public money. The adoption of CoST Infrastructure Data Standard in Thailand has inhibited misbehaviour in procurement and strengthened bidding competition, as proposals and the delivery of projects are subject to greater scrutiny.

Source: (CoST, 2018[98]) (CoST, 2019[99]) (CoST, 2020[100])

Financing

Challenges

Globally, public finance has been the main source of infrastructure investment. For instance, in Asia, the public sector provides approximately 70% of total infrastructure investment (OECD/ADBI/Mekong Institute, 2020[101]). Given that the COVID-19 crisis is adding further pressure to already strained public finances of

many developing countries, developing alternative financing sources and innovative financing mechanisms will be crucial for bridging the infrastructure investment gap highlighted earlier.

Over the last decade, low-income countries (LICs) received less than 2% of total private investment (Tyson, 2018[102]). Promoting the involvement of institutional investors, including domestic pension funds, is therefore crucial in developing regions. However, institutional investors in Africa are constrained by their limited experience and capacity in infrastructure investment (Ashiagbor D. et al., 2018[79]). Key constraints include a perceived lack of well-structured bankable investment opportunities, weak and fragmented financial markets, insufficient returns, high risk in the development phase, and political and regulatory barriers and weaknesses (Ashiagbor D. et al., 2018[79]). Given heightened real or perceived risks, risk mitigation instruments can be important for catalysing private investment (Ashiagbor D. et al., 2018[79]).

A key obstacle to infrastructure financing in developing and emerging economies is the lack of capacity to develop viable projects that attract investors, meet the long-term needs of local populations, and deliver adequate returns. Investors also require sufficient information and data to assess projects before making investment decisions. Furthermore, large infrastructure investments can pose significant fiscal risks, particularly by pushing some poor and small countries to exceed levels of debt that are considered sustainable (OECD, 2018[103]). Many developing countries therefore need to improve their capacity to monitor, analyse, and manage debt with transparent risk management strategies.

Solutions

Strengthening capacity to prepare bankable projects through improving the effectiveness of project preparation facilities and risk mitigation instruments

Adequate project preparation capacity is essential for generating bankable projects in developing regions. (Ashiagbor D. et al., 2018[79]). Local governments, in particular, experience challenges in developing and preparing infrastructure projects due to the smaller size of projects and limited capacity at local levels (Oberholzer B. et al., 2018[104]).

Project Preparation Facilities (PPFs) are facilitators that link projects to an external source of finance from the public or private sector, national and international development banks and other donors. PPFs play a particularly significant role at the subnational level in directing finance from the international or national level to local projects. In addition, PPFs provide technical assistance and capacity building, thereby contributing to establishing effective implementation frameworks and reforming the general environment for project preparation (Oberholzer B. et al., 2018[104]).

While some PPFs have developed sophisticated approaches ensuring efficient and effective project prioritisation and preparation, private sector involvement in PPFs remains limited mainly due to the insufficient predicted returns of infrastructure projects (Oberholzer B. et al., 2018[104]). Currently, many project preparation facilities exist but they are unevenly distributed across developing regions (over 50 in Africa but very few in Asia) and most of them suffer from overly narrow rules of operation, which impedes their ability to help develop successful projects (World Bank, 2011[105]). In addition, the conditions on access to the PPFs are often very complex and time-consuming (OECD/ACET, 2020[72]). Improving the effectiveness of PPFs requires strengthening well-functioning existing funds, merging others, and creating new ones where there is a clear demand, particularly at the regional level (World Bank, 2011[105]). Achieving higher effectiveness also requires greater flexibility, such as minimising restrictions on the sectors and types of preparation activities that funds can support, allowing funds to provide grants to private sector project sponsors with claw-back provisions, and allowing funds to finance detailed engineering design (World Bank, 2011[105]).

In response to the challenges, some PPFs such as the World Bank's Global Infrastructure Facility (GIF) have been developing wide-ranging global portfolios across low- and middle-income countries. The GIF also encourages private sector involvement by establishing solid networks with the private sector, including commercial banks and institutional investors (GIF, n.d.[106]).

Encouraging private sector involvement also requires improvements to risk mitigation instruments (for a more in-depth discussion of risk mitigation, refer to Chapter 3). The African Union Development Agency – New Partnership for African Development (AUDA-NEPAD), for instance, launched the 5% agenda in 2017, a campaign to increase the allocation of African asset owners to African infrastructure from its low base of approximately 1.5% of their assets under management to 5%. The 5% agenda envisages the establishment of an African Infrastructure Guarantee Mechanism, with a view to encouraging pension and sovereign wealth fund investment into infrastructure in Africa (AUDA-NEPAD, 2018[107]).

Enhance fiscal transparency and improve capacity for debt management with required technical and financial expertise

As highlighted by the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], it is critical to ensure that the overall infrastructure investment envelope is sustainable in the medium- and long-term, taking into account the overall debt level and policy objectives, through measuring, disclosing and monitoring multi-year spending commitments. Privately-financed projects can also be the source of significant fiscal risks (see section on management of fiscal risks in Chapter 2). It is therefore important that off-balance sheet commitments and contingent liabilities resulting from infrastructure projects are monitored and analysed (OECD, 2020[93]). Improving capacity to monitor, analyse and manage debt with transparent risk management strategies requires strengthening technical and financial expertise, international co-operation in the form of capacity building, knowledge sharing, providing institutional advice and a platform for multi-stakeholder engagements. Risk mitigation also requires better data collection. Creditors have a role to play in making terms and conditions of lending public, straightforward and easy to track (UN, 2018[108]).

In 2017, the African Development Bank conducted a series of capacity building programmes on debt management in **Ethiopia**. The capacity building programmes covered loan negotiations and management, domestic debt and capital markets development, and enhancement of analytical and evaluation capacity, among others. The government was able to improve debt management and increase domestic resource mobilisation with the skills and competencies acquired through the programmes. In addition, government authorities could apply the acquired skills for rigorously assessing risks associated with various financing options and facilitating the design and implementation of prioritised public investments (AfDB, 2017[109]).

Conclusions and key messages

Many of the most urgent policy priorities that depend on quality infrastructure investment pre-date the pandemic. However, the COVID-19 crisis has both increased the salience of these priorities while making it more challenging for governments to deliver on them. The crisis has, first of all, highlighted the importance of resilience and the need to be prepared not only for future pandemics, but other hazards, in particular, climate-related threats that are likely to increase in frequency and scale. Second, the crisis has placed the spotlight on regional disparities in terms of access to infrastructure, particularly for communication infrastructure, which have in turn exacerbated existing inequalities between better and less well-endowed regions. Third, the crisis and the intense pressure it is placing on public finances will constrain future public resources available for investment in infrastructure. Developing countries are likely to be particularly affected given their lower fiscal capacity.

In this context, it is critical to ensure the most efficient deployment of public and private resources for quality infrastructure investment, whether as part of recovery packages or green investment programmes. Further, given the urgency and scale of the required investments, the effectiveness of infrastructure investments will also need to be maximised through adopting supporting policies and measures.

Key messages

Mobilising infrastructure investment at the necessary scale in order to support the low-carbon transition and protect biodiversity will require a series of enabling policies, regulations, planning and decision-making frameworks, as well as financial incentives:

- At a policy and regulatory level, and in order to provide a stable framework for long-term investment decisions, governments should demonstrate ***policy commitment to long-term climate goals, international biodiversity targets and other environmental objectives***. Carbon pricing can play an enabling role if set at a sufficiently high level and if concerns over distributional aspects are addressed.
- ***National and subnational strategies, infrastructure plans and pipelines should be aligned with long-term climate and development objectives***.
- In addition, ***decision-making frameworks should integrate the social cost of carbon and other externalities, such as air pollution, as well as biodiversity considerations***, and address trade-offs and synergies with broader well-being outcomes.
- ***Regulatory frameworks*** should be supportive of deployment of low-carbon infrastructure systems.
- Financing the shift to low-carbon infrastructure systems requires the ***pricing and management of climate-related risks*** across the financial system and ***related disclosures***. Better choices can also be incentivised through the ***adoption of economic instruments*** that help internalise the negative impacts of infrastructure on biodiversity.

Promoting infrastructure that is resilient to new and evolving hazards in a context of heightened uncertainty requires robust yet flexible governance, planning and regulatory systems to adapt decision-making to emerging data, as well as incentives for investing in resilience.

- Given the large number of stakeholders involved in infrastructure and the related services across different sectors over the life cycle, ***clarification of the roles and responsibilities for investing in resilience*** and disaster recovery is needed in order to ensure sufficient investment in resilience.
- ***Resilience standards and regulations need to be reviewed and updated*** to reflect evolving knowledge about hazards and their ***implementation needs to be continuously monitored***.
- More ***flexible and adaptive infrastructure planning approaches*** that can accommodate uncertainty, and take ***a dynamic approach to infrastructure investments***, help to ensure alignment with policy objectives over time.
- The ***systematic collection of data on the resilience levels of infrastructure assets*** is indispensable to understand a system's capacity to withstand shocks.
- Governments can ***incentivise resilience investments by private infrastructure actors*** by providing dedicated ex ante financial support.

Uneven access to infrastructure is a key contributor to regional disparities which risk being exacerbated by the COVID-19 crisis:

- Governments can seek to redress regional imbalances through their recovery programmes by ***developing national infrastructure strategies that have a focus on regional disparities***, and

strengthening the capacities of regions and municipalities to manage infrastructure investment.

For developing countries, in spite of their continued efforts, lack of capacity and corruption remain key constraints that inhibit the potential for infrastructure investment to contribute effectively to economic growth and sustainable development:

- Both ***institutional and individual capacity for project planning, preparation, and implementation*** should be enhanced in developing countries, and ***standards, rules and processes should be institutionalised. Anti-corruption measures including explicit policies and rules with adequate enforcement mechanisms*** are critical for ensuring public investment is effective and for encouraging private investment.
- In particular, ***enhancing the capacity to prepare bankable projects*** is critical for attracting investments in infrastructure in developing countries. Project preparation facilities can help in this regard but their effectiveness needs to be improved in a number of cases. Developing countries also need to ***enhance fiscal transparency and their debt management capacity*** to ensure large infrastructure investments do not result in unsustainable debt levels.

Future work

The COVID-19 crisis has brought to the fore a number of dilemmas and trade-offs that policymakers will need to consider in implementing quality infrastructure investment as they seek a path out of the crisis that will not only place their economies on a stable footing but also contribute to creating more sustainable, inclusive and resilient economies and societies. Given the complexity of many of these dilemmas, it will be vital for governments to identify innovative practices, learn from each other, and find out what works best. These dilemmas can form the basis for an agenda for the OECD's future work on infrastructure.

- ***Aligning investments with long-term policy goals***. While many governments recognise the importance of ensuring infrastructure investments are aligned with long-term objectives, they often lack the frameworks and institutional set-up that can link investments decisions with long-term policy goals. New institutional and planning models that are grounded in better coordination are necessary to generate greater coherence across policy areas, and between policies and investments.
- ***Understanding trade-offs and synergies.*** Adopting a narrow view of the benefits from infrastructure investment can result in poor long-term decisions that fail to support broader development goals. However, further evidence is required on the potential trade-offs and synergies, for instance, between mitigation action and health benefits.
- ***Navigating complexity and uncertainty.*** Governments are taking steps to adapt their planning and decision-making frameworks to accommodate multiple and higher-level objectives, and greater uncertainty. However, new approaches are mostly limited to a few innovative jurisdictions, and have yet to be mainstreamed.
- ***Addressing the tension between efficiency and resilience.*** Systems that have been optimised through a narrow lens of efficiency are highly susceptible to failure when operating conditions deviate from a narrow band. The crisis has highlighted the risks associated with an excessive focus on efficiency. However, in a context of scarce resources, it is paramount that infrastructure investment decisions are guided by value for money considerations. Policymakers will need to find a better equilibrium between efficiency and resilience going forward. This will require further work in terms of understanding how much resilience is necessary, and how to make systems more resilient in a cost-effective manner.

- ***Resolving the ambiguity over the responsibility for financing infrastructure resilience.*** This has to take account of the broader societal benefits of infrastructure resilience that are difficult to monetise and that do not accrue to the infrastructure providers responsible for implementing them. It also needs to assess the current ex ante and ex post financing landscape so as to better identify and address any prevailing disincentives to invest in infrastructure resilience measures or risk transfer instruments (such as disaster risk insurance). There is also considerable scope to explore innovative financing instruments to address the complex and perhaps shared nature of resilience financing.
- *Addressing the perceived tension between institution building and investment needs in developing countries.* Developing countries urgently require infrastructure investment to support their development, and often explain that they cannot be beholden to the slow process of building institutions. However, as some countries have shown, institutions and processes can support the efficient delivery of quality infrastructure through promoting learning and standardisation. Developing countries will need to steer a path that involves drawing on external support for addressing urgent needs while building the institutional capacity that can, ultimately, give them greater agency and control over their long-term development.

2 Effective governance as a foundation for implementing quality infrastructure following COVID-19

Introduction

Making the case: how can good infrastructure governance contribute to a resilient, inclusive and green economic recovery?

Even prior to the COVID-19 crisis, many countries were behind in the achievement of policy objectives related to sustainable and inclusive economic growth. The devastating effects of the COVID-19 pandemic across the world are threatening to reverse by decades the progress made to achieving the SDGs in all countries (OECD, 2020[110]). As many countries have already recognised, infrastructure investment will be at the core of the response to achieve a sustainable and inclusive long-term recovery. Good governance will be more important than ever to ensure that infrastructure investment helps to address the lasting consequences of the COVID-19 crisis and contributes to human well-being, competitiveness, productivity, and public service delivery.

High quality public governance is essential for aligning infrastructure policies with the long-term policy goals

One of the main challenges faced by OECD countries in implementing infrastructure projects has been the quality of public governance (OECD, 2016[55]). 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[111]). Governance deficiencies appear to be an important factor explaining the large differences in perceived infrastructure quality across countries that display a similar public capital stock (Demmou and Franco, 2020[112]). Without robust institutional capacities and appropriate processes and appraisal methods, there is a high likelihood that strategic choices regarding infrastructure investments will be suboptimal, and that infrastructure investments will fail to deliver their expected outcomes.

Governance has a key role to play in delivering well-articulated and whole-of-government infrastructure responses. The goal of advancing sustainable development is frequently hindered by regulatory and policy frameworks that are not aligned with sustainable development objectives (OECD, 2020[110]). Redrawing decision-making processes to promote policy coherence can facilitate the implementation of infrastructure investments that support the achievement of multidisciplinary objectives, such as resilience, social

inclusion, sustainable growth, and gender equality. The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], the OECD Recommendation on Public Procurement [OECD/LEGAL/0411], the OECD Recommendation on Principles for Public Governance of Public-Private Partnerships [OECD/LEGAL/0392], the OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402], and the OECD Recommendation on Policy Coherence for Sustainable Development [OECD/LEGAL/0381] all provide guidance for policy-makers and key stakeholders on the institutions, processes, and policy tools needed to effectively deliver economic, social, and environmental policy goals in an integrated manner, accelerate progress towards a sustainable and inclusive recovery, and ensure affordable and equitable access to infrastructure services.

Good governance, planning, and decision-making can have a positive impact on economic outcomes

The efficient provision of infrastructure services has been long linked to higher productivity, which underpins long-term economic growth (Aschauer, 1989[113]; Eberts and McMillan, 1999[114]; Seitz and Licht, 1995[115]; Chandra and Thompson, 2000[116]). However, recent evidence suggests that the impact of public infrastructure on economic growth is diminished if the investment process is inefficient (IMF, 2015[117]; IMF, 2014[118]). Similar results have been found in terms of productivity gains from investment at the firm-level. Both the level of investment in infrastructure and the efficiency with which it is allocated and managed are determinants of the extent of the productivity gains achieved (Demmou and Franco, 2020[112]).

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 delivers value for money to the public sector and end-users. Evidence also suggests that sound governance correlates with high quality infrastructure (Demmou and Franco, 2020[112]). However, governance challenges are diverse and occur throughout the infrastructure life-cycle (OECD, 2017[26]). The quality of public governance needs to be constantly strengthened through iterative processes to ensure that public bodies base their decision-making on sound planning and are responsive to rapidly changing political and economic environments.

Better governance improves the returns on public and private infrastructure investment

Investments to build new or maintain existing infrastructure generally have not kept pace with countries' needs (Schwartz et al., 2020[119]; Global Infrastructure Hub; Oxford Economics, 2017[120]). However, in response to the impacts of the COVID-19 crisis, governments are planning considerable fiscal stimulus packages, most of which are expected to contain large investments in infrastructure. In order to meet investment needs, governments are aiming to increase investment in infrastructure from domestic and international savings, improve resource efficiency, and promote collaboration between the private and public sector. Infrastructure governance will play an important role in ensuring these investments are well-targeted and increasing the effectiveness of infrastructure investment.

Public investment on its own will not be sufficient for meeting long-term infrastructure investment needs, particularly given that government budgets are under intense pressure as a result of the crisis. As will be outlined in Chapter 3, private investment has the potential to supplement public investment in bridging the investment gap. However, investors, particularly long-term ones, expect governments to be competent and reliable partners and to promote a stable business climate for investment. Infrastructure governance frameworks that allow for innovative approaches to fund and finance infrastructure programmes linked to economic stimulus packages could be a powerful tool to mobilise investors, diversify sources of financing, and optimise risk allocation.

Infrastructure governance is key to support the economic and social recovery efforts from the crisis

A widespread trend observed in OECD countries in responding to the COVID-19 crisis has been to accelerate infrastructure projects that can provide immediate boosts in employment. At the same time, many countries have expressed the aim to achieve a sustainable recovery and higher long-term growth through infrastructure development, and have pledged to invest in projects that are conducive to a resilient, inclusive, and green recovery.

Infrastructure planning and decision-making is confronted with a context of increasing complexity, interdependence, and uncertainty. Governments will therefore require the right set of tools to navigate difficult policy choices in the short- and medium-term so as to not lose sight of long-term sustainability objectives and international commitments in the design and implementation of economic recovery packages.

The recent mobility restrictions and disruptions to the economy have also highlighted the precarious living and working conditions faced by vulnerable groups, and the differentiated infrastructure needs of men and women from diverse backgrounds (OECD, 2020[121]). As highlighted by the UN SDGs Report 2020, one billion slum dwellers worldwide are acutely at risk from the effects of COVID-19, suffering from a lack of adequate housing, no running water at home, shared toilets, little or no waste management systems, overcrowded public transport, and limited access to formal health care facilities (UN, 2020[74]). Two key questions arise for policymakers. First, how will the long-term vision for infrastructure and corresponding national plans adapt in response to these growing infrastructure needs. Second, which infrastructure projects and sectors will be prioritised in a pipeline or shortlist of projects, and developed in order to effectively tackle income and territorial inequality, inadequate and uneven access to public services within countries, and critical infrastructure, resilience, and climate change challenges.

Main challenges and policy solutions

1. What are the main policy and institutional enablers of sound long-term infrastructure planning?

Challenges

Delivering successful infrastructure projects requires a comprehensive preparation phase. Motivations for adopting long-term strategies are heterogeneous and are substantially determined by the development aims and economic conditions of each country (OECD, 2019[122]). However, weak or insufficient planning impedes successful resource optimisation, coordination, implementation, and operation. A siloed approach to planning, for example, can make it difficult to achieve cross-sectoral policy objectives, hinder a thorough analysis of the synergies and trade-offs across infrastructure investments, and increase the risk of project overlaps. In addition, poor planning can interfere with the definition of clear institutional mandates, competences, and decision powers across relevant departments and agencies. Only 14 OECD countries have a long-term strategic infrastructure vision that cuts across all sectors, while 11 only have infrastructure plans for certain sectors (e.g., transport, energy, water and sanitation, health, housing, communications) (OECD, 2019[122]).

The performance of long-lived, capital intensive infrastructure investments is extremely sensitive to changing circumstances. The environment for infrastructure investment is subject to deep uncertainty, resulting from technological and environmental change, which creates major challenges for long-term planning. Moreover, external shocks (e.g. climate risks, pandemics) and political and economic fluctuations can hinder the design and implementation of a clear and coherent strategic plan.

A further challenge stemming from weak cross-sectoral planning, as highlighted earlier, relates to the increasing interconnectedness and interdependence of infrastructure systems both across geographical areas and across sectors. Technological advancement is blurring the boundaries of sectors such as energy, transport and communications and the planning framework needs to respond to the needs of the infrastructure system as a whole.

Integrating planning and budgeting is also a challenging task in infrastructure investment. Without budgeting, strategic plans do not take into account resource allocations and lack adequate means of implementation. When budgeting is not aligned with the planning process, budgets have a short-term focus and are driven by fiscal pressures instead of addressing social needs.

Likewise coordination across levels of government can be difficult. This is a key issue, given that a majority of public investment is made at the subnational level (OECD, 2019[123]; OECD, 2017[26]). Transaction costs, competitive pressures, resource constraints, differing priorities, and fears that the distribution of costs or benefits from co-operation will be one-sided, for example, can impede efforts to bring governments together for the formulation of a national infrastructure plan (OECD, 2019[123]; OECD, 2017[26]) .

Solutions

The main levers for policy and institutional frameworks that enable sound infrastructure planning are explored and analysed in detail below.

Align the long-term strategic vision with strategic policy objectives and adapt to uncertain and complex conditions

The first step towards quality infrastructure is to have a clear vision for the future and a credible roadmap to achieve it. As mentioned in the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], a long-term vision for infrastructure can help governments establish an adequate institutional framework, implement clear governance arrangements, define needs and targets, coordinate across stakeholders, and develop reliable action plans. Defining a clear strategic vision can also help countries in more effectively targeting gaps in access to infrastructure services. Adopting a long-term vision for infrastructure will add value if it is the product of a broad-based political consensus across national and subnational governments and is supported by effective stakeholder engagement processes, and presents a whole-of-government plan that is mindful of the relationships between the environmental, economic, and social impacts of infrastructure.

Efforts to harness infrastructure investment to support a sustainable and green recovery could prove more effective if framed under a strategic plan that also maximises the outcomes of other policies that support inclusive long-term growth and well-being (i.e. climate resilience, social inclusion, sustainable growth and gender equality policies).

A sound infrastructure vision is needed as the foundation for economic stimulus interventions that involve major infrastructure investment. Governments can maximise the benefits from economic stimulus interventions if they respond not only to the urgent needs arising from the COVID-19 crisis, but also to the long-term policy goals that they have previously defined. Government interventions can also be more responsive to impacts and benefits of infrastructure on women's lives and their economic empowerment (OECD, 2019[124]), especially after the COVID-19 crisis, if these are translated into tangible policy objectives and integrated into long-term infrastructure plans (OECD, 2021[125]). In **Canada**, Infrastructure Canada is currently working on a gender-based analysis framework (GBA+) to understand how infrastructure investments impact men, women, and gender non-binary people differently over the short and the long-term. The GBA+ framework is used by the Canadian government to mainstream gender considerations throughout the early stages of the planning and decision-making processes (Infrastructure Canada, 2020[126]; Government of Canada, 2020[127]).

Learning from past recessions, **Ireland** plans to maintain high capital investment levels and accelerate project delivery as a response to the current COVID-19 context (OECD, 2020[121]). The **Irish** government is undertaking a review of the country's National Development Plan to optimise project implementation across the different agencies that have large capital investments in their budgets. In particular, the review process will aim to improve connectivity to deliver economic prosperity and environmental sustainability and ensure better alignment with environmental objectives. In addition, the capability of the public sector to deliver infrastructure projects over the long-term has been subject to recent analysis. Ensuring the delivery of critical infrastructure services to citizens, the immediate economic impact of public investments, and environmental sustainability are themes expected to be taken into account in the update of **Ireland's** strategic vision for infrastructure.

Institutional frameworks and decision-making processes must facilitate the adaptation of existing infrastructure programmes to evolving circumstances. The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] identifies ample decision making powers, the right skills and competences, and sufficient financial resources as key factors in providing public entities with the ability to react more promptly while implementing policies that are in line with the overarching infrastructure vision for the country. Regularly updating infrastructure plans can also help ensure that policy decisions reflect the most recent developments and changing infrastructure needs.

Uncertainties arising from factors such as rapidly evolving technologies, the impacts of climate change, and behavioural changes in society creates a challenge for planning infrastructure assets with lifetimes that span decades. Some governments are adapting their strategic planning approaches to accommodate this underlying uncertainty (Box 2.1).

Box 2.1. Scenario Planning in the Netherlands

In the Netherlands, the Dutch Futures Lab is a cross-governmental initiative in which a series of societal scenarios are shared across departments of government for them to analyse and interpret in more detail with respect to their own fields of work. The scenarios consider the impacts of significant potential economic and social changes such as shifts in the energy sector, in digitalisation, the sharing economy, spatial development, and transport. This exercise helps departments focus infrastructure investments on projects that are robust across multiple scenarios, and identify thresholds within the scenarios that would trigger additional investments.

By sharing a common set of scenarios across multiple departments, this approach can create a shared understanding of the key uncertainties and range of possible futures, and thus provide the basis for a more coherent policy response to major long-term challenges. Furthermore, it seeks to encourage broader and more participative engagement with the planning process, and therefore draws upon a range of modelling tools and sources of knowledge, as distinct from the traditional approach of relying on a single set of modelled inputs.

Source: (Marsden et al., 2018[128])

Undertake needs assessment to support decision making and investment

Infrastructure creates value when it contributes effectively to addressing social needs or facilitates economic activity. The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] has brought attention to how successful infrastructure programmes are generally strategic in nature; that is, that they are informed by a rigorous assessment of needs at the national and subnational levels, with

the assessment forming the basis for developing a plan which sets priorities and determines how needs will be addressed. Needs assessments can enable the adoption of investment decisions that take long-term development goals into account in a transparent and consultative way. Furthermore, it can reduce the potential for overlap and duplication, providing a more efficient use of limited resources.

Evidence-informed policy-making involves assimilating information from multiple sources, including statistics, data, and the best available research and evaluations, before making a decision to plan, implement, or alter public policies and programmes (OECD, 2020[129]). Governments with a strategic approach to the use of data across the public sector are better able to anticipate societal trends and needs, and consequently to develop more effective long-term plans (OECD, 2019[130]). Sound data governance is key to ensure that data is produced, applied as intended, and delivers the expected outcomes. The OECD Recommendation on Digital Government Strategies [OECD/LEGAL/0406] invites governments to create a data-driven culture in the public sector by developing frameworks to enable and guide the use and re-use of evidence, statistics, and data, which can be beneficial to increase openness and transparency and incentivise public engagement. More specifically, the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] encourages countries to harness digital technologies, release open data and use data analytics to enhance infrastructure policy and decision-making.

Engagement with citizens and businesses can help governments to attain a full and deep understanding of infrastructure needs and means of addressing them. User-driven decision-making can thus facilitate better access to higher quality services, while also increasing levels of citizen satisfaction and trust in government (OECD, 2020[131]). Governments can improve infrastructure service delivery and design by focusing on understanding how users' experience infrastructure and how this can impact infrastructure planning, design, and development.

As highlighted by the OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402], needs can be identified at different levels of government, to ensure welfare-enhancing and productivity-enhancing infrastructure. In **Australia**, the Australian Infrastructure Audit has been collecting extensive data on major capital cities, corridors, traffic congestion, and population demographics to project future trends that serve as inputs for the Australian Infrastructure Plan and the Infrastructure Priority List (OECD, 2020[132]).

Infrastructure assets are long-lived and needs must be projected into the future. In doing so, planners should take into account the country's long-term development goals along with the impact of future trends, major future risks, and uncertainties. This can contribute to future-proofing investment plans and improving the resilience of the nation's infrastructure. To address infrastructure needs for the next 20 years, **Colombia** adopted in 2015 an Intermodal Transport Master Plan, which was the product of a joint effort across different national level entities and agencies (OECD, 2020[132]). The master plan was based on data on transport infrastructure density and quality of existing transport infrastructure, cities' and regions' growth trends, and current traffic flows. Using this data, the Colombian government forecasted local and regional economic growth, and used these forecasts in modelling future demand for transport infrastructure in various parts of the country over a 20-year period. The results from this strategic foresight analysis informed the choice of projects included in the infrastructure plan and served as an input to the design of transport policies such as the fourth generation toll-road infrastructure concessions programme.

Develop robust annual and multiannual capital budgeting to support sustainable investment

Long-term infrastructure planning should take the overall fiscal plans and constraints of the government into consideration, in order to ensure that plans are realistic and can be delivered within the envisaged timeframes. As the OECD Recommendation on Budgetary Governance [OECD/LEGAL/0410] highlights, the development and implementation of a national framework that supports public investment is key to meeting national development needs in a cost-effective and coherent manner (OECD, 2015[133]).

Governments can make sure that long-term infrastructure plans are fiscally sustainable by systematically and rigorously linking these plans with their medium-term fiscal plans and the annual budget formulation process. A medium-term expenditure framework (MTEF) is a common practice among OECD countries to align budgets with medium-term strategic priorities (OECD, 2019[122]). It can help to integrate fiscal policy and budgeting over a multi-year horizon, creating linkages between fiscal forecasting, fiscal objectives, and rules and the forward planning of multi-year budget estimates, in order to provide the basis of budget negotiations in the years to follow (OECD, 2019[122]). To support implementation, the MTEF should take into account estimates of the costs associated with the infrastructure projects of the government.

Infrastructure plans should also have a proper link with the annual budget formulation process, since it is at this time that resources are allocated to government projects and programmes. The way capital expenditure is integrated into the overall budget process has different advantages and disadvantages. While full integration between current and capital expenditure can improve planning, facilitate co-ordination, and increase flexibility, separate budgets can ensure that mandatory items such as entitlements do not crowd out discretionary items such as capital investment (Posner, 2009). Governments need to be aware of the inherent challenges of their system in order to ensure that proper mechanisms are in place to address them. If a government decides to submit capital and current budgets separately, it will need to strengthen the selection mechanisms for capital projects to make certain that line ministries better integrate their capital and current expenditure decisions. If it decides on a unified budget, it should ensure that it is accompanied by guidelines or fiscal rules as well as the political will to limit government borrowing that finances current expenditure (Burger, P. and I. Hawkesworth;, 2013[134]).

Box 2.2. Budget allocations and clear prioritisation: Germany's 2030 Federal Transport Infrastructure Plan (FTIP)

The Federal Transport infrastructure Plan (FTIP) is an overall strategy for the development of the Federal Government's transport infrastructure with investment totalling EUR 269.6 billion for the implementation of all first priority projects within the timeframe set for the FTIP 2030.

One of the main objectives of the FTIP is to achieve a realistic and fundable overall strategy for the construction and structural maintenance of German infrastructure. A record level of funding is available for investment, and the German Authorities put an emphasis on synchronising the funds to be invested and the projects in a way to allow for the implementation of all first priority projects within the timeframe set for the FTIP 2030.

Of the funds from the new FTIP, EUR 141.6 billion will be invested in structural maintenance and replacement. This is around EUR 60 billion (EUR 58.9 billion) and thus approximately 71% more than the funds which were available under the FTIP 2003 (EUR 82.7 billion for structural maintenance and replacement). The overall picture shows a record share of 69% for structural maintenance/replacement. (For comparison: 56% in the FTIP 2003).

Germany is strengthening its major transport arteries and hubs, thereby enhancing the capacity of the entire network. At the same time, Germany is investing in important projects for the development of the regions. For this reason, in the road sector, 75% of the investment in upgrading and new construction goes into projects with significant impacts on a large area and 25% goes into regional development measures. Across all modes of transport, 87 of total German investment is going to projects with significant impacts on large areas.

Source: (OECD, 2020[132])

In **Germany**, the Federal Transport infrastructure Plan (FTIP) sets out an overall strategy for the development of the transport infrastructure at the federal level. The plan includes a detailed descriptions of the funds allocated to each type of investment (new projects, maintenance, replacement, and upgrade) (Box 2.2).

Strengthen capacities for public investment management and ensure coordination across sectors and levels of government

Good governance of infrastructure depends on numerous institutions within and across levels of government. Regions, and especially cities, are responsible for the implementation of policies that have a direct impact on sustainable development and citizens' well-being (e.g. transport, energy, broadband, education, health, housing, water and sanitation) (OECD, 2019[123]). As such, infrastructure governance is not only the preserve of central governments, but a process where all levels of governments, with different mandates and levels of autonomy, are actively involved. Chapter 4 of this Handbook addresses the role of subnational government in financing and managing infrastructure investment to pursue local and regional development goals. This section highlights the practices that can be adopted by national governments to strengthen coordination between all actors that play a role in infrastructure investment.

The impact of COVID-19 crisis has been highly heterogeneous, especially affecting more vulnerable regions and populations (OECD, 2021[135]). A greater emphasis on regional disparities has made itself evident in the past few months and will impact the way in which countries plan and deliver infrastructure at the subnational level. Implementing co-ordinated responses across government departments and levels of government can help countries in tackling these regional imbalances. Both temporary measures adopted to ensure provision of critical infrastructure services to face the immediate effect of the crisis, as well as long-lived infrastructure investments to be made in future years, can benefit from having a strong territorial dimension.

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] and the OECD Recommendation on Effective Public Investment across Levels of Government [OECD/LEGAL/0402] invite countries to design and implement investment strategies tailored to the place the investments aim to serve. Well-cemented relationships across levels of government can be helpful for governments to decide, in a collaborative way, what projects should be built at a regional level to support an inclusive economic recovery. Even before the crisis, **Canada** had adopted a long-term infrastructure plan that focused on bilateral agreements with local governments, which must prepare multi-year plans and identify priority projects in order to receive national level funding (OECD, 2020[121]). This multi-level co-ordination will play an even more crucial role in **Canada** in addressing the COVID-19 crisis' aftermath, as it is expected that local governments will increasingly turn to these bilateral agreements to speed infrastructure investment for economic recovery.

Adopting effective instruments for co-ordinating across national and subnational levels of government and working together with subnational areas through regular inter-governmental dialogue and co-operation has also been identified as a good practice. Constant communication and open dialogue with local authorities was one of the most useful tools for **Colombia** in the development of infrastructure-related policies throughout the COVID-19 context (OECD, 2020[136]). The National Infrastructure Agency adopted biosecurity guidelines whose success was mainly due to its previous collaboration with local governments. In the process of designing these guidelines, the **Colombian** government held more than 60 virtual meetings with governors, mayors, COVID-19 regional managers, and social leaders to define uniform parameters that address safety and well-being concerns in the re-opening of construction sites.

Co-ordination between sectoral ministries is also key to ensure that investment across sectors contributes to the pursuit of common development goals. As infrastructure services become increasingly interdependent, or even converge, across sectors (e.g. electricity, transport, digital), infrastructure planning and procurement strategies that continue to rely on a siloed approach can limit the effectiveness of public

investment. Coordination mechanisms such as cross-sectoral planning processes or infrastructure coordination bodies can limit the possibilities for overlap between projects and promote synergies between investments. Co-ordination of all institutional stakeholders is an essential pre-requisite for efficient and effective infrastructure planning and should be ensured early in the planning process.

In response to co-ordination challenges across government departments, **Australia** has created Infrastructure Australia, an independent statutory authority responsible for evaluating infrastructure needs, developing a strategy to address those needs, and prioritising infrastructure investments (OECD, 2017[87]). A key strength of Australia's infrastructure planning system is its integrated strategy that considers all infrastructure sectors within a single plan, which encourages greater alignment across sectors and investments and creates more space for generating synergies. Since the establishment of Infrastructure Australia in around 2008, all six Australian State governments have also established independent infrastructure advisory bodies. Thus, strategic infrastructure planning is being carried out consistently at both national and subnational levels (ITF/OECD, 2021[137]).

2. How can evidence-based project selection and prioritisation processes be embedded in government decision-making?

Challenges

Governments face a substantial task in determining which of the many identified investment possibilities are best able to contribute to the achievement of identified policy goals. Only 19 OECD countries report that they have a shortlist of priority projects, with most driven by some combination of cost-benefit analysis results, infrastructure plans, and strong political backing (OECD, 2019[122]). Political dynamics can undermine sound decision making on infrastructure when processes for identifying priority projects and choosing delivery modes are not sufficiently formalised (OECD, 2017[87]). If the incentives are skewed towards displaying tangible results to a certain constituency, some infrastructure needs, as well as the operation and maintenance of existing assets, might end up being neglected, resulting in inefficient investments that fail to respond adequately to the needs of the population. In the context of a wider focus on well-being and sustainable development, infrastructure investment is increasingly required to address multiple economic, social, and environmental objectives beyond a narrow definition of user needs. This creates challenges for decision-makers, who are required to weigh and balance different (and sometimes competing goals) in selecting and prioritising projects. Existing decision-making frameworks are not always well-adapted to accommodating a more diverse set of objectives.

Solutions

Tools to improve the investment decision-making process, ensure accountability and promote a clear and transparent decision-making process, are analysed below.

Ensure that the political decision-making process is informed by robust, independent evidence-based analysis

The contribution of infrastructure to economic development and wellbeing goes beyond the construction of the asset. What ultimately generates an economic or societal return is the access to and quality of the service provided by the infrastructure. Politicians have a strong incentive to prioritise infrastructure investments with high visibility. This is particularly the case where political cycles are short, and political priorities are often driven by the urgent short-term needs of the population. Having the right institutional framework and decision-making process in place can help to better inform political decision-makers, enable stakeholders to engage in more effective, evidence-based dialogue with government, and constrain

politically opportunistic decision-making. In all of these ways, it will tend to favour evidence-based infrastructure decision-making.

As pointed out in the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], governments benefit from decision-making processes that are based on a sound understanding of the expected returns of infrastructure projects in terms of value for money, and social and economic efficiency (OECD, 2020[111]). Most OECD countries already support infrastructure prioritisation and decision-making processes which give significant weight to the results of a cost-benefit analysis, as well as the presence of the project in a long-term strategic plan (OECD, 2018[138]). Strengthening cost-benefit analysis practices can become an effective way to ensure that a portfolio of infrastructure projects maximises value for money.

In order to form the basis for sound decision-making processes, CBA needs to be anchored in a robust methodology. The strength of CBA lies in its logical simplicity and the fact that it generates clear quantitative values (e.g. Net Present Values, Benefit/Cost ratios) that can be used to compare and rank projects, even across sectors. However, cost-benefit analyses traditionally privilege impacts that can be readily monetised. CBA methodologies that consider non-monetised impacts are thus less prominent, which can lead to potential shortcomings in the project selection and prioritisation processes. Tools to broaden the scope of CBA methodologies in order to accommodate multiple objectives and uses, as well as tools to analyse wider social and economic benefits beyond the scope of a CBA, are also discussed in the following subsections.

The way CBAs are integrated into the investment decision-making process is also crucial to ensure an evidence-based project selection and prioritisation process. The stage at which the analysis is carried out, the institutional arrangements (e.g. whether CBA results are independently vetted), and the type of information included in the assessment are all important in ensuring a sound technical appraisal process is completed and that it is able to exert significant influence on the political decision-making process.

The Norwegian two-stage quality assurance process for large transport infrastructure projects can serve as an example on how to integrate a rigorous and independent appraisal process under a robust multi-stage framework (Box 2.3).

Box 2.3. The two-stage quality assurance process for large projects in Norway

In Norway, projects with estimated costs in excess of NOK 750 million are subject to additional scrutiny via a two-stage quality assurance process. The process includes input from independent reviewers and was initially implemented to combat cost overruns.

- QA1 focuses on quality assurance of choice of concept. It is conducted prior to the government cabinet's selection of projects for inclusion in the National Transport Plan. The central purpose of this analysis is to check, at a relatively early stage, that the project has undergone a process of "fair and rational" choice. It is conducted by the responsible ministry or government agency and includes investigation of alternative solutions, socio-economic impacts, and relevance of the project to transport needs. There is emphasis on environmental and social impacts, land-use implications, and regional development. This evaluation, *inter alia*, must include a "do-nothing" option ("zero option") and at least two alternative and conceptually different options. The external reviewers' role includes analysis as well as review of documents.
- QA2 focuses on quality assurance of the management base and cost. It applies to projects that are included in the National Transport Plan but have yet to be submitted to parliament for approval and funding. The purpose of QA2 is to check the quality of the inputs to decisions, including the cost estimates and uncertainties associated with the project, before it is submitted

to parliament to decide on funding allocation. It includes assessment of cost estimates derived from basic engineering work and assessment of at least two alternative contracting strategies. Notably, however, QA2 does not include revisiting and updating the cost-benefit analysis performed in QA1, unless the project seems to have been significantly altered from the option chosen at QA1. In addition, QA2 focuses on project management in the implementation phase.

The Norwegian project appraisal and selection process includes considerable early-stage consultation and discussion between the agencies and lower levels of government, as well as with other interested parties. Likewise, the requirements for CBA in the project appraisal and selection process and other objective analyses are comprehensive.

Source: (OECD, 2017[139]; OECD, 2017[139]; OECD, 2017[139])

Another well-known example is the use of CBA within the **United Kingdom**'s five case model. One of the main attributes of the model is that the CBA is at the core of the appraisal process, but it is effectively integrated with other relevant decision criteria. Although decisions are based on the results of all five case studies, CBA and value for money are used in the economic case following guidance issued by HM Treasury (the Green Book) and are given substantial overall weight. The Green Book sets out the required overall methodology, and list the inputs and parameters to guide the socio-economic assessment of proposed projects and programmes (HM Treasury, 2013[140]).

Several countries have established independent infrastructure advisory bodies over the past decade in order to work with, but stand apart from, conventional government agencies responsible for infrastructure policy, planning, and delivery (ITF/OECD, 2021[137]). A few of them have been appointed to undertake independent assessments of project business cases. In Australia, Infrastructure **Australia** develops a list of priority projects based on full business case assessments (OECD, 2017[87]). Initiatives and projects included on the List are assessed by the Infrastructure Australia board through a structured, five-stage Assessment Framework (problem identification, initiative identification, options assessment, business case assessment, and benefits realisation). The business case objectively considers the potential solutions identified and if it is positively assessed by the Infrastructure Australia Board, the project is added to the Infrastructure Priority List.

Supplement CBA with other methodological tools to accommodate multiple objectives and uses

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] suggests that countries should adopt rigorous project appraisal and selection processes that pay due consideration to both economic efficiency and social, environmental, and climate costs and benefits throughout the whole of the asset's life cycle. While regular cost-benefit analysis can be effective in guiding the choice of projects that deliver the most value for money, it may not adequately accommodate impacts that are not easily expressed in monetary terms. Some countries have used indirect quantification tools to broaden the scope of CBA to include non-monetary impacts. Indirect valuation techniques can broaden the scope of CBA, thus enabling a wider range of sustainability impacts to be taken into account (ITF/OECD, 2021[137])

While CBA is an important component of the evidence-based decision-making process, there are relevant elements outside its scope that should be considered alongside the CBA, such as a project's contribution to strategic policy goals, and impacts that are difficult or even impossible to quantify (e.g. gender equality, inclusiveness, resilience).

Some countries have adopted complementary methods to analyse both monetary and non-monetary costs and benefits, such as multi-criteria analysis (OECD, 2017[87]). While countries' approach to multi-criteria

analyses can differ, in general terms the methodology assigns impact scores to various factors, weights the importance of those factors, and aggregates the weighted impacts of each factor to generate a single value and produce a ranking among projects. For example, the Infrastructure Prioritization Framework (IPF) developed by the World Bank considers government preferences including SDG- and quality infrastructure investment (QII)-related preferences in the optimisation process to identify criteria scores and weights.

A multi-criteria analysis framework can serve as a complement to cost-benefit analysis, as it can be used to accommodate more long-term goals and strategic issues, as well as to improve alignment with broader policy priorities (Marcelo et al., 2016[141]; OECD, 2017[87]). One caveat to multi-criteria analysis is the assignment of scores, which can be largely arbitrary and not respond to general public preferences (OECD, 2006[142]). That said, rigorous guidance on its use can help avoid some of the risks of "gaming" to which this methodology is vulnerable.

The **United Kingdom** has adopted general guidelines for the incorporation of multi-criteria analysis in decision-making processes (Department for Communities and Local Government, 2009[143]). The guidelines provide an explanation of techniques that do not necessarily rely on monetary valuations as a way to complement the use of monetary methodologies such as financial analysis, cost-effectiveness analysis, and cost-benefit analysis. The guidelines include an extensive description of a number of techniques, their merits, and case-studies to familiarise public officials with their use.

Iceland has adopted a gender approach to assess the gender impact of infrastructure investments included in the COVID-19 economic recovery programme. The assessment analyses the gender ratio of jobs created during the construction of the infrastructure assets, potential jobs that can be created once the construction is completed, and the overall impact of infrastructure assets on female users. The Ministry of Finance and Economic Affairs of Iceland is planning to incorporate gender impact assessments as a regular practice during capital budgeting processes following the COVID-19 crisis. Likewise, the **Canadian** GBA+ framework (see Section 1 on long-term infrastructure planning) considers the positive and adverse effects of infrastructure investments on men, women, and gender non-binary people, including health, social, or economic effects (Government of Canada, 2020[127]). The implementation of this impact assessment methodology is intended to allow for a more detailed and specific description of positive and adverse effects, in order to refine the results of initial analyses conducted throughout the decision-making process.

Integrate wider economic impacts in project decision-making for non-marginal or transformative projects

When evaluating value for money in infrastructure projects, cost-benefit analysis focuses on the direct benefits that projects' bring as compared to the costs involved in the development of such projects. However, there may be broader, indirect economic benefits that result from infrastructure investment that are not considered in standard cost-benefit analysis. For example, some infrastructure investments have been found to give rise to benefits in terms of productivity growth within the affected area due either to positively affecting the productivity of infrastructure sectors, or improving productivity in firms that use infrastructure services as productive inputs (Demmou and Franco, 2020[112]).

Wider economic impacts have also been identified in the case of transport infrastructure investments, where three main sources of economic benefits have been identified: effects on proximity and agglomeration, attractiveness for private investment, and impacts on labour force participation (Venables, 2016[144]). Investments in transport infrastructure generally reduce transport costs, facilitate local trade, and incentivise economic activity to cluster in one geographical area, generating agglomeration economies that improve firms' productivity (Holl, 2006[145]; Seitz and Licht, 1995[115]). Investments in transport infrastructure can also make areas served by the infrastructure more attractive for residents, workers, and firms to invest in, creating additional value (Venables, 2016[144]). Finally, transport investments can

effectively increase the size of the labour market and enable more workers to access jobs (Venables, 2016[144]).

However, not all wider economic impacts constitute benefits. For example, transport projects in one location may often displace activity that would have taken place elsewhere (ITF/OECD, 2021[137]). Investment in transport infrastructure can create hub-and-spoke dynamics between different regions served by the same infrastructure, widening regional disparities, and crowding out smaller firms from local markets as bigger firms have more access to less developed regions (Puga, 2002[146]).

Identifying and measuring the wider economic impacts of infrastructure investment can facilitate better-informed decision making, in particular in the case of large projects designed to have transformative impacts. However, these analysis are data intensive and add to the resources required for the overall project appraisal. As a consequence, they can only be justified where projects are likely to have impacts that go beyond those of a conventional transport scheme – i.e., reducing congestion, reducing accidents, and improving the local environment (ITF/OECD, 2021[137]).

A key risk associated with the inclusion of wider economic impacts in project appraisal is that of double counting. Thus, particular care must be taken to avoid this error. In general, wider economic benefits (WEB) analysis is only likely to be relevant and significant in determining project choice outcomes where very large projects are concerned. Given the high level of uncertainty surrounding the results of WEB analysis, scenario analysis and/or sensitivity analysis are generally employed in this context. Including WEB analysis can provide additional relevant information to decision-makers in the case of major infrastructure projects, but demands analytical expertise and data. It should be used with caution and only where appropriate (ITF/OECD, 2021[137]).

Countries have used WEB analysis to support investment decision making in different ways. While some countries like **New Zealand** have accepted the use of this type of analysis as part of the formal evaluation framework, some countries like **Australia** use them as sensitivity tests. In the case of **Australia**, practitioners are advised to present CBA results without WEBs, and then with WEBs in order to inform the investment decision (Transport and Infrastructure Council of Australia, 2016[147]).

Use robust, independent evidence-based analysis to guide the decision on the delivery mode

As highlighted by the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], the decision on the way in which the infrastructure asset will be provided and financed (i.e. delivery mode) should be grounded in value for money and optimal allocation of risk between the parties, with no institutional, procedural, fiscal, or accounting biases for any particular delivery mode (OECD, 2020[111]).

The relative value for money generated by different delivery modes depends on factors such as on the capabilities of the public and private sectors, the characteristics of the project, the degree of certainty of future revenues, and the desired allocation of risks and controls (OECD, 2017[26]). Pipeline development should also be informed by the capabilities and capacities of the government itself and the potential financing market. The framework for infrastructure development should not unduly favour certain types of delivery modalities due to tradition, special subsidies, or accounting rules (OECD, 2017[26]). The analysis should therefore be based on previously-defined clear criteria, and the use of value for money analytical tools to compare service delivery options (OECD, 2020[111]).

3. How can governments increase trust and ownership of infrastructure planning and delivery?

Challenges

Infrastructure investments are particularly prone to fraud and corruption. Integrity risks can arise at each stage of the investment lifecycle, as most countries have recognised, yet integrity instruments often leave gaps (OECD, 2017[26]). The extent of public officials' discretion over investment decisions, the large sums of money involved, and the multiple stages and stakeholders involved contribute to making them more vulnerable to undue influence. Fraud and corruption in infrastructure planning and delivery results in higher economic and social costs as a result of misappropriated resources, excessive costs, poor quality, inadequate services, and health and environmental damage, and can undermine citizens' trust in government. Disinformation further reduces the perceived legitimacy of infrastructure projects amongst stakeholders, and negatively impacts trust and shared ownership of infrastructure planning and delivery. A clear example of this is the wave of disinformation that has accompanied the global spread of COVID-19, undermining policy responses and amplifying distrust and concern among citizens (OECD, 2020[148]). Poor targeting of infrastructure investments due to citizens' disengagement also negatively impacts trust in the public sector, ultimately slowing the development of such projects. Good governance of decision-making processes can help governments ensure resources are being used productively.

Solutions

Promote systematic and effective stakeholder participation

Stakeholder engagement is essential for legitimacy, transparency, and the identification of infrastructure needs and can thus enhance the performance of infrastructure projects (OECD, 2017[26]) Proactively informing, consulting, and engaging with stakeholders at all stages of the policy-making cycle can facilitate the incorporation of their perspectives and expertise, which is critical to increasing trust in infrastructure programmes.

Systematic and effective stakeholder participation goes beyond providing information to affected citizens. Promoting and protecting civic space (i.e. the possibility for citizens to be informed, organise, and freely participate in public life) is a precondition for good infrastructure governance, facilitating open debate, citizens' access to information and open data, public oversight of planning and spending, and accountable responses to needs.

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] provides guidance on how governments can facilitate the participation of users and impacted communities during the relevant phases of the project life cycle, ensuring debate and oversight on the main economic, fiscal, environmental, and social impacts of the project. For example, representative deliberative processes can help policymakers to better understand public priorities, identify where consensus is and is not feasible, and make legitimate decisions that involve tough trade-offs (OECD, 2020[149]).

In Victoria, Australia, citizens were brought together to deliberate on the infrastructure needs of the population, and how these needs should be addressed in the 30-year infrastructure strategy. Jury members were recruited through a random selection process, and provided a report with a set of recommendations that were used to inform Victoria's Infrastructure Investment Plan. The recommendations provided by the citizens' jury were made publicly available in the Infrastructure Victoria webpage.

The OECD Recommendation on Open Government [OECD/LEGAL/0438] and the OECD Recommendation on Digital Government Strategies [OECD/LEGAL/0406] promote innovative ways to effectively engage with stakeholders to source ideas and co-create solutions, including digital technologies

and technology-driven approaches. Digital tools are becoming a key mechanism for informing citizens and stakeholders, and enabling their participation and engagement in a meaningful way. The use of high-quality open data and free tools can also play a crucial role in ensuring information is timely and available to the public. User and data-driven policies are an important piece in governments' tool-boxes to guide decision-making processes, contribute to improved efficiency and effectiveness, and raise transparency and accountability.

Italy created an open data portal called "OpenCoesione" for all projects financed by European and national funds for cohesion, offering information on their implementation and the achievement of the projects' objectives. The data portal has a specific section dedicated to public works, where information on new infrastructure, and on the performance of maintenance, recovery, restoration, expansion, and completion works as well as demolition of existing infrastructure, is available to the public.

Manage threats to integrity

A whole of government approach is essential to effectively address integrity risks in infrastructure development. The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] suggests the adoption of risk-based approaches to identify, mitigate, and address fraud, collusion, abuse, corruption, undue influence and capture risks at each stage of the infrastructure project life cycle and develop tailored control mechanisms. Transparency and integrity in the process of planning and delivering COVID-19 stimulus packages will be crucial, especially considering the size of the economic stimulus packages and the associated risks of misappropriation and fraud. Although fraud and corruption are not new phenomena, early evidence shows that they have been increasing during the current crisis. As governments transition from addressing the immediate crisis to focusing on economic recovery, integrity violations may continue to rise and undermine recovery efforts (OECD, 2020[150]).

Providing an adequate degree of transparency throughout the project life cycle by offering accessible, joined-up, and high-quality open data and ensuring control and oversight are some practices that can be useful and have been previously highlighted by the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460]. The active use of data offers transparency about success and failure in ways that support accountability and stimulate public engagement and trust (OECD, 2019[130]). Particularly throughout the procurement stage of infrastructure projects, ensuring maximum openness of information, including open data stored in an accessible location, as well as full disclosure of the measures adopted to ensure an economic recovery, can be good practices to ensure integrity (OECD, 2020[150]). Open data can also play a significant role in providing transparency and accountability with respect to the actual costs of project implementation, and facilitating monitoring and oversight in the execution of public funds allocated to infrastructure investment. The online portal Opencantieri managed by the Ministry of Infrastructure and Transportation of **Italy** is an example on how to provide open, complete, and up-to-date information on ongoing public infrastructure projects (G20, 2019[151]).

Effective accountability and oversight of the economic stimulus packages can already start to be addressed by governments. Reinforcing internal control, internal audit, and oversight functions is not only useful for the implementation of these recovery measures, but can also bring positive outcomes in the longer-term. The guiding principles for an improved assurance system for high risk projects introduced by the United Kingdom's National Audit Office in 2010 is an example of these type of initiatives (G20, 2019[151]). Governments can allocate, where necessary, the appropriate funding to ensure the necessary resources for conducting real-time audits of the economic stimulus packages (OECD, 2020[150]). Likewise, they can establish specialised oversight bodies, while ensuring they have a clear and coherent mandate relative to existing accountability actors (OECD, 2020[150]). Finally, given the rapid pace at which these programmes are required to be rolled out, it may not be feasible to conduct a comprehensive integrity risk assessment, and thus public officials can be encouraged to document and report any obstacles and workarounds as they arise (OECD, 2020[150]).

4. What procurement strategies support quality infrastructure investment?

Challenges

Procurement strategies (from the choice of the delivery mode to the definition of award criteria and contract management) are frequently based on the habits of the contracting authorities, rather than strategic choices. Entities face difficulties when unduly favouring certain types of procurement modalities due to tradition, special subsidies, or accounting rules. Similarly, if failures occur, they are often linked to the contracting authorities' limited capability to deal with complex projects. The procurement process should enable decision-makers to deliver projects in a way that maximises the value generated for society as a whole.

The increasing emphasis on ensuring that infrastructure delivers broader value in terms of economic, environmental, and social benefits places new demands on the procurement function. Procurement processes that place an exclusive focus on cost may not be supportive of achieving broader policy goals. At the same time, procurement procedures must guard against sacrificing transparency and objectivity in seeking to accommodate a wider set of outcomes.

The evolving nature of infrastructure systems (e.g. low-carbon energy systems) and the encroachment of digital technologies into the traditional infrastructure space has implications for how innovation can be accommodated and incentivised through procurement.

Solutions

A number of policy solutions can support procurement strategies that deliver quality infrastructure investments.

Accelerate infrastructure investments by developing public procurement competencies

In the context of COVID-19, countries are looking at ways to accelerate infrastructure investments, which are often delayed by bottlenecks in the implementation of procurement processes. The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] and the OECD Recommendation on Public Procurement [OECD/LEGAL/0411] provide guidelines on how to make the most of efficient and effective procurement processes to attain sustainable, innovative, and quality infrastructure projects.

For instance, in **Italy**, the task force appointed to define Italy's recovery path called for speeding up infrastructure investment and simplifying procurement rules related to public works (Italian Government, 2020[152]). To address potential shortcomings in the procurement process, countries are increasingly introducing certification frameworks for infrastructure projects that ensure qualifications throughout the infrastructure life-cycle, and tackle specific competencies related to public procurement. **New Zealand** developed the so-called Rapid Mobilisation Playbook aimed at sharing lessons on how to run accelerated processes while also managing risk effectively. The Playbook guides procurers on topics such as delivery model selection, taking into account to the complexity of the project and the capability of the procuring entity (New Zealand Government, 2020[153]).

Similarly, in the **United Kingdom**, the Major Projects Association contributes to professional development of stakeholders involved in infrastructure projects, addressing key areas such as sustainable procurement. Finally, the trend for enhancing the speed and capacity of procurement implementation depends on the adoption of detailed guidelines and strategies on how to accelerate the procurement of infrastructure projects (OECD, 2020[150]). Moreover, effective procurement strategies are an essential element to ensure that infrastructure investments produce high-quality investments that actually contribute to the original

objectives and support countries' economic recovery. This requires targeted and fit-for-purpose delivery strategies, as well as balancing the speed of delivery and the quality of the infrastructure project.

Indeed, the complexity, scale, time-span, and oftentimes interconnectedness of infrastructure projects call for a specialised workforce, both on the public and the private sector sides. It should be capable of designing and implementing complex procurement strategies, understanding and allocating risks, and above all, adapting standards procedures to the very nature of infrastructure projects. Thus, supporting quality infrastructure, particularly in the COVID-19 context, requires the definition of new strategies and processes that take into account several dimensions, such as the strategic use of procurement, the inclusion of standards for Responsible Business Conduct (RBC), among others.

Align procurement strategies for infrastructure with national long-term priorities

As a first priority to enhance the link between quality infrastructure and public procurement strategies, countries could seek to align their procurement strategies with national level policy priorities and long-term development goals. For instance, strategic procurement can be used to ensure that infrastructure investment contributes to broader goals, such as sustainability, upgrading the skills of the construction workforce, ensuring responsible business conduct, promoting innovation, etc. In **New Zealand**, the public procurement policy framework is set up to contribute to 'broader outcomes'. In particular, when procuring construction works over a certain threshold, New Zealand contracting authorities need to incorporate questions about skills and training development of the construction workforce, as part of the "construction skills and trainings" outcome. Contracting authorities also need to give consideration to "transitioning to a net zero emissions economy and designing waste out of the system" (Ministry of Business, 2019[154]). **Germany**, too, has set up a public procurement policy framework that is conducive to quality infrastructure investment. Specifically, it has introduced a national-level competence centre within the central purchasing body by the Ministry of the Interior – the so-called 'Kompetenzstelle für nachhaltige Beschaffung – that supports contracting authorities in integrating sustainability requirements in tenders. A similar competence centre is available for innovation ('KOINNO – Kompetenzzentrum innovative Beschaffung').

Procurement strategies can also address the quality of implementation of infrastructure projects. Given the labour intensive nature of infrastructure, it is an area of frequent labour rights abuses. Furthermore, the long and fragmented supply chains with multiple tiers of contractors increase challenges in monitoring compliance with labour rights and RBC standards. Public procurement strategies have strong potential as a tool to ensure ethical and inclusive supply chains through the promotion of RBC standards in contract implementation. For instance, contracting authorities can select a contractor that promotes an ethical supply chain, covering not only the first tier but also the full supply chain. Further, it is important to follow-up on suppliers' compliance with RBC requirements.

In addition, green infrastructure can also be promoted through the use of targeted procurement strategies that take into account life-cycle costing (LCC) when awarding public works contracts. In the **Netherlands**, the Rijkswaterstaat (the Department of Public Works of the Ministry of Infrastructure and the Environment) makes use of specific tools to assess the sustainability attributes of public works tenders, such as CO2 emissions as well as the environmental impact of construction materials. Furthermore, using LCC in procurement processes serves to maximize value for money through reducing inefficiencies and reducing costs over the long-term.

Similarly, procurement can be a powerful demand-driven tool for innovation in infrastructure investment and delivery, generating technologies that are not commercially available on the market. This is particularly relevant given the critical role of new technologies in delivering the low-carbon transition. The municipality of Frederiksberg in **Denmark** leveraged public procurement to implement nature-based solutions to address its urban flooding problems. As an ideal solution suitable for dense city streets was not yet

available on the market, Frederiksberg used an innovation partnership model in order to procure a customised solution for heavy rainfall management (European Commission, 2020[155]).

However, while public procurement strategies could be effective to introduce innovation in infrastructure, a balanced approach should be taken to avoid unwanted consequences. For instance, in **Italy**'s Puglia Region the authorities are looking at how technology can help in addressing tomorrow's infrastructure challenges and creating greater resilience. Specifically, they have launched two pre-commercial procurement (PCP) procedures aimed at developing technology to increase the efficiency of water management infrastructure. To mitigate risks brought by disruptive technologies and to maximise the impact of innovative solutions on public service delivery, the authorities are assessing risks and opportunities to conduct a public procurement for innovation (PPI) procedure for a large-scale deployment of these technologies. Introducing an innovative solution would allow the water management authorities to monitor and repair water leaks throughout the distribution network, generating savings and reducing water losses. The authorities are also exploring innovative ways to reduce or recycle sludge in wastewater, thereby reducing the environmental impacts. Procurement of innovation entails a component of management of intellectual property rights (IPR), which should be performed in such a way as to provide an incentive for suppliers to deliver innovative solutions.

Ensure transparent and effective management of procurement operations, including contract management

Public procurement processes for infrastructure are increasingly accompanied with extended transparency requirements, which can generate a wealth of data for stakeholders. This is often the case for major flagship projects such as the Olympics and Universal Expositions. The importance of transparency is coming to the fore in the context of the COVID-19 crisis. Indeed, in the medium-term, it is expected that governments will place increased emphasis on maintaining and retaining documentation on procurement processes resulting from economic stimulus packages. While transparency is essential as an objective in itself, countries should go beyond the simple availability of data, and ensure that this data is meaningful for project stakeholders. Indeed, as shown in the development of the New International Airport in **Mexico**, it is essential to provide consistent, user-friendly, and meaningful data that allows stakeholders to extract value from it (OECD, 2018[156]). For instance, specific indicators could be adopted for monitoring quality infrastructure criteria, such as energy-efficiency performance.

Finally, good practices for managing ongoing infrastructure contracts or procedures are also highly encouraged (OECD, 2020[150]). Some governments have already made efforts to provide general guidelines to address the impacts of COVID-19 on ongoing infrastructure projects.[14] Beyond detailed negotiations about contractual arrangements, public-private partnership and private finance initiative contractors have been advised to focus on making sure that contract services continue to be provided during the crisis and recovery stages.

5. What strategies can be implemented to ensure fiscal sustainability and infrastructure performance over the asset life-cycle?

Challenges

Failure to oversee the performance of infrastructure service delivery can have a negative impact on value for money through the asset's life cycle. Infrastructure agencies tend to focus more on infrastructure development and less on life cycle monitoring and evaluation (OECD, 2017[26]).The responsibility to ensure adequate performance of infrastructure normally rests with the agency in charge of the project's implementation. The lack of involvement of other central agencies such as central budget authorities, supreme audit institutions, and regulatory authorities often presents a challenge. The lack of accountability

over the provision of infrastructure services may lead to the inability to reach predefined service delivery targets and expected outcomes.

Solutions

Strategies to strengthen fiscal sustainability and infrastructure performance over the asset life cycle are analysed below.

Monitor the implementation and operation of infrastructure assets

Monitoring the whole-of-life performance of an asset is crucial to ensure the asset fulfils its intended purpose. Monitoring refers to the function performed by government ministries and related entities to seek assurance on the implementation of an infrastructure investment, relative to the milestones and undertakings established at the time of the decision to invest was taken. It can be highly beneficial to governments to monitor implementation as it is often prone to delays, higher than expected costs, and changes to specifications resulting from differences between how implementation was planned relative to real life circumstances at the time of implementation.

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] highlights the relevance of monitoring asset performance against predefined service delivery targets and expected outcomes to ensure the asset performs throughout its life. The whole-of-life performance should be monitored from the moment a decision is taken to proceed with an infrastructure investment project through to the active use of that infrastructure. Effective monitoring of performance depends on ensuring the systematic collection, storage, and management of relevant data over the entire life cycle of the infrastructure asset. The application of digital technologies and data analytics can support data collection on asset lifecycles, and improve operational performance and the management of asset maintenance and replacement with a view to optimising costs, extending the life of assets, and reducing operational carbon.

Ex-post value for money evaluations are also highly beneficial as they allow for evidence-based decision-making and regulatory processes. Adopting an integrated set of responsibilities and functions designed to identify, report and take action on risks and challenges facing an infrastructure project during its implementation can benefit governments by minimising waste and ensuring the desired outcomes are obtained. Monitoring the implementation of an infrastructure asset is a function performed by the government agency responsible for the implementation, combined with oversight by at least one other government organisation, such as a ministry of finance or a similarly specialised body, to help governmental decision-makers stay appraised of the circumstances and take remedial action as required.

Reporting practices on the status of infrastructure projects during the implementation period of each project vary across governments. In countries such as Australia, Canada and the United Kingdom, the status of the implementation of infrastructure projects is reviewed on at least an annual basis (OECD, 2020[132]). In the **United Kingdom** the information is available in the Annual Report on the Government Major Projects Portfolio. The reports increase awareness of the implementation status and risk of projects across government, the private sector and stakeholders. The reports also support the identification of lessons and corrective measures that may benefit future projects. A similar example is the 2018 Australian Infrastructure Budget Monitor, which focuses on the status of the implementation of transport infrastructure in **Australia**.

Given that governments undertake multiple infrastructure investments at any one time, in aggregate the activity represents an investment portfolio that can be assessed and managed based on a range of criteria, including implementation risk. While it is true that the line ministry responsible for the implementation of an infrastructure asset would be expected to monitor the implementation progress of its projects, including an assessment of the potential risks across the entire portfolio of public investment activity can help

governments be familiarised with and take into consideration the implementation risks across all government agencies and asset types in their decision-making processes. **New Zealand**, for example, makes use of risk profiles for each investment project to determine which projects would benefit from monitoring assurance (OECD, 2020[132]). Government ministries in New Zealand complete a risk profile assessment to identify the inherent risk of a project which then helps them to prioritise the allocation of monitoring resources to projects with greatest implementation risks. Applying such portfolio management techniques to high-risk projects can help the government understand and better manage the overall extent of risk to which it is exposed.

Monitor and manage fiscal risks related to infrastructure

Fiscal risks is the term used for describing sources of potential large deviations from the fiscal forecast. They are defined as "the probability of significant differences between actual and expected fiscal performance" (OECD, 2020[157]). The OECD Recommendation on Budgetary Governance signals the benefits of establishing mechanisms for identifying, managing, and taking fiscal risks into consideration in all decision-making processes, including for infrastructure investments due to the high capital requirements involved and significant levels of contingent liabilities associated with certain contracts such as concessions and PPPs. Global crises and recessions, like the one resulting from the COVID-19 pandemic, increase probabilities that fiscal risks materialise, putting public finances under serious strain and endangering long-term sustainability (OECD, 2020[157]).

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] invites countries to measure, disclose, and monitor multi-year spending commitments, liabilities, and contingent liabilities resulting from infrastructure projects, as this can help understand associated fiscal risks and better inform decision-makers during the planning and budgeting stages. There are several fiscal risks potentially associated with government infrastructure. For instance, cost over-runs during the construction phase are a common feature of large infrastructure projects. In addition, risks of explicit or implicit guarantees being called are significant, for instance, in the context of risk allocations in public-private partnerships or government bailouts in the case of default by the private sector or state-owned enterprises in infrastructure contracts.

Fiscal risks originating in public-private partnership (PPP) contracts have been a major concern in the last decade. The OECD Principles for Public Governance of Public-Private Partnerships highlights the importance of using the budgetary process transparently to minimise fiscal risks, and ensuring that the budget documentation discloses all costs and contingent liabilities (OECD, 2012[158]). More recently, the G20 IMF Reference Note on Fiscal Risks and Public-Private Partnerships identifies the main sources of fiscal risks arising from PPP contracts and strategies for how governments can manage them (IMF, 2020[159]).

Infrastructure-related fiscal risks may also include the cost of decommissioning certain types of infrastructure. Countries can reduce fiscal risk by regularly reviewing the amortised cost and depreciation of infrastructure assets reported in the government balance sheet, to make sure that these assets receive appropriate maintenance and avoid any unforeseen reconstruction or replacement costs.

The management of fiscal risk entails a number of components (Figure 2.1), including the collection and analysis of information on a wide variety of risks, a prevention and mitigation strategy, and a clear allocation of responsibilities among various actors for implementing the strategy (OECD, 2020[157]). A number of international standards and tools are available to address the issue of fiscal risks. For instance, the IMF and World Bank's Public-Private Partnerships Fiscal Risk Assessment Model (PFRAM) is a tool that has been developed to help governments assess fiscal costs and risks arising from public-private partnership projects (International Monetary Fund / The World Bank, 2019[160]). Likewise, the EUROSTAT Manual on

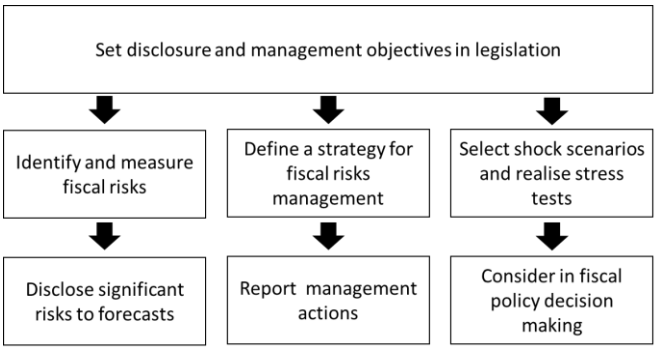
Government Deficit and Debt – Implementation of ESA 2010 provides a detailed methodological framework for assessing sovereign debt resulting from PPPs.

Governments may adopt different approaches to prevent or mitigate fiscal risks associated with infrastructure. For example, **New Zealand** measures potential costs associated with the reconstruction of crucial infrastructure in the event of natural disasters (OECD, 2020[132]). The **United Kingdom** laid out a strategy for strengthening its frameworks for managing fiscal risks associated with "major projects" by enhancing transparency and management incentives around the issuance of loans and other financial transactions, updating its so-called Green Book in 2018 to reflect advances in appraisal and evaluation of major projects and establishing the Infrastructure and Projects Authority (IPA) in 2016 to improve the way infrastructure and major projects are delivered (HM Treasury, 2018[161]).

Chile benefits from a historically centralised budget process focused on ensuring fiscal sustainability (OECD, 2017[87]). The Budget Directorate of the Ministry of Finance produces an annual report on contingent liabilities that includes minimum income guarantees on concessions. The fiscal framework provides a strong basis for ensuring the sustainability of public investment in infrastructure, and takes into account fiscal risks arising from the concessions programme. Contingent liabilities must be authorised by the Ministry of Finance in Chile. Since 2006, these have been compiled in a registry of contingent liabilities.

In **France**, there is a mandatory gateway process (Evaluation de la Soutenabilité Budgétaire – ESB) for every infrastructure project planned as a government-pay PPP (« marché de partenariat »), whether at the state or sub-national level. The ESB process is thus a legal requirement that brings transparency to the stock of sovereign debt obligations (off-balance sheet) resulting from PPP contracts.

Figure 2.1. Components of a fiscal risks management framework



Source: (OECD, 2020[157])

Pay adequate attention to operation and maintenance

Infrastructure is long-lived and the adverse effects of aging infrastructure can threaten assets' value for money and capacity to deliver the services that they are intended to provide. Underinvestment in maintenance can also pose a risk in terms of over-exposing already brittle infrastructure to further hazards and disasters (Blazey, Gonguet and Stokoe, 2020[162]). A life-cycle approach to infrastructure investment takes into account the potential costs of operation and maintenance since the very inception of the project. Indeed, the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] invites countries to optimise costs and asset quality throughout the entire life-cycle, including the operation, upgrade, maintenance, and decommissioning phases.

The COVID-19 crisis has created additional needs and requirements for the operation and maintenance of a number of infrastructure assets. Social distancing, shifts in demand, and strict hygiene requirements

have had a direct impact on infrastructure operations. It is important that governments engage in a constant dialogue with public and private operators so as to ensure that these requirements do not have a negative impact on service quality, fiscal sustainability, or investment returns. After the COVID-19 crisis, countries are increasingly concerned with integrating multiple uses of infrastructure during the planning phase of the projects and favour designs that take into account potential future retrofitting. Additionally, the crisis shed light on the key role that the operation of infrastructure services plays in increasing governments' resilience to external shocks. Ensuring the appropriate delivery of services like energy, communications, transport, or water and waste management was critical for governments' ability to cope with the drastic changes that were brought by measures for restricting mobility that were introduced to slow down the spread of the disease (OECD, 2020[163]).

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] presents a number of governance tools and practices that can help countries pay due consideration to the operation and maintenance of infrastructure assets. First, a rigorous assessment of the condition of existing assets and future infrastructure needs can facilitate the inclusion of maintenance and upgrading projects, as well as their corresponding budget allocations, in the long-term strategic plan and MTEF. For example, for the preparation of its Federal Transport Infrastructure Plan, **Germany** assessed the existing transport infrastructure networks on the major transport arteries and hubs to identify the need to maintain and upgrade infrastructure assets in their operational phase (OECD, 2020[132]). The result of this analysis helped the German government to determine that EUR 141.6 billion of the plan's total funding (EUR 269.6 billion) should be invested in the structural maintenance of existing networks, while only EUR 98.3 billion was allocated to upgrading and new construction projects.

Countries can also account for the full cost of the infrastructure asset's life cycle (including maintenance and upgrade costs) during the budgeting, project appraisal, and selection processes, ensuring that the projects that are ultimately selected take into account these costs and benefits. A transparent allocation of risks and the adoption of a plan to manage, monitor, and mitigate risks throughout the asset's life cycle is an additional tool that can ensure the availability of resources for unexpected maintenance or upgrade costs. Monitoring the asset's performance during the operation phase permits the measurement of the asset's condition, use, and functionality, and can help inform operators on the maintenance required to ensure that the delivery of public services is effective, safe, and accessible. An analysis of accrual basis financial data showing cumulated amortisation and depreciation of assets and technical assessments of existing infrastructure has also been explored as an option for governments to plan for the maintenance of the most appropriate assets in order to meet current and likely future demands, and the disposal of assets that are no longer required. Finally, ensuring appropriate incentives for the optimisation of the financial and service performance of infrastructure assets is key to foster sustainability over the project lifecycle. Appropriately timed and scaled maintenance and upgrade spending can have a positive impact on asset performance and sustainability objectives.

Reinforce resilience of critical infrastructure systems and services

Infrastructure needs to be resilient to time, usage, obsolescence, and slow changes in climate conditions. When subject to external shocks, such as natural hazards or human-induced threats, infrastructure assets should also rapidly adapt and outperform any disruption in order to avoid severe social and economic impacts. Following the COVID-19 pandemic, there are strong expectations for more resilient economies and societies. Extended delays in restoring critical services to the population can potentially slow down emergency responses, further aggravate the effects of an external shock, and hinder economic recovery efforts.

As highlighted by the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], and more specifically the OECD Policy Toolkit on the Governance of Critical Infrastructure Resilience

(OECD, 2019[39]), good governance plays a major role in fostering investments aimed at reinforcing resilience in infrastructure systems. Given the increasing interdependencies and interconnectedness between infrastructure assets, sectors, and systems, and the diversity of infrastructure delivery models, governments can benefit from adopting a whole-of-government approach to critical infrastructure resilience in order to reduce the risk of service disruptions. A good practice for coordinating policy objectives and balancing relevant trade-offs across several functions in government is to establish a national policy on critical infrastructure resilience that brings together risk management central bodies, sectoral ministries and agencies overseeing infrastructure delivery, as well as economic regulators (Box 2.4). A national strategy can prove effective for addressing governance challenges already mentioned in Chapter 1.2 regarding clear roles and responsibilities for resilience and reconstruction and rehabilitation costs.

Box 2.4. Strategic Framework for energy supply resilience in Finland

In Finland, the resilience of the energy production, transmission, and distribution networks is a key priority due to the risks that the infrastructure system is exposed to that can result in potentially severe impacts. As a response to these threats, Finland has developed a strategic framework for Security of Supply, with a clear vision for resilience and definition of the country's critical infrastructure services.

Through the strategic framework, Finland has been able to harmonise national preparedness guidelines, outline clear roles and responsibilities across departments and subnational governments, as well as strengthen the role of regulators in ensuring well-functioning markets and sound regulation for critical infrastructure resilience. The strategy also establishes principles of cooperation and partnership with the private sector and international parties, especially since the voluntary cooperation between industry and sectoral government authorities has been fundamental in fostering trust and build consensus on resilience objectives.

Source: (OECD, 2019[39])

Developing an understanding of the complex (inter-)dependencies and vulnerabilities across critical infrastructure systems is important in order to prioritise resilience efforts. As mentioned in Chapter 1.2, a dynamic approach to infrastructure planning, project selection, and prioritisation continues to be a challenge for countries. The use of methodologies and metrics to identify and prioritise investments in critical functions, systems, and assets can help governments overcome this obstacle. For example, in the **Netherlands** the National Coordinator for Security and Counterterrorism (NCTV) developed a 3-step methodology: first, identify critical infrastructure assets and categorise them according to their criticality (A or B); second, assess their vulnerabilities to multiple risks; and third, set priorities for resilience investments. Public Safety **Canada** has also undertaken high-level inter-dependency analyses of individual critical infrastructure sectors with an examination of cascading impacts. It is currently evaluating critical infrastructure inter-dependency modelling tools developed by the research community.

As previously highlighted in Chapter 1.2, obtaining better data and information about past risks and potential threats is a pre-requisite for building resilience. Establishing trust between governments and operators is a key step towards securing information sharing on risks and vulnerabilities. By obtaining a comprehensive and shared understanding of this information, governments can conduct robust resilience analyses. Information-sharing platforms can foster the exchange of information, although it is essential to build confidence among stakeholders that information shared voluntarily will be secure and will not be publicly disclosed. In addition, building partnerships with operators is an effective way to agree on a common vision and achievable resilience objectives, especially since these measures can have financial implications and raise questions about who will take on the additional costs of investing in resilience. In

Switzerland, for example, the Critical Infrastructure Protection strategy coordinated by the Federal Office for Civil Protection is based on partnerships and platforms for critical infrastructure operators, federal and subnational authorities. Besides risk analysis and information sharing, the Critical Infrastructure Protection strategy sets resilience objectives for critical infrastructure operators.

Governments can further incentivise operators to invest in resilience by defining a mix of policy frameworks and regulatory tools to prioritise cost-effective resilience measures across the infrastructure life cycle. In **Finland**, the Energy Authority sets the requirements for business continuity and reliability standards in the electricity sector, while the National Emergency Supply Agency provides tools, guidance, and methods for operators to comply with these regulations. The **French** government, critical infrastructure operators, and local authorities have agreed on a mix of measures to increase critical infrastructure resilience for the risk of a major flood in Paris, including information-sharing tools, emergency preparedness, and vulnerability reduction policies for existing and future infrastructure.

Monitoring can increase accountability and ensure the effective implementation of critical infrastructure resilience policies and measures. As has been mentioned in Chapter 1.2, conducting continuous monitoring of resilience policies and regulation can also drive early adoption of resilience measures. Regular reporting, inspections, performance assessments, or peer reviews are some examples of good monitoring practices. Fines for noncompliance can also be used, but so can positive incentives such as recognition or awards for implementation good practices. Open access evaluations or rankings are another incentive that can create peer pressure and motivate operators to prioritise investments in resilience. In **Korea**, the Ministry of Interior and Safety makes public the annual evaluation ranking of disaster response capacities amongst critical infrastructure operators. The resulting peer pressure creates additional incentives for operators to keep up their public image.

Finally, in addressing the transboundary dimension of infrastructure systems, governments may consider cooperating with neighbouring countries on critical infrastructure resilience policies, where appropriate. Sharing information and good practices, adopting common approaches, and developing joint standards in critical infrastructure resilience are among some policy options that can foster international and transboundary cooperation in this area. The **Canada** – **United States** Action Plan for Critical Infrastructure promotes an integrated approach to critical infrastructure protection and resilience by enhancing coordination of activities and facilitating continuous dialogue among cross-border stakeholders.

Promote good governance of economic regulators

As highlighted in Chapter 1, regulation is one of the most relevant levers of government action in terms of directing infrastructure stakeholders on how to optimise infrastructure life-span and costs, assess risk exposure, and build resilience. Infrastructure projects often involve many policy areas, several layers of legislation and regulation, and different levels of government. Legitimate, coherent, efficient, and predictable regulatory frameworks incentivise investment in public infrastructure, and ensure the delivery of ongoing improvements in infrastructure performance. Many economic regulators operate as independent bodies within the framework and can provide technical input to decision-making. Economic regulators can give confidence to investors in regulated sectors through: the definition of a reasonable return based on a stable and consistent methodology, and taking into consideration actual risks and financial market conditions; engaging in consultation on the regulatory framework through a transparent process; and adopting clear criteria for efficiency assessment of investments. The social and economic fallout from the crisis will inevitably impact the delivery and access to infrastructure services in the upcoming years. Regulators have always played a substantive part in supporting market efficiency, quality, reliability, and affordability of services in regulated infrastructure sectors, and have been active participants in ensuring critical infrastructure service provision following the COVID-19 crisis (OECD, 2020[163]; OECD, 2020[164]).

As highlighted by the OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460], life cycle costs and asset quality can be optimised through ensuring effective price and quality regimes. Regulators can bring to the table a consolidated economic or functional view of the sector or a given project, and use the information collected for setting tariffs to inform decision-makers about capital costs, asset depreciation, and consumers' preferences. Investment decisions can also benefit from effective price and quality regimes, as tariffs can cover the costs of infrastructure maintenance and upgrade and thus reduce fiscal stress on governments. For example, in **Scotland**, water and waste charges are reviewed on a regular basis in a process called the Strategic Review of Charges, which ensures that the operator is adequately funded to make capital investments (OECD, 2019[165]). Through these charges, Scottish Water has been able to use tariff setting processes effectively to fund capital investments from revenue and decrease public debt levels.

Regulators can further put in place measures to help industry actors to cover financial shortfalls and recover from economic losses. In the context of COVID-19, for example, a number of different measures have been adopted by regulators in **Portugal, Italy and Lithuania** to protect operators from default and recoup unexpected costs linked to the pandemic (OECD, 2020[163]). In Portugal, the Energy Services Regulatory Authority imposed a moratorium on network access payments for suppliers with invoices falling more than 40%. Likewise, in Italy the Regulatory Authority for Energy, Networks and Environment added a cap and floor to costs for dispatching units that do not manage to predict their consumption. Finally, the Lithuanian National Energy Regulatory Council is prompting a review of household tariffs, costs from deferrals or payments in instalments from consumers, interest costs of loans and costs of protection measures from companies.

Under the current COVID-19 context, economic regulators can provide data, objective advice, and technical decision-making to secure the efficiency and resilience of new economic and market models in the infrastructure sector (OECD, 2020[163]). Through data collection and interactions with stakeholders, regulators hold key insights into the functioning of markets and regulations, which can support decision-making and bring confidence to market actors particularly in times of uncertainty as the COVID-19 crisis continues to unfold (OECD, 2020[163]). In the case of **France**, the French transport regulator (Autorité de Régulation des Transports) has been evaluating the issues faced by the railway, road, and airport sectors throughout the pandemic outbreak to inform the government on the impacts of the pandemic, and has been collecting data on the interruption of rail infrastructure management, renewal projects, and related costs (OECD, 2020[163]).

The OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] also suggests that countries evaluate whether regulation is necessary and how it can be most effective and efficient in achieving policy goals. As has been seen throughout the COVID-19 crisis, easing of regulations or fast-tracking of new regulation has helped governments support developers and providers of infrastructure services by providing them with the flexibility to adjust to new conditions (OECD, 2020[163]), and it will continue to be an important tool as long as the uncertain economic and social effects of the crisis remain in place.

Conclusions and key messages

The current, unprecedented global circumstances give countries an opportunity to review infrastructure governance and work together to develop a shared vision that contributes to a sustainable and inclusive economic recovery. While there has been an increasing focus on infrastructure governance in recent years, the crisis has sharpened the need to accelerate reform efforts in this area. The COVID-19 crisis has highlighted and even exacerbated some major challenges, trade-offs, and dilemmas affecting the development of quality infrastructure.

Through transformative and integrated policies governments can address the underlying causes of vulnerability, in particular weak governance and institutions. Robust infrastructure governance frameworks can enable both agile and smarter infrastructure investment decisions, ensuring that resources are channelled towards projects that will effectively address the social, economic, environmental, and political impacts of the COVID-19 crisis. In particular, the following key lessons could be highlighted from OECD good practices and experience:

Key messages

- A ***strategic long-term vision for infrastructure***, adequately informed by a thorough needs assessment and stakeholder engagement process can help to ensure that investment decisions respond to the needs of the entire population in an inclusive way. This vision will have an additional value if it presents a whole-of-government plan that is mindful of the relationships between the environmental, economic and social impacts of infrastructure in the long-run. Strategic plans also need to accommodate the heightened uncertainty and complexity resulting from the crisis and other drivers such as technology and environmental change.
- ***Clear, transparent and comprehensive prioritisation processes*** can become governments' best tool to ensure that investment in infrastructure delivers the expected social and economic benefits, while contributing to long-term policy objectives. A ***rigorous project appraisal and selection process*** should take into account economic, social, fiscal, environmental, and climate-related costs and benefits and account for the full cycle of the asset. Furthermore, ***integrating broader considerations in the use of cost-benefit analysis*** can facilitate the formal incorporation of these factors that are generally not monetised in the decision-making process.
- ***Ensuring that long-term infrastructure plans are fiscally sustainable*** can be done by linking the plans with budget allocations and aligning them with medium-term expenditure frameworks. A robust, transparent, and accountable capital budgeting framework should support the implementation of the plan, in order to meet national development needs in a sustainable, cost-effective and coherent manner. Measuring, disclosing, and monitoring multi-year spending commitments, liabilities, and contingent liabilities resulting from infrastructure projects can help understand associated fiscal risks and better inform decision-makers during the planning and budgeting stages.
- ***Promoting systematic and effective stakeholder participation*** and defining strategies to ***manage threats to integrity*** are key to increase trust and ownership of infrastructure planning and delivery. The current crisis scenario calls for additional efforts to ensure transparency, openness, and access to relevant information and foster stakeholder participation during the strategic planning process and throughout the entire lifecycle of the infrastructure asset.
- ***Effective procurement strategies*** to deliver and operate infrastructure projects are essential to ensure that infrastructure investments contribute to the original objectives and support countries' economic and social recovery. In order to achieve this, procurement strategies can be better aligned with national level policy priorities and long-term development goals, address the quality of implementation of infrastructure projects, promote innovation, and take into account the management of ongoing infrastructure contracts. Governments can benefit, in particular, from procurement processes that are competitive and transparent in nature.
- Effective infrastructure governance requires to look beyond the planning and prioritisation process and ***ensure infrastructure is fiscally sustainable and performs over the asset life-cycle***. This requires monitoring strategies, paying due consideration to the operation, maintenance and upgrade of infrastructure assets, fostering investments to reinforce resilience in infrastructure systems, and monitoring and managing fiscal risks related to infrastructure. Furthermore, ***strengthening the governance and performance of economic regulators*** will be key to support

market efficiency, quality, reliability, and affordability of services, and ensuring critical infrastructure service provision following the COVID-19 crisis.

Future work

The current economic and social context demands that special attention be paid to infrastructure governance. Strengthening public institutions will be key to invest better and ensure a sustainable recovery. Looking ahead, the OECD can support subnational and national governments in the implementation of the newly adopted OECD Recommendation on the Governance of Infrastructure [OECD/LEGAL/0460] through offering a number of policy tools for achieving enhanced infrastructure governance frameworks.

- Improving infrastructure governance requires a rigorous assessment of government's capabilities, strengths and key areas for improvement. The OECD Infrastructure Governance Indicators and the Implementation Toolkit of the Recommendation can offer governments a comprehensive measure of the dimensions that are essential to ensure effective infrastructure governance, as well as guidance on how to put in practice some of the solutions presented in this chapter.
- Countries face challenges specific to their national circumstances that hinder well-functioning governance frameworks. Tailored policy recommendations and detailed guidance on responsive and efficient planning, decision-making and delivery of infrastructure programmes, as well as procurement and implementation of infrastructure mega-projects, can be offered through country reviews and project reviews.
- Advancing the dialogue on infrastructure planning, investment, and delivery to generate long-lasting effects requires continuous engagement and support for public officials. With the support of the Network of Senior Infrastructure and PPP Officials and the Working Party on Leading Practitioners on Public Procurement, the OECD delivers regular webinars, workshops, regional events, and seminars to discuss latest trends and challenges related to the governance of infrastructure.

3 Mobilising finance for quality infrastructure investment

Introduction

The infrastructure investment needed to support the delivery of the key policy priorities outlined in Chapter 1 is significant. In many countries, where the government owns a range of key economic and social infrastructure assets, the public sector will be a key driver of infrastructure investment, complemented by private sector infrastructure investment. However, there is continued underinvestment in infrastructure globally. At current investment trends, this is expected to translate into a cumulative investment gap of USD 5.2 trillion until 2030, or as high as USD 14.9 trillion until 2040, when the achievement of the sustainable development goals (SDGs) is taken into account.

A number of developed economies have launched or proposed massive public investments in infrastructure as part of COVID-19 recovery packages, many of which include important green components. However, these packages are typically limited to a few years, and could be followed by fiscal consolidation. High levels of infrastructure investment will need to be sustained over the next decade in order to deliver on critical policy objectives. The problem in developing economies runs deeper, as many countries do not have the fiscal capacity to increase public investment significantly, even in the short term.

Private investment can supplement public investment in order to bridge the investment gap on the condition that it generates value for money with respect to the public option. Meanwhile, investor appetite for infrastructure investment remains strong. In developed economies, the continued low yield environment and competition for core infrastructure assets have meant that there is no shortage of capital to meet most investment needs in the private sector. Global “drypowder” or undeployed funds in infrastructure funds reached $212bn in 2019, twice as much as at the end of 2015. Also, actual allocations to infrastructure in many large pension funds surveyed annually by the OECD remain below target.

Attracting private investment is not simple, however. Infrastructure investment is complex and presents risks, some of which may take time to materialise over the long lifespan of infrastructure assets. Ensuring a diverse range of financing instruments and vehicles, along with appropriate risk mitigation approaches, can broaden the investor base and reduce investment risks, particularly where the infrastructure investment is structured as a stand-alone project. Other approaches will be required for regulated providers of infrastructure services that may need to be incentivised through various mechanisms. Section 3.1 explores some of the solutions for increasing private investment in quality infrastructure.

Another key challenge is the need to finance new types of infrastructure systems, particularly low-carbon energy, and mobility systems, and accommodate the integration of digital technologies. These new infrastructure systems and technologies, while yielding major potential benefits, nevertheless create significant uncertainty for investors. The investment that needs to be mobilised therefore has to finance

not the traditional infrastructure technologies that dominated the 20th century, but rather the next generations of low-carbon infrastructure systems and technologies, many of which are not commercially available today.[15] Section 3.2 outlines a number of potential solutions that can enable investment into new infrastructure systems and technologies.

It is an unfortunate reality that the countries, regions, and communities that are most deprived and have the greatest need for infrastructure investment are also those where investment is less likely reach. Section 3.3 explores how different innovative infrastructure financing models and institutions can catalyse infrastructure investment for promoting sustainable development.

Governments are increasingly recognising the systemic nature of infrastructure finance and are adopting more pro-active approaches for catalysing private finance that seek to tackle multiple barriers simultaneously. Section 3.4 examines some of the strategies and institutional solutions that governments are implementing with a view to enhancing private investment.

Main challenges and solutions

1. Scaling-up financing for quality and sustainable infrastructure

Delivering a low-carbon transition and achieving the SDGs will require the massive roll-out of a range of infrastructure systems and technologies. Such a scaling-up and acceleration of infrastructure investment will need to involve multiple sources of both public and private financing. Moreover, given the diversity in infrastructure technologies and sectors, their differing economic profiles, and their different stages of maturity, a variety of infrastructure ownership, delivery, and financing models will be required. Privately-financed infrastructure investments are often delivered through a regulated model or a contract-based model. The relevant policy instruments will vary depending on the nature of the investments, and the delivery approach.

The choice of infrastructure delivery model shapes financing options

A significant proportion of the required investments will need to be made by regulated utilities or state-owned companies such as in the context of expanding and upgrading electricity networks to accommodate the higher levels of renewable generation, more decentralised production, and more effective demand management. A regulated model is particularly relevant for investments in areas which are characterised by significant change and uncertainty, for instance, as a result of rapidly evolving technology or unpredictable consumer responses, and therefore require a high degree of flexibility.

Investments made by public or private corporations in *regulated sectors* such as electricity and communications will rely on traditional corporate financing channels, and access to deep and liquid capital markets for both debt and equity. Scaling-up financing for these types of investments will require mechanisms that influence incentives and behaviours in financial markets, particularly with regard to integration of ESG considerations, for investments to be aligned with policy priorities. It will also depend on putting in place a regulatory framework that encourages investments in the right types of assets, and drives innovation (for instance, by encouraging utilities to adopt demand-side technologies) (see below).

Some categories of long-lived capital intensive assets operating in stable business environments can be delivered and financed effectively through *project-based vehicles* such as public-private partnerships (PPPs) where cash-flows are secured by way of long-term contracts. This applies, for example, to projects funded by availability payments as in the case of certain social infrastructures or projects which are protected from excessive fluctuations (e.g. through guarantees) as in the case of certain renewable power generation projects or motorway concessions. These investment models are subject to a distinctive project

financing regime, which has implications for the nature of the financing and risk mitigation instruments. Scaling-up financing for such investments will depend on achieving an appropriate allocation of risks between public and private parties, and developing suitable financing channels, vehicles, and risk mitigation instruments that can bridge the cash-flow and risk profile of projects and the preferences of investors.

It should be recognised that as a result of rapidly changing technologies, business models, and consumer behaviour, the above categories are not fixed. Both investors and governments need to be alert to potential evolutions when selecting delivery and financing models. Thus an asset that could have been considered a stable long-term investment and therefore a suitable candidate for a PPP, could suddenly be confronted by a competing technology operating under an entirely different business model and set of rules.

Financing needs evolve over the infrastructure life cycle

The financing needs of infrastructure projects also vary according to the life cycle of projects and evolution of risks, which may call for different sources of finance and classes of investors. For instance, the higher degree of uncertainty present during the early phases of a project (related to factors such as construction risk and uncertainty over future demand) may inhibit certain risk averse investors who privilege predictable and stable cash flows from investing in this phase of the project, be it equity or debt. They may, however, invest at later stage, in the operational phase, when these early stage risks have been eliminated or mitigated. Banks with project finance expertise may have a higher risk tolerance and be prepared to provide debt financing over this early phase based on an assessment of the project and sponsor creditworthiness.

a) Deepening capital markets, mobilising alternative sources of finance, and ensuring proper financial regulatory frameworks

Challenges

Banks have traditionally been the leading sources of debt finance for infrastructure projects. The complex project finance structures employed for many large infrastructure projects have required financing institutions with sufficient lending capacity along with the expertise to structure projects and perform due diligence. While banks are likely to retain an important role in infrastructure financing for the foreseeable future, other sources of debt financing will need to be tapped to close the infrastructure investment gap.

Outside of the banking sector, the largest pools of capital are held by institutional investors such as pension funds, insurance companies, and sovereign wealth funds.[16] In 2017, major asset owners in the OECD area, comprising pension funds, insurance companies, and public pension reserve funds, who together represent key segments of the institutional investment market, held USD 63.7 trillion in assets of which USD 11.4 trillion is theoretically available for infrastructure (OECD, 2020[166]).

Due to the typically long-term nature of their liabilities, institutional investors are considered a good match for the financing needs of infrastructure projects that have long-term and stable cash flows, notably brownfield assets. The long-term focus of many institutional investors means that they tend to have higher tolerance for illiquidity, and may seek it out in order to secure the “illiquidity premium”. Also, unlisted infrastructure exhibits a low correlation with other asset classes, which contributes to portfolio diversification. Interest from institutional investors is also fuelled by the low-return environment for traditional fixed income instruments. As a result, institutional investors are important actors for supporting the large-scale deployment of infrastructure technologies that have been proven technically and commercially.

Total combined ownership of infrastructure assets by pension funds and insurance companies domiciled in the OECD and G20 countries amounted to USD 472 billion (OECD, 2020[166]). Investment by pension funds and insurance companies in infrastructure projects are held primarily through unlisted funds and

direct project-level equity (OECD, 2019 and OECD 2020). A total of USD 380 billion of institutional investor assets are held in unlisted funds and USD 177 billion are held in project equity (OECD, 2020[166]).

However, overall allocations to infrastructure by pension funds remain limited, not even reaching 1% of AUM for those surveyed by the OECD. While many large pension funds recognise the benefits that infrastructure brings to their portfolio and have established target allocations or are planning to do so (OECD, 2020[166]), numerous pension funds have yet to include infrastructure as a component of their portfolio. Pension funds that have yet to establish allocations for infrastructure cite factors such as illiquidity, regulatory obstacles, and perceived risk as barriers to investing in the asset class (OECD, 2020[166]).

The somewhat idiosyncratic and heterogeneous nature of infrastructure investment means that a high degree of expertise and internal capacity is required for making direct investments, which may not be available to many small or medium-sized pension funds and insurance companies. Moreover, not all institutional investors exhibit a preference for illiquid infrastructure investments. For instance, defined contribution pension funds and asset managers privilege more liquid and tradeable instruments including listed stocks, and securitised products such as REITS and YieldCos (OECD, 2020[166]). Furthermore, there may be regulatory barriers to institutional investment in infrastructure.

This highlights the importance of appropriate channels and risk mitigation structures that can match the risk appetites, time horizons, and liquidity preferences of investors and thus facilitate the flow of finance into infrastructure investments. In particular, capital market instruments and vehicles that can offer a variety of risk-return characteristics, lower transactions costs, and provide somewhat greater liquidity, are crucial for expanding the universe of infrastructure investors. Further, regulatory frameworks governing institutional investors should keep pace with the development of capital market instruments and vehicles for infrastructure, enabling investment while maintain proper safeguards to maintain stability and protect ultimate beneficiaries and policyholders.

Solutions

Review and where appropriate reform capital market regulation to ensure the availability of appropriate capital market instruments and vehicles for channelling financing for infrastructure, while ensuring adequate investor protection

Capital market instruments and vehicles play a crucial role in bridging the preferences of investors -- in terms of factors such as risk tolerance and liquidity -- and the profile of investments, thus enabling financing to be channelled from asset owners to individual projects.

They also allow financing to adapt to the risk profile of infrastructure investments as it evolves throughout the project's life cycle. At the early stage of project development, risks are considered to be highest given the presence of construction risk and the uncertainty over future operations and revenues. Financing costs at that stage are correspondingly high. Equity investors during the project development and construction phase are principally project developers that have the technical capacity to manage development risks, while debt is provided by banks that have the capacity to perform due diligence and monitor the project.

Institutional investors tend to avoid taking on construction risk, and have a clear preference for projects that are operational where there is greater certainty regarding cash flows. Capital market instruments and vehicles help to create secondary markets where the original investors and lenders can offload their holdings, thereby freeing up their scarce capital and allowing them to finance new greenfield assets. Conversely, these instruments enable the participation of more risk averse institutional investors once the risk profile of a project has diminished.

A wide variety of capital market instruments and vehicles helps to cater to the preferences of different investors and adapt financing to the evolving risk profile of the project as it moves through the life cycle

(see Table 3.1 below). From the institutional investor perspective, capital market instruments may give them exposure to infrastructure assets at an acceptable risk-return ratio, and help them diversify their exposure across multiple assets. From an early stage investor or lender's perspective, it enables them to recycle their scarce capital and deploy it into new projects. From the project company's perspective, these instruments enable refinancing which helps reduce the project's cost of capital in line with the evolving risk profile of the project.

Table 3.1. Taxonomy of instruments and vehicles for infrastructure financing

<table>
<tr><th colspan="2">Modes</th><th colspan="2">Infrastructure finance instruments</th><th></th><th>Market vehicles</th></tr>
<tr><td>Asset category</td><td>Instrument</td><td>Infrastructure project</td><td>Corporate balance sheet / Other entities</td><td></td><td>Capital pool</td></tr>
<tr><td rowspan="4">Fixed income</td><td rowspan="3">Bonds</td><td>Project bonds</td><td rowspan="2">Corporate bonds, Green bonds</td><td rowspan="3"></td><td rowspan="3">Bond indices, Bond funds, ETFs</td></tr>
<tr><td>Municipal, Sub/sovereign bonds</td></tr>
<tr><td>Green bonds, Sukuk</td><td>Subordinated bonds</td></tr>
<tr><td rowspan="2">Loans</td><td rowspan="2">Direct/Co-investment lending to infrastructure project, Syndicated project loans</td><td>Direct/Co-investment lending to infrastructure corporate</td><td>Debt funds (GPs)</td></tr>
<tr><td>Syndicated Loans, Securitised loans (ABS), CLOs</td><td></td><td>Loan indices, Loan funds</td></tr>
<tr><td>Mixed</td><td>Hybrid</td><td>Subordinated loans/bonds, Mezzanine Finance</td><td>Subordinated bonds, Convertible bonds, Preferred stock</td><td></td><td>Mezzanine, Debt funds (GPs), Hybrid debt funds</td></tr>
<tr><td rowspan="2">Equity</td><td>Listed</td><td>YieldCos</td><td>Listed infrastructure & Utilities stocks, closed end funds, REITs, IITs, MLPs</td><td></td><td>Listed infrastructure equity funds, Indices, Trusts, ETFs</td></tr>
<tr><td>Unlisted</td><td>Direct co-investment in infrastructure project equity, PPP</td><td>Direct/Co-investment in infrastructure corporate equity</td><td></td><td>Unlisted infrastructure funds</td></tr>
</table>

Source: (OECD, 2015[167])

The following selection comprises a sub-set of instruments and vehicles from Table 3.1 that can enhance access to capital and mobilise institutional investors, starting with direct instruments and then considering indirect forms of investment through market vehicles, such as listed and unlisted infrastructure funds.

Direct: Infrastructure bonds

By providing liquidity and lowering the required levels of investment from individual investors, infrastructure bonds facilitate institutional investment into infrastructure debt and promote portfolio diversification. The depth and liquidity of bond markets in a number of economies mean that they can support the mobilisation

of very large amounts of capital. Further, because of their liquidity, infrastructure bonds typically have a lower cost of capital than bank loans and are thereby effective instruments for refinancing debt once a project become operational.

Project bonds can be sold to a wide investor base or be sold to a more limited set of investors, through a private placement; the latter non-public route affords more flexibility and has reduced reporting requirements, but is restricted to qualified investors. Depending on the project in question and country and capital market setting, project bonds may need to be underpinned by some form of credit enhancement in order to attract institutional investment, and keep borrowing costs manageable.

Canada has a long history of financing infrastructure through a mature and robust project bond market, allowing institutional investors to invest in infrastructure projects through relatively low-risk, tradeable securities. Its established availability-based PPP market relies on a strong supply of long-term project bonds, which provides long-term, low-cost financing in PPP projects (OECD, 2019[168]). These bonds are primarily used to finance brownfield assets and involve private placements. The sums raised can be significant; for instance, in 2016, two 100 MW solar power generation facilities each raised more than CAD 600 million through issuing privately placed bonds (World Bank, 2017[169]). On the demand side, the prevalence of defined benefit pension schemes and large annuity market in Canada may help to explain strong institutional demand for long-term project bonds, given the need for asset-liability matching (Infrastructure Australia, 2014[170]).

Direct: Green bonds

Green bonds, climate bonds, and other similar instruments are structurally akin to normal bonds but, through the labelling, and adherence to relevant standards, provide a signalling function for investors in search of investment opportunities with sustainability features, including sustainable infrastructure investment. The green bond market has been growing rapidly, albeit from a small base, due in large part to government issuance.

While most green bonds are corporate bonds that are backed by the issuing firm's balance sheet rather than the project, with bond proceeds earmarked for green projects within the corporation, green *project* bonds have recently gained traction. An example for these nascent green project bonds are the bonds financing the Campo Palomas wind farm in **Uruguay**. The USD 135.8 million bond was issued in 2017 by Invenergy Renewables LLC, ring-fenced for the specific wind farm, under the umbrella of the Inter-American Investment Corporation.

Direct: Listed infrastructure project company IPO

A number of countries facilitate direct listings of infrastructure project companies on their stock exchanges as a means of tapping financial markets for capital and broadening and diversifying their investor base. A key challenge in allowing such listings is the absence of a trading period and negative profitability for project companies in their early stages which is when they most need to raise equity capital to cover the construction phase. Securities regulators and stock exchanges typically overcome this challenge by waiving some of the listing requirements for infrastructure project companies or making them less onerous (e.g. profitability requirement), while introducing specific listing requirements, risk mitigation measures, and/or disclosure requirements to protect investors in infrastructure project company IPOs.

The Securities Commission of **Malaysia** has a well-established framework for listing infrastructure project companies (IPC) on the stock exchange. Under the IPC listing framework, an infrastructure project company qualifies for listing if it possesses the right to build and operate an infrastructure project under a minimum remaining concession or license period of 15 years (shorter if the IPC has a profit track record (Azman, 2009[171])) and with total project costs of RM500 million (USD153 million) or more. While the IPC framework waives some of the requirements that apply to standard listings, it imposes additional disclosure requirements relating to, for example, the agreement underlying the concession and construction risks that

could impact the business (IOSCO, 2014[172]). In **Hong Kong, China** the Stock Exchange of Hong Kong also allows IPC IPOs. Certain basic listing requirements relating to the trading period (minimum of three years) and financial standards can be waived if the IPC and its project(s) satisfy certain conditions. However, because of the additional perceived risks surrounding infrastructure projects, the Hong Kong Securities and Futures Commission applies a number risk-mitigation factors when considering listing applications by such companies. In **Australia**, the securities commission has developed specific disclosure guidance for listed and unlisted infrastructure entities and their advisors to ensure clear and consistent disclosures for retail investors, to enable them to understand better the characteristics of these types of entities and related investment risks (ASIC, 2012[173]).

Indirect: Unlisted funds

Unlisted funds are the most popular instrument for institutional investors, with USD 380 billion, or 37% of all institutional infrastructure investment, provided through this instrument (Kopitz, 2014[174]). Unlisted funds provide the benefits of direct investments such as illiquidity, higher returns, and low correlation with other asset classes, while delegating the responsibility for investment decisions to a specialised asset manager. Institutional investors invest in an unlisted infrastructure fund as limited partners ("LPs"). Recent OECD analysis indicates that unlisted funds are the dominant conduit for pension fund and insurance company infrastructure investments (Kopitz, 2014[174]). Unlisted funds are managed by the general partner of the fund ("GPs"), often an investment bank or investment management firm. The general partner then invests contributions to the fund in various infrastructure assets on behalf of the limited partners, i.e. the investors (OECD, 2014[175]).

Box 3.1. Green infrastructure investment through unlisted funds

Unlisted funds are not just a popular instrument for infrastructure investments in general, but are also a key instrument for making infrastructure investments greener. Only 31% of the infrastructure investments made through unlisted funds are currently allocated to green assets. This suggests that there are already substantial green investments through unlisted funds, but also considerable potential to upscale green infrastructure investment through this instrument. The key function of unlisted funds is particularly striking for pension fund investments, as the bulk (75%) of pension fund infrastructure investment is channelled through unlisted funds.

The importance of unlisted funds for greening infrastructure investment lies also in their use as a primary asset classes for investments in the real economy. More than 70% of the investments through unlisted funds (as well as through direct equity and debt) are directed towards physical assets. This means that investments through unlisted funds have an unmitigated effect on the infrastructure composition of the economy, and therefore can help to directly and quickly shift and scale up green infrastructure in countries' infrastructure portfolios.

Unlisted funds are also a welcome channel for direct public intervention. Rather than intervene at the project level, public financial institutions such as development banks or green investment banks can set up a fund or co-invest at the fund level, thereby supporting multiple projects at once. De-risking instruments or credit-enhancement techniques, among others, have successfully been deployed to mobilise institutional investment to large effect, most notably by the UK Green Investment Bank before being privatised.

Source: (Kopitz, 2014[174]); (Röttgers, Tandon and Kaminker, 2018[176])

Meridiam funds provide a good example of unlisted equity fund opportunities for institutional investors that have a time horizon and fee structure aligned with economic profile of infrastructure assets. Further, rather uniquely, many of their funds invest in greenfield projects and have a lifespan of 25-years. This provides institutional investors with access to potentially higher-returns than would be the case for brownfield assets (the average net return targeted by the fund is 11-12% over 25 years) (OECD, 2014[175]).

Indirect: Listed fund structures

Attracting investment through public equity markets may also be an attractive method for countries that lack significant scale or capacity in private markets investment, or that have growing retail investor bases, pension savings, or foreign investment in listed shares. A number of countries have established capital market vehicles to enable institutional and retail investors to invest in portfolios consisting of infrastructure investments. This can be done via a new form of a collective investment scheme or some variant such as a real estate investment trust (REIT) repurposed as an infrastructure investment trust (IIT). Through listing the units of such schemes, authorities can enable a broad range of investors, including in some cases, retail investors, to provide capital for infrastructure projects and infrastructure companies.

REITs are widely used equity instruments in the real estate sector that aggregate revenues from a variety of properties via a trust structure often providing favourable tax treatment. Extending qualifying income of REITs to infrastructure revenues or establishing a dedicated instrument such as an Infrastructure Investment Trust (InvITs) are approaches used by a number of countries to expand their equity financing options. **Turkey**, for instance, has introduced of "Infrastructure-based REITs" whose shares have to be sold to public or qualified investors (OECD, 2016[177]). **India** has established a regulation for Infrastructure Investment Trust (InvITs) that can be issued either through public offerings or private placements (PwC, 2019[178]). A number of InvITs have been created for a range of infrastructure assets, including fibre broadband, telecommunication towers, gas pipelines, and roads and highways.

Thailand's Infrastructure Funds (IFF) are closed-end mutual funds that can invest in domestic greenfield and brownfield projects, such as railways, electricity grids, waterworks, expressways, communications, and alternative energy. IFFs have been used primarily as an additional source of finance for state-owned enterprises and private companies involved in developing large infrastructure projects. IIFs where greenfield assets make up more than 30% of fund assets can be sold only to institutional investors. The country's Infrastructure Trusts are a hybrid of mutual funds and REITs; unlike IFFs, they can invest in foreign assets and borrow up to three times their equity. In **Indonesia**, Infrastructure Investment Funds can be offered to the public and are designed to channel investment funds to public infrastructure projects.

Securitisation

Securitisation refers to the process of aggregating assets or financial flows and covers a wide variety of instruments (e.g. Yieldcos, CLOs, etc.). Securitisation reduces transaction costs, diversifies idiosyncratic risk, and creates liquidity for unlisted assets. Structured debt instruments in the form of collateralised loan obligations (CLOs) that package loans and distribute them as asset-backed securities not only provide investors with needed liquidity, but have the added benefit of further tailoring the risk profile of instruments to accommodate the risk preferences of different investors.

There have been a few innovative attempts to apply the securitisation model to the infrastructure sector, despite the challenges posed by the heterogeneity of infrastructure assets. **Singapore**, for example, has supported the establishment of an Infrastructure Take-Out Facility, Bayfront Infrastructure Capital (BIC), to mobilise institutional capital for infrastructure debt in Asia-Pacific and the Middle East (Box 3.2).

Box 3.2. Bayfront Infrastructure Capital (Singapore)

Bayfront Infrastructure Capital (BIC) is an Infrastructure Take-Out Facility (TOF) that serves to mobilise institutional capital for infrastructure debt in Asia-Pacific and the Middle East. It does so by facilitating the transfer of exposure in long-term project and infrastructure loans from banks to institutional investors, enabling the recycling of bank capital into new infrastructure lending.

The TOF was designed and structured by Clifford Capital, a specialist arranger and provider of project and structured finance solutions to Singapore-based companies. Clifford Capital is supported by the Government of Singapore and also acts as both the sponsor and manager of the facility.

The portfolio comprises infrastructure loans for projects spread across 16 Asian and Middle Eastern economies. The projects largely have stable and predictable long-term cash flows, including through offtake agreements entered into with counterparties including major global corporates, state-owned enterprises, and government or government-linked sponsors. The underlying project and infrastructure loans were sourced from leading commercial banking institutions.

The portfolio loans have been bundled into three investment grade rated notes that are listed on the Singapore Exchange. A separate unrated subordinated note serving as a first-loss tranche and corresponding to 10% of the total issue has been retained solely by Clifford Capital, thus providing credit enhancement to the senior notes.

BIC fulfils several objectives, including addressing Asia-Pacific's infrastructure financing gap by mobilising institutional capital, unlocking additional capital by facilitating capital recycling by banks, and addressing market frictions.

Source: (OECD, 2019[179]; Bayfront Infrastructure Capital, 2018[180]; Clifford Capital press release, 2018[181]) OECD 2019; Global Trade Review (27 July 2018), "Clifford Capital launches Asia's first project finance securitisation" www.gtreview.com/news/asia/clifford-capital-launches-asias-first-project-finance-securitisation/; Bayfront Infrastructure Capital, webpage, https://www.cliffordcap.sg/bayfront-infrastructure-capital (accessed 20 September 2019); and Clifford Capital press release (25 July 2018), "Inaugural Infrastructure Project Finance Securitisation in Asia", https://www.cliffordcap.sg/resources/ck/files/20180725%20Press%20Release%20-%20TOF.pdf.

Islamic finance

İslamic finance practices which have risk-sharing aspects and an asset-based approach are well-suited for financing infrastructure assets and can play a vital role in mobilising domestic and international private resources for quality infrastructure investment. Sharia compliant financial instruments such as sukuks can help to widen the investor base for infrastructure. The Indonesian government for example has issued sharia-based financing (sukuk) to encourage both domestic and foreign sharia financial institutions and other Islamic funds (such as Hajj Fund) to participate in financing infrastructure development. In early 2019, the government of Indonesia issued USD 750 million of green sukuks with a five-and-a-half year tenor and USD 1.25 billion of regular sukuks with a 10-year tenor, both of which were oversubscribed (OECD, 2019[168]).

Enable the development and pooling of infrastructure expertise and collaborative investments

Certain large pension funds have developed specialised expertise in infrastructure investing, and are active across the infrastructure investment life cycle, including upstream in the planning and design phases (Box 3.3 further below). However, not all institutional investors have the size, experience and capabilities to be so actively involved in the infrastructure investment process. Moreover, regulatory restrictions on unlisted investments may impede their ability to invest in infrastructure and develop related expertise.

Collaboration platforms enable groups of investors (either of a similar class or of different classes) to pool investments thus benefiting from economies of scale, lower fees (through bypassing third-party fund vehicles), access to expertise, and diversification of risks. Such platforms are particularly relevant for smaller institutional investors that lack the internal skills and financial capacity to pursue transactions independently. When different classes of investors come together within a platform they not only pool resources, but they can bring together complementary financing capabilities, skills, and risk bearing capacity.

For example, IFM Investors is an investor-owned fund manager initially created by **Australian** superannuation funds. It invests on behalf of institutional investors including superannuation and pension funds, sovereign wealth funds, insurers, endowments, foundations and universities. Infrastructure represents an important component of its portfolio with USD 44.5 billion in AUM. Ownership by 27 pension funds ensures that its interests are aligned with those of its investors. Recently, in **Sweden**, three National Pension Funds set up a jointly owned infrastructure holding company to undertake direct investments in infrastructure-related companies (see Box 3.3).

Box 3.3. Polhem Infra

In 2019, a group of Swedish National Pension Funds (AP1, AP3 and AP4) formed new investment holding company aimed at making direct investments in Swedish or Nordic unlisted companies in the public and private sector that are focussing on infrastructure. The focus of investments relates to energy, transport, renewables, and communication infrastructure.

Investments will primarily be made alongside other long-term industrial or financial partners or otherwise solely. A key criterion for partnerships is that the actors share its view on sustainability, and act in a way that is socially, environmentally, and financially sustainable.

Polhem Infra is an active investor seeking to strengthen, develop, and refine the long-term business of its investee companies. Polhem Infra has indicated that it is ready to commit to holding periods of 50-100 years for investments in unlisted Nordic energy companies (mainly owned by municipalities), unlike typical private equity holding periods of seven years.

The formation of Polhem Infra required changes to Swedish pension investment legislation, allowing public pension funds to make investments in unlisted companies through an unlisted holding company. The funds are not allowed to assume operational management of these holding companies; moreover, the limit on voting control of these holding companies is set at 35 percent for each fund. The changes also removed the requirement for the funds to invest at least 10 percent of assets with external fund managers. In setting forth these and other related reforms enabling more flexibility in pension funds investments, the Swedish Minister of Finance considered the reforms would increase the AP funds' opportunities for higher returns and for more long-term sustainable investments.

Sources: (Polhem Infra, 2020[182]), (The Law Reviews, 2017[183]), (IPE, 2019[184]), (European Pensions, 2019[185])

Identify and where appropriate address unnecessary regulatory barriers, while ensuring protections for beneficiaries and fulfilling prudential and market integrity objectives

Private sector investors have noted varying regulatory treatment across jurisdictions of portfolio-level unlisted infrastructure debt and equity investments amongst pension funds and insurance companies. Regulatory restrictions (e.g. quantitative limits) or risk-based capital charges can be particularly acute in relation to emerging markets, with clear distinctions being made between OECD and non-OECD

economies. Investors noted that such treatment may not accurately reflect the actual risk within in a region or economy (G20/OECD, 2020[186]). Further, concerns have been registered about the impact of bank regulatory reforms on bank lending to infrastructure projects, particularly in emerging markets.[17]

Regulatory frameworks for institutional investors may need to be sufficiently flexible or evolve to allow for, or encourage, innovative models and partnerships, enabling new sources of capital for infrastructure to be tapped and a better deployment of capital. For instance, efforts among pension funds to pool assets dedicated to infrastructure and build economies of scale have been witnessed in several countries (see above), which may require legislative or regulatory changes. There may also be regulatory barriers to institutional investors making direct loan financing of infrastructure, without the intermediation of a bank.

Pension fund regulation is notable for its variation across jurisdictions, with different forms and methods in place by regulators. Quantitative limits on certain portfolio investments, such as in equity investment, or in private markets, could limit a pension fund's ability to invest in certain infrastructure assets (G20/OECD, 2020[186]). In some cases, restrictions may not reflect the actual risk profile of infrastructure investments.

In **Canada**, for example, legislative amendments have been made to permit life and health insurance companies to make long-term investments in public infrastructure. In particular, a federal life and health insurance will, subject to conditions to be specified via regulations, be able to acquire control of, or acquire or increase a substantial investment in, a permitted infrastructure entity, that is, an entity that only makes investments in infrastructure assets or engages in any other permitted activities (OECD, 2019[168]). In **Chile**, legislative measures were introduced in 2016 that aimed to facilitate different sources of financing for infrastructure, while at the same time tackling the low-yield environment in order to improve attainable returns by both the pension funds and insurance companies. Specifically, the measures enabled pension funds to invest in alternative assets, including those linked to infrastructure (OECD, 2019[168]).

Establish mechanisms to promote greater transparency with regard to public sector financial liabilities

Private financing of public infrastructure may generate a number of fiscal risks which need to be acknowledged, understood, and managed (see Chapter 2 for guidance on managing fiscal risks). Public-private partnerships, when funded through government payments (availability payments), create long-term financial obligations similar to those incurred through debt. The provision of public guarantees (see below for a discussion of the role of guarantees in the context of risk mitigation) to support private investment generates contingent liabilities that, if realised, can undermine fiscal sustainability. Transparency with regard to these various forms of public sector liabilities is a crucial prerequisite for managing fiscal risks.

Private sector lenders and investors also have an interest in ensuring that the indebtedness of borrowing countries remains sustainable. The disclosure of liabilities assists in the assessment of debt sustainability and thus promotes financial stability. Private sector participants can contribute to greater debt transparency through applying the voluntary *Principles for Debt Transparency*, developed by the Institute of International Finance (IIF), in their infrastructure financing activities.

b) Shaping the risk profile of projects through risk mitigation and incentives

Challenges

From the perspective of an investor, the financial success of an investment in an infrastructure project depends fundamentally on the ability of the project to generate a steady stream of cash flows that enables the investor to earn an acceptable return on capital. Uncertainty over future revenue streams therefore constitutes a key obstacle to private sector investment in infrastructure. Factors that might reduce, disrupt, or delay those cash flows are sources of risk.

Due to the idiosyncratic, illiquid, and long-term nature of most infrastructure projects, infrastructure investments are characterised by a complex array of risks spanning the political and regulatory environment, the macroeconomic and business environment, and the technical aspects of a project (Table 3.2). Moreover, these risks evolve over the life cycle of a project. The non-recourse[18] nature of many infrastructure investments further amplifies the importance of understanding the risks associated with a given project, given that lenders will be limited to access to the cash flow and assets of the project company in the event of default. The risk profile of investments and the ability of investors to manage, mitigate, or transfer those risks is therefore a key determinant of investor appetite for infrastructure. As a consequence, investing in infrastructure involves, at its core, rigorous risk analysis, risk allocation, and risk mitigation.

It follows that a major obstacle to mobilising financing at scale for infrastructure projects is the difficulty in properly assessing, mitigating, and transferring risks. First, many of the risks affecting infrastructure investments relate to the general political, economic, and regulatory environment over which investors have no control and often limited insight. Second, the delivery process itself, particularly for large non-standardised assets, is an inherently complex and uncertain venture involving numerous actors and is highly sensitive to unanticipated events (Flyvbjerg, 2017[187]). The long-term nature of infrastructure projects means that investments are vulnerable to unforeseen (and in many cases unforeseeable) developments that can impact key financial variables (revenues and costs).

Table 3.2. Risks related to infrastructure assets over the project life cycle

<table>
<tr><th>Risk Categories</th><th>Development Phase</th><th>Construction Phase</th><th>Operation Phase</th><th>Termination Phase</th></tr>
<tr><td rowspan="6">Political and regulatory</td><td>Environmental review</td><td>Cancellation of permits</td><td rowspan="2">Change in tariff regulation</td><td>Contract duration</td></tr>
<tr><td rowspan="2">Rise in pre-construction costs (longer permitting process)</td><td rowspan="2">Contract renegotiation</td><td>Decommission</td></tr>
<tr><td>Asset transfer</td></tr>
<tr><td colspan="3">Currency convertibility</td></tr>
<tr><td colspan="4">Change in taxation</td></tr>
<tr><td colspan="4">Social acceptance</td></tr>
<tr><td colspan="4">Change in regulatory or legal environment</td></tr>
<tr><td colspan="4">Enforceability of contracts, collateral and security</td></tr>
<tr><td rowspan="5">Macroeconomic and business</td><td>Prefunding</td><td colspan="3">Default of counterparty</td></tr>
<tr><td rowspan="3" colspan="2">Financing availability</td><td colspan="2">Refinancing risk</td></tr>
<tr><td colspan="2">Liquidity</td></tr>
<tr><td colspan="2">Volatility of demand/market risk</td></tr>
<tr><td colspan="4">Inflation</td></tr>
<tr><td colspan="4">Real interest rates</td></tr>
<tr><td colspan="4">Exchange rate fluctuation</td></tr>
<tr><td rowspan="6">Technical</td><td colspan="3">Governance and management of the project</td><td rowspan="5">Termination value different from expected</td></tr>
<tr><td colspan="3">Environmental</td></tr>
<tr><td>Project feasibility</td><td rowspan="2">Construction delays and cost overruns</td><td rowspan="2">Qualitative deficit of the physical structure/ service</td></tr>
<tr><td>Archaeological</td></tr>
<tr><td colspan="3">Technology and obsolescence</td></tr>
<tr><td colspan="4">Force majeure</td></tr>
</table>

Source: (OECD, 2015[167])

The COVID-19 crisis has added a new layer of uncertainty to infrastructure investment particularly with regard to future demand, and has also highlighted the need for robust, resilient business models and financial structures, capable of withstanding shocks and stresses, and for an ability to dynamically manage risks, which requires a collaborative approach with governments.

The failure to secure financing for many projects therefore often boils down to investors not being willing to accept a certain level of risk and/or insufficient returns to compensate for a given level of risk. Under such circumstances, external support can shift the risk-adjusted return of a project and thus change the calculus of the investor. External support can come in a number of forms including: (i) influencing the overall level of risk; (ii) promoting risk mitigation mechanisms that reduce exposure to a particular risk; and (iii) providing incentives that increase returns thereby justifying a given level of risk.

Government intervention can play a role in providing external support for each of these categories. However, government intervention should be carefully calibrated to address those risks that the private sector is unable to influence and for which the private market has insufficient risk-bearing capacity. Moreover, such support should be closely aligned with the government's priorities.

By ensuring targeted support, governments can use limited amounts of public funds to catalyse much larger amounts private financing for infrastructure projects. Carefully calibrated government intervention can facilitate the financing of certain projects through lowering or transferring specific risks. The overall cost and related contingent liabilities should be considered in the provision of guarantees and incentives (see Chapter 2 for guidance on managing fiscal risks associated with infrastructure investments).

Solutions

Influencing the overall level of risk

Ensure stable and appropriate legal and regulatory frameworks, along with supportive governance and investment environments that can attract quality infrastructure investment

Governments influence the general level of risk associated with infrastructure investments through establishing a sound and impartial legal framework that ensures the enforcement of contracts, along with stable rules and a fair tax regime that provide a strong degree of certainty and transparency for investments. For regulated assets, a stable regulatory framework is paramount for providing certainty to investors. In addition, specific areas that shape risk for investors over which governments exert control include investor protection (including protection against expropriation and insolvency regimes) and dispute resolution mechanisms.

Good public governance of infrastructure as outlined in Chapter 2 also plays a key role in instilling confidence among private investors. Investors, particularly long-term investors, expect governments to be a competent and reliable partner, and to promote a stable business climate for investment. Making investment more attractive for the private sector will necessarily depend on ensuring a well-managed project with a sound preparation phase, and building confidence around revenue flows and sources.

Ensure stable, reliable and diverse sources of funding [19]

Stable and reliable sources of funding, whether based on user fees, availability payments, or a combination of the two, are essential for providing private investors with the necessary confidence for making long-term commitments. Funding sources can be established through contracts, as in the case of PPPs, or through regulation, as in the case of regulated assets. When assets are funded primarily through user fees, it is important that such fees, particularly when paid by consumers, are set at levels that are affordable and perceived as fair.

However, not all projects will generate sufficient revenues from user fees to cover costs and provide investors with adequate returns. Under such circumstances, diversifying sources of funding can create a more robust financial foundation for investors. For example, the **United States** has established a Center for Innovative Finance Support under the Federal Highway Administration that encourages state and local jurisdictions to look for new revenue sources through value capture to address funding shortfalls, and

provides technical assistance in these areas. These sources can include development impact fees, joint development, land value tax, sales tax districts, or tax increment financing (TIF) (OECD, 2019[168]).

Seek to minimise environmental and social risks during the project preparation phase, and provide full transparency regarding these risks to investors

As the contracting authority for most infrastructure projects with responsibility for delivering projects, governments have a strong influence over many of the environmental and social risks that could afflict infrastructure projects. Contracting and planning authorities make many of the key early decisions that shape the risk profile of the project, namely its nature and location. They are also responsible for developing feasibility studies and environmental impact assessments, and mitigating many of the environmental and social risks.

As noted further below, institutional investors are increasingly concerned with ESG issues. For governments seeking to mobilise institutional investment, it is important that they provide full transparency to investors with regard to risks relating biodiversity, cultural heritage, land rights, and other social and environmental issues, and, where possible, to mitigate them.

Risk mitigation mechanisms

Promote diversified risk mitigation instruments and incentives that can support a variety of different investor types and financing modalities (equity, bank loans, debt), based on an assessment of financing needs and market capacity, and contingent liabilities

Risk transfer mechanisms are used principally for risks that the investor is unable to manage or influence such as political risk. There are many different types of risk transfer mechanisms, including contractual mechanisms, insurance policies, or guarantees. Risk transfer mechanisms can consist of legal instruments (construction contracts) and market-based solutions (private insurance), or guarantees and other forms of credit enhancement, such as subordinated debt, provided by the public sector. Further, risk transfer mechanisms can address a single risk (e.g. political risk insurance or minimum revenue guarantees) or be comprehensive (e.g. credit guarantees that protect against default irrespective of the cause).

Market-based solutions such as private insurance are only available for certain risks (those that satisfy criteria of insurability), and even for insurable risks capacity in the private markets might be limited, particularly for the longer tenors required for infrastructure projects.[20] When market instruments are unavailable or provide insufficient protection, public intervention may become necessary in order to facilitate private sector involvement. This is particularly the case when implementing financing solutions that involve the participation of institutional investors with lower risk appetites. Further, the provision of private insurance is often conditional on the existence of a public sector guarantee as a backstop.

Guarantees

Guarantees provided by the public sector (including governments, development banks, specialised agencies, and multilateral development banks (MDBs)) can cover a wide range risks that impact various actors in the infrastructure financing ecosystems. For guarantees to be credible, they typically require the backing of the Ministry of Finance or an MDB.

Minimum revenue guarantees provide protection against demand and revenue risk for the project company (and by extension to the investors) by supporting operational cash flows. Guarantees can also backstop the payments obligations of state-owned off-takers or the availability payments of contracting authorities. Further, some guarantees may focus on protecting specific financial instruments such as bank loans or bonds. For instance, credit guarantees cover some (partial guarantees) or the entire amount (full

guarantees) of debt service in the event of default. Guarantees can be provided as part of a blended finance transaction (see section 3a below).

In the **United States**, the Federal government provides support for state and local governments seeking to finance large-scale transportation projects with tolls and other forms of user-backed revenue, but which might face difficulties in obtaining financing at reasonable rates due to uncertainties associated with such revenue streams. The Transportation Infrastructure Finance and Innovation Act (TIFIA) program provides credit assistance for qualified projects of regional and national significance through loans, loan guarantees, and lines of credit. The preferred approach is the use of guarantees. The goal is to attract private and other non-Federal co-investment in surface transportation (OECD, 2019[168]).

For governments to make effective use of guarantees, they should establish ex ante clear and transparent rules regarding the types of guarantees that can be offered and the requirements and criteria governing their use, as well set clear global limits on the overall level of liabilities that can be supported. For example, **Mexico**'s national development bank, Banobras, clearly sets out the types of guarantees it offers for infrastructure projects and municipal subnational governments (Box 3.4).

Box 3.4. Case study: Guarantees provided by Mexico's national development bank

The National Bank of Public Works and Services (BANOBRAS) is the Mexican development bank responsible for infrastructure financing. BANOBRAS was given the authority to offer new financial guarantees in order to increase private sector investment in public infrastructure projects.

BANOBRAS provides a range of financial guarantees for both states and municipalities, as well as for projects:

- **Securities debt guarantees:** These guarantees can be used to support bonds issued to the market by project developers.
- **Bank guarantees:** These guarantees support the debt service the project must pay to a bank due to contracted loans.
- **Guarantees for service provision projects:** These guarantees are intended to cover the periodic payment obligations of the contracting units derived from the service provision contracts signed with the suppliers of the service.
- **Pari-passu guarantees** are other similar schemes with the main difference that losses are assumed pro rata between BANOBRAS and commercial banks.

Source: (OECD, 2019[168])

In **Indonesia**, the Indonesia Infrastructure Guarantee Fund (IIGF), a state-owned company, makes guarantees available for well-structured PPPs with the aim of providing more certainty in achieving financial closure, by way of improving the creditworthiness or bankability of PPP projects. The IIGF guarantees are also intended to increase transparency, clarity, and assurance in the provision of guarantees. The IIGF cooperates with development partners in order to increase its guarantee capacity (OECD, 2019[168]).

Subordinated debt

The use subordinated debt and mezzanine debt serves a similar function as partial guarantees by absorbing losses before senior issues, thus having the effect of raising the credit quality of senior tranches. Subordinated debt/mezzanine debt can be provided by development banks and other public lenders as a way of incentivising participation by commercial banks or institutional investors in the debt issued by a project company.

Asset recycling

As described above, construction risk and uncertainty associated with future revenues from a project represent significant obstacles to mobilising private capital for infrastructure. Partly as a consequence, the supply of infrastructure investment opportunities often does not match the risk appetite of many investors, including institutional investors.

Australia successfully pioneered an approach called asset recycling which goes a long way to address this mismatch. Under the Australian Asset Recycling Initiative (ARI), Australian States made the initial investment covering the project development and construction phase. Once the project became operational, the asset was sold to private investors, and the proceeds were reinvested in new infrastructure development. The Australian federal government supported this scheme by providing incentive payments of 15% of sale proceeds to the state governments. The ARI served to unlock over $AUS 17 billion in infrastructure spending (Jaggers, 2018[188]; OECD, 2019[168]).

By separating the early, more volatile phase of the project during which cash flows are much more uncertain, from the operational phase when cash flows are visible, stable, and predictable, contracting authorities can attract a wider range of investors (including institutional investors), and thus lower the cost of capital. Asset recycling effectively allows governments to unlock the monetary value of assets on their balance sheets in order to create new infrastructure at no additional cost to taxpayers.

Asset recycling is a concept that can be adapted to different contexts and circumstances, the main idea being that owners of infrastructure assets can sell or lease them, permit broadened ownership over them (thus dilutive of control), or cede revenues, in order to tap capital for new, greenfield investment. For instance, in **Thailand**, the initial assets of the Thailand Future Fund, an infrastructure fund (IFF) launched by the Thai government, were two expressways of the Expressway Authority of Thailand (EXAT), of which 45% of net toll revenues were transferred to the fund through a Revenue Transfer Agreement (RTA). EXAT was able to use the proceeds from the transfer of revenues to develop new greenfield projects (OECD, 2019[168]).

Enhancing returns

Where appropriate, consider the targeted use of incentives that can enhance the risk-return profile of investments

Government can also address the return side of the equation as a way of stimulating private investment. Various forms of grants and tax incentives can increase the returns to equity or debt holders. These types of incentives are particularly relevant for projects that have high social returns, but lower private returns.

Grants consist of payments usually made by the contracting authority to the entity executing the project (OECD, 2015[167]).These payments can be of monetary nature or in-kind, for example through the contribution of land or assets. Capital grants, for example, reduce to the total capital outlay for the project thus enhancing returns for equity investors. In **India**, for example, the Viability Gap Funding Scheme (VGF) provides financial support in the form of grants, one time or deferred, to certain PPP projects to make them commercially viable by covering up to 20% of the capital cost of a project (OECD, 2016[177]).

Tax incentives can be applied to a wide range of taxes (property, corporation tax, dividends, capital gains, etc.) and can thus be tailored to specific components of the capital structure. Reduced tax rates on dividends and capital gains have a similar effect as capital grants and increase returns to equity holders.

Grants and tax incentives need to be with used with prudence, however, in order to avoid distorting the competitive landscape or undermining fiscal sustainability.

c) New forms of public-private collaboration

Challenges

The PPP market has seen some decline in recent years, with confidence being reduced on the public or private side, for various reasons, including for instance renegotiations. Furthermore, a number of countries in emerging and developing economies are reluctant to adopt PPP models. Private participation in PPPs have fallen globally in the past decade, gradually declining from USD 55 billion in 2010 to USD 30 billion in 2019; as a share of private infrastructure investment, private participation in PPPs has fallen from 36 percent to 28 percent (GIH, 2020[189]). Aside from considering the issue of how PPP models can be strengthened, this development also raises the question of whether new collaboration models for infrastructure projects beyond PPPs can provide a mechanism for involving private sector capital. Innovative partnership models involving central governments and especially local authorities are needed to build comfort with private sector capital and support long-term collaboration (G20/OECD, 2020[186]).

Solution

Consider innovative collaborative models beyond PPPs that involve a long-term vision and a sharing of risks and rewards over time

New forms of collaboration between the public and private sector have emerged in which there is a long-term vision and risks and rewards are shared over time, with a view to ensuring mutual confidence and trust. This can extend to, and include, the greenfield investment stage: there is scope to tap interest from a growing class of institutional investors seeking to provide financing for the entire life-cycle, both greenfield and brownfield; and there are very large investors focussing on greenfield assets given the greenfield "premium" (G20/OECD, 2020[186]).

Collaboration could involve, for instance, large public pension funds leading major public infrastructure projects and thus being actively involved in the design and development phases, as has been the case in **Canada**, with the direct involvement of CDPQ Infra in the development of a new light rail system (REM) in Montreal (see Box 3.5), an approach that has gathered some international interest[21]. Once completed, the REM will be the fourth-largest automated transportation system in the world after Singapore, Dubai, and Vancouver (The Law Reviews, 2017[183]).

Another model could be a common ownership approach in which public sector authorities or publicly owned utilities recycle part of their assets and establish co-ownership with long-term investors, who are minority shareholders but have enough influence to develop assets together with the authorities (G20/OECD, 2020[186]). For instance, Infranode and Mirova have worked together, through a common fund, to acquire partial ownership of energy companies owned by municipalities in the Nordic region. For instance, in 2019, they entered into an agreement to buy a minority stake (33.9 percent) in the Finnish energy utility company Loiste, from two Finnish municipalities. The transaction has allowed Loiste to recycle capital for other uses.[22] This type of model provides an opportunity for small unlisted utility companies to access capital and undertaken new investments, including those required to meet increasingly strict emission targets.

Box 3.5. CDPQ Infra and the new Montreal light rail system (REM)

The Caisse de dépôt et placement du Québec (CDPQ) is a Canadian institutional investor that manages the assets of the Quebec public pension plan and a number of other Quebec pensions. With over CAD 330 billion under management, it is the second-largest pension investor in Canada. The mandate of the fund as set out in its founding statute includes, in addition to achieving an optimal return on capital for its depositors, to contribute to Quebec's economic development.

The Caisse has a 20-year track-record of investing directly in infrastructure projects, and infrastructure amounted to 8.1% of its total portfolio at the end of 2019. In 2015, CDPQ established CDPQ Infra, an investment holding company that plays the role of developer for certain infrastructure projects by providing integrated management of the planning, financing, construction, and operating phases. By leveraging its extensive expertise in infrastructure investing, CDPQ Infra seeks to add more value and retain more risk by controlling the upstream development, and thus potentially generate higher returns.

CDQP Infra's first investment is in the Réseau Express Métropolitain (REM), a new fully automated and electrified 67-km light rail system in Montreal to be built, in which it has invested CAD 2.95 billion (total cost of CAD 6.3 billion) representing 70% of the project's equity. It expects to earn a return on equity of 8-9%. The Quebec government has provided a CAD 1.28 billion subordinated equity investment. The Canada Infrastructure Bank has provided $CDN 1.28 billion, 15-year secured loan. The Quebec government will be funding the operation of the REM based on assumed operating costs[23] per passenger.

According to an agreement published in 2015, when the Quebec government decided to invest in the privately-led project, returns are to be shared based on return thresholds. A priority return is first allocated to CDPQ Infra, reflecting its role as project developer and operator, and its assumption of construction, ridership, and operating risks. After this threshold is met, dividends are mainly paid to the government until a minimum target rate of return (deemed to be equivalent to the cost of borrowing for the government) is reached. Thereafter, dividends are paid out in accordance with ownership interests. The shared equity participation is intended to create an alignment of private and public interests, with the government able to capture an upside return, with CDPQ Infra holding the downside risk[24].

There is also a mechanism for sharing revenues generated by increases in land values of properties adjacent to the stations (see land value capture in Chapter 4), with CDPQ Infra expected to receive CAD 512 million. It will also benefit from royalties from adjacent new property developments.

The Quebec Government's financing of the investment into REM was enabled through the issuance of its fourth Green Bond, intended to fund public transit projects, and mainly the REM.

Sources: (CDPQ Infra, 2017[190]), Infrastructure Investor (September 2019), Quebec Ministry of Finance

d) Incentives and disclosure for improved sustainability

Challenges

Private investment in infrastructure not only needs to be scaled-up but it ultimately must be directed towards investments that are aligned with key policy priorities that contribute to a strong, inclusive, and green recovery. If private infrastructure investment flows towards projects that are carbon intensive and polluting, then it will lock-in emissions and contribute to environmental degradation over the lifetime of the asset. Further, infrastructure investments that fail to provide benefits for communities, or cause harm to those communities, represent a net cost to society and are more prone to failure.

As discussed in Chapter 2, governments can influence the direction for infrastructure development through choices made during the course of project planning, preparation, and procurement. However, for regulated or merchant infrastructure, governments have less of a direct influence on investment choices. In this case, incentives provided through sectoral regulation and financial markets can help steer infrastructure towards policy priorities, while possibly also supporting the management of investment risks.

Increasingly, institutional investors and asset managers are seeking to manage ESG-related risks in their infrastructure investments, to preserve and enhance asset value over time and obtain downside protection (OECD, 2020[191]). ESG factors feature as key sources of risk for infrastructure projects, given for instance the importance of social acceptance, governance, and management, and environmental characteristics and impacts. The long lifespan of infrastructure assets, and the central role of infrastructure in economies and societies, and its wide-ranging impacts, mean that ESG factors can generate political, regulatory, and reputational risks (e.g. adverse change in regulation) over the infrastructure life cycle.

Elements of an ESG ecosystem are coalescing with, for example, the development of various standards and performance benchmarks for sustainable infrastructure. However, the ESG investing services industry as it relates to infrastructure is still relatively immature and some investors complain of a lack of consensus over definitions and standards for sustainable infrastructure, and of insufficient data to support decision-making (OECD, 2020[191]).

Solutions

Adopt regulatory frameworks for regulated infrastructure networks that align incentives with policy goals

As noted above, a significant proportion of infrastructure investment is undertaken by corporations operating in regulated or competitive markets, such as in the case of electricity or communication networks. In such sectors, regulation will be crucial for shaping the quantity of investment. Regulation will also need to facilitate the transition of infrastructure systems towards a low-carbon future. This is particularly the case for electricity systems which need to accommodate much higher levels of renewable and distributed generation resources, enable prosumerism, promote energy efficiency, and integrate smart technologies for managing demand.

Traditional regulatory approaches based on cost-of-service compensation models are a barrier to innovation and modernisation as they tend to incentivise over-investment in capacity, since additions to the capital stock translate into higher revenues. While investments to increase the capacity of electricity networks will be necessary to meet growing demand (for example, due to electrification of transport) and accommodate greater variability, a balanced approach that also integrates demand-side measures and promotes innovative approaches can ensure that grid enhancement takes place in a cost-effective way.

Regulatory frameworks therefore need to evolve from mechanisms that privilege inputs to approaches that incentivise outputs. Performance-based regulation (PBR) is a regulatory approach that seeks to align the interest of the network operators with those of customers and wider policy goals. PBR sets out the objectives for the system expressed in specific criteria and metrics, and provides network operators with considerable discretion in terms of how to achieve those objectives. The measured performance against these metrics can then be reflected in the operators' remuneration (for instance, through adjustments to the operator's cost of capital or bonus payments) (Phillip Baker, 2019[192]).

For example, **Italy**'s power system has been experiencing a rapid expansion of intermittent renewable energy resources and distributed generation, particularly in the south of the country which has led to congestion and reverse power flows[25]. In order to ensure that the network adapts to a more decentralised model, Italy's network regulator ARERA is introducing an output-based incentive scheme to encourage

smart grid roll-out. The scheme proposes two output metrics that seek to capture the extent to which the network can accommodate distributed generation supported by bonus payments (Phillip Baker, 2019[192]).

Promote disclosure of sustainability strategies and ESG risks

Investors are increasingly recognising that non-financial ESG risk factors can have a material impact on risk-adjusted returns and long-term value (OECD, 2020[191]). An essential condition for improved risk management is better disclosure of long-term risk factors by both corporations and financial intermediaries, and how these risks are being actively managed and mitigated – but also how related opportunities are being seized. The FSB's Task Force on Climate-Related Financial Disclosures (TCFD) provides a voluntary framework for analysing and disclosing climate-related financial risks and opportunities for use by companies in providing information to investors, lenders, insurers, and other stakeholders. The recommended disclosures relate to governance, strategy, risk management, and metrics and targets.

A number of countries have instituted reporting requirements relating to ESG practices. In **France**, for example, asset managers, pension funds, and insurance companies must provide information not only on how they integrate ESG factors in their investment and voting decisions but also on the climate risks they face and how their portfolio construction contributes to the transition to a low-carbon economy (OECD, 2020[166]). **New Zealand** has recently announced that all banks, institutional investors, and publicly-listed corporations will be required to disclose climate risks in line with TCFD requirements by 2023. Further work is needed, however, to ensure that corporate ESG disclosures, ratings, and investment communications processes are consistent, transparent, and effective (OECD, 2020[191]).

Facilitate consensus over definitions and standards for sustainable infrastructure

While green bonds are helping to match ESG or climate-oriented investors with green projects, there have been concerns about "greenwashing. A number of government-led initiatives are underway to help establish standards or definitions for sustainable investing through the creation of sustainable finance definitions or taxonomies. For example, in June 2020, the **European Union** adopted a Regulation on the establishment of a framework to facilitate sustainable investment, usually referred to as "the EU taxonomy" (see Box 3.6). Other countries have also developed official definitions of sustainable finance, or are considering doing so: to name a few, People's Republic of China (**China)**, **India**, **Canada**, the **United Kingdom**, **New Zealand**, **Singapore** (OECD, 2015[167]). Taxonomies and other forms of labels provide much needed clarity for investors, and thus help to lower transaction costs. The EU-supported International Platform on Sustainable Finance has established a working group to work toward a "common ground taxonomy" to highlight the commonalities among existing taxonomies, with a view to enhancing transparency on definitions and contributing to the scaling up of cross-border green investments[26].

Efforts to develop labels are being extended to the infrastructure sector through a number public-private collaborations. For instance, FAST-Infra is an initiative involving the International Finance Corporation, OECD, Global Infrastructure Facility, Climate Policy Initiative, and HSBC, and which aims to scale-up financing for sustainable infrastructure in developing countries. A core element of FAST-Infra is the creation of a sustainable infrastructure label that would be applied to infrastructure assets, thus providing a signal to investors regarding the sustainability features of specific investments. Also, the Blue Dot Network, an initiative promoted by the governments of the **United States**, **Japan** and **Australia** in consultation with private sector, is seeking to develop a certification scheme for infrastructure projects that satisfy certain environmental, social, governance, and financial standards, so as to attract global investors.

Box 3.6. The EU taxonomy for sustainable activities

The European Commission put forward in March 2018 an action plan on financing sustainable growth that called for the establishment of an EU classification system for sustainable activities, an EU taxonomy. The Taxonomy Regulation entered into force in July 2020.

The EU taxonomy aims at defining which economic activities can be considered as sustainable as per European legislation. The definition of sustainability includes social elements on top of environmental objectives. The six environmental objectives identified for the purposes of the taxonomy are:

- Climate change mitigation;
- Climate change adaptation;
- Sustainable use and protection of water and marine resources;
- Transition to a circular economy;
- Pollution prevention and control;
- Protection and restoration of biodiversity and ecosystems.

For an economic activity to be considered taxonomy-compliant, it must:

- Contribute substantially to one or more of the environmental objectives;
- Do No Significant Harm to any other environmental objective;
- Comply with minimum social safeguards (the OECD Guidelines for Multinational Enterprises and the UN Guiding Principles on Business and Human Rights, including the International Labour Organisation's ('ILO') declaration on Fundamental Rights and Principles at Work, the eight ILO core conventions and the International Bill of Human Rights).

Source: (OECD, 2020[193])

Multilateral development banks (MDBs) are working with relevant private initiatives to develop an Aligned Set of Sustainability Indicators for infrastructure – ASSI. ASSI is a collaboration between international sustainability standard-setters (GIB, CEEQUAL, ISI, ISCA and GRESB), along with DFI partners (WB PPIAF and GIF, EBRD, IADB). No data is collected by ASSI; it defines a set of core indicators which are drawn from member inputs. The indicators do not entirely capture the complexities that sustainability entails, but they do capture the market view of core sustainability indicators. In a separate initiative, the MDBs have recently taken stock of, and compared, their respective sustainable infrastructure indicators as part of an effort toward a Common Set of Aligned Sustainable Infrastructure Indicators (SII) (IADB, 2020[194]).

2. Financing the next generation of infrastructure technologies

Challenges

The infrastructure systems required to deliver a green and low-carbon transition are dramatically different from many of those existing today. This raises particular challenges relating to how such infrastructure systems can be funded and financed as the challenge of delivering novel technologies differs from that of provisioning technologies that have been proven technically and commercially.

For instance, while some of the fundamental renewable energy technologies such as solar photovoltaic and wind have become (or are rapidly becoming) cost-competitive with fossil-fuel based electricity

production, other key technologies such as offshore wind power, large-scale battery storage, and CCS, though they may be proven at a technical level, are still at an earlier stage in their cost curves. Some energy or mobility solutions have yet to reach commercial scale, while others face uncertain business models. Different phases of development for infrastructure technologies will have very different risk profiles with implications for the sources of financing and the types of investors that would be suitable.

Moreover, digitalisation is increasingly playing a role in shaping what type of infrastructure is required and how it is delivered. It offers the potential to deliver infrastructure services much more efficiently which would be a boon to both governments and investors, but it can also be highly disruptive to existing infrastructure systems, creating uncertainty for policymakers, planners, and investors. The investment that needs to be mobilised therefore has to finance not the old infrastructure technologies that dominated the 20st century, but the next generations of infrastructure systems and technologies that will dominate the 21st century.

Many of the infrastructure systems that will be necessary to achieve deep decarbonisation are based on technologies that are currently still under development or have yet to be proven at commercial scale (see Chapter 1). Novel infrastructure technologies that are at the development stage will require strong support and patient investors in order get through the “valley of death curve” and reach commercial feasibility. The long development timescales and regulatory risks associated with energy and other infrastructure technologies can represent a major obstacle for developers and investors. Certain technologies may be technically proven in pilots or demonstration projects, but have yet to be scaled-up to a commercial scale. This introduces uncertainty over the long-term costs and the commercial feasibility of the technology. Furthermore, uncertainty around future revenue streams due to either immaturity of the business model or regulatory uncertainty, such as in the case of electric vehicle charging networks, will inhibit certain classes of investors that depend on predictable revenue streams.

Private sector investment is likely to be essential for driving the innovation necessary to achieve transformation of infrastructure systems. However, on its own, it is unlikely to be able to deliver the scale of the investment with the required urgency given the risks involved in early stage investments. Public capital therefore has an essential role to play in driving change and opening a path for private investment. The key to success will be in applying public capital efficiently to stimulate innovation and encourage the private sector to make calculated bets.

Solutions

Provide early-stage financing for technology development and demonstration projects

Given the extremely high risk involved in developing novel infrastructure technologies and systems, private investors are often reluctant to sink sufficient capital into technologies that are unproven, whether technically or commercially. Public finance has played a critical role in the development of numerous breakthrough technologies that have become integral features of modern life such as the Internet, GPS and touchscreens (Mazzucato and Semieniuk, 2017[195]). Early stage investments by public entities in high-risk, capital intensive, and long-term demonstration projects that are aligned with a country’s long-term strategic interests can pave the way for private sector investment by reducing uncertainty.

For example, Sustainable Development Technology Canada (SDTC) is a fund established by the government of **Canada** to “identify and fund Canadian companies developing and demonstrating new technologies with the potential to transform the environmental and economic prosperity of Canada”. While it is accountable to Parliament through the Minister of Innovation, Science and Economic Development Canada (ISED), it is governed by an independent, 15-member Board of Directors, comprised of private and not-for-profit sector leaders from across Canada with a broad range of experience and expertise. Since its inception in 2001, SDTC has invested over CAD 1.15 billion in 400 companies, creating 13,000 jobs.

Collaborate with private sector investors in scaling-up and rolling-out new infrastructure systems

Certain infrastructure technologies may not face major technical challenges, but require financing to support their scaling-up under circumstances with uncertain economics, unstable business models, and evolving regulatory frameworks. For example, a massive roll-out of charging infrastructure is required to enable a transition to electric mobility. However, developers of such infrastructure face long-term demand risks: while penetration of electric vehicles (EVs) is growing rapidly, it is still very low compared to that of its internal combustion engine (ICE) rivals.

The role of the European Investment Bank (EIB) in supporting the development of the offshore wind market in **Europe** in its early phases through providing co-financing offers a roadmap for rolling-out technologies that are still maturing and/or involve significant construction risk such as floating offshore wind and hydrogen networks. The **United Kingdom** government is implementing a novel approach for building-out charging infrastructure for electric vehicles by leveraging its commitment to allocate funding to a dedicated fund (Charging Infrastructure Investment Fund; see Box 3.7 below) to mobilise private capital, for co-investment. This effort parallels a similar effort in the United Kingdom to spur the next generation of essential communication infrastructure through a National Digital Infrastructure Fund.

Box 3.7. Charging Infrastructure Investment Fund

The United Kingdom's Charging Infrastructure Investment Fund (CIIF), a Limited Partnership vehicle with the UK government as cornerstone investor, is mandated to make investments in companies whose business substantially comprises the ownership, provision, development, construction, maintenance, and/or installation of electric vehicle charging infrastructure destined for the public. It reflects an ambition on the part of the UK government to be a world leader in electric vehicle technology and uptake. The fund was established to catalyse finance from private investors, with the UK government committed to providing matching investments, up to a ceiling of GBP 200 million.

By delegating, through a competitive bidding procedure, the investment decisions to an asset manager with specialist knowledge of the sector that will invest across a range of companies and technologies, this approach stimulates innovation by encouraging competing technologies and business models.

Due to the nascent nature of the industry, the investment parameters for the Fund are wide and allow for investments to take the form of equity, mezzanine, and possibly senior debt investments. Certain criteria were established to ensure public benefit. The Fund is not available for refinancing.

To date, the fund has raised a total of GBP 75 million from investors, notably the Church Commissioners of England and Masdar, a subsidiary of Mubadala, a sovereign wealth fund from Abu Dhabi, bringing deployable funds to GBP 150 million given the matching government co-investment.

Source: (OECD, 2020[193])

Adapt regulation and market design in order to incentivise innovation

It is often uncertainty around business and regulatory models that constitutes the major barrier to investment in new infrastructure technologies as it makes it difficult to assess and quantify market opportunities. Innovation in regulatory models is often required to support the adoption and diffusion of new technologies. At the same time, it is important not to over-regulate in early stages of technological

development as that could stifle innovation. The use of regulatory "sandboxes" can provide a safe space to trial various regulatory and business models. For example, Ofgem, the **United Kingdom**'s regulator for electricity and gas networks, launched a regulatory sandbox for innovators in energy markets, enabling them to trial innovative products, services and business models that cannot currently operate under existing regulations. Regulatory waivers enabled firms to trial peer-to-peer energy trading and an innovative tariff based on smart home technology (Attrey, 2020[196]).

As part of its Hydrogen Strategy which sets out an ambitious roadmap for the development of a clean hydrogen industry in **Europe**, the European Commission is envisaging significant investments in electrolyser capacity. Early investments in hydrogen may require forms of public support that provide certainty regarding prices and/or volumes, for example, through procurement. Eventually, as the sector becomes more competitive, investments will need to be supported by an appropriate regulatory framework that establishes network access conditions given that hydrogen networks are likely to exhibit natural monopoly characteristics (FSR, 2020[197]).

The deployment of electricity storage faces similar challenges in terms of the multiple competing technologies currently being explored and the need to integrate them into the existing electricity system. Ofgem in the **United Kingdom** has sought to provide regulatory clarity on the treatment of electricity storage within the regulatory framework. Following a public consultation, it has instituted changes that will ensure that the licensing regime for electricity storage is subject to the same rules and regulations as other forms of generation, and that address current issues storage providers face surrounding final consumption levies (where some providers currently face double-charging of such levies) (Ofgem, 2020[198]).

3. Financing infrastructure that promotes sustainable development

As highlighted in section 1.4, developing countries face a large gap in infrastructure investment. The IMF estimates that additional spending required to bridge the infrastructure gaps by 2030 in emerging economies and developing countries (relative to a baseline of current spending to GDP) amounts to USD 2.6 trillion, or 2.5% of the 2030 world GDP (Gaspar et al., 2019[199]). Financing new, quality infrastructure offers an opportunity for developing countries to leapfrog inefficient and polluting systems of the past.

Delivery and financing approaches targeted to the realities of developing countries are therefore required to ensure that these countries are not starved of infrastructure investment that is crucial for their development and the ability of all countries to deliver the 2030 Agenda for Sustainable Development. Blended finance approaches leverage development finance to mobilise commercial finance for quality infrastructure in developing countries by improving the risk-return profile of investments.[27] When implemented with a view to supporting financial market development in developing countries, blended finance can offer a pathway towards scaling-up quality infrastructure investment in developing countries. Given their established role as infrastructure financiers, mobilisers of commercial capital and market developers, development banks – and in particular national development banks (NDBs) – are well placed to play a key catalytic role in mobilising private financing for quality infrastructure. In advancing blended finance and promoting the role of development banks, the Addis Ababa Action Agenda, and the related Integrated National Financing Frameworks that provide a framework for financing national sustainable development priorities, should be considered.

a) Blended finance as an effective approach to catalyse commercial investment for infrastructure in developing countries

OECD data show that official development finance interventions mobilised over USD 205 billion of private finance in 2012-2018, with a rapid acceleration in 2018 (+28% compared to 2017). On average in 2017-2018, the largest volumes of private finance mobilised (USD 26.5 billion, or over 61% of the total) targeted economic infrastructure and services, especially the energy (28% of the total) and banking and financial

services (27.5%) sectors, but also transport and storage, and communication. On the other hand, social infrastructure and services received much less financing, and the water and sanitation sector only attracted USD 0.9 billion (2.1%) of private capital in 2017-2018 (OECD DAC, 2020[200]).

These trends show that blended finance is an effective approach for mobilising commercial finance and strengthening the financing systems on which infrastructure investments rely. By deploying development finance in a way that addresses investment barriers that prevent commercial actors from providing capital in SDG-relevant sectors such as infrastructure, blended finance operates as a market-building instrument that provides a bridge from reliance on grant and other concessional financing towards commercial finance (OECD, 2019[201]).

Challenges

Private investors are often reluctant to finance projects in developing countries due to a range of factors such as perceived political risks, regulatory uncertainty, and institutional weaknesses. Moreover, the lower-income levels in these countries may inhibit cost-recovery based on user fees. In many cases, very shallow and immature local financial markets, coupled with information asymmetries and market imperfections further discourage commercial actors. Infrastructure projects in developing countries therefore regularly fall victim to an imbalance between the elevated perception of risks and insufficient financial returns to compensate for those risks.

While the deployment of blended finance has increased over the years, important concerns have been raised about blended finance, particularly on associated risks and unintended impacts that could arise if this form of financing is scaled-up without appropriate policies, checks and balances in place, ensuring mobilisation and additionality as well as minimum concessionality. Evidence on how blended finance is applied is still limited, partly due to the lack of a clear and common understanding of blended finance. Moreover, complex governance patterns and high intermediation often hinder monitoring and evaluation of blended finance activities (Winckler Andersen et al., 2019[202]).

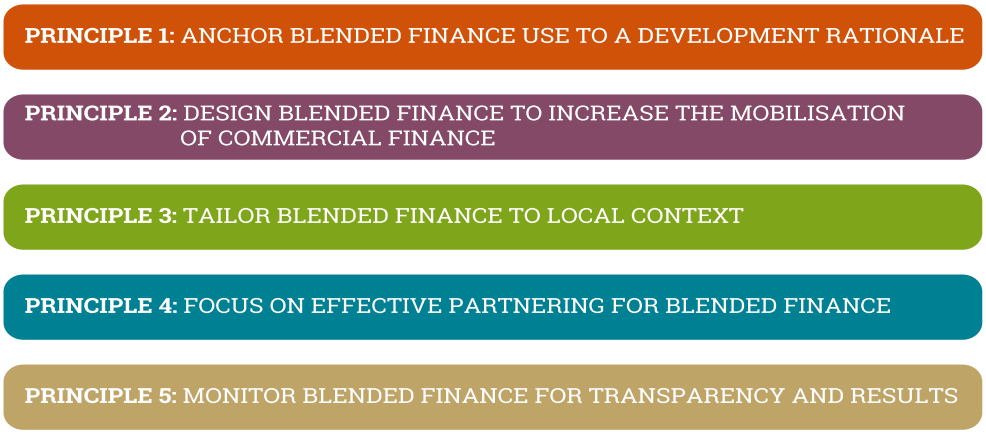
Solutions

Adopt and promote a common framework on blended finance, enhancing coordination and increasing transparency

A common blended finance framework is indispensable to develop good practice and co-ordinated policy approaches. In 2017, the OECD Development Assistance Committee (DAC) endorsed the Blended Finance Principles, providing an action-oriented framework for donors in designing effective blended finance approaches (see Figure 3.1) (OECD DAC, 2018[203]).

The leaders of the G7 and the G20, under the Canadian G7 Presidency in 2018, the G20 Japanese Presidency in 2019 and the French G7 Presidency in 2020, pledged to implement the OECD-DAC Blended Finance Principles to promote transparency and accountability of blended finance operations (G7, 2018[204]). The OECD's Development Assistance Committee, which brings together donors, has also approved the Blended Finance Guidance, which provide practical recommendations to put the Principles into practice and effectively design and implement blended finance programs (OECD, 2021 Forthcoming[205]).

Figure 3.1. The OECD DAC Blended Finance Principles: what it takes to blend finance effectively



Source: (OECD DAC, 2018[203])

Deploy blended finance instruments and mechanisms that best fit risks, investment attributes and development objectives of infrastructure projects

Several financial instruments can be used in blended finance transactions to alter risk-return profiles of projects and attract commercial investment that otherwise would be deployed elsewhere, such as equity, debt and mezzanine instruments, guarantees, collective investment vehicles, as well as grants and technical assistance (OECD, 2018[206]). Blended finance actors should carefully consider the whole range of financial instruments and mechanisms and deploy them to target different risks and development challenges, while taking into account the local and sectoral context and ecosystem.

Promote an effective use of different types of guarantees to mitigate risks and mobilise private capital for infrastructure

Guarantees are the leveraging mechanism that mobilised the largest volumes of private finance by official development finance interventions in the infrastructure sector, through the mitigation of various types of risks, resulting in a lower cost of capital (OECD DAC, 2020[200]). They are also commonly used in blended financing for projects in water and sanitation utilities. One example is the Philippine Water Revolving Fund (PWRF), which was set up with both primary and secondary guarantees provided by a combination of public and private actors – see Box 3.8 below for further details on this project (OECD, 2019[201]).

Box 3.8. The Philippine Water Revolving Fund: a blended solution to bridge to rural-urban divide in access to water utility services

Despite the Philippines making progress in recent years in improving access to water and sanitation services, the country still lags behind in terms of water supply service coverage and access to piped water due to underinvestment. Water service providers face barriers to access to capital from banks, which had limited exposure to this sector due to elevated credit risk, resulting in high lending costs.

The Philippine Water Revolving Fund (PWRF) is an innovative financing facility created to enhance water service providers' access to private finance and encourage private sector participation. The facility blended ODA funds channelled through the Development Bank of the Philippines (DBP) with

commercial finance from private banks. Japan International Cooperation Agency (JICA) allocated an initial JPY 1.5 billion (USD 16.3 million) concessional loan to the DBP with a 30-year maturity (inclusive of a 10-year grace period), with a liquidity risk cover provided to local banks through a stand-by credit line from DBP and the Municipal Development Fund Office. JICA's concessional loan to the DBP was backed by a sovereign guarantee from the Government of the Philippines. An initial financing mix of 75%-25% between JICA/DBP funds and participating commercial finance institutions, respectively, was adopted under the PWRF. The facility can provide tenors of up to 20 years at fixed interest rate allowing water service providers to better manage their debt capacity. Private sector participation under PWRF is not only through debt but also equity or a combination of both. To encourage the participation of commercial financiers, participating private banks benefit from a partial guarantee from the Local Government Unit Guarantee Corporation, a private entity, which is backed by a co-guarantee from United States Agency for International Development's Development Credit Authority, provides credit risk enhancement to commercial banks thus reducing their credit risk exposure.

The PWRF was implemented alongside two market-enabling components: a credit rating system to inform investors and a water project appraisal training to lenders with little prior experience in the sector. The PWRF resulted in an expansion of utility services and increased engagement of banks in the provision of loans to water service providers. The sub-projects financed through PWRF resulted in an estimated 216 872 new household connections to water services as of January 2017. Financing terms of local banks have also improved, with tenors increasing from 7 years to between 15 and 20 years at lower, fixed interest rates.

Source: (OECD, 2019[201]), Making Blended Finance Work for Water and Sanitation: Unlocking Commercial Finance for SDG 6, https://dx.doi.org/10.1787/5efc8950-en

Pool capital through blended finance funds and facilities to mobilise investment from different sources at scale

Collective investment vehicles such as blended finance funds and facilities are also a prominent channel to scale up blended finance in developing countries. Such vehicles pool and mobilise capital from various sources and thus benefit from reduced transaction costs resulting from economies of scale as well as the ability to target specific investment segments or regions (Basile and Dutra, 2019[207]). As a result, larger volumes of commercial investment can be channelled towards sustainable development projects. For example, the Development Bank of Southern Africa (DBSA), with funding from the Green Climate Fund, established the Climate Finance Facility (CFF), a blended finance debt facility targeting climate-compatible infrastructure investments in the ZAR-denominated countries of the Southern African Development Community. The CFF will supply a range of credit enhancement mechanisms, such as subordination, and first loss or tenor extension to local commercial banks with the aim of ramping up climate finance in domestic markets (OECD, 2019[208]).

Provide technical assistance to develop bankable infrastructure projects and build local capacity

Within blended finance, development finance providers can provide technical assistance in the project preparation phase to support activities such as feasibility studies, policy advice, capacity building, and awareness-raising that contribute to the overall success of a project and so boost investor confidence (OECD, 2018[206]). Emerging evidence shows that technical assistance also plays a critical role to develop and fund large-scale water infrastructure projects that can attract commercial finance. For example, the

Private Infrastructure Development Group's (PIDG) Technical Assistance Facility supported the development of the Kalangala Infrastructure Services (KIS) project, that upgraded the water and transport infrastructure of Kalangala (Uganda) and which mobilised over USD 6 million of commercial finance from the Nedbank Group (OECD, 2019[201]).

b) A key role for development banks in facilitating quality infrastructure financing

As publicly-owned financial institutions with a development or policy mandate, development banks are established providers of countercyclical funding (Griffith-Jones, Marodon and Ocampo, 2020[209]) and financiers of infrastructure. Further reasons supporting a strengthened role of development banks in quality infrastructure and a sustainable recovery include (OECD/The World Bank/UN Environment, 2018[34]):

a) *They provide concessional and non-concessional finance for quality infrastructure projects in developing countries.* These projects provide a proof-of-concept to commercial investors for specific technologies, investments and business models, with potential for refinancing by commercial investors in advanced stages of the project cycle.

b) *They can directly mobilise additional commercial capital to projects* by improving the risk-adjusted returns from quality infrastructure investment through risk mitigation tools and approaches. They can also act as intermediaries in blended finance (see preceding section on blended finance) and lead arrangements for syndicated lending.

c) *They can indirectly catalyse broader capital flows by supporting governments to reform infrastructure and investment policies*, removing barriers to investment and stimulating the creation of future-proof markets that scale up overall investment for resilience and sustainable development. They also help governments in infrastructure planning and project pipeline development, which can further catalyse public and private investment for quality infrastructure.

Underpinning all three dimensions is the contribution that development banks make to building capacities – institutional, technical, and knowledge – both for public institutions and for private market participants. While all development banks provide value-added in terms of financing, mobilisation, and policy support, NDBs have distinct advantages over their international counterparts when it comes to mobilising and catalysing finance for quality infrastructure given their in-country expertise, their embeddedness in national policy frameworks, and their proximity to local markets (OECD/The World Bank/UN Environment, 2018[34]; OECD, 2019[208]):

Challenges

As outlined in section 1.4, developing countries face a number of challenges that inhibit their ability to attract financing for quality infrastructure investment. In addition to factors such as weak capacity for preparing bankable projects, elevated perceptions of risk, foreign exchange risk, and underdeveloped regulatory frameworks, many developing countries lack the financial depth to mobilise capital in sufficient quantities for quality infrastructure projects. Domestic commercial banks may not have the necessary project finance expertise or may simply lack the capital required for financing large infrastructure projects. Domestic capital markets often do not have the volume, liquidity, and level of sophistication necessary for mobilising the levels of investment that are required for infrastructure. In developing economies, it is frequently the case that institutional investors such as pension funds and insurance companies are either absent, or simply too small or lacking in experience to be able to finance major infrastructure projects – and in particular quality infrastructure projects. Finally, foreign investors are often reluctant to invest in long-lived infrastructure projects in developing countries for the reasons mentioned above.

Development banks and in particular NDBs can play a critical role in solving the infrastructure financing challenge in developing countries. NDBs are often among the few domestic financial institutions present

in developing countries with sufficient capital and expertise for financing infrastructure. Moreover, their policy role and their parastatal nature means that they have both more risk appetite and greater ability to mitigate risks. Despite their potential, NDBs sometimes lack effectiveness, and are not performing the role that they could be playing in terms of supporting infrastructure development and helping a country to advance towards the SDGs.

Solutions

In order to have a truly transformational impact, NDBs must support countries by using their capital to catalyse much larger amounts of private financing, and helping them to leap-frog less sustainable development pathways. This means delivering on the climate targets and action plans to which countries around the world have committed, aligning their overall portfolios with the goals of the Paris Agreement, scaling-up efforts to mobilise commercial investment, and supporting client countries in pursuing climate-sound development (OECD, 2017[14]).

Development banks cannot deliver on this agenda alone – their activities are dependent on and strongly influenced by shareholder and client governments. While the governance arrangements of national and subnational development banks may vary, many of them are an integral part of government systems, and their mandates and activities respond directly to policy signals (OECD, 2019[208]).

The effectiveness of development banks in promoting quality infrastructure investment can be improved by three actions:

Strengthen mandates, incentives, and capacity

While development banks have high potential to be important and effective implementation institutions for quality infrastructure that support sustainable development trajectories, many can improve internal approaches to support outcomes that are more resilient. Aligning portfolios with climate objectives is especially pressing in this regard, as climate change is a source of not only socioeconomic but also financial risk – posing a dual impact for development banks with mandates to fulfil both socioeconomic and financial outcomes.

Given the indivisible link between sustainability and climate action, embedding climate objectives into mandates will be critical for delivering quality infrastructure that supports sustainable development. Governments, as shareholders of these institutions, need to strengthen the mandates of development banks to deliver ambitious climate action, including through quality infrastructure investments. Establishing incentive and results frameworks that encourage climate action is also critical, as current incentive systems often focus on disbursement or commitment that fail to capture support provided for sustainable development and long-term resilience. Development banks also need to strengthen the capacity and skills available for scaling up climate action and addressing systemic risks.

Mobilise new sources of finance and catalyse change in markets

Infrastructure and sustainable development face a financing gap that persists across countries. As a result, development banks have increased efforts to unlock commercial investment for development outcomes using for example blended finance approaches. Development banks and DFIs that operate internationally are the most prominent actors in blending and other risk mitigation instruments to date, but a number of NDBs are also beginning to shift from direct financing for infrastructure projects to strategies that mobilise additional commercial resources. With knowledge in local markets and the ability to finance projects with local currencies, NDBs have their own comparative advantages to mobilising commercial capital (OECD, 2019[208]). The Development Bank of Southern Africa (DBSA) is an indicative example for how integrating mobilisation objectives into mandates and incentive systems can enable NDBs to deliver on this potential (Box 3.9).

Box 3.9. Revising funding models, incentive systems and mandates to enable mobilisation

The case of the Development Bank of Southern Africa

The Development Bank of Southern Africa (DBSA) is a wholly government-owned national development bank with a focus on infrastructure promotion in South Africa and other countries in Southern Africa. Although capital was initially provided by the South African Government, DBSA is commercially self-financed and rarely supplemented by public credit lines. This is reflected in its mission to "promote [the] sustainable use of scarce resources." The bank's relatively small size of ZAR 84 million in assets (USD 6.3 million) in 2017, 1.8% of GDP, further incentivises DBSA to leverage its balance sheet and mobilise additional commercial finance.

An uncertain economic environment in 2016 further emphasised the need to use funds strategically, and DBSA reduced its disbursement target and introduced a mobilisation target in its strategic objectives. In its 2018 Annual Report, DBSA set out a trajectory of increasingly ambitious catalysation targets. In 2018, the target key performance indicator stood at ZAR 25.6 billion (USD 1.9 billion), with a steady yearly increase to ZAR 49.2 billion (USD 3.7 billion) in 2021. DBSA remains one of the few development banks – including multilateral and bilateral – to include catalysation targets in corporate scorecards.

Note: The trajectory of DBSA's mobilisation KPIs was set before the COVID-19 crisis, and targets for 2020 and 2021 may be subject to revision.
Source: (OECD, 2019[208])

The potential of development banks goes beyond their ability to de-risk and mobilise commercial capital, however, to provide policy support and capacity building that facilitates the creation of markets and make financing and implementing quality infrastructure projects easier. The two-way nature of the bridge these institutions form between public and private spheres means they often have a seat at the table in policy reform discussions and can use this link to stimulate market creation and scale up quality infrastructure financing markets. In particular, NDBs can also help to shape and direct public and private investment through targeted support to governments in infrastructure project planning, especially in developing project pipelines and making projects bankable. Institutional incentive systems and capacity development are critical to enabling a risk appetite for development banks to adopt this more transformational role, and many lack the organisational structures to increase this catalytic potential.

Use concessional finance strategically

Development banks are significant sources of preferential financing options and often finance in concessional terms. In many cases, the use of concessional financing reflects the policy direction of government shareholders, but NDBs for example also hold high potential to act as intermediaries for international sources of finance (OECD, 2019[208]; Griffith-Jones, Attridge and Gouett, 2020[210]). Using both concessional and commercial rate financing, development banks in general have the flexibility to de-risk projects at different entry points and mobilise additional finance from the private sector, and should be encouraged to take a stronger role in catalysing finance for quality infrastructure and a green recovery.

To maximise impact, concessional financing can support infrastructure projects that provide socially and environmentally positive spillover effects, but which commercial players might reject in favour of less sustainable projects under market terms. As development banks are first-movers in many economies, they also support projects with a view to providing proof-of-concept for new technologies and business models and can transition from concessional to increasingly market conditions over time (Box 3.10). Even within

a new proof-of-concept project, development banks are able to refinance and include commercial investors later on in the project cycle. For example, as market biases remain for carbon-intensive infrastructure, development banks can use their flexibility as providers of concessional finance and fulfil their development mandate by supporting proof-of concepts for low-emissions infrastructure that provide social and environmental benefits.

Box 3.10. NDBs as first-movers in green innovation financing

Direct equity investments by Brazil's National Development Bank BNDES

In its efforts to build markets, promote a green economy in Brazil, and engage in green innovation financing, BNDES's direct equity investments in Sunew, a company aiming at the large-scale manufacturing and commercialisation of Organic Photovoltaic (OPV) films to generate solar energy, is worth highlighting. The OPV technology was developed by the Brazilian research centre CSEM, which BNDES supported in 2013 through FUNTEC. The FUNTEC agreement provided for the pre-emptive right for BNDESPAR (BNDES's equity investment arm) to eventually participate in the start-up companies created to produce and commercialise the products resulting from the research. This right was exercised by BNDESPAR in the context of Sunew, CSEM's spin-off company. In 2015, BNDESPAR subscribed shares in Sunew for an amount of BRL 4.5 million (USD 1.3 million), which gave it rights to 30% of the company's shares, with the rest held by CSEM (45%), a private investor (15%) and the company's funders (10%). Subsequently, there have been further capital increases, mainly needed to enable commercialisation of the OPV films, in which Sunew was successful in attracting capital from four new private investors, including some angel investors. BNDESPAR then approved subsequent capital increases to maintain its ownership interest in Sunew.

Note: Amounts in USD calculated using OECD exchange rates at (OECD, 2020[211]).
Source: (BNDES, 2017[212])

Promote collaboration within the ecosystem of development banks

Multilateral development banks (MDBs) work with both public and private development and commercial actors, putting them in a good position to support a sustainable recovery to COVID-19 through an ambitious quality infrastructure agenda. MDBs can have a critical role in expanding the types of financial structures available to NDBs during this period of increased uncertainty (Box 3.11). NDBs and MDBs have different yet complementary institutional advantages with a significant potential to improve the effectiveness of their operations when combined. Both institutions have a history of supporting quality infrastructure investments and share similar dual mandates to support socio-economic outcomes alongside financial returns.

NDBs and MDBs also both have expertise and knowledge in market building and supporting catalytic change beyond finance to include policy and capacity development. Their respective comparative advantages in both of these areas can reinforce each other and support outcomes that are overall more effective: while NDBs have primarily tailored their expertise to the local context, and this notably includes at subnational levels, MDBs have mostly tailored theirs internationally. This includes in the depth of their respective access to local actors versus international ones, public and private. Importantly, this also includes the type of currency that each institution is able to lend in – with NDBs bringing an important benefit of deploying finance in local currency.

Box 3.11. Channelling MDB Infrastructure Financing

The World Bank's RIFF project with the Trade Development Bank

In June 2020, the World Bank committed USD 425 million in International Development Association (IDA, part of the World Bank Group) financing for infrastructure in Eastern and Southern Africa through the Regional Infrastructure Financing Facility (RIFF). This finance will be channelled through the Trade Development Bank (TDB), a regional development bank, with the aim of expanding long-term finance to private firms in select power, transport, logistics, and social infrastructure sectors in the region.

The project will focus on addressing the long-term infrastructure financing gap with a set objective to mobilise an additional USD 975 million of private finance with the USD 425 million in IDA funds. The RIFF will also focus on supporting the recovery to COVID-19 by ensuring that infrastructure financing contributes to job creation, trade and investment or technology transfer.

Source: (World Bank, 2020[213])

4. Infrastructure financing strategies: a systemic and coordinated approach

Challenge

The preceding sections have highlighted the extent to which infrastructure financing is a complex system: a diverse ecosystem of investors, financing channels and instruments, incentives and risk mitigation tools is required to accommodate the wide range of infrastructure types and delivery models, and the evolving financing needs and risks over the project life cycle. Furthermore, elements of infrastructure governance such as procurement systems, and the contractual and regulatory framework, play a key role in delivering investable assets.

Given the systemic nature of infrastructure financing, very narrow interventions are unlikely to be effective on their own. However, many jurisdictions approach the infrastructure financing challenge through a siloed lens and lack a comprehensive strategy that is based on a coordinated and systemic approach.

For private financing to play an effective role in supporting long-term objectives, a strategic and coordinated approach that identifies barriers and bottlenecks – including upstream in policy and governance frameworks – and develops financing solutions that can bridge the investment needs and the profiles and risk appetite of investors, taking into account the country's context, is required. The starting point for countries is developing a good understanding of the future infrastructure investment needs and, based on that, identifying the appropriate delivery and regulatory models, and matching financing tools that can deliver the necessary investments, taking into account a country's context and existing institutional and financial endowments.

Solutions

Establish and promote infrastructure plans and project pipelines that are aligned with long-term objectives

The choice and design of financing mechanisms for infrastructure projects must be part of a broader infrastructure development strategy that is framed by a long-term strategic vision that sets out the main objectives that should inform policymaking and planning (see Chapter 2 on governance). The long-term

strategic vision needs to be translated into roadmaps and plans that describe the technologies and the types of investments required to achieve these objectives. This involves, for instance, establishing pathways to meet Nationally Determined Contributions (NDCs) and determining the necessary investments in infrastructure required to meet the NDCs. These high-level plans can then form the basis for developing pipelines of projects and programmes that provide private investors with a forward-looking assessment of the market opportunity.

Infrastructure project pipelines that are well-aligned with government policies and goals provide prospective investors with a clear sense of the government's needs and intent (OECD, 2018[25]). In other words, they provide evidence to institutional investors of a regular supply of projects, which are needed to justify country allocations within their infrastructure investment portfolio. This could include not only new-build pipelines being identified by governments, but also brownfield government-owned assets that could be monetised (see asset recycling below). For example, in **Australia**, Infrastructure Australia, an independent body, prepares an Infrastructure Audit consisting of a 15-year rolling infrastructure plan that outlines the country's infrastructure needs. The Audit is then used a basis for developing a rolling Infrastructure Priority List which consists of a prioritised list of nationally significant investments. The investments outlined in the Priority List undergo a rigorous prioritisation process and are independently assessed by the Infrastructure Australia Board.

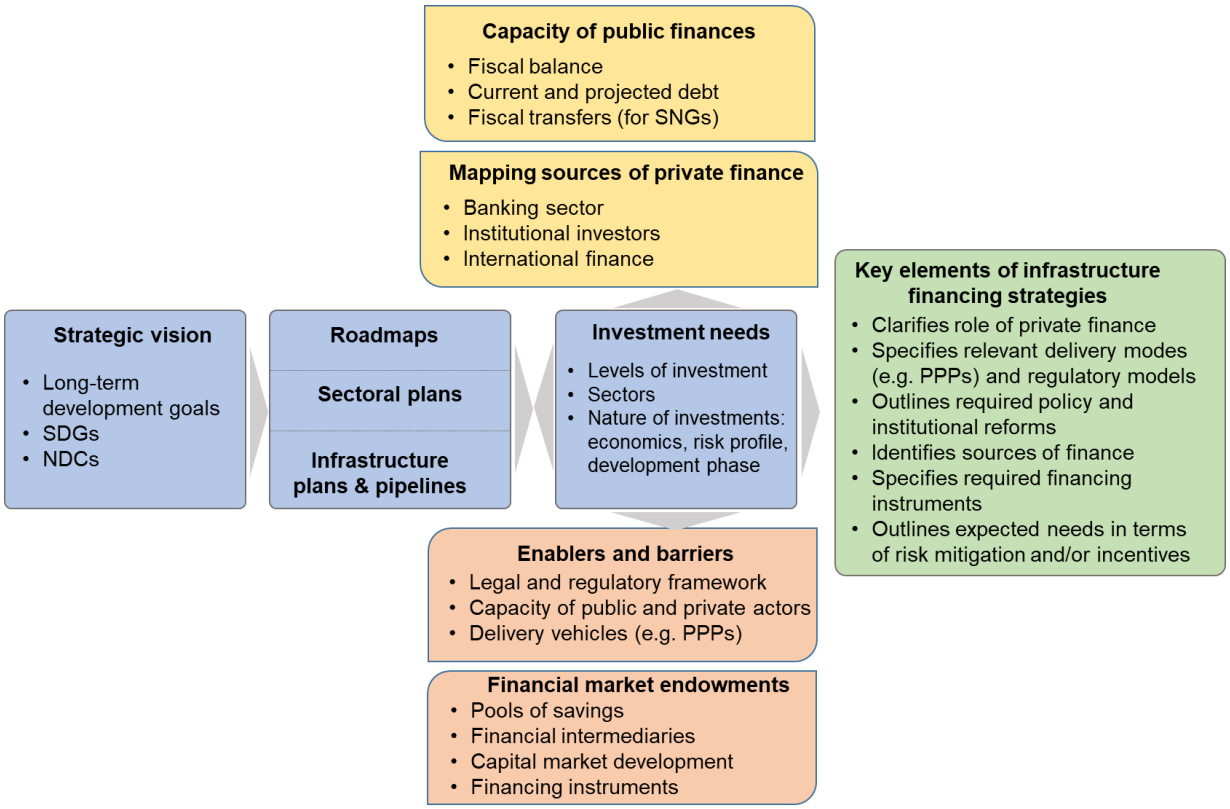
> Consider developing infrastructure financing strategies that assess financing needs, and systematically identify and address the various barriers to mobilising financing.

The role of private finance needs to be considered in light of an assessment of the required overall investment levels, the medium- to long-term capacity of public finances, and the particular nature of the required investments including their economics, risk profiles, and phase of technological and commercial development.

The potential contribution of private finance depends on the existing financial endowments of an economy in terms of pools of savings, financial intermediaries, level of capital market development, and availability of financing instruments. Sources of both domestic and international finance should be considered as part of a comprehensive financing strategy. Enabling conditions and barriers such as the legal and regulatory framework, the existence of appropriate delivery vehicles (such as PPPs), and the capacity of public and private actors are also instrumental in determining the scope for private finance. Of particular importance for private financing are the choices regarding delivery, regulatory, and funding models as these determine the ultimate revenue and risk profile for the investment.

An infrastructure financing strategy should therefore consider an analysis of sources of financing, existing endowments, enabling conditions and barriers can serve as the basis for developing an infrastructure financing strategy that: specifies the role of private finance; identifies the relevant delivery modes (e.g. PPPs) and regulatory models for different categories of investments; outlines key policy and institutional reforms; identifies sources of finance; specifies the required financing instruments; and outlines the expected needs in terms of risk mitigation and/or incentives (see Figure 3.2).

Figure 3.2. Framework for Infrastructure Financing Strategies



Adopt a strategic and coordinated approach to mobilising private financing

Since infrastructure investment typically involves multiple sources of financing (banks, institutional investors, capital markets, national development banks, etc.), subject often to multiple regulatory or oversight frameworks, financing strategies benefit from a systemic approach that is guided by a degree of co-ordination to ensure alignment across multiple government bodies including relevant government ministries, independent agencies such as stock market regulators, supervisors of pension funds and insurers, banking regulators, and central banks, as well as possibly infrastructure regulators.

Thus, a “whole-of-government” approach, which may be coordinated by a central government entity (such as, for example, a Ministry of Finance), may help to mobilise the various components of the system and tackle multiple barriers simultaneously (e.g. ensuring the availability of appropriate instruments, providing protection against certain risks linked to infrastructure development or operations, establishing appropriate funding mechanisms, reducing information asymmetries and transactions costs, ensuring appropriate regulation, etc.).

In **Mexico**, for example, the federal government implemented a comprehensive approach to fostering private investment in infrastructure that involved a variety of tools, vehicles, and institutions (Box 3.12).

Box 3.12. Mexico's reforms for fostering greater institutional investment in infrastructure

Mexico's pension fund industry is relatively large with assets amounting to 16% of GDP in 2015. While pension funds are allowed to invest up to 18% of their assets in infrastructure, they need to be in publicly listed instruments with an investment grade rating. Since 2008, Mexico has implemented a series of reforms to foster greater participation of pension funds in financing infrastructure investment which include:

- The establishment in 2008 of a national infrastructure fund (FONADIN), a platform for coordinating infrastructure investment in Mexico, and whose role includes maximising and facilitating the participation of private capital in infrastructure projects.
- The adoption of a new framework for Public Private Partnerships (PPPs), including new PPP legislation introduced in 2012 covering all levels of government.
- The creation of a diverse set of new capital markets instruments for infrastructure that were tailored to the needs of institutional investors. These include project bonds as well as a series of listed equity instruments specifically designed to appeal to pension funds.
- The introduction of a suite of new financial guarantees to be offered by Mexican public financial institutions including BANOBRAS, the national development bank, and FONADIN, the national infrastructure fund.
- Changes made to the regulations of insurance companies and pension funds to enable investment in the new products, subject to prudential constraints.

Source: (World Bank, 2017[169]; OECD, 2019[168])

Consider empowering public financial institutions to address barriers and catalyse private financing

The systemic and multidimensional nature of infrastructure requires holistic solutions. Moreover, as a consequence of the complexity of infrastructure finance combined with the significant barriers, simply creating an enabling environment and opening up the sector to private participation is a necessary but not a sufficient condition for attracting investment at the required scale, even in many developed jurisdictions.

Governments are increasingly looking to act not only as enablers but as orchestrators in mobilising financing, and are playing a more pro-active role in structuring investment opportunities and removing barriers to private investment. An increasingly common approach is to empower existing institutions or to establish new institutions that combine both financial instruments with technical know-how and local knowledge with a view to shepherding projects through the financing process.

As noted, public financial institutions (PFIs), such as national development banks (NDBs) and infrastructure banks, are increasingly called upon to play strategic and catalytic roles in implementing infrastructure financing strategies. In particular, their role is transitioning from that being the principal providers of direct investment to one of catalysing private financing through the targeted application of public resources to provide various de-risking and transaction-enabling interventions.

For instance, as shown in section 3 above, NDBs are beginning to shift from direct financing for infrastructure projects to strategies that mobilise additional commercial resources. Through their strong capitalisation, access to state guarantees and high credit ratings, PFIs are well-placed to mobilise low-cost financing from international capital markets or from pools of household savings, keeping in mind the need

to ensure a level playing field with other providers of infrastructure financing (Röttgers and Youngman, 2020[214]).

Because many PFIs also concentrate expertise, their role can extend beyond enabling financial transactions towards upstream activities such as helping in developing project pipelines, providing advisory services, and engaging in capacity-building and market development. For example, in **Canada**, part of the role of the Canada Infrastructure Bank is to advise governments and public authorities on the planning, design, procurement, and implementation of revenue-generating infrastructure projects, and to work with project proponents to explore new and innovative approaches to project finance and delivery (Box 3.13) (OECD, 2019[168]).

Box 3.13. Canada Infrastructure Bank: a catalyst for private finance

As a key component of the Government of Canada's CAD 180 billion long-term infrastructure plan, the Canada Infrastructure Bank (CIB) was established to leverage public funds of CAD 35 billion to invest, and seek to attract investment from private sector and institutional investors in revenue generating infrastructure projects that are in the public interest. The CIB works collaboratively with public and private sector partners to plan, finance, and deliver on a wide array of infrastructure projects that otherwise would not have been undertaken in Canada. The CIB model will push the involvement of the private sector in Canadian infrastructure one step further by having it invest directly in infrastructure where the project has revenue-generating potential through various user-pricing models. The key benefits include bringing private capital to large-scale projects that are within the public interest, reducing fiscal pressure on governments at all levels for managing their infrastructure, and transferring more project risk to the private investors. Under this mechanism, the private sector is incentivised to take on a significant portion of the demand and revenue risk for the project.

The CIB operates like a merchant or investment bank that brings investors together and implements appropriate financial capital structures for infrastructure projects, and will: a) help public dollars go further by attracting private investment to free up government resources for other infrastructure priorities; b) use federal support strategically by advancing new and innovative financing models to help more projects get built, including major transformational projects; c) act as a centre of expertise in support of evidence-based decision-making through fostering better data collection across the Canadian infrastructure sector; and d) develop a pipeline of potential projects and promote investment opportunities to catalyse the market. The CIB will work closely with procurement agencies and with industry to develop projects, share knowledge, and promote innovative approaches to project design, financing, and structuring. The CIB will use a wide breadth of financial instruments: a) debt (e.g., loans), both unsubordinated and subordinated; b) equity investments, both unsubordinated and subordinated; c) where appropriate, loan guarantees; and d) other innovative financial tools.

Source: (OECD, 2019[168])

Further, new collaborative approaches and forms of partnership are emerging that bring together the respective strengths of public and private actors. Public institutions are often particularly well-placed to intermediate with other public sector actors and take on specific risks in the interest of pursuing certain policy objectives. Private actors can bring sectoral and financing expertise accumulated over multiple transactions, and have experience in mobilising capital markets.

For example, **Indonesia** has established PT Indonesia Infrastructure Finance (IIF) as a private national company providing infrastructure financing and advisory services that are focused on commercially viable infrastructure projects. PT SMI[28], Asian Development Bank (ADB), the International Finance Cooperation

(IFC), KFW and SMBC are the shareholders of IIF. The IIF's main purpose is to catalyse financing for infrastructure development in Indonesia. Supported by the strong capitalisation from the shareholders as well as long-term subordinated loans from development partners, IIF has a very sound financial basis to provide solutions for financing infrastructure development in Indonesia (OECD, 2019[168]) .

Conclusions and key messages

Financing for quality and sustainable infrastructure will need to be significantly scaled-up to deliver key policy priorities and contribute to a strong, inclusive and green recovery from the COVID-19 crisis. Alternative sources of financing will need to be mobilised, particularly institutional investors such as pension funds and insurance companies. Financing sources and instruments also need to be tailored to the nature of the investments that are required to deliver, in particular, a low-carbon transition, and which involve, in many cases, new infrastructure technologies that have yet to be proven on a commercial scale.

Key messages

- Broadening the investor base requires ***deepening of capital markets*** by ensuring the availability of appropriate ***capital market instruments and vehicles*** for channelling financing for infrastructure projects, and ***addressing regulatory barriers*** that might inhibit institutional investor participation while ensuring ***adequate investor protection***.
- Investor appetite for infrastructure is shaped by the risk profile of investments and the ability of investors to manage, mitigate or transfer those risks. ***Carefully calibrated government intervention can influence the risk profile*** of infrastructure investments by influencing the overall level of risk, managing environmental and social risks, and promoting diversified risk mitigation instruments and incentives such as guarantees and subordinated debt. Government liabilities associated with any public sector guarantees should be ***adequately disclosed***.
- In addition to scaling-up, ***private financing needs to be steered towards supporting key policy priorities***. Both financial markets and regulation can provide incentives for influencing asset allocation and private sector investment:
  - Governments help to can promote sustainable finance through strengthening disclosure requirements for long-term risks and encouraging common standards for sustainable finance.
  - Getting the regulatory models right is essential for enabling the transition of electricity networks.
- Many of the infrastructure systems that will be necessary to achieve key policy priorities including deep decarbonisation are based on technologies that are currently still under development or have yet to be proven at commercial scale.
- ***Public capital therefore has an essential role to play in driving change and opening a path for private investment*** through providing early-stage financing for technology development and demonstration projects, collaborating with private investors in rolling out new infrastructure, and adapting regulation and market design to incentivise innovation.
- Financing infrastructure in ***developing countries is subject to specific challenges***. Innovative delivery and financing approaches are therefore required to ensure that developing countries are not starved of infrastructure investment that is crucial for their development.
- ***Blended finance approaches*** that involve mixing development finance with sources of commercial finance offer a potential pathway out of this dilemma.
- Given their local knowledge and their trusted role in implementing policy mandates, ***national development banks (NDBs)*** serve as effective intermediaries between governments and private

investors, and are therefore well placed to ***play a key catalytic role in mobilising private financing for quality infrastructure***.

- For private financing to play an effective role in supporting long-term objectives, ***a strategic and coordinated approach*** that identifies barriers and bottlenecks – including upstream in infrastructure governance – and develops financing solutions that can bridge the investment needs and the profiles and risk appetite of investors, taking into account the country's context, is required.

Future work

The scale of infrastructure financing required to support a sustainable recovery from COVID-19 and deliver long-term policy priorities is unprecedented, and will require a step change in the ability of countries to mobilise financing from private sources. While this chapter provides a roadmap for diversifying financing sources, and highlights a range of both well-tested and more innovative approaches, further research, collaboration, and knowledge sharing is required in order to ensure that private investment can fill the financing gap. Specifically, the dominant delivery models for privately-financed infrastructure, PPPs and regulated assets, both have their applications, yet it is becoming clear that they need to be complemented with new delivery models that can bridge the economic and risk profile of investments, the needs of long-term investors, and the capacity of governments. This chapter has identified a number of innovative collaborative models that have been implemented in limited manner and a specific context. Further work is required to determine whether these and other models can be generalised, replicated and scaled-up.

The chapter highlights the potential catalytic role that can be played by development banks (including both national development banks (NDBs) and multilateral development banks (MDBs)) in mobilising new sources of finance. Development banks can perform a particularly critical role through providing concessional finance at the proof-of-concept stage or in providing debt finance for greenfield projects, where private finance is more hesitant to venture. However, many development banks have limited balance sheets which may restrict their capacity to finance infrastructure projects. Approaches that enable them to recycle their assets in order to free up their capital for new lending may help to extend their impact. Further innovation and work on developing instruments such as securitisation that enable development banks to transfer assets from their balance sheet to commercial investors should be considered.

4 Subnational governance and investment in infrastructure

Introduction

Regional disparities in access to infrastructure can exacerbate regional inequality and undermine social cohesion, as outlined in Chapter 1. The COVID-19 crisis has served to highlight and, in many cases, aggravate existing disparities in access to health care, high-quality communication infrastructure, and public transport. Redressing these regional disparities is therefore a key priority of many governments. This will depend in large part on the capacity of subnational governments – state, regional, and local governments – to manage infrastructure investment.

The importance of subnational governments with regard to infrastructure investment in the context of COVID-19 recovery goes well beyond a focus on regional disparities. This is because subnational governments play a central role in investing in sustainable infrastructure. Over the past decades, the responsibilities of subnational governments with respect to infrastructure have increased in a majority of OECD countries. On average, subnational governments are in charge of 57% of public investment in the OECD, and almost 40% around the world (IEA, 2020[13]). Subnational governments are also on the frontline of managing investments that support climate mitigation and adaptation efforts (G20/OECD, 2020[186]). Across the OECD, they are responsible for 64% of environment and climate-related public investment (OECD, 2020[215]; G20/OECD, 2020[186]). Furthermore, infrastructure investments, regardless of which level of government is ultimately responsible, almost invariably have a large local impact. Ensuring that infrastructure planning and implementation takes into account the interests of local communities and meets user needs requires the involvement of subnational governments.

Regions and cities play a role in making our societies more resilient and sustainable, as they are confronted with, and have to manage, the health, economic, and environmental crises that often arise locally or have an impact on local populations and communities. The COVID-19 global crisis has shed light on the pressing need to upgrade health infrastructure, accelerate digital and climate transition, as well as to ensure social housing and public transport performance, among others (see Chapter 1). Much of the infrastructure that is strongly affected or mobilised by the COVID-19 crisis falls under the responsibility of subnational government, including health care (hospitals, primary care health centres, etc.), social services, education (primary and secondary schools, higher education), public transport, roads, social housing, utility networks (water, waste, energy, etc.), and ICT infrastructure.

Megatrends such as digitalisation, climate change, demographic change, and urbanisation have deepened the demand for additional investment in quality infrastructure in regions and cities. Urbanisation requires upgrades in urban infrastructure to meet rising demand. The number of people living in cities (high-density places of at least 50 000 inhabitants) has more than doubled over the last 40 years – from 1.5 billion inhabitants in 1975 to 3.5 billion in 2015. By 2050, it is projected to reach 5 billion people, representing almost 55% of the world population (OECD/European Commission, 2020[216]).

Prior to the COVID-19 crisis, it was estimated that global investment, both public and private, financed only half of the world's infrastructure needs (OECD, 2017[14]; OECD, 2019[39]; Mölleryd, 2015[217]; IEA, 2017[218]; Bhattacharya et al., 2016[219]). Some projections show that new houses will need to be built for 3 billion people by 2030 (Woetzel, 2016[220]). Cities and urban areas have important needs for maintenance and new investments in renewable energy, low-carbon buildings, energy efficiency, waste and pollution management systems, and clean public transport. Regions and municipalities that are lagging behind in productivity need infrastructure that helps them integrate with the broader national economy (Bhattacharya et al., 2016[219]). It is worth noting, however, that data on infrastructure needs at both the national and subnational levels are very limited. Addressing this information gap is critical to better identify investment needs and trends for subnational infrastructure.

The COVID-19 global pandemic is generating high uncertainty and affecting all policy areas. While there are many different possible scenarios for the post-COVID-19 "new normal", notably with respect to urbanisation, it is clear that investment in sustainable and resilient infrastructure is a key piece of post-pandemic rebuilding. National and subnational governments need to invest more by better exploiting the existing and potential fiscal resources for investment and mobilising private investment.

National, regional, and local governments also need to invest in a smarter way, by prioritising needs, focusing on the post-crisis priorities in health, digital, and environmental infrastructure, and better managing public investment at all levels of government. While subnational and national governments are confronted with many challenges in their infrastructure investment strategies to recover from the COVID-19 shock, two areas deserve particular attention:

1. Addressing subnational governance obstacles for effective infrastructure investment
2. Addressing larger financing gaps for infrastructure investment in local and regional governments

Solutions to address governance and financing challenges for infrastructure investment in regions and cities are interconnected. This chapter first outlines a number of potential solutions to strengthen the capacities of cities and regions for prioritising strategic sustainable infrastructure projects that support the recovery from the crisis, and to improve coordination of infrastructure investment. It then explores mechanisms to better use sources of traditional public funding for infrastructure in cities and regions, as well as mobilise external financing, in particular from capital markets and the private sector.

Main challenges and solutions

1. Addressing subnational governance obstacles for effective infrastructure investment

Infrastructure investment is a major component of many recovery packages launched by governments. A number of countries have announced large public investment stimulus packages to support the recovery from COVID-19 – generally much larger than those introduced during the 2008 financial crisis. A strong call has been made by the OECD and the International Monetary Fund (IMF) to scale up public investment to address the challenges of the post-COVID-19 recovery.

Subnational governments will play a key role in the implementation of recovery programmes given that they are responsible for almost two thirds of public investment in OECD countries. In addition, regions and cities will play a major role in enhancing infrastructure investment to address the challenges of the post COVID-19 world, and to build more resilient and sustainable cities and regions. However, subnational governments face a number of governance challenges that affect their capacity to deliver infrastructure investment. Resolving these challenges will be crucial for the implementation of infrastructure investments in the context of recovery strategies and ensuring the efficient use of public resources.

Challenges

Within the OECD there are more than 136 000 subnational governments with wide diversity in terms of their investment capacities and resources (OECD, 2014[35]). They are confronted with different types of challenges depending on their size, their responsibilities, and the support they receive from national governments. However, many of these challenges are common across OECD countries and include a lack of expertise or capacity to design and plan infrastructure investment with a long-term perspective, poor coordination across jurisdictions, levels of government and sectors, and difficulties in handling frequently changing national regulations (Box 4.1).

The 2008 crisis taught important lessons with respect to implementing investment recovery strategies, and drawing from these can help avoid some of the mistakes that were made at the time. First, while some public investment projects can be accelerated, care must be taken not to focus on speed as the only criteria. Recovery strategies are unique opportunities for regions and municipalities to invest in quality infrastructure and address long-term priorities (e.g. sustainability and resilience). Second, as was the case in 2008-2009, there is a risk of fragmentation of national investment recovery strategies into numerous small projects taking place at the municipal level, leading to the loss of economies of scale and an inefficient use of public resources by subnational governments (OECD, 2011[221]).

Box 4.1. Main challenges faced by subnational governments in public investment

The OECD and European Committee of the Regions (CoR) conducted a survey in 2015 among subnational governments in the EU, with a total of 295 respondents from all EU countries except for Luxembourg. The result of the survey provided a comprehensive picture of the governance challenges reported by subnational governments in the EU, which are also applicable to many other OECD countries. Some key findings include:

- A large majority of respondents (90%) consider excessive administrative procedures and red tape as a challenge, and for more than half of respondents it is a 'major' challenge. The existence of lengthy procurement procedures (and the delays caused by such systems) also ranks high among the hurdles faced by subnational governments in implementing infrastructure projects. Furthermore, the existence of multiple contact points for completing these administrative procedures is seen as a problem by three quarter of responding subnational governments.
- The lack of capacity to adequately design and plan infrastructure investment in a long-term perspective is seen as a key challenge by a majority of respondents. Two thirds of subnational governments (65%) report that the capacity to design long-term infrastructure strategies is lacking in their city/region. A dearth of sufficient in-house expertise to design infrastructure projects, perceived by 56% of subnational governments, especially small municipalities and inter-municipal structures, hinders their ability to turn strategies into viable projects. Furthermore, though ex ante appraisals, analyses, and tools (such as cost-benefit analysis, environmental impact assessment, territorial impact assessment, etc.) are implemented, two-thirds (66%) of subnational governments lament that the results are not consistently used in decision-making. A similar proportion reports failure to take into account the full life cycle of infrastructure investment when designing the project.
- Effectively coordinating infrastructure investment among various levels of government is necessary but difficult. It is necessary for reducing information asymmetries, reducing funding gaps, and ensuring that strategic priorities for infrastructure development align. However, in reality, 84% of subnational governments in the survey mentioned a mismatch between regional or local needs and those prioritised at the national level. Contributing factors can include limited

political will and an administrative culture unaccustomed to working among different levels of government for public infrastructure investment. Introducing or enhancing coordination mechanisms will be fundamental if the subnational infrastructure investment needs are to be met successfully.

- Though the potential benefits of coordination across jurisdictions might seem obvious, it is perceived as a significant challenge by most subnational governments surveyed. More than three quarters of subnational governments report the absence of a joint investment strategy with neighbouring cities/regions. This is particularly marked as an issue for large subnational governments (inter-municipal cooperation bodies, regions, and large municipalities). Nearly the same amount cite the lack of incentives (such as financial incentives) to cooperate across jurisdictions as a problem.

Note: A total of 295 respondents from all EU countries participated in the survey.
Source: (Allain-Dupré, 2017[222]; OECD-CoR, 2015[223]).

Solutions

Multi-level governance arrangements allow countries to maximise the returns on infrastructure investment for development. Key issues include the need to integrate infrastructure investment priorities in broader regional or local development strategies, and co-ordinate investments vertically across levels of government and horizontally across sectors and jurisdictions. Other critical issues are linked to the capacities of regional and local governments to plan and deliver infrastructure. The OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402] – an OECD legal instrument with 40 Adherents – provides guidance on strengthening coordination across sectors, levels of government and among jurisdictions, as well as strengthening capacities of subnational governments to design and implement public investment projects (Table 4.1).

Integrate long-term objectives into recovery strategies in regions and cities

The COVID-19 crisis provides an opportunity to focus investment on long-term objectives such as pursuing a low-carbon transition, promoting resilience, and reducing regional disparities (see Chapter 1). Subnational governments also need to integrate long-term priorities into their COVID-19 recovery strategies. Such priorities include advancing the digital transition, targeting climate priorities, improving health care, and investing in smart public transport and quality housing. Studies show that while metropolitan regions in the OECD contribute about 60% of production-based greenhouse gas (GHG) emissions, remote rural regions may emit three times more GHG emissions per capita than large metropolitan regions (OECD, 2021[225]). All types of regions and municipalities (i.e. metropolitan areas, cities, rural communities, etc.) should actively integrate these long-term priorities into their policies, plans, and programmes to the greatest extent possible.

Setting conditions for recovery investment funds can help direct resources to the key priorities (OECD, 2019[123]). For example, national and subnational governments can consider introducing green and resilience-building criteria for allocating public investment funding. Regions and municipalities can use stimulus packages to support and disseminate green technologies, such as grid investments that facilitate the use of renewable energy and electric vehicles, or nature-based solutions such as landscape and watershed restoration and management. At the same time, governments need to avoid investing in stranded assets, for example in declining technologies or in zones at high risk of damage from hazards such as flooding and wildfires (World Bank, 2020[226]). By the same token, new buildings need to be zero-emission consistent, or else they will have to be refurbished at higher cost in the future.

Table 4.1. Synthesis of key recommendations contained in the OECD Recommendation on Effective Public Investment Across Levels of Government

Principles	Key elements
Co-ordinate public investment across levels of government & policies	
1. Invest using an integrated strategy tailored to different places	• Mechanisms exist to ensure that sub-national investment plans reflect national and sub-national development goals • Complementarities between investments in hard and soft infrastructure • Data available and used to support the territorial assessment and planning processes
2. Adopt effective instruments for co-ordinating across national and subnational levels of government	• There should be communication pathways between national and subnational governments (be it on financing instruments, programme design, resource allocation etc.) • Trust among different levels of government • Co-financing arrangements for public investment exists
3. Co-ordinate horizontally among subnational governments to invest at the relevant scale	• Economies of scale should exist • Synergies between neighbouring or other sub-national governments
Strengthen capacities for public investment & promote policy learning at all levels of government	
4. Assess upfront the long-term impacts and risks of public investment	• *Ex ante* assessments • Long-term operational and maintenance costs should be assessed from the early stages of the investment decision Long-term risks and impacts should be identified
5. Engage with stakeholders throughout the investment cycle	• Mechanisms exist to identify and involve stakeholders throughout the investment cycle • Involvement of public, private and civil society stakeholders • Consultation processes should be inclusive, open and transparent • Feedback from stakeholders is integrated into investment decisions and evaluation
6. Mobilise private actors and financing institutions to diversify sources of funding and strengthen capacities	• Financing institutions should offer more than just financing (eg capacity building of the government)
7. Reinforce the expertise of public officials and institutions involved in public investment	• Cultivate human resources management, knowledge and relationships that ultimately help to improve capacity of officials • Technical assistance should be provided
8. Focus on results and promote learning from experience	• Outcomes to be achieved must be clearly identified from the outset • Through evaluations, performance information contributes to inform decision-making at different stages of the investment cycle
Ensure proper framework conditions for public investment at all levels of government	
9. Develop a fiscal framework adapted to the investment objectives pursued	• Intergovernmental fiscal framework is clear, with timely indications of transfers between levels of government • Grants and co-financing instruments should be present • Enabling conditions for sub-national governments to exploit their own revenue raising potential
10. Require sound and transparent financial management at all levels of government	• Budgeting and financial accountability should be done for the medium and long terms.
11. Promote transparency and strategic use of public procurement at all levels of government	• All stages of the procurement cycle should be transparent, competitive and monitored • Objectives of the procurement should be clearly defined
12. Strive for quality and consistency in regulatory systems across levels of government	• Public consultations are conducted in connection with the preparation of new regulations of sufficient duration, accessibility and appropriately targeted • There should be consistency across sectors and levels of government in national and local policies and targets.

Source: (OECD, 2019[123]; OECD, 2014[224]).

Regions and municipalities around the world are planning for life after COVID-19 with a variety of investments to achieve economic recovery and environmental sustainability, placing particular emphasis on sustainable urban mobility and energy efficiency. The recent OECD-CoR survey shows that 65% of respondents support prioritising the transition to a low-carbon economy "to a large extent" (OECD, 2020[227]). Some regions and cities have started to give a new impetus to their green strategy. The city of Milan offers a good example with its 2020 Adaptation Strategy (Box 4.2). Cities such as London, Montreal and Paris have expanded the number of bike lanes, introduced better hygiene on public transport through contactless fare payments, and encouraged low-emission transport options, such as electric vehicles and scooters. This is also true in many cities in developing countries, including new bike lanes in Chennai, **India**, and more investment into smart and green cities in **China**. The increasing number of green recovery initiatives among city governments showcases their capacity to experiment with innovative solutions that simultaneously address COVID-19 and climate related challenges (OECD, 2020[228]).

Box 4.2. The Adaptation Strategy in Milan (Italy): sustainable infrastructure and rethinking the rhythm of the city

Milan launched the 2020 Adaptation Strategy, which includes rethinking the rhythm of the city to spread the mobility demand over time, adapting infrastructure and public services to the new distancing measures, as well as ensuring that essential services are made available within a 15 minute-walk. It sets comprehensive actions to reduce travel demand (e.g. promoting smart and remote work models); improve and diversify mobility options (e.g. promoting bicycles, electric scooters, shared vehicles); increase public transport safety (e.g. limiting the number of people in public buses and subways, reducing crowds at bus stops and train stations with safety distancing); clear sidewalks; integrate public transport with other mobility systems; enhance automation of transport and parking tickets and passes; and invest in short-term parking spaces (e.g. for delivery of essential goods for healthcare and emergency services).

Source: (OECD, 2020[228]), City Policy Responses, OECD Publishing, Paris

The COVID-19 crisis is pressing many cities to accelerate their pursuit of digital solutions (OECD, 2020[228]). Digital innovation is a means to render urban services more efficient. Data-driven innovation in particular can increase efficiency and promote integration of urban systems ("system of systems"). For example, big data availability on transport flows, energy, water and waste systems permits an unprecedented depth of analysis and facilitates targeted real-time interventions for the better management of urban systems. Smart grids can also be connected to the transport system (mainly with electric vehicles) and home devices to manage energy supply and demand more efficiently (OECD, 2019[229]). COVID-19 is reinforcing the need to invest in communication infrastructure, and to attract private investment in this area. For example, the Smart City Infrastructure Fund established in 2018 by pension investors and the Global Infrastructure Investor Association invested over USD 75 million in the deployment of Smart-City ready communication infrastructure in the city of Fullerton, California (Global Infrastructure Investor Association, 2020[230]).

Coordinate infrastructure investment among levels of government to align priorities

Coordination across level of government is necessary to identify investment opportunities and bottlenecks, manage joint policy competencies, minimise the potential for investments to work at cross-purposes, ensure adequate resources and capacity to undertake investments, and create trust among actors at different levels of government. As highlighted by the OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402], the impact of public investment depends to a significant extent on how governments manage this shared competency across levels of government.

The need for coordination was further reinforced by the management of the COVID-19 crisis and the recovery. In the 2020 OECD-CoR survey, 90% of surveyed subnational governments consider that coordination in the design and implementation of recovery measures is the most important tool for a successful exit strategy (OECD, 2020[227]).

It is also critical to have effective multi-level governance systems, in which responsibilities are clearly assigned, financed, and monitored. Several tools can be used to strengthen the coherence of infrastructure investment among levels of government, such as co-financing arrangements, contracts, formal consultation processes, national agencies or representatives working with subnational areas, and regular inter-governmental dialogue. A 2018 OECD survey shows that many countries have adopted these mechanisms, especially co-financing arrangements and/or regional development strategies/programmes (24 out of 27 countries) (OECD, 2019[123]). If well-designed, for example, by limiting the potential for excessive procedures and red tape, these tools can help to better clarify responsibilities across levels of government, and thereby facilitate the effective implementation of investments. Box 4.3 illustrates two examples of coordination mechanisms.

Box 4.3. Intergovernmental coordination for infrastructure investment in OECD countries

The Australian National Federation Reform Council

In June 2020, the Prime Minister of Australia, with the agreement of Premiers and Chief Ministers, announced a new National Federation Reform Council (NFRC) to replace the Council of Australian Governments (COAG), with the National Cabinet positioned at the centre of the NFRC. The NFRC, which, in addition the National Cabinet, comprises the CFFR and the Australian Local Government Association (ALGA), meets once a year to focus on priority national issues. It is intended that the new model will streamline processes, enabling improved collaboration, communication, and effectiveness.

Under the new structure, the National Cabinet will oversee seven ministerial reform sub-committees in select areas, consolidating the work of 19 ministerial forums and nine regulatory councils. These areas include rural and regional; skills; energy; housing; transport and infrastructure; population and migration; and health.

State-region Contracts – France

State-region planning contracts (*Contrat de plan État-région* – CPER) were established in 1982 and are important tools for the planning, governance, and co-ordination of regional policy among levels of government, notably for infrastructure investment. They have broad thematic coverage, are cross-sectoral, and take a territorial approach that is applied across diverse policy fields including industrial, environmental, and rural issues. For 2014-2020, State-region Contracts focus on five priorities: (i) higher education, research, and innovation; (ii) national coverage by very high-speed broadband and development of digital technologies usages; (iii) innovation, promising niches, and the factory of the future; (iv) multi-modal mobility; and (v) the environmental and energy transition. In order to ensure equality among territories within the regions, the contracts will mobilise specific resources for priority areas: urban priority neighbourhoods, vulnerable areas undergoing major economic restructuring, areas facing a deficit of public services (rural areas), metropolitan areas and the Seine Valley. Inter-regional contracts for mountainous and fluvial basins will be renewed. The 2021-2027 generation of CPER will include a section and funds specifically dedicated to the recovery covering a two year period, in addition to “common law” funds over seven years.

Source: (Australian Government, 2020[231]) (Ministrère de la Cohésion des Territoires et des Relations avec les Collectivités Territoriales, 2020[232])

Adopt a place-based and integrated approach across sectors for infrastructure investment

All levels of government need to seek and build on complementarities across sectors when undertaking public infrastructure investment (OECD, 2014[233]). This is a way to avoid building "cathedrals in the desert", which may lead to an inefficient use of public resources. For example, investments in housing should to be complemented by investments in transport networks. Such complementarities need to be built into integrated strategies from the outset, and can require specific governance mechanisms, such as a broader regional or local development strategy, to ensure that they materialise. Infrastructure needs to be well-coordinated with spatial and land use planning, as well as other with horizontal policy areas (e.g. housing, environment, industry, agriculture, water) so that they are mutually reinforcing.

The value of designing an integrated approach to territorial and urban development from the start of the planning process should not be ignored. Cities that take an integrated approach – combining the social, economic, and environmental dimensions – generate strategies for building resilience, social cohesion, and sustainability, and may help mobilise external financing from financial partners. The design and implementation of integrated strategic plans requires managing the coordination challenges associated with bringing together different city sectoral departments, as well as those linked to measuring impact and results (Council of Europe Development Bank, 2020[234]).

Infrastructure investment strategies inevitably vary by area, i.e. urban versus rural areas, or mixed locations. To design place-based strategies, subnational actors are pivotal in identifying local needs and exploring synergies among investment priorities, given they are likely to have more first-hand knowledge of policy complementarities and trade-offs in the region than national governments. Sound economic and technical feasibility analysis should guide such strategies, to ensure that the priorities and programmes are based on a realistic view of resource availability and constraints. Building subnational capacity to design infrastructure strategies is crucial. A pre-requisite for capacity building is also to limit constant changes in the rules. A stable and predictable legal and regulatory framework underpins the economic efficiency of infrastructure investments.

It is just as important to invest in soft infrastructure (e.g. human capital, research and development, innovation, labour market needs, business needs, etc.) as in hard infrastructure. The objective is to put the right infrastructure in the right place to maximise its contribution to sustainable development and to the well-being of the population. To achieve this, subnational governments need to consult with a broad range of stakeholders – not only representatives from different levels of government, but also non-government subnational actors such as businesses, universities, non-governmental organisations (NGOs), etc. To underpin this, a robust and clear regional or local development strategy for infrastructure is critical, as it can also help attract private investment. By setting out the policy orientation and clarifying government support in the medium- and long-term, it can help boost the confidence of private investors – particularly important in times of crisis recovery, such as that associated with COVID-19.

A place-based and integrated approach for infrastructure investment needs to be supported by good data. Governments should encourage the production of data at the right territorial scale to inform investment strategies and produce evidence for decision-making. Subnational governments, especially municipalities, are key elements in addressing information and data gaps for infrastructure. In order to better understand the accessibility to key infrastructure sectors and investment needs, national governments should mobilise regional and local governments in information collection. For example, in order to develop the National Investment Plan 2020-2050, the government of the **Czech Republic** used regional authorities to gather local investment plans. Data are collected via a system of Regional Permanent Conferences. The government will use the data collected on local needs to create a long-term fiscal framework and define investment priorities for the Czech Republic. The National Investment Plan was then further developed based on consultations with local and regional authorities and stakeholders (OECD, 2019[123]). Having

information regarding the annual income and expenditures of regions and municipalities can also be very useful for the assessment of infrastructure-related to the territorial environment.

Box 4.4. Examples of place-based and integrated infrastructure investment

The City of Genoa, Italy

In a move to build resilience and ensure quality infrastructure investment, the City of Genoa (Italy) developed and approved its "Lighthouse Genova Città Faro" resilience strategy in November 2019. The strategy offers an innovative and integrated framework to assess and build the resilience of municipal investments and initiatives by classifying municipal assets into three categories: grey assets (physical infrastructure), green assets (urban environment), and soft assets (socio-economic assets and governance). The emphasis on soft assets for resilience is one of the innovative features of this framework, as it allows the City of Genoa to identify and address the socio-economic vulnerability of urban residents and increase the social value of investments that enhance resilience. This approach is based on evidence indicating that a traditional focus on grey and green assets is insufficient to build resilience given the new threats and shocks cities face. The City of Genoa's experience demonstrates how to integrate resilience into existing planning and investment budgeting processes, while also using plans and operational tools already in place for implementation – such as the Municipal Investment Plan. The City of Genoa plans on implementing this new strategy through an action plan designed using a participatory approach, and which will be updated annually.

Japan

In Japan, the national and subnational governments are closely linked in an expanding portfolio of national and subnational "National Resilience Plans" (NRPs). These plans aim to ensure that important infrastructure systems such electricity, airports, ICT, railroads, and flood protection can perform their functions in the event of any disasters, and thus protect human lives and support the national economy. The NRPs have legal precedence over other plans, and they are strongly focused on breaking down the governance silos in policy and investment delivery in order to secure holistic and inclusive resilience. In the COVID-19 context, 26 national resilience working groups also provide recommendations for how to better integrate pandemic risk-reduction into Japan's resilience paradigm.

All prefectural (regional) and local plans are formulated on the basis of local risk assessments, built on the advice of local experts and open meetings. By March 2020, all of Japan's 47 prefectures had adopted their own regional version of the NRP, and 1 355 out of 1 741 cities and towns had either adopted or were formulating their own plans. Over JPY 6 trillion per year are allocated to fund hard infrastructure and soft measures (e.g. enhancing public governance capacity) for building resilience. The Tokyo Metropolitan Government, for example, planned to allocate JPY 733 billion within fiscal year 2020 for modernising critical infrastructure (waterworks, transport, communications, medical, flood protection, etc.), as well as for disaster resilience, pandemic response, and other public goods.

Hertfordshire County, United Kingdom

Hertfordshire County in southern England is committed to reinvigorating and reinventing its towns to respond to the challenges of COVID-19. The Hertfordshire Growth Board launched the Watford Junction Quarter transformation programme to achieve its local development vision: a distinctive new urban quarter focused around a major transport hub of regional importance including a thriving town centre, mixed use neighbourhoods, much needed housing, employment opportunities, and enhanced retail, leisure, and community offerings. The programme comprises several core interconnected elements:

- Expand and enhance Watford Junction Station and strategic transport infrastructure, providing an enhanced station interchange, pedestrian access via a new public access footbridge across the railway tracks to improve connectivity and station capacity.
- Open up and connect a major town centre redevelopment site on brownfield land in order to facilitate creation of a new urban quarter delivering housing and employment space.
- Enhanced local infrastructure (environmental and educational) to optimise the level of development to be delivered in a highly sustainable location.

Source: (Council of Europe Development Bank, 2020[234]), Investing in inclusive, resilient and sustainable social infrastructure in Europe: the CEB's experience; (OECD, 2019[123]), Effective Public Investment across Levels of Government: Implementing OECD Principles, https://www.oecd.org/effective-public-investment-toolkit/; (OECD, 2020[227]), Place-based recovery: How counties can drive growth post-COVID-19, https://www.grantthornton.co.uk/globalassets/1.-member-firms/united-kingdom/pdf/publication/2020/place-based-recovery.pdf; DeWit, Djalante and Shaw (2020[235]), Building Holistic Resilience: Tokyo's 2050 Strategy, https://apjjf.org/-Andrew-DeWit--Riyanti--Djalante--Rajib-Shaw-/5386/article.pdf; (The Cabinet Secretariat of Japan, 2020[236])

Facilitate cross-jurisdiction cooperation for infrastructure to achieve economies of scale

Cooperation across jurisdictions is fundamental to supporting recovery efforts, including averting a fragmented approach to public investment. Such cooperation extends across borders, too. Cross-jurisdiction cooperation is useful for reducing the duplication of infrastructure investments among local or regional authorities, and may further contribute to creating spatial complementarities (spatial complementarities can also be an element of an integrated approach for investment, as discussed in the previous recommendation). Co-operation and partnerships between local governments are also crucial for metropolitan areas where their functional borders do not always coincide with the administrative territorial borders (OECD, 2014[233]). Cross-jurisdiction cooperation is relevant for small municipalities with low populations and low tax revenues, as well. Given the need to achieve economies of scale, it is important for subnational governments to mutualise risks and expertise, as well as procurement and to develop e-procurement. Nevertheless, cross-jurisdiction cooperation for subnational infrastructure investment is a challenge for local governments in many countries, in particular in large functional urban areas (FUAs).

Mechanisms to support such cooperation include contracts, specific public investment partnerships, or joint authorities. National governments can provide incentives and/or create opportunities for regional and/or local governments to match public investment with the relevant geographical area. By 2018, 16 out of 27 OECD countries had established specific incentives to foster co-operation across municipalities in the form of special grants, special tax regimes, additional funds for joint public investment proposals, or bonus grants for municipalities that generate savings through co-operation (G20/OECD, 2020[186]). For many years in the **United States**, in order to obtaining grant funding from the federal government for transport infrastructure and waste water investments, local governments were required to create a metropolitan planning organization (MPO) and support funding requests with a regional plan for the respective sector. Some governments, for example those of **Canada**, **Norway** and the **United States**, provide consulting and technical assistance, promote information sharing, or provide specific guidelines on how to manage collaboration (OECD, 2017[14]).

Box 4.5. Cooperation across municipalities for joint infrastructure projects

In **Brazil**, the Foz do Rio Itajaí Region, comprised of 11 municipalities and located in the state of Santa Catarina, is planning a network of five Bus Rapid Transit (BRT) corridors and six priority bus lanes as part of the region's integrated mobility strategic plan. The municipalities lack a quality public transport system with 80% of trips currently undertaken with private vehicles. The project is expected to reduce congestion and improve air quality by increasing the share of trips made by public transport, which is expected to rise from 10% up to 45% by 2045.

In the **Netherlands**, the Hague Metropolitan Area (MRDH) brings together 23 municipalities to work on a sustainable region with clean, quiet, and energy-efficient transport. The current package contains a total of 26 measures, and each is carried out by an average of seven municipalities. The communities take between 3 and 25 measures aimed at reducing CO_2 emissions. The MRDH picks up 14 measures based on its core tasks and supplements them with 2 new measures. A number of measures are being taken by a larger group municipalities, such as the Metropolitan cycle routes measure (20 municipalities) and the expansion of charging infrastructure (18 municipalities).

The *Building Accessibility Together* is the accessibility programme of the Amsterdam Metropolitan Area (MRA), in which the government and the Region are working together since 2018 on the challenges in the field of accessibility and urbanisation. The collaborating parties include the Ministries of Infrastructure, Water Management and the Interior, and the authorities represented in the Amsterdam Metropolitan Area partnership (i.e. the provinces of Noord-Holland and Flevoland, the Amsterdam Transport Region, and 32 municipalities including Amsterdam, Haarlem and Zaanstad). The business community is also involved in many projects. A programme council meets at least twice a year.

In **France,** inter-municipal cooperation bodies with own-source taxes (*établissements de cooperation intercommmunale à fiscalité propre - EPCI*) are playing an increasing role as local public investors. While in 1993, their investment expenditure amounted to 8% of municipal investment, they now account for 25%. This reflects the increase in the coverage of French territory by EPCI. In January 2020, there were 1 254 EPCI, grouping all 35 000 French municipalities. It also reflects and the growing importance of their responsibilities. The 2015 NOTRe law (New territorial organisation of the Republic) has further increased the number of mandatory responsibilities that inter-municipal cooperation bodies have. The EPCI includes *métropoles* (metropolises), introduced by the 2014 "MAPTAM" law on the modernisation of public territorial action and metropolises. The *métropoles* status is reserved for functional urban areas greater than 400 000 inhabitants. There were 21 *métropoles* in France as of 1st January 2020, including the three largest metropolitan areas, Paris, Lyon, and Aix-Marseille-Provence. French *métropoles* carry a growing number of major infrastructure projects at the metropolitan scale. According to their legal status, *métropoles* have to "design and conduct projects for economic, ecological, educational, cultural, and social planning and development" in order to "improve cohesion and competitiveness and contribute to the sustainable and mutually supportive development of the regional territory".

Source: (PwC-Global Infrastructure Facility, 2020[237]) (Metropool regio Amsterdam, 2020[238]) (MetropoolRegio Rotterdam den Haag, 2020[239]) (ADCF, 2019[240])

2. Addressing larger financing gaps for infrastructure investment in local and regional governments

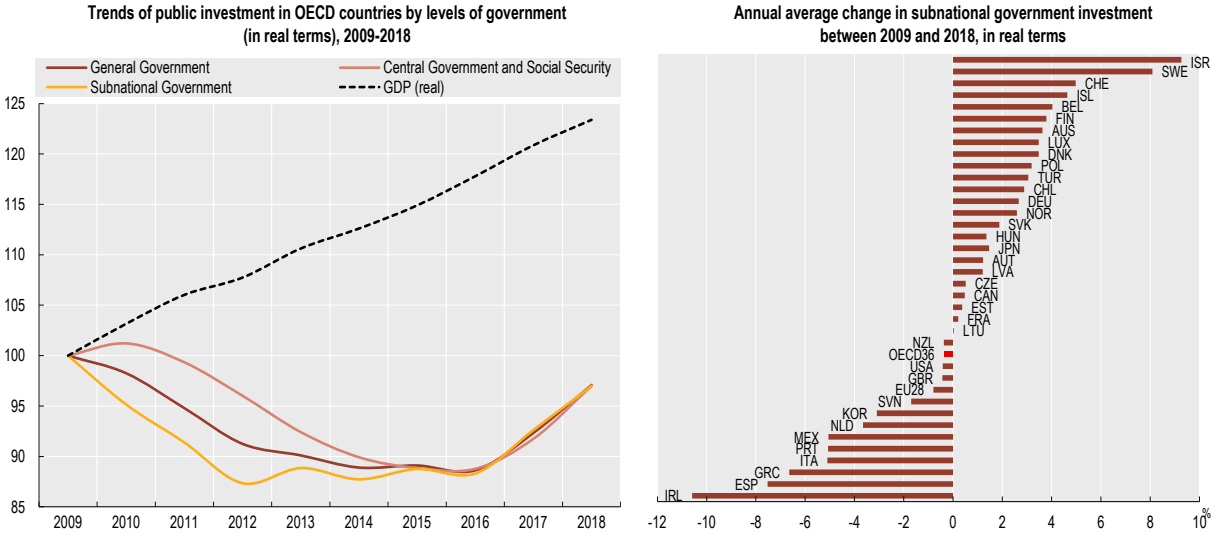
Challenges

The COVID-19 crisis is strongly affecting subnational government finance. Subnational expenditures, particularly on health and social services, are increasing. Meanwhile, subnational revenue is declining, particularly in terms of tax revenue and user charges. In the CoR-OECD survey conducted in 2020 among over 300 representatives of subnational entities in the EU, 85% of subnational governments surveyed report a negative impact on their finances in the short- and medium-term (OECD, 2020[227]).

Not all subnational governments are exposed to the same risks. Those that rely on revenues that are sensitive to economic fluctuations and those with significant health, public safety, and social welfare responsibilities are more vulnerable (OECD, 2020[241]). Results of the CoR-OECD survey also show that large cities of over 500 000 inhabitants expect the most severe impact, as they depend more on taxes and user charges than other jurisdictions (OECD, 2020[227]).

For almost a decade prior to the COVID-19 crisis, subnational governments have grappled with the growing demand for infrastructure coupled with insufficient funding. The 2008 global financial crisis and the adoption of fiscal consolidation measures from 2010 onward put a severe strain on subnational finance. Subnational public investment was cut back in a majority of OECD countries. It took around a decade for subnational public investment to recover to the 2008 pre-crisis level, in real terms and as a percentage of GDP. Overall, between 2009 and 2018, subnational public investment in OECD countries decreased by 0.3% per year in real terms (but 1.8% per year between 2009 and 2016) (Figure 4.1).

Figure 4.1. Change in public investment from 2009 to 2018 by levels of government in the OECD (in real terms)



Source: (OECD, 2020[8]), Regions and Cities at a Glance 2020; Calculation based on (OECD, 2014[35]), Subnational Government in OECD Countries: Key data 2018.

The risk of using public investment as an adjustment variable is high post COVID-19, given the contraction of self-financing capacities and increasing deficits (OECD, 2021[135]). The scissor effect on subnational public finance, i.e. an increase in expenditure and a decline in revenue, could lead to increased deficits and short and long-term debts. This may lead to fiscal consolidation plans in the medium-term, such as after 2010, leading to potential cuts in public investment, which could undermine the recovery. In some regions and cities, public investment projects have already been cancelled or postponed. A May 2020 survey of 200 German municipalities indicated that half of them had postponed their investment, and one-third expected investment to decrease or plummet that year (KfW, 2020[242]). A survey in the United States found that 65% of cities are being forced to delay or completely cancel capital expenditures and infrastructure projects (National League of Cities, 2020[243]).

To a large extent, the fiscal impact of the COVID-19 crisis on subnational governments depends on the support provided by central governments to maintain, or boost, subnational investment through stimulus packages (capital transfers), as well as to build the ability of subnational governments to access long-term borrowing. While monitoring the long-term sustainability of public finances, it is nevertheless important for countries to avoid replicating the scenario that took place after 2010 when drastic cuts in subnational public investment had a pro-cyclical effect and impeded the recovery.

Challenges in financing social infrastructure in region and municipalities

Quality social infrastructure can have a positive impact on social cohesion by ensuring equal access to good quality, affordable basic services for all, and contributing to greater productivity. The COVID-19 crisis has exposed the vulnerabilities that can arise from protracted underinvestment in the health, education, and other social sectors. The capacity of existing infrastructure to provide services in the wake of the pandemic has been severely strained, particularly in the health sector (Council of Europe Development Bank, 2020[234]).

Across OECD countries, subnational governments are in charge of many social-sector responsibilities, as well as health and education which have a large societal effect (e.g. nurseries, retirement homes, social housing, regional and local hospitals, primary care centres, schools, etc.). There are and will continue to be pressing needs for social infrastructure investments post COVID-19, including to introduce digitalisation into social infrastructure, in order to ensure greater individual and community resilience.

The investment gap for social infrastructure is significant, and was so even before COVID-19. For example, it is estimated that in Europe there is a EUR 100-150 billion annual investment gap in social infrastructure, and that the level of investment in social infrastructure has lagged behind that in traditional infrastructure (ELTI, 2017[244]). One reason is that social infrastructure is often the responsibility of local authorities, which face specific budget constraints and limited access to financial markets (Council of Europe Development Bank, 2020[234]). Another reason is that, unlike economic infrastructure, social infrastructure investments have distinctive features that are not always attractive for the private sector. Social infrastructure projects are generally small and they rarely produce cash flows, except in some sectors such as health or housing. Meanwhile, economic infrastructure, such as toll roads, ports, airports, or power generation plants, usually collect revenues in the form of user charges and fees from end users. This is one explanation why, in the European Union, around 90% of social infrastructure is publicly financed, depending on sectors and countries. In addition, private investors privilege investments in wealthier regions and metropolitan areas that can yield higher returns. Relying too much on the private sector for reducing the investment gap may thus result in more regional inequality (ELTI, 2017[244]).

Challenges in financing infrastructure maintenance

Prior to the COVID-19 crisis, infrastructure spending was insufficient to address both the need for building new infrastructure and maintaining existing infrastructure. Infrastructure maintenance is a large challenge

for many countries, in particular in the OECD. The quality of infrastructure has deteriorated in some countries and deficiencies in infrastructure can hamper productivity, socio-economic opportunities, and resilience. In a 2016 survey among local governments in the U.S., 42% of respondents reported that the current state of the existing local infrastructure adversely affects the quality of life in a community (Chen and Bartle, 2017[245]).

Financing the maintenance of infrastructure has its particular challenges when compared to financing new construction. In the short-term, it is politically painless to avoid spending funds on infrastructure maintenance, leaving the consequences to the next administration (Bhattacharya et al., 2016[219]) (GrantThornton, 2020[246]). Maintenance expenditure is considered a current expenditure, rather than a capital expenditure, and therefore often cannot be financed through borrowing according to the "Golden Rule" that applies to local governments in many OECD countries. Also, in general, subnational governments have an easier time accessing loans or grants from international institutions to construct new infrastructure than to maintain what is already in place. In Europe, a particular problem is that public authorities cannot apply EU Structural and Investment Funds for infrastructure maintenance, as the Funds are only for construction and upgrade (European Court of Auditors, 2020[247]).

Post COVID-19, the risks are that maintenance expenditure may slow or be further cut back given a tight fiscal context. The future costs for repairing, renewing, or even replacing infrastructure that has suffered from a lack of maintenance are often higher, not to mention the safety risks involved. Investing in maintenance is much needed, and the recovery from COVID-19 is the right time to do so as maintenance projects are relatively small, generally quick, and often less complex, so these investments can be rapidly implemented (IMF, 2020[58]).

Solutions

Use appropriate measures to support lower-level governments to maintain or boost their infrastructure investments for the recovery

Higher-levels of government – international, national, or regional – should support subnational governments in their efforts to maintain or increase their infrastructure investment for recovery. For example, a large part of the **European Union** recovery and resilience package is targeted on supporting government infrastructure investment. The Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU) initiative was adopted in May 2020 to continue and extend the crisis response and crisis repair measures delivered through the Coronavirus Response Investment Initiative (CRII) and the Coronavirus Response Investment Initiative Plus (CRII+). It aims to contribute to a green, digital, and resilient economic recovery. REACT-EU will add fresh additional resources to existing cohesion policy programmes, i.e. to the existing 2014-2020 envelopes and to the proposed envelopes for the 2021-2027 period. The Just Transition Mechanism focuses on the most affected regions to alleviate the socio-economic impact of the transition, and will also support infrastructure investment at subnational level.

National governments should support subnational public finance to allow subnational governments gain more fiscal space for public investment. A number of state and regional governments are also developing initiatives to support public investment in their areas, and to support local government investment projects. As of June 2020, more than two thirds of OECD countries had adopted measures to support subnational public finance. Various fiscal instruments have been activated including measures on the revenue side (e.g. emergency grants and compensation schemes, and tax arrangements) and the expenditure side (e.g. VAT exemptions, public procurement), relaxation of fiscal rules, and diverse measures aimed at facilitating financial management (OECD, 2021[135]).

Regarding fiscal rules, while their primary purpose is to mitigate subnational fiscal risks through the imposition of constraints on fiscal policy, they are also susceptible to pro-cyclical tendencies if they are too

rigid or subject to short time frames. Therefore, during a crisis, it may be possible to relax such rules along two lines, either formal escape clauses that can be triggered by prescribed circumstances, and/or an effective suspension of the rules in practice when it is unreasonable to expect subnational governments to comply (OECD, 2020[241]). Nonetheless, adopting these fiscal instruments should be temporary, with the goal to help subnational governments recover from the crisis. In addition, the specific design and implementation of these measures will vary from country to country, depending on existing inter-governmental fiscal relations, and the culture and practices of dialogue and negotiation between the central and subnational governments (OECD, 2021[135]).

More generally, national governments can activate different levers to help maintain, or even boost, regional and local infrastructure investment. In addition to helping subnational governments improve their self-financing capacity (i.e. gross savings), measures can include relaxing budget and debt rules, increasing capital transfers, easing the access to long-term credit and financial markets, and supporting project preparation and implementation (Box 4.6).

Box 4.6. Examples of policy measures supporting subnational government public investment

In **Austria**, a EUR 1 billion package was established to support municipal investment by increasing federal capital transfers from 25% to 50% of municipal investment.

In **France**, as part of its emergency plan and recovery measures, the government increased the current Support Grant for Local Investment from EUR 0.6 billion to EUR 1.6 billion, placing particular emphasis on financing green and health sector investments. While waiting for the new generation of State-Region planning contracts to be signed, “recovery agreements” are being discussed between the central and regional governments for 2021-2022.

In June 2020, the **German** federal government adopted a “package for the future” of EUR 130 Billion. It includes measures to support states and municipal investment. Municipalities will receive fiscal support from the federal budget amounting to an additional EUR 4 billion per annum through higher federal payments into social housing schemes. The federal government will also increase its grants to finance public transport systems and sport facilities. Several Länder, such as Bavaria, Baden-Wuerttemberg, Hesse, North-Rhine Westphalia, Saxony-Anhalt, and Saxony have announced comprehensive support packages that include measures to support infrastructure investment.

In **Korea**, the government implemented several financial packages to stimulate the economy, including measures to support local governments. The First Financial Stimulus Package of KRW 4 trillion included support related to internal and local tax. The 2020 Supplementary Budget amounted to KRW 11.7 trillion, and included support to the most severely hit areas of Daegu City and North Kyeongsang Province. Support to local governments for the recovery are also included in the Korean New Deal.

Source: (UNDP, 2017[248])

Optimise and diversify subnational resources to finance investments, using public and private sources

Subnational governments have a wide range of funding sources and financial tools at their disposal to finance infrastructure investment. Yet, they do not or cannot always take advantage of these due to a restrictive fiscal framework, weak financial engineering capacities, or budget limits. Public sources of funding must be mobilised and diversified to finance infrastructure investment, but they will not be sufficient to cover the investment needs. To supplement public resources, subnational governments need to seek

external financing, mainly through mobilising the private sector including institutional investors. Subnational governments should seek to mobilise and strategically allocate different resources, and adopt instruments that are adapted to the specific characteristics and needs of projects.

Optimise the use of traditional budgetary tools

Subnational governments need to optimise the use of traditional budgetary tools. For example, as far as investment in environmental and climate infrastructure is concerned, many traditional sources of subnational government revenue can be designed or adjusted to create funding for climate-neutral investment projects. Establishing a multi-annual budgeting process linked to investment strategic planning can be particularly beneficial. Adequate medium/long-term financial planning will help improve the framework for implementing infrastructure investment with respect to balancing revenue and spending. The capacity for financial planning and management can be particularly important for securing infrastructure maintenance, which usually requires current expenditure and/or periodic investments.

Subnational governments also need to increase their self-financing capacities for infrastructure investment, both for construction and maintenance. They can adopt a variety of instruments in using own-source funding. For example, linkage fees can be charged to finance public housing[29]. Earmarked taxes such as tobacco and fuel taxes, tolls, congestion pricing, and carbon taxes can be used for financing road, public transit, water and sewerage construction and upgrading, although they may risk reducing flexibility in sectoral allocation (OECD, 2021 forthcoming[249]).

Environmental taxes, including carbon taxes, offer a potential source of expanded revenue for subnational green investment projects. More taxing power would provide subnational governments with the possibility of implementing a regional or local climate-friendly tax policy. This can be done through rates and bases, but also by creating local eco-taxes. For example, the City of Portland (Oregon, **United States**) managed to raise a tax for all fuel sold in the city. The revenue generated is used for street repair, sidewalk construction, creating safer corridors for bicycles, and intersection safety. Policymakers must identify who gets taxed from the outset, on what basis, how the tax is designed, whether changes in technology or behaviour could ultimately influence the level of tax receipts obtained, and how the funds will be used. The stability offered by this type of revenue stream is an important consideration (G20/OECD, 2020[186]). In addition, global climate change imperatives offer potential for tax reform, including property tax and zoning reforms at local levels to finance sustainable infrastructure and inclusive growth while preserving local and global environments (OECD, 2020[227]). User charges and fees such as congestion charges, parking fees, high occupancy toll lanes, and water and wastewater charges can constitute additional sources of revenue for climate-related infrastructure investments, while incentivising GHG emissions reduction and adaptation to climate change (G20/OECD, 2020[186]).

National governments can increase direct financial support to subnational governments through earmarked grants and subsidies to develop climate compatible infrastructure and demonstration projects, for example. National funds directed to climate-related investments and activities can be an important lever to encourage subnational climate action and catalyse further investment. Since 2000, **Germany** has funded climate-related projects through its National Climate Initiative (OECD, 2020[215]). **Canada** created the Low Carbon Economy Fund in 2017, as a primary means for the federal government to implement the Pan-Canadian Framework on Clean Growth and Climate Change at the provincial and territorial levels (OECD, 2020[215]). An explicit goal of both funding mechanisms is to catalyse additional investments, and both are a primary means for the national-level government to implement their climate goals at the state/provincial level (G20/OECD, 2020[186]).

Exploit new sources of revenue

Making the most of property income and land-based financing instruments is another way of diversifying revenue sources to finance infrastructure. Significant potential remains to exploit land-based financing instruments as a revenue-raising mechanism for subnational infrastructure investment. While data on the

rate of use of land value capture (LVC) by subnational governments could not be found, one estimate stated that infrastructure investments could be paid for by capturing 16% of total land value increases (Lincoln Institute of Land Policy, 2017[250]). Local governments are well positioned to use this mechanism. For one, local governments usually have discretion over land use, and planning schemes can be devised to generate additional value on existing pieces of land. In addition, land is fixed and immobile, and thus a fee or tax can only be evaded if the owner actually sells the property and moves to (or invests in) a different piece of land (Bhattacharya et al., 2016[219]). There are a variety of LVC tools available for subnational public infrastructure financing, with differing levels of sophistication, including taxes, fees and user charges, to more innovative mechanisms such as land banking, tax increment financing, and betterment levies. Tax increment financing for example can be used to finance physical infrastructure for brownfield remediation and city centre revitalisation and infilling. Many OECD countries have adopted one or several LVC tools for infrastructure financing. In cases where LVC has been successful, it is largely attributed to deep local support, technical competences, institutional mechanisms, and a commitment from leadership.

LCV financing for infrastructure can be explored at municipal and metropolitan levels. For example, a municipality can charge developers a fee for additional development rights to fund infrastructure. In some jurisdictions, developers can bid at auctions to purchase building rights in the form of higher Floor Area Ratio ("FAR") from the city. This is the case of CEPACs (*Certificados de Potencial Adicional de Construção*) in **Brazil**. The City of São Paolo has generated nearly USD 2 billion from CEPACs to fund infrastructure and planning programmes within a designated redevelopment area. The Washington Metropolitan Area Transit Authority (WMAT) in the **United States** has adopted a strong approach towards joint development for financing infrastructure, using multiple instruments such as site leasing, long-term development agreements on WMATA-owned land adjacent to stations, air right sales, connections agreement, etc. in the metropolitan area (German National Climate Initiative, 2020[251]).

Leverage capital markets and private sector resources

As outlined in Chapter 3, a range of capital market instruments exist (including various debt instruments and equity funds) for mobilising external financing for infrastructure investment exist. However, access to borrowing by subnational governments remains difficult in some countries because of strict prudential rules. Although it is crucial to maintain fiscal discipline and avoid situations of excessive indebtedness and fiscal distress, some debt rules could be softened, at least on a temporary basis, to facilitate infrastructure investment and participation in recovery plans. Long-term borrowing to finance investment can permit a better allocation of resources over time, and contributes to greater intergenerational justice. It is also a financial necessity in a context of insufficient local savings and capital transfers, especially in times of high fiscal pressure. Finally, with current long-term interest rates close to zero in many advanced economies, the social rate of return on public investment is likely to exceed the financing costs for many projects. This is a good time to use borrowing to boost public investment.

Countries with a margin of manoeuvre to soften strict fiscal rules on subnational governments can facilitate access to borrowing. Subnational government access to bond financing is very difficult in **Europe**, but is widespread in **North America**, **Japan** and **Korea**. In the **United States**, state and local governments borrow money from investors to fund specific projects by issuing municipal bonds, which are tax-exempt and used for economic and social infrastructure projects across the country. In **Canada**, municipal bonds are not tax-exempt, but they are widely used to finance provinces and municipalities. In several provinces, municipalities can borrow at low interest rates and low transaction costs through municipal financing authorities or corporations (MFAs or MFCs) that are centralised provincial lending agencies with high credit ratings. In **Japan**, local government bonds (*chihousai)* are also widespread and can issued by Japanese Local Governments (prefectures, municipalities (cities, towns and villages), Tokyo's special wards and local government cooperatives) to borrow money.

National governments should facilitate local government access to capital markets. In general, national governments may consider assisting subnational governments by using their higher credit rating to lower the cost of borrowing by borrowing from capital markets on their behalf and then on-lending to subnational governments (OECD, 2020[227]). Nevertheless, in many G20/OECD countries, subnational governments, and especially cities, are not legally allowed to issue bonds on capital markets. When it is allowed, it is not always widespread. Transaction costs of bond issuance are still prohibitive for small subnational governments in many countries. Yet bonds are a potential solution for the largest municipalities and regions, as they have a sizeable financial foundation. In many OECD countries, national and/or regional governments actively assist local governments by providing technical assistance for project appraisal and implementation, and assist local governments to explore joint borrowing across jurisdictions. They also help by setting up specialised agencies to pool local debt, thereby facilitating access to lower-cost finance for infrastructure investment. Leveraging national-level support is also particularly important in developing countries, where many local government-led projects have difficulties in accessing external financing as a result of their weak subnational balance sheets and creditworthiness, lack of a domestic borrowing market, legal restrictions on subnational borrowing, and lack of clear sovereign backing, among other factors (Pilkington and Buchalla Pacca, 2019[252]).

Subnational pooled finance mechanisms (SPFMs) are one promising mechanism to facilitate subnational government's access to capital markets to finance infrastructure development. SPFMs have been developed in several countries, such as in the case of the municipal bond banks in the **United States**. These mechanisms provide joint access to capital markets for subnational governments that share similar missions and credit characteristics, but lack the financial scope and scale, expertise, and credit history to access credit markets on their own. This can be particularly helpful for small projects, as they mitigate debt service payment risk, diversify project risk, and provide the technical professional management required to enable sustainability and access to private finance. Beyond economies of scales, pooling demand for capital has a number of advantages, in particular higher volumes and liquidity, and diversified products, which can lead to significant cost benefits for local governments.

SPFMs have been used in Nordic countries where local government funding agencies are well established (**Denmark**, **Finland**, **Sweden**, **Norway**) and are developing in **France**, **New Zealand** and the **United Kingdom** (Box 4.7). Other examples include **Canada**'s Provincial-Municipal Finance Corporations, and the Municipal Bond Banks in the **United States** (sponsored by the states but privately managed).

Green bonds and similar instruments such as climate bonds and environmental impact bonds constitute another promising source of finance for sustainable infrastructure investments for subnational governments, especially large cities. In fact, subnational governments are becoming significant issuers of green bonds or climate bonds, particularly in the **United States**. Big cities such as New York plan to use their green bond revenues on waste water adaptation and a USD 1.7 billion subway expansion. Wuhan in central **China** has a total bond issuance of USD 8.7 billion, with planned projects including flood protection and a public bicycle service. Amsterdam, Gothenburg, Johannesburg, Lagos, Mumbai, and Tokyo are all potential green bond issuers (The City of Portland, 2016[254]). In July 2020, the West Berkshire Council issued the **United Kingdom**'s first local government green bond using a crowd investment platform. This innovative financing solution is called Community Municipal Investment and encourages local citizens to become investors for green projects in their own municipalities (National Economic and Social Council of Ireland, 2018[255]).

Box 4.7. Subnational Pooled Financing Mechanisms

The Nordic model of local government funding agencies is long established in **Denmark**, **Finland** and **Sweden,** providing participating municipalities the possibility of tapping into the bond markets through the agency in exchange for an initial capital contribution. The first municipal funding vehicles were created in the Nordic countries: *KommuneKredit* in Denmark set up at the end of the 19th century (1898), *Kommuninvest i Sverige* AB in Sweden (1986) and Municipality Finance PLC in Finland (1989). In **Belgium**, the *Crédit Communal de Belgique*, now a national public bank (Belfius) was also a municipal co-operative bank dedicated to the financing of member municipalities when it was created in 1860.

Amid the backdrop of the 2008 global crisis, new local government funding agencies have emerged in the OECD. In **New Zealand**, the New Zealand Local Government Funding Agency Ltd (LGFA) was created in 2011 to provide efficient funding costs and diversified funding sources for the country's local authorities. In **France**, *Agence France Locale*, was created by 11 subnational governments (one region, three departments, four inter-municipal co-operation bodies, and three municipalities) in December 2013 as a result of new banking legislation. *Agence France Locale* is 100% owned by French local authorities. In the **United Kingdom**, the English Local Government Association (LGA), together with the Welsh Local Government Association (WLGA), started to explore the possibilities of creating a Municipal Bond Agency in 2011. The UK Municipal Bonds Agency Plc was created in June 2014 as a public limited company, owned by local councils and the Local Government Association. Its objective is to help local councils to finance their investment in projects including infrastructure and housing in an efficient and cost-effective manner.

Source: (OECD, 2017[253])

Despite difficulties in attracting private sector financing for social infrastructure, innovative solutions in this area are emerging, including social bonds, bundled PPPs, and even crowdfunding for small projects. Social bonds started life as an offshoot of the green bond category and are now developing separately, indicating that they are equally viable for issuers and investors. Social bonds are used to finance projects or assets that result in a positive social outcome. In 2017, the Council of Europe Development Bank (CEB) developed a Social Inclusion Bond Framework with the first bond issuance of EUR 500 million in April of the same year. This Framework is in line with the International Capital Markets Association (ICMA) Social Bond Guidance developed in 2016. The proceeds from this issuance are exclusively to finance social investment dedicated to social housing, education, and job creation in micro, small, and medium enterprises (MSMEs).

Social bonds issued by subnational governments are also increasing in number. The city of Los Angeles in the **United States**, for example, which faces a large housing deficit, pioneered the issuance of a series of social bonds amounting to USD 276 million to finance construction of 10 000 housing units for the homeless (Environmental Finance, 2019[256]). The city of Toronto in **Canada** recently issued a social bond of CAD 100 million to finance a revitalisation programme that provides specialised care for vulnerable populations, including a long-term care home, a transitional living facility, an emergency shelter, affordable housing, and a community hub (City of Toronto, 2020[257]).

Coronavirus responses bring these innovative and new instruments into greater focus. Following the outbreak of COVID-19, the Community of Madrid in **Spain** turned to capital markets to raise funds to support the regional health system, issuing a EUR 52 million 3-year social bond (BBVA, 2020[258]). In **France**, the framework used by the Île-de-France regional government for its green and sustainable bond

issuances was slightly modified with the addition of a sub-category to ensure the eligibility of social and health actions adopted during the fight against COVID-19 (Region Ile-de-France, 2020[259]).

Public-private partnerships (PPPs) can also be applied as a mechanism for mobilising private investment for subnational infrastructure delivery. PPPs need to be undertaken carefully at the subnational level, based on a robust evaluation of value-for-money (see also Chapters 2 and 3), and should be used primarily by regions and larger jurisdictions that have the necessary fiscal and institutional capacities. They should be directed towards large-scale projects in priority infrastructure sectors. In general, PPPs are not appropriate for small projects that can appeal to local governments, as they do not necessarily represent value for money nor are they always commercially viable. In such cases, provisions can be made for bundling across sectors or jurisdictions to encourage economies of scale or attract operators.

Multi-authority procurement at the local level is one example in which different local authorities either jointly procure an asset and separately contract for services, or jointly procure both the asset and services. For this type of bundling to happen, mechanisms for inter-municipal and regional co-ordination are necessary in order to identify the potential synergies for public investment and specifically for PPPs (OECD, 2018[260]). In addition, data and information on infrastructure accessibility and needs at the right territorial scale (e.g. the metropolitan area that goes beyond the administrative borders of municipalities) could facilitate bundling. Local governments should also collect information and generate knowledge on the fluctuations in their cash flows in the long-term, which to some extent would also help provide certainty in structuring PPPs.

Box 4.8. Example of bundling subnational public-private partnerships

A practice highlighted by PPP practitioners is the bundling of smaller projects into larger ones in order to improve scale and viability thus making them more attractive to larger players in infrastructure, and enabling better financing options, including PPPs. In some cases, governments in multiple jurisdictions are involved. An example of bundling is the programme designed by the Pennsylvania Department of Transportation which aggregated the construction and maintenance of a few hundred small bridges into a single PPP project under its old bridges rehabilitation programme. This helped manage the limited viability of individual PPP projects given that the average cost of the individual bridges was as low as approximately USD 2 million.

Source: (IISD, 2020[261]).

Finally, as outlined in Chapter 3, there is significant room to enhance the role of institutional investors (e.g. pension funds and insurance companies) in financing regional and municipal infrastructure projects, but this depends, at least in part, on the ability of the subnational government to attract such financing. Investment can take place through specialised infrastructure equity funds, for example, which may also involve other private investors, such as urban developers. Some cities can choose to facilitate private financing by setting up exchanges to match public infrastructure projects with financial backers. The City of Chicago attempted to create an initiative, the Chicago Infrastructure Trust (CIT), to pursue projects that leverage private sector resources through alternate financing and procurement approaches, and harness private sector expertise to help close the infrastructure gap (the Trust was dissolved in 2019). Despite this potential and the significant investment need, such actors are currently investing very little in climate-related projects at subnational level (OECD, 2019[262]).

Conclusions and key messages

The ability of subnational governments to invest effectively in infrastructure will be key to the successful implementation of COVID-19 recovery strategies. Policymakers at all levels should keep in mind the following key messages as they design and implement their recovery strategies:

Key messages

- ***Governments need to support subnational infrastructure investment.*** Subnational governments play a critical role in investing in sustainable and resilient infrastructure, which is essential for post-pandemic rebuilding. To achieve a successful COVID-19 recovery, subnational public investment should not be sacrificed.
- ***Investment recovery strategies need to incorporate long-term objectives.*** In the investment recovery strategies that are being designed and implemented, municipalities, regions, and national governments need to align short-term recovery needs with long-term objectives to make sure countries are better prepared to address future shocks, whatever their nature. Regions (states and provinces) and municipalities should focus on green and digital priorities as top priorities, but also on building more resilient health systems and investing in social housing to reduce disparities across and within regions.
- There should be ***coordination among all levels of government*** to ensure timely investment to support the recovery, while ensuring quality of infrastructure investments. While many public investment projects can be launched in the short-term, care must be taken not to focus on speed as the only criteria, and to avoid atomising investment funding in a myriad of small projects. Intermediate levels of government – regions, states, provinces – should be included in national investment recovery strategies.
- Infrastructure investment needs to be part of an ***integrated approach to place-based regional and local development.*** Investing in infrastructure (especially "hard" or physical infrastructure) alone is insufficient to support regional growth and well-being, to generate recovery from a crisis, or to build regional resilience. Such investment must be part of a broader strategic approach, complementing policy measures and other investments designed to advance regional and local needs, for instance in education, labour market and skills, R&D and innovation, industrial transition, etc.
- Subnational governments should ***optimise and diversify their financial resources for infrastructure investment***. They should optimise the use of public funding (e.g. national grants, taxes and fees), and explore innovative funding instruments such as land-value capture mechanisms. Subnational governments also need to mobilise capital markets and institutional investors for relevant infrastructure projects through appropriate funding and external financing mechanisms.

Future work

Looking ahead, the OECD can support subnational and national governments in their investment recovery strategies post-COVID-19, by:

- Providing concrete policy recommendations and guidance on investment recovery strategies across levels of government, and of regions and cities, including good practices and pitfalls to avoid. This includes, for example, the monitoring of countries' implementation of the OECD Recommendation on Effective Public Investment Across Levels of Government [OECD/LEGAL/0402] in the context of public investment recovery strategies.

- Improving the collection of subnational public finance data to facilitate comparable and robust analysis in 100+ countries as part of the World Observatory on Subnational Finance and Investment Initiative launched by the OECD and United Cities and Local Governments (UCLG).
- Monitoring the efforts made by subnational governments to enhance climate-related finance and invest in sustainable infrastructure.

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Notes

1 This report focuses on “hard” infrastructure which consists of the physical assets and networks that underpin the functioning of an economy (e.g. electricity, transport, communications and water) and the provision of essential social services (e.g. health and education). This contrasts with the concept of “soft” infrastructure which consists of the various institutions, policies, laws and regulations that are required to sustain the economic, health and social, health of a country.

2 Efforts to define and promote quality infrastructure investment have been made in various international fora, starting with the G7 Leaders endorsement in June 2016 of the G7 Ise-Shima Principles for Promoting Quality Infrastructure Investment. This was reinforced by the Leaders statement at the G20 Hangzhou Summit in September 2016 that affirmed the concept of quality infrastructure investment.

3 The G20 Principles for Quality Infrastructure Investment, developed under the Japanese G20 Presidency and endorsed by G20 leaders in 2019, provide a voluntary framework to assist countries in pursuing investments that maximise the economic, social, environmental, and development impact of infrastructure.

4 Throughout the Handbook, affordability should be considered taking into account the entire life cycle costs of infrastructure projects; from a government’s perspective, it means that projects can be accommodated within the government’s current and future budget constraints; from the end-users perspective it refers to the ability and willingness to pay the tariffs or other user charges associated with the access and use of the infrastructure asset (OECD, 2020[111]).

5 Hazards can be categorised in: hydrometeorological; geohazards (seismogenic and volcanogenic, e.g. earthquakes); environmental hazards; chemical hazards (such as from industry, agriculture and transport); biological hazards (pathogenic microorganisms, toxins, and bioactive substances); technological hazards; societal hazards (brought on by human activities extra-terrestrial (originating outside the Earth’s atmosphere, e.g. asteroids) (United Nations Office for Disaster Risk Reduction, 2016[265]).

6 This is measured by Theil inequality index of GDP per capita based on TL2 regions.

7 Metropolitan areas and regions near metropolitan areas saw a higher speed and capacity for recovery from the impact of the 2008 crisis, compared to regions that only have access to a small/medium city, or are far from metropolitan areas.

8 A discussion of the basis for calculating the social cost of carbon and examples of international practice of its use in cost-benefit analysis are provided in OECD (2018) Cost-Benefit Analysis and the Environment: Further Developments and Policy Use.

9 Vulnerability describes the conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards (United Nations Office for Disaster Risk Reduction, 2016[265]).

10 Exposure describes the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest (United Nations Office for Disaster Risk Reduction, 2016[265]).

11 Early warning systems, climate-resilient infrastructure, improved dryland agriculture, mangrove protection, and investments in making water resources more resilient.

12 The assessment of regions' capacity to adapt to remote working is based on the diversity of tasks performed in different types of occupations and is structured in two steps. The first step is classifying each occupation based on the tasks required and according to the degree to which those tasks can be performed remotely. Such a classification is based on a recent study by (Dingel and Neiman, 2020[273]), which is built from the O*NET surveys conducted in the United States. The second step relies on data from labour force surveys and consists of assessing the geographical distribution of different types of occupations and subsequently matching those occupations with the classification performed in the first step.

13 Other regions have adopted similar connectivity plans: In 2016, the Association of Southeast Asian Nations (ASEAN) adopted the Master Plan on ASEAN Connectivity (MPAC) 2025 that aims at achieving a connected and integrated ASEAN structured across its five strategic areas, namely sustainable infrastructure, digital innovation, seamless logistics, regulatory excellence and people mobility (ASEAN, 2016[76]). In Latin America, the Union of the South American Nations (UNASUR) established the South American Council of Infrastructure and Planning (COSIPLAN) in 2013, a forum to hold political and strategic discussion on the integration of infrastructure. Participating countries of the UNASUR established the Initiative for the Integration of the Regional Infrastructure of South America (IIRS) to link the region's economies through the development and the implementation of transport, energy and communications projects (IIRSA, n.d.[77]).

14 See for example the United Kingdom's "Procurement Policy Note 02/20: Supplier relief due to COVID-19" and the "Guidance Note on Supporting vital service provision in PFI /PF2 (and related) contracts during the COVID-19 emergency" (OECD, 2020[15]).

15 The IEA estimates that up to one half of emissions reductions in a net zero emissions by 2050 scenario stem from technologies such as hydrogen and CCUS that are not commercially available today (IEA, 2020).

16 While asset managers manage a vast amount of capital they do so on behalf of the actual owners of that capital who are primarily pension funds and insurance companies.

17 See for instance (Center for Global Development, 2019[277]). Note that research conducted by the Financial Stability Board (FSB, 2018[278]) suggests that any impacts arising from financial regulatory reforms in recent years are of a second order relative to other factors, such as the macro-financial environment, policy, and institutional factors.

18 Non-recourse or partial recourse financing is a feature of project finance structures which limits creditors to the cash flow and assets of the project company in the event of default of the latter.

19 Funding of a PPP project refers to how investment and operational costs are repaid over time to compensate the private partner that provides the debt or equity for the project. Ultimately, public infrastructure can only be paid (1) by users of the infrastructure through direct user charges, such as tolls in the case of highways; or (2) by taxpayers through the government's periodic payments to the private partner (often referred to as "availability payments"). Financing of a PPP project refers to raising money upfront to pay for the design, construction, and early operational phases of an infrastructure asset, whether through debt or equity instruments of a public or private nature (International Monetary Fund / The World Bank, 2019[160]).

20 Capacity in private markets for political risk insurance is shaped by market dynamics. Total private capacity in 2018 for non-payment public obligor lines amounted to USD 3.0 billion. Capacity declines at longer tenors, with capacity for tenors above 15 years less than USD 1.5 billion (BPL Global, 2018[274]).

21 See "Remodeling infrastructure financing: A Q&A with CDPQ Infra's Macky Tall".

22 See https://infranode.se/infranode-mirova-acquire-minority-stake-loiste-2/.

23 See structure here: https://www.cdpqinfra.com/sites/cdpqinfrad8/files/medias/pdf/2017-03-28_faits_saillants_en.pdf

24 See also Deloitte study for background: https://rem.info/sites/default/files/document/Rapport-due-diligence-VF.pdf

25 Reverse power flows occur when energy flows from the medium-voltage (MV) distribution network to the high-voltage (HV) transmission network, and are an indicator of a critical distribution grid condition.

26 See International Platform on Sustainable Finance, Annual Report (October 2020).

27 The OECD defines blended finance as "the strategic use of development finance for the mobilisation of additional, commercial finance towards sustainable development". Development finance can include official and private finance, e.g. from foundations, with a development purpose. Commercial finance can include public finance, e.g. from sovereign wealth funds or public pension funds, and private finance, which is seeking market rate returns (OECD, 2018[206]).

28 PT Sarana Multi Infrastruktur (PT SMI) is a state enterprise that is 100% owned by the Government of Indonesia through the Ministry of Finance. It was established with a mandate to be a catalyst for the acceleration of infrastructure development in Indonesia, and to support the implementation of PPP schemes.

29 Linkage fees are usually charged to developers of the existing housing programme and are applied to the construction of affordable housing.