Improving Delivery Models

Introductory Paper: Improving the delivery of infrastructure for a transformative recovery
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Foreword

Infrastructure investment can be a powerful engine for economic recovery – but challenges delivering infrastructure projects make this difficult to realise

Infrastructure investment can be a key driver in the global economic recovery needed due to the COVID-19 induced slowdown. Global Infrastructure Hub (GI Hub) analysis undertaken for the G20 in 2020 found that for every USD1 invested in infrastructure, USD1.5 is returned to the economy. Forthcoming GI Hub work shows that governments are aware of this and have committed USD3.2 trillion to infrastructure since the start of the COVID-19 pandemic.

Yet, beyond the announcements and the economic models, the process of delivering infrastructure is neither instantaneous nor devoid of potentially costly pitfalls.

Infrastructure delivery is a highly complex network of interactions, processes, and agreements that start at conceptualisation and continue all the way to the decommissioning of the asset. The International Monetary Fund (IMF) found that on average 33% of a project’s budget merely covers inefficiencies in the delivery process.¹ A separate report by the Inter-American Development Bank (IADB) found that cost overruns account for 28% of the total infrastructure investment cost.²,³

While cost is not the only measure of a successful project, the fiscal constraints of governments are well documented, and given the massive stimulus measures announced, these constraints can only get tighter. Therefore, it is important to make every dollar go further and reduce inefficiencies in the delivery of infrastructure to optimise time and outcomes.

The GI Hub introduces an initiative to address common challenges in infrastructure delivery

This paper introduces the GI Hub’s Improving Delivery Models initiative and aims to provoke thought and discussion on how infrastructure delivery models can be improved – especially in the context of the current, COVID-19 recovery. It provides commentary on key trends observed while developing the initiative (part ii) and explores some of the topical infrastructure delivery challenges and associated improvements identified under three broad pathways (part iii):

1. Balancing long-term predictability with short-term flexibility
2. Managing uncertainty
3. Investing in capabilities and innovation.

Improving Delivery Models showcases 61 improvements to 28 challenges observed in the global infrastructure market, and highlights over 100 case studies, examples, and resources to illustrate these improvements.

For more information on these resources and to explore the initiative visit infrastructuredeliverymodels.gihub.org.

¹ Well Spent: How Strong Infrastructure Governance Can End Waste in Public Investment, IMF, page 201
² From Structures to Services: The Path to Better Infrastructure in Latin America and the Caribbean, IADB, page 32
³ While not the only measure, cost overruns are an important and commonplace metric when considering how well projects are being delivered.
1  Key trends reshaping infrastructure delivery

There is widespread evidence that many of the challenges faced in delivering infrastructure can be traced back to the process of choosing the delivery model⁴ and making decisions on how a project is structured. In fact, the IMF recently found that 67% of cost overruns on infrastructure projects originate prior to contract award.⁵

‘Delivery model’ encompasses all aspects⁶ of the infrastructure decisionmaking process as outlined below:

“The delivery model is designed and developed during a front-end planning phase when the sponsor and client define the overall strategic objectives or vision, shape the governance structure, secure financing, and prepare the contracting and procurement approach. An execution phase occurs when the project receives approval to proceed and contractors responsible for design, construction, integration, fit out, testing, and operational handover are employed to deliver the project. In some cases, the delivery model extends into an operational phase when a contract requires the provision of services to operate, maintain, and finance an asset over an extended period of time.”⁷

Even before the COVID-19 pandemic, we were seeing an evolution from a traditional infrastructure delivery approach (criticised for its lengthy, linear / sequential, prescriptive, and often confrontational structure) toward more collaborative, iterative, innovative, and outcome-based approaches. What was driving this evolution?

Our research and stakeholder engagement identified eight trends that are re-shaping the infrastructure sector:

- Unprecedented demand
- Larger and more complex projects
- Rising risks to the solvency of industry players
- Increasing focus on outcomes – especially climate transition
- Digitalisation across the industry
- Evolving roles between the public and private sectors
- Skills shortage across the industry
- Increasing use of more cooperative delivery models

⁴ See below definition and scope
⁵ Well Spent: How Strong Infrastructure Governance Can End Waste in Public Investment, IMF, 2020
⁶ Procurement model, packaging model, and contractual model
⁷ Delivery Model Innovation: Insights From Infrastructure Projects, Project Management Journal, 2019
1.1 Unprecedented demand

There is an unprecedented demand for, and corresponding volume, of new infrastructure projects planned and under delivery, coupled with an increasing need to maintain and refurbish existing assets.

Example: Bipartisan Infrastructure Deal (USA Infrastructure Plan)

The American Society of Civil Engineers’ 2021 Infrastructure Report Card identified that the USA infrastructure funding gap has increased from USD2.1 trillion in 2017 to USD2.6 trillion over 10 years, with the Report Card assigning a C- to America’s infrastructure. To help address this gap the Federal Government has brokered a Bipartisan Infrastructure Deal that will allocate USD550 billion in new funding to infrastructure over the next five years. The deal represents some of the largest federal investments in recent years into several asset types within the transport, water, energy, and telecommunications sectors.

With the specific projects and programs to be funded yet to be specified, the scale of the investment will put immediate pressure on governments and industry to rapidly plan, procure and deliver the intended spend.

1.2 Larger and more complex projects

Increased demand, population growth and urbanisation have led to larger and more complex (and more expensive) infrastructure projects becoming more common. Most major infrastructure projects are in highly urbanised locations and deal with below and above-ground services, disrupting the use of existing infrastructure. This complexity has stretched traditional planning and procurement processes.

Example: Grand Paris Express (France)

The Grand Paris Express (GPE) is a landmark project that will add 200 km of fully automated metro rail to the existing Paris rail network, including the longest single underground metro line in the world. In fact, 90% of the GPE will be underground involving 22 tunnel-boring machines.

The scale and complexity of the project is unprecedented: located in highly urbanised areas, interconnecting new lines with existing ones, building 68 stations, 250,000 new housing units and major urban developments. As at June 2021, there were 450 contracts in execution. A dedicated public delivery agency, The Société du Grand Paris (SGP), was established to manage the program delivery. The delivery models evolved from traditional bid build where an 80% complete detailed design was produced by engineering firms contracted by the client team before engaging a series of a contractors to execute the works, to a wider range of ‘global’ delivery options.

Read more in the Improving Delivery Models initiative - Grand Paris Express case study.

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8 2021 Report Card for America’s Infrastructure, American Society of Civil Engineers, 2021
9 Fact Sheet: Historic Bipartisan Infrastructure Deal, The White House, 2021
1.3 Rising risks to the solvency of industry players

There is a rising awareness among governments of the importance of a sustainable construction industry, emphasised by the increased volume of projects and scarcity of resources. In the past 10 years, major contractors withdrew from the market, mainly regarding Public-Private Partnership (PPP) contracts or fixed-price contracts due to severe balance-sheet impacts related to, (i) unbalanced risk allocations, (ii) mismanaged scope variations, and (iii) resulting cost overruns.

Example: Carillion (United Kingdom)

In January 2018 the UK construction company Carillion collapsed, putting thousands of jobs at risk, after creditors and the government refused to bail out the company struggling under more than GBP1.5 billion (USD2.6 billion) of debt. Among the multiple reasons for its bankruptcy, the Public Administration and Constitutional Affairs Select Committee pointed out ‘the aggressive approach of risk transfer’ in PPIs, from government, and the lack of understanding of its consequences. More broadly, massive losses have been reported by the constructions industry around the world facing a ‘profitless boom’ and pushing some of them to withdraw from fixed-price contracts.

1.4 Increased focus on outcomes – especially climate transition

The breadth of outcomes expected from infrastructure has changed. Infrastructure delivery is no longer just about delivering the physical asset, it is now about delivering environmental, sustainable, resilient, social, inclusive, and economic outcomes. Governments, industry, and society are increasingly cognisant of the social and environmental impacts (direct and indirect) infrastructure can deliver along with an improved understanding of the economic benefits and costs. Infrastructure decisionmaking is evolving to optimise these outcomes across the life of assets.

The energy transition towards a carbon neutral economy by 2050 has, and will have, a major impact on the type of infrastructure delivered as well as the manner of delivering infrastructure. For example, the proportion of renewable energy projects has grown constantly over the past ten years and represents 23.2% of the global transactions in 2021.10 Governments and delivery agencies need to rethink the delivery of infrastructure, using public procurement to boost deployment of green technologies and consider net zero outcomes at all stages of the procurement and delivery process.

Example: Dubai Expo 2020 (United Arab Emirates (UAE))

The UAE Government set sustainability as a core focus for the Dubai Expo 2020, with each pavilion having its own sustainability key performance indicator. The Expo implemented a range of sustainable design and construction practices including diverting 85% of its waste away from landfill and the reuse and repurposing of construction waste (concrete) for temporary roads, public realm sub-base, and logistics areas. It also included an asphalt mix made up of 20% recycled tyres from local waste.

10 Inframation, accessed 29 September 2021
1.5 Digitalisation across the industry

The ability and availability of InfraTech and data-based technologies has continued to grow, however benefits to productivity, efficiency, and quality have yet to be fully realised. Digitalisation applies to infrastructure delivery – using InfraTech – and service delivery. ‘Infrastructure as a Service’ models, such as mobility as a service, are enabled by digitalisation and will change infrastructure demands and user behaviour.

Example: Digital by default (Australia, UK and G20)

While the technologies that underpin InfraTech and data-based technologies already exist, their widespread adoption has been fragmented. Governments around the world, (e.g. Australia and the UK) have been making strides towards increasing adoption. The recent 2021 Australian Infrastructure Plan by Infrastructure Australia (IA) and the Transforming Infrastructure Performance Roadmap to 2030 from the UK Infrastructure Projects Authority (IPA) lay out practical steps for each jurisdiction to embrace digitalisation. IA recommends that procuring agencies should adopt a ‘digital by default’ approach to infrastructure planning, delivery, and operations, referencing evidence that implementing best technology practices could result in a productivity improvement of up to 15% and an improvement of more than 5% in cost efficiencies.12

In the roadmap, IPA outlines the development of a future Digital Twin Mandate to build on the progress already made under the Digital Built Britain program and through the Centre for Digital Built Britain. The first step is the implementation of the Information Management Mandate, which ‘sets out the requirements for improving information management using existing processes, standards and technologies.’ Implementation of this mandate will be delivered through application of the UK BIM Framework.13

The G20 is also aware of the need for digitisation of infrastructure, with the GI Hub publishing a Stocktake of InfraTech Use Cases that illustrates the application and benefits of technology applied to infrastructure. The stocktake, developed as part of the G20 Riyadh InfraTech Agenda, comprises of over 60 user cases of a spectrum of technologies.

Read more in the Improving Delivery Models initiative - Digital Design Built Policies case study.

1.6 Evolving roles between the public and private sectors

The respective roles of government and the private sector have evolved in the provision of infrastructure. Over the past decade, the internal capabilities in technical engineering of governments globally have declined, with this capability increasingly supplemented by private sector parties. This has been accompanied by an evolution (or re-positioning) of governments’ role in infrastructure towards concentrating on essential public services (such as health and education) and provision and governance, while infrastructure delivery (including operation and maintenance) is ‘outsourced’ to private parties. Governments are becoming an enabling of essential public service infrastructure provision rather than a provider. Yet,

11 ‘Infrastructure technology, or InfraTech, can be described as the integration of material, machine, and digital technologies across the infrastructure lifecycle. At its broadest definition, InfraTech can be considered any technology that impacts the development, delivery, and ongoing operation of infrastructure.’ - G20 Riyadh InfraTech Agenda, G20 Infrastructure Working Group, 2020
12 2021 Australian Infrastructure Plan, Infrastructure Australia, 2021
13 Transforming Infrastructure Performance: Roadmap to 2030, UK Infrastructure and Projects Authority, 2021
delivery capability of government (and industry) is being strained with the increasingly rapid demand for infrastructure. Capacity building therefore remains an issue.

**Example: Concession Pipeline (Brazil)**

Between 2020 and 2022, Brazil will auction a pipeline of more than USD44 billion in lease and concession contracts for transportation infrastructure projects. This is one element of the Brazilian Government’s broader agenda to increase the private sector participation in public infrastructure provision. Since 2019 the government has issued concessions for 70 projects worth a combined USD11 billion of investment.¹⁴

Through a broad privatisation agenda, the Brazilian Government aims to attract greater foreign investment to meet its goal of USD65 billion invested in infrastructure per year by 2022. To encourage greater investment, the government has sought to streamline procurement processes as it seeks private bidders for its Partnership and Investment Program. The government is reassessing its portfolio of 134 state-owned corporations, the majority of which do not cover their operating expenses.

In addition to private finance being sourced, the efficiency and expertise of private parties is also desired to improve access and efficiency of services. For example, in the past year the Brazilian Government has let its first water and sanitation PPPs¹⁵ and is beginning the process to let several port administrator concessions.¹⁶

### 1.7 Skills shortage across the industry

Shortages of infrastructure engineering and technical skills are a major concern globally in developed and emerging markets, for both the public and private sectors.

In Canada, BuildForce, which provides labour market information and programs for the construction workforce, anticipated that 257,000 construction workers will retire by 2029 creating a shortfall of 100,000 construction workers.¹⁷

According to the *2020 Construction Outlook Survey* by the Associated General Contractors of America (AGC), 81% of construction firms have trouble filling positions, and 72% anticipate labour shortages to be the biggest hurdle in the next few years.

In the UK, a large majority of construction and engineering firms have reported serious concerns about a lack of skilled workers, even more since Brexit and COVID-19, and the *Mind the skills gap* report found that businesses in the construction industry are 18% understaffed.

The suppression of the State Public Engineering function in France in 2008 created a gap for the management of national infrastructure projects at the local level, partially compensated by regional and local capabilities as well as dedicated agencies by sectors.

The International Labour Organisation points out the shortage of skilled employees in the green building industry is a result of specific qualification requirements.¹⁸ In Australia, the shortage of skills in public infrastructure is even more acute given the pipeline of projects in the foreseeable future.

¹⁴ Brazil’s next big transport projects, IJ Global, 8 June 2021
¹⁵ Winners announced for Rio sanitation auction, IJ Global, 5 May 2021
¹⁶ Codesa privatization advances, IJ Global, 10 August 2021
¹⁷ Construction industry fears a skilled-trades shortage, The Globe and Mail, 23 February 2021
¹⁸ Shortage of Skilled Employees in Green Building Industry, International Labour Organization
Example: 2019 Australian Infrastructure Audit

‘At all levels and for all types of infrastructure, access to appropriate skills is a problem...High quality procurement and project management skills within the public service support value for money outcomes for users and taxpayers, while minimising unforeseen risk to sector participants.’

1.8 Increased use of more cooperative delivery models

The trends around demand, complexity, solvency, outcomes, and roles have tested the rigid application of existing procurement and delivery practices in many jurisdictions. This in turn has generated interest in more collaborative approaches to contracting, leveraging private sector capabilities to inform the packaging and structuring of projects, and evolving the existing contractual suite to be less adversarial while maintaining competitive tension.

Example: Team 2100 and the Thames Estuary Asset Management Program (UK)

Team 2100 used an integrated delivery team under an Alliance Framework with a 10-year program of works under a unified mission coupled with commercial arrangement to support shared outcomes. This resulted in an engaged and co-located ‘Integrated Delivery Team’ which identified more than 262 improvements and is expected to deliver GBP100 million in savings over 10-years. It is focused on creating long-term value through collaboration and shared values, with KPIs developed jointly and measured regularly against 10-year and whole-of-life benefits. The project will help improve London’s tidal flood defences, with increased storm surges and sea level rise forecast over the coming century.

Read more in the Improving Delivery Models initiative - Team 2100 case study.

While not an exhaustive list, the trends discussed above represent those seen most globally through GI Hub research. These trends manifest themselves in the challenges and improvements highlighted in the Improving Delivery Models initiative. Mitigating the challenges and leveraging those opportunities are critical to the successful delivery of infrastructure.

2 Global improvements to infrastructure delivery

2.1 Cutting through complexity: Improving Delivery Models initiative

Despite the abundance of literature available on how to improve infrastructure delivery, GI Hub identified that there was no collated global source of improvements to the challenges met in infrastructure delivery. Our stakeholder consultation and research demonstrated that while every jurisdiction has a unique infrastructure environment, many of the same challenges were apparent, and many transcended a specific delivery model. They also highlighted that it is important to look at delivery of infrastructure holistically, considering how infrastructure financing, procurement methods and contracting arrangements support the realisation of the desired outcomes.

19 2019 Australian Infrastructure Audit, Infrastructure Australia, 2019
The Improving Delivery Models initiative aims to capture and showcase improvements to the challenges of delivering infrastructure. For simplicity, we categorised the identified challenges (and associated improvements) by six overarching themes:

- **Capabilities and capacity**: Improving organisational ability to adequately plan, deliver, operate, and maintain quality infrastructure.
- **Co-operation**: Partnering with other connected parties to achieve improved shared outcomes.
- **Efficiency**: Optimising delivery to maximise infrastructure outcomes.
- **Finance**: Identifying and securing funding and financing of infrastructure.
- **Risk**: Ensuring that risk in delivery is adequately planned, managed and allocated appropriately.
- **Sustainability**: Considering the environmental sustainability impact infrastructure can provide.

An analysis was also conducted on delivery models currently used across the G20 countries to create a Contractual Model Overview. The models identified have been aggregated under four main types aligned with the World Bank classification. This initiative links with other GI Hub practical tools and guidance. Key linkages were identified and made with regards to financial structuration (Innovative Funding and Financing) and technical or contractual specifications (Output Specifications for Quality Infrastructure Investment guidance and the PPP Risk Allocation tool).

It is our hope that this initiative can help policymakers and practitioners take steps towards improving infrastructure delivery, leading to better outcomes for government, industry and communities.

### 2.2 Three improvement pathways for infrastructure delivery

This section highlights some of the main discussion pain points on the state of infrastructure delivery. It navigates through the Challenges and Improvements Framework provided in the Improving Delivery Models initiative to explore pathways and solutions toward improved infrastructure delivery. The pathways and solutions are discussed in the following sections:

#### Pathway 1: Balancing long-term predictability with short-term flexibility

Well-planned and prioritised infrastructure investments require long-term planning based on assessment of future needs translated into a project and programs pipeline that is prioritised and actionable.22

The investment decision-making process leading to procurement includes several critical stages and a multi-dimensional approach (technical, economic, financial), evolving with the project maturation. This involves several iterations and approvals at key points of the project development between the project owner, the line Ministry / Department, the Treasury / Budget

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20 [PPP knowledge Lab](https://www.worldbank.org/en/), The World Bank
21 GI Hub’s [Contractual Models Overview](https://gi-hub.org) classifies the delivery model per main functions (Design, Built, Operate, Maintain, Finance), and for each of them indicates the various names and variants used across jurisdictions, the main characteristics and appropriateness of each.
22 [Governmental Processes Facilitating Infrastructure Project Preparation](https://gi-hub.org), GI Hub, 2019
authority, and potentially the infrastructure body (‘inter-agencies relation’) on strategic decisions such as budget, delivery options, and contractual model.

At the project level, a robust decisionmaking process and clarity of direction early in project development is important to ensure a successful project delivery. Figure 1 shows that lack of clarity and late decisionmaking will result in higher costs and greater uncertainty of outcomes. In the UK, for example, the Guide to Preparing an Assurance Review report\(^\text{23}\) recommends identifying and recording the ‘Blockers to delivery’ that are outside of the program or projects’ control and might impact time, cost, quality, and scope of the project. The Construction Playbook\(^\text{24}\) recommends that contracting authorities conduct a delivery model assessment (DMA) at the early stage of the decisionmaking process to inform the first business case.

Gateway Reviews also recognise that scope changes have a greater impact on cost as the project progresses through its lifecycle. Robust decision-making and clarity of direction early in project development is important to successful project delivery. A lack of clarity and late decision-making will result in higher costs and greater uncertainty of outcomes.

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**Figure 1 The cost of change over the delivery lifecycle**

The initiatives Challenges and Improvements Framework highlights improvements and examples to address those challenges. Here are seven examples from the Framework.

### 2.2.1.1 Taking a flexible approach on the determination of the budget envelope and including sufficient risk allowances in cost estimates.

The initial budget estimate for a new infrastructure project based on pre-feasibility studies is normally highly indicative. Therefore, it is important to avoid premature public announcements on the infrastructure cost:

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\(^{23}\) Project assurance review guidance and template, UK Infrastructure and Projects Authority, 2021

\(^{24}\) The Construction Playbook, UK Government, 2020
“Public pressure often leads to premature political announcements that become binding, and studies have shown that the earlier the first cost announcement, the larger the overrun.”

Infrastructure project cost estimates are highly dependent on the stage of the project lifecycle and design maturity. The assurance review process should allow adjustment and reassessment of the initial budget estimation following scoping and definition evolution. Project budgets should be developed (and only approved after) using updated cost estimates with industry-standard contingency and risk allowances commensurate with the project’s level of design and risk transfer.

The delivery and funding strategy will be further developed and the budget envelope for government (a subset of the project costs for revenue generating projects) can be set. Governments may want to budget to a P90 contingency – sufficient contingency that there is a 90% probability that the budget will not be exceeded.

As for reporting these evolutions of the initial budget estimates, the Grattan Institute recommends that:

“State revenue offices should report these estimates or budgets and reconcile between them as projects develop and costs become more certain.”

Once the packaging strategy has been decided, the funding allocation decisions should be able to be reviewed at the procurement stage. A comprehensive risk identification process that is compliant with industry standards can be used to develop contingencies and risk allowances.

**Key Message**

Include sufficient risk allowances in cost estimates at the procurement stage. When the packaging strategy has been decided, the funding allocation decisions should be able to be reviewed accordingly. Contingencies and risk allowances should be developed through a comprehensive risk identification process that meets industry standards.

### 2.2.1.2 Considering the whole lifecycle cost of capital spending projects at inception

The project budget should not just be limited to the design and construction of the asset. The operation and maintenance of infrastructure assets is a critical element that is often overlooked when budgeting for projects. For example, the World Bank’s *Benchmarking Infrastructure Development* report found that of countries surveyed only 23% calculate the whole lifecycle cost of capital spending projects at inception (Figure 2).

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25 The Rise of Megaprojects: Counting the costs, Grattan Institute, 2020
26 The Rise of Megaprojects: Counting the costs, Grattan Institute, 2020
27 Benchmarking Infrastructure Development, The World Bank, 2020
Considering **whole-of-life costs** can provide a better packaging approach and allows project owners to factor in long-term sustainability elements that can lead to greater efficiencies and more sustainable outcomes. Such considerations are increasingly important with the push towards decarbonisation and the adoption of circular economy principles. For example, some jurisdictions have started to use Should Cost Models to better forecast what a project or program should cost over its whole life and the risks associated with different options or scenarios.

### 2.2.1.3 Integrating procurement strategy and contract packaging as part of the delivery option analysis

Too often the contractual model selection becomes the central question while the procurement and packaging strategies are overlooked. In some jurisdictions the choice of a contractual model imposes the choice of a specific procurement procedure and therefore the question about a procurement strategy does not even arise.

The 2020 European Union Compendium of Large Infrastructure Projects recognises that:

> “the procurement strategy and the selected procurement procedures play a key role in the design and development of the overall delivery strategy for the project, specifically in connecting the front-end development stage with the delivery stage. This can have a significant effect on the overall capability of project organisation and is likely to require innovation in the way that procurement processes are designed and implemented by contracting authorities.”

The question of a **packaging strategy** which refers to the most suitable sizing and (un) bundling of scope items is often overlooked and at times completely absent from the decisionmaking process. The packaging strategy should be central, precede the selection of the contractual model and be assessed carefully before the launch of the tender process. The

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**Figure 2: World Bank Benchmarking Procurement report survey 2020**

Does the government calculate the whole lifecycle cost of capital spending projects at inception?

<table>
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<th></th>
<th>G20</th>
<th>All Countries</th>
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<td>6</td>
<td>9</td>
</tr>
<tr>
<td>No</td>
<td>40%</td>
<td>23%</td>
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</tbody>
</table>

Source: Benchmarking Infrastructure Development, The World Bank, 2020

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28 Benchmarking Infrastructure Development, The World Bank, 2020

29 Compendium of large infrastructure projects, European Union 2020
scoping studies are part of the packaging strategy, and a failure to properly define this will often lead to cost overruns at a later stage.

2.2.1.4 Leveraging market sounding to define the delivery option

The delivery model, especially the packaging strategy, should be re-assessed following consultation with the market to incorporate industry feedback and inputs. Market sounding allows the project owner to test the project’s general assumptions with the private sector, seek feedback on initial project scoping, including proposed risk allocation, and helps create the market conditions needed to deliver sustainable and innovative solutions. While most countries have adopted market sounding, many are yet to implement its use (Figure 3).

Among the G20 countries, some jurisdictions have been using the practice of market sounding for a long time and have established good practices. Others have more recently added it to their legislation and are just starting to conduct market soundings, having been reluctant to engage directly with prospective proponents fearing accusations of favouritism.

In Europe, it has been introduced by Art 40 of Directive 2014/24/EU which states that:

‘Before launching a procurement procedure, contracting authorities may conduct market consultations with a view to preparing the procurement and informing economic operators of their procurement plans and requirements.’

The practice of market consultation has been used successfully in France by the Société du Grand Paris to source and pre-qualify a list of potential bidders and to facilitate a re-think of the initial packaging strategy. In the UK, Transport for London has used it to drive competition and innovation in reducing the network’s lighting whole lifecycle costs in the London Underground.

Figure 3: InfraCompass 2020 - Percentage of countries that use a market sounding

<table>
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<th>No</th>
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<tr>
<td>65%</td>
<td></td>
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<tr>
<td>35%</td>
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</table>

Source: InfraCompass 2020, Global Infrastructure Hub, 2020

2.2.1.5 Leveraging market sounding to right-size project packages

The sizing of the project packages is a key tool to shape competition and align with the capacity and capability of the market. For example, market engagement allowed the contracting authority, Sydney Metro, to re-think the ‘delivery and packaging strategies’ of the Sydney Metro West project (Figure 4).

30 Compendium of large infrastructure projects, European Union, 2020
31 Guidance on Innovation Procurement, European Commission, 2021
The question of project packaging is intrinsically linked to the question of interface risk management. More packages lead to more interfaces and more contracted parties for the contracting authority to manage. Interface risk in complex projects is a major challenge and requires a capably resourced contracting authority to oversee.

**Key Message**

At the end of the decisionmaking process, the delivery options including procurement and packaging strategies should be part of the decision and tested through market consultation with stakeholder and industry to allow a sound project definition (scope, size, major risks).
2.2.1.6 Adopting a contractual model agnostic approach

No one model provides a ‘silver bullet’. Regardless of the form of contract, if the project is well planned, prepared, structured, and managed, it will be successful and vice-versa. The contractual model should be viewed as a functional instrument to service the project owner’s requirements, not to restrict it. An agnostic approach toward delivery strategies and an unbiased budget comparison process will eventually yield better project outcomes.

In some jurisdictions, the investment decisionmaking process is highly dependent on (and actually initiated by) selection of the contractual model. This can bias the whole project development appraisal exercise, forcing everything to be shaped to meet the specific features of the contractual model, instead of the project needs. Moreover, in some jurisdictions, the project appraisal exercise to evaluate the best contractual model is only mandatory for some contracts (often PPPs). This exercise should be done for all projects, above a certain threshold, regardless of the contractual model chosen.

The selection of a contractual model should be assessed at the end of the infrastructure investment decision process. The model chosen should support the specific project needs, scope and outcomes defined by the project owner and be informed by the procurement, packaging and risks strategy. The contract should be ‘instrumentum’ – an instrument to serve and support the project owner’s needs, not the other way around. The overreliance on the contractual model to solve a poorly planned and scoped project is a ‘vue de l’esprit’.

“It is necessary to develop the commercial approach and the procurement strategy before making the decisions needed for the contracting strategy.”

In developed and emerging countries there is a need for innovations in how projects are funded and financed (e.g. blended finance, risk-mitigation and guarantees schemes, green bonds, use of existing revenues to develop new infrastructure programs, and other revenues levers). Contractual models should be flexible enough to allow innovative funding and financing solutions independently of the contract category / legal regime where such a solution is deemed best. They should also be flexible to adapt to the changing roles of government and industry, evolving into ‘hybrid’ or ‘new’ models if needed.

2.2.1.7 Developing flexible contract templates and control mechanisms

Some jurisdictions have implemented pragmatic, functional and non-ideological approaches to contracts by using templates, modules and standards. Templates, such as the New Engineering Contract (NEC) suite can cover the type of mission or functions outsourced, where the contractual specific legal regime does not constitute a prerequisite. The ‘module’ approach, where each element of the contract (e.g. price structure, payment mechanisms) can be specified by the contracting agency and tailored to the project in question, is an approach increasingly being investigated by governments around the world.

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33 For standard, simple or repetitive infrastructure projects, under a certain amount, the selection of a contractual model by the public buyer, is usually straightforward (e.g., Design Bid Build, Design & Build).
34 An illusory effort, based on and creating unrealistic expectations.
35 The Construction Playbook, UK Government, 2020
36 See the Tin Sui Wai Hospital case study for an example of how an NEC contract was implemented.
Key Message:
Adopt a clear, agnostic approach to contract model selection using professional assessments, market input and sound decisionmaking parameters. An agnostic approach toward delivery strategies and an unbiased budget comparison process will yield better project outcomes. The contractual model should be viewed as a functional instrument to service the project owner’s requirements, not to restrict it.

2.2.2 Pathway 2: Managing uncertainty

Managing uncertainty is crucial to improving the delivery of infrastructure projects. Yet cost-overruns, especially for large and complex infrastructure projects, seem to be the ‘norm’.

In 2014, Danish economist and Oxford Professor Bent Flyvberg devised, ‘the iron law of megaprojects: over budget, over time, over and over again’. The Grattan Institute’s report on the rise of megaprojects\(^{37}\) in Australia states that large projects overrun more often and by more, in dollar terms and percentage (Figure 5). This feature is shared in many jurisdictions. For example, Crossrail in the UK had initially been planned to cost GBP14.8 billion, but the most recent cost estimation is up to GBP18.7 billion. This is even more challenging for large programs such as Olympic games or new transport networks. The Grand Paris Express project in France is estimated at EUR35.142 billion, more than 15 billion over the 2013 estimate.

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\(^{37}\) The Rise of Megaprojects: Counting the costs, Grattan Institute, 2020

\(^{38}\) Adapted from The Rise of Megaprojects: Counting the costs, Grattan Institute, 2020
“There is now a substantial body of literature that addresses the challenges of successfully managing the front-end development of large infrastructure projects. Debate exists about the root causes of these challenges and the explanatory power of different theories but, to date, the dominant theme has been that large infrastructure projects often fail because sponsors and clients systematically make poor decisions during the planning phase.”

This should not be viewed as just an issue for megaprojects. Analysis by the IADB showed that of 231 projects financed by IADB (83) and the World Bank (148) in Latin America between 1985 and 2015, cost overruns represented on average 22% and 17% respectively of the total project cost.

Ultimately every infrastructure project must manage uncertainty effectively. Cost overruns have occurred on many infrastructure projects due to a lack of proper front-end development. To correct this, governments need to reach a higher degree of certainty through better cost estimation, design maturity, risk allocation, and collaboration, and a clear direction on community outcomes. Supercharging the efforts on the front-end and de-risking projects through design, early works and new approaches of risk management is likely to produce much better outcomes than sticking to the traditional approach of transferring risk to the private sector.

The Improving Delivery Models Framework highlights several improvements and examples to address those challenges including:

2.2.2.1 Cost estimation and risk pricing

Cost accuracy evolves with the design maturity of a project. At the early-stage of the project maturation (feasibility studies), the cost estimation carries a high level of uncertainty. It should be refined and become more accurate as the project moves toward the final business case and the launch of the tender process where a reference design is expected. But even at this stage, cost estimation is far from the real project cost, especially for large and complex infrastructures, as they can comprise of many external elements (including interfaces with other third-party infrastructure). The average increase between the tender price and the definitive project cost was 79.8% in 25 major projects in the UK between 2009 and 2018. The International Transport Forum visualises this evolution in cost and time accuracy over the delivery lifecycle in its Risk Pricing in Infrastructure Delivery report (Figure 6).

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39 Delivery Model Innovation: Insights From Infrastructure Projects, Andrew Davies, Samuel C. MacAulay, Tim Brady
40 From Structures to Services – The Path to Better Infrastructure in Latin America and the Caribbean, IADB, 2020, page 34
41 Business cases typically include an estimate of the median cost or “P50” and the worst case “P90”
42 ICE Report reducing the gap between cost estimates and outturns for major infrastructure projects and programs
“When tender prices are treated as final costs by clients long before a project reaches adequate maturity where scoping, design or discovery is at an advanced stage a lack of expertise about the nature of infrastructure projects is revealed. As projects mature, estimates improve in accuracy, simply because more is known about the location and what factors need to be taken into consideration.”

Key Message

Go slow to go fast. Design maturity aligned with contract price firming through further studies and investigations will reduce the gap between cost estimates and out-turns.

Improving Delivery Models highlights a number of examples to improve cost estimation, such as adequate levels of design maturity or the use of a cost estimation database. Much of this front-end development is focused on identifying and quantifying the risks involved in a project.

2.2.2.2 Re-thinking the approach of risk assessment

An appropriate risk allocation and more broadly risk management are vital for any infrastructure project. An appropriate risk allocation is one that is informed by all specific elements of the project, where the level of unknown is assessed and addressed through provisions or appropriate contingencies and risk allowance is shared by all parties. Appropriate risk allocation, regardless of the contractual model, is the best way to achieve a desired level of competition.

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Figure 6 Evolving estimation accuracy over the project lifecycle

— Adapted from Risk Pricing in Infrastructure Delivery, Making Procurement Less Costly, ITF, October 2018, Figure 7
— Delivery Model Innovation: Insights From Infrastructure Projects, Project Management Journal, 2019
Gi Hub has been working on this topic since 2016, publishing its [PPP Risk Allocation tool](#) which covers 19 infrastructure sectors. An abundance of literature on this topic exists. Two key points may be highlighted here. Firstly, a balanced risk allocation should be conducted for any type of contractual model. A design, build, maintain contract can transfer risks as efficiently as a design, build, finance, maintain contract. The effectiveness of the risk allocation depends on the alignment of design maturity with the assignment of contractual obligations to the parties best suited to fulfil them, irrespective of the contractual model. Secondly, in large projects and especially in PPPs, typically under fixed-priced contracts, a reflection in recent years has begun to [rebalance risk-allocation](#) and be open and fair about project risk to avoid project failure and negative behaviours.

“Despite the belief risk is transferred and therefore managed, poorly allocated risk exposes government to inflated project costs and the risk of project cost and time over-runs, or potential project failure. At its best, this practice is misleading as it erroneously suggests risks are being effectively managed. The practice of forcing industry to accept risks they cannot reasonably control, or bear increases the likelihood of variations and inflated budgets, including excessive contingencies. It increases the risk of default and can drive negative behaviour.”

There are numerous examples of inefficient risk allocation (especially for utility and other third-party services), environmental risks and inground conditions when the ‘unknown’ factors are too high. This leads to major cost overruns that are unsustainable for the public and the private sector. Early works, detailed investigations of ground and other unknown conditions together with appropriate mitigation and scope variation mechanisms are among the solutions to improve the risk allocation.

### Key Message

An appropriate risk allocation is one that is informed by all specific elements of the project, where the level of unknown is assessed and carefully addressed through provisions or appropriate contingencies, and risk allowance is shared by all parties. Appropriate risk allocation, regardless of the contractual model, is the best way to achieve a desired level of competition.

### 2.2.2.3 Consider early contractor involvement and collaborative contracting

When uncertainty around risks is too high to properly launch a fixed-price contract tender, there are avenues to progress a project by stages, in co-operation with the private sector, such as early contractor involvement (ECI) or collaborative contracting (Alliancing).

45 Gi Hub [PPP Risk Allocation Tool](#), 2016
46 [Rebalancing risk allocation](#), WEF - Rebalancing risk allocation on infrastructure projects, DLA Piper, Owen Hayford
47 [IA Infrastructure Plan](#), September 2021, page 275
ECI and Alliancing are usually multi-stage processes typically used in highly uncertain environments and where the project owner and contractor work jointly to develop a preliminary design, a project scope, and a target cost. Collaborative approaches and ECI can be effective contracting approaches to manage uncertain risks and have been used successfully on large and complex infrastructure projects. Infrastructure New South Wales released a Framework for Establishing Effective Project Procurement\(^{48}\) (Figure 7) with a series of recommendations to improve the delivery of infrastructure projects. The framework recommends best practice procurement including:

- Using early works packages to **mitigate risks** such as site and utility risks where appropriate
- Using **collaborative approaches** such as open book, target cost and incentivised cost approaches for risks that cannot be efficiently priced or transferred to the private sector
- Including a **risk allowance in the budget**, using a probabilistic assessment of known risks included in the risk register and a deterministic contingency allowance, to cover unknown or strategic risks.

While use of early contractual involvement and collaborative contracting requires an enhanced level of client capability, it can manage uncertainties so the project’s level of design maturity progresses to a point that an appropriate pricing structure (target-price or fixed-price) can be determined for the full project.

Contracting out under a **fixed-price contract** when the level of uncertainty is too high and design maturity too low, is not a good practice and should be avoided as it is likely to generate inevitable cost overruns and claims from contractors. Target-price contractual structure with mechanisms to firm up the price if required and as the project progresses, can be more appropriate in this instance.

**Key Message**

Collaborative and progressive contracting approaches, especially for large and complex infrastructure projects, where a firm price cannot be realistically determined, should be considered by contracting authorities. This requires a change of mindset and behaviour by both parties.

### 2.2.3 Pathway 3: Investing in capabilities and the enabling environment

All the above considerations lead to the most critical improvement of all: capabilities and capacity. This was pointed out as the top priority of our stakeholder consultation, and the cornerstone of every successful project, regardless of the contractual model.

Considering evolving project complexity and risk profiles, such capabilities are as important at the front end of the project as at the back end when contract renegotiations may become necessary. The skilled and experienced professionals who are in high demand in the industry do not appear overnight.

Overall, the industry needs to invest massively in infrastructure competencies to ensure personnel capacity meets demand. This includes upskilling the existing workforce to enable use of new data, technologies and innovations for transformative infrastructure. Complementary to this, is the need for governments to understand and plan for what they expect industry to

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[48] Framework for Establishing Effective Project Procurement for the NSW infrastructure program, June 2021
deliver. This means understanding market capacity and providing a clear pipeline of work to help industry plan and prepare to deliver the expected projects. For example, Infrastructure Australia\textsuperscript{49} and the Infrastructure and Projects Authority, UK\textsuperscript{50} conducted data driven market capacity analysis given the scale of the expected project pipelines in both countries.

At a project level, the Improving Delivery Model’s Framework highlights several improvements and examples to address capability and capacity challenges including:

2.2.3.1 Establishing a dedicated public delivery authority

Public delivery authorities can be established for specialised projects or programs to build internal capacity over a large program of work. The Société du Grand Paris, overseeing the largest metro network extension project in Europe, grew to 800 employees in 10-years. To reinforce capabilities and inclusivity within these major delivery agencies and through the implementation of their large infrastructure programs, some governments have developed infrastructure skills and training programs with ambitious targets to increase diversity and inclusivity.\textsuperscript{51}

2.2.3.2 Diversifying the workforce base

Specific policies or practices can be established to ensure women, minorities, and low-income residents are better integrated into the workforce on major public projects. The GI Hub Inclusive Infrastructure and Social Equity guidance showcases a number of such case studies. In particular, the equity plan on the U.S. Bank Stadium defined project-specific inclusivity mandatory targets to achieve better diversity.\textsuperscript{52} It is important to plan and identify social value outcomes early in the project through greater understanding and engagement with local communities and to cascade social investment from the infrastructure project down to affected communities.

2.2.3.3 Considering delivery partner, intelligent client or integrated project delivery models

Other solutions exist that address the challenge of limited infrastructure delivery capabilities, such as: the delivery partner model where the private sector provides its delivery management expertise on behalf of the project owner; the intelligent client model to upskill capabilities through partnerships with professional infrastructure development body, as experienced by Thames Water in the UK; or the integrated project delivery model where the project owner, design and construction delivery teams work collaboratively as a single unit with alignment of interest and outcomes through incentives.

Key Message

Invest massively in infrastructure competencies to ensure personnel capacity meets demand. This includes upskilling the existing workforce to enable use of new data, technologies, and innovations for transformative infrastructure.

2.2.3.4 Allow the private sector to bring innovation into the public procurement space

Although public procurement processes aren’t keeping pace with the industries dynamism, accelerating innovation in infrastructure in all its dimensions is key to supporting a growing economy and a sustainable recovery. The private sector is

\textsuperscript{49} Infrastructure Market Capacity, Infrastructure Australia, 2021
\textsuperscript{50} Analysis of the National Infrastructure and Construction Pipeline 2021, UK Infrastructure and Projects Authority, 2021
\textsuperscript{51} Read New South Wales Infrastructure Skills Legacy Program case study
\textsuperscript{52} Inclusive Infrastructure and Social Equity - U.S. Bank Stadium case study, Global Infrastructure Hub, 2019
the first contributor to the success of innovative procurement practices. The *Guidance on Innovation Procurement* published by the European Commission highlights specific innovation and case studies to attract more innovation in public procurement.

Competitive dialogue, innovative partnerships or other innovation-procurement procedures can be used to promote new technologies (InfraTech) and green solutions however, there is a complexity and administrative burden where flexibility and agility would be needed. Innovation is often under-valued and not properly rewarded (bid costs) or assessed (criteria of selection), discouraging private sector solutions.

If innovation is not encouraged by the public contracting authority it will be hard to make it happen. Current procurement practices can often discourage innovation, pushing for the lowest price. Industry has a role to play in bringing forward new ideas, working with public authorities to determine how best to put these ideas into practice.

“It is important to recognise that, along with numerous advantages, innovation procurement also entails risks and costs. It requires a cultural shift not only among the public buyers themselves, but also in the entire ecosystem: among the economic operators, political authorities, auditors and even the academia. In this context, a clear policy statement is essential to address risk aversion and possible additional costs arising from blocking innovation.”

2.2.3.5 Enabling an outcome-driven framework for procurement

Accelerating innovation for public infrastructure requires a strong policy framework to attract innovation and innovators, overcome risk aversion and administrative burden, innovation-friendly procurement procedures, and the ability to promote objectives such as sustainability.

It is imperative that governments, public procuring authorities and project owners set clear outcomes for infrastructure projects across environmental, social and economic considerations. These range from the macro level to the micro level. For example, at the macro level projects have a crucial role to play in achieving *sustainability and carbon emissions reductions*, particularly through infrastructure policies and procurement processes.

The OECD’s paper *The Role of Public Procurement in low-carbon innovation* outlines the role of public procurement selection criteria to foster low-carbon innovation, such as through using the Most Economically Advantageous Tender (MEAT) methodology and setting specific criteria for CO₂ emissions reductions.

An example of applying the MEAT methodology can be seen in The Netherlands, by the Dutch Ministry of Infrastructure and the Environment (RWS). RWS used the MEAT methodology to incorporate a CO₂ rating of the bidding company and an assessment of environmental impacts of material use in the proposed project.

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53 OECD Report Public Procurement for Innovation – Good practices and Strategies, 2017
54 *Guidance on Innovation Procurement*, European Commission, June 2021
55 The GI Hub’s *InfraTech Use case library* compiles 65 cases studies across a range of technologies such as IOT, sensors, AI, drones, data, and electric vehicles
56 *Guidance on Innovation Procurement*, European Commission, June 2021
57 OECD *The Role of Public Procurement in low-carbon Innovation* – 12-13 April 2016
58 Box 5.11 p222, *Investing in Climate, Investing in Growth*, OECD, June 2019
2.2.3.6 Improving delivery and outcomes through community involvement

At the micro level, project design, construction, and operation rely on a welcoming community. Community involvement is therefore critical to developing the best outcomes for a project. Insufficient community consultation can lead to inadequate scoping that results in the project not meeting community expectations around things such as accessibility, inclusivity, and quality.

Broader community benefits also need to be considered, such as employment opportunities and ethical sourcing of labour and materials. The Improving Delivery Models Framework provides several examples of how community involvement has improved infrastructure delivery.

Key Message

Accelerated innovation for public infrastructure requires a strong policy framework to attract innovation and innovators, overcome risk aversion and administrative burden, innovation-friendly procurement procedures, and the ability to promote sustainable objectives through procurement criteria. Community consultation and involvement is essential to maximise the impact of this innovation.

3 Conclusion

For further challenges and improvements, explore the Improving Delivery Models Framework (see below) and associated resources and let us know your thoughts. The Framework is intended to be a living document that can be continuously added to as new challenges, solutions and case studies arise, and we welcome your suggestions as a result. Provide your feedback at contact@gihub.org.

Addressing common challenges faced in infrastructure delivery

Many of the challenges faced in delivering infrastructure can be traced back to the process of choosing the delivery model and the subsequent structuring of the project at an early stage. Improving Delivery Models showcases proven improvements to the infrastructure delivery process made by G20 governments and industry and offers a Delivery Challenges and Improvements Framework using the following six themes that encapsulate major, global improvements made by governments and industry to improve infrastructure delivery models.