

Delivering better value and better outcomes

**A discussion document on changing practices
in infrastructure delivery**

New Zealand Infrastructure Commission / Te Waihanga

Te Waihanga seeks to transform infrastructure for all New Zealanders. By doing so our goal is to lift the economic performance of Aotearoa and improve the wellbeing of all New Zealanders.

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Foreword

We must do better

New Zealand is inefficient in terms of the value we get from the infrastructure we build – in fact we're near the bottom 10% of high-income countries.

Our traditional approach to infrastructure delivery has relied on lowest-price tenders as the way to deliver public value. We have relied on a project-by-project process, focused on lowest price, risk-transfer and adversarial commercial relationships – an approach which has not delivered efficiency, stability or reliability of results.

The UK government realised 15 years ago that they'd achieve better value by becoming more savvy and sophisticated clients of infrastructure. By creating a new collaborative framework for delivery, they could better leverage the experience and ability of their construction partners – to both reduce the costs and improve the infrastructure outcomes.

Te Waihanga appointed Mace Group to research the latest international approaches to infrastructure delivery, with a focus on the best practice principles emerging from the UK. Their findings form the basis for this report.

The report also contains case studies that showcase some local and international agencies that are leading the charge in applying these new principles to infrastructure delivery.

While infrastructure delivery is the focus of this report, it will need government-wide alignment around policy, strategy, asset management and procurement to achieve the results we need. But if we can do this, international experience suggests that improvements of up to 30% reduction in project costs are possible [1].

This report is aimed at public sector organisations who manage, plan, deliver, and maintain infrastructure – particularly decision-makers responsible for or involved with procurement decisions and/or supply chain management. I encourage you all to think about how your organisation could become a more sophisticated client. How can you begin to adopt these delivery principles and reshape the way you plan, procure and deliver your next infrastructure projects?

The report will also interest suppliers and advisors of infrastructure client organisations.

Andy Hagan

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Executive summary

Since the late 1980s, New Zealand's central and local government clients' have delivered infrastructure on a project-by-project basis, contracting their design, construction and maintenance activities to the market.

This has gradually shifted these client organisations toward being 'solution takers' rather than 'solution makers' - meaning they do not possess the in-house expertise for the rigorous thinking to connect strategies to solutions to meet infrastructure needs.

At the same time, infrastructure (construction particularly) has been cyclical and lacked a certain pipeline of work, so companies have taken on more risk to compete for work. This has contributed to some firm failures and disincentivised investment in skills, with potentially an impact on market and market depth.

We face an infrastructure challenge

New Zealand has a backlog of maintenance and renewal needs to deal with, as well as the future challenges of changing population and demographics, decarbonisation, climate resilience and adaptation, and rising construction costs and service level expectations.

If we aimed to address this by building infrastructure in the traditional way, it would cost New Zealanders nearly double what we spend today. This would mean increasing average taxes by 21% or nearly doubling the national debt – neither of which would likely be publicly acceptable.

Alternatively, we can learn from what others are doing and plan, design and build infrastructure in ways that make it more affordable, including using non-built solutions where we can.

We don't get good value and costs are rising

New Zealand spends a similar amount on infrastructure as other high-income countries¹, however in terms of the value² we get from this we're around the bottom 10% of these countries [2].

New Zealand has experienced long-term growth in the real cost of infrastructure, and this is expected to continue. Two trends at work here are:

- Construction wages are rising faster than the value they produce.
- Over time, service level expectations have grown and will continue to grow – as people expect smoother roads and cleaner water etc.

Other factors affecting the present and future costs of what we build include:

- high materials prices
- rising consenting costs and time taken to consent projects
- lower efficiency building some infrastructure (e.g., tunnels) than other countries
- vulnerability to a wide range of shocks and stresses³.

¹ World Bank's 2020 definition of high-income countries as countries with per-capita GDP greater than US\$12,536.

² Value in this context refers not only to the cost paid, but also benefits delivered by a given investment.

³ New Zealand has the second highest natural-disaster-loss-risk in the world at 0.66% of GDP [17].

Where tradition holds us back

Under the traditional delivery approach, infrastructure clients use external consultants to design projects one by one and then get them delivered by supply chain contractors who are chosen through competitive tender processes.

This approach usually creates highly transactional relationships, where a contract is the main means of achieving the tendering party's financial objectives and where value-for-money is measured by lowest initial price and maximum transfer of risk. This also results in risk and low prices getting pushed down the supply chain – as it's not unusual for 80% of a project's total value to be sub-contracted [1].

Where the traditional approach works well is usually with low complexity and low uncertainty projects. Such projects allow for complete contracts⁴ and, where the market has had experience with similar projects, they can engage in a competitive and risk-aware manner.

Outsourcing has also brought a 'hollowing-out' of delivery capability within infrastructure clients – so they are less able to be an active and sophisticated client in both planning and delivery stages.

Delivering infrastructure is hard, and is being done in an increasingly complex and uncertain environment. Effective and efficient delivery requires an understanding of the interconnectedness between investment intentions, the technical solutions available, and the market's capability and capacity to provide these solutions.

Adopting what's been learnt already

Fortunately, we are not alone. Many countries around the world are grappling with low construction sector productivity and escalating infrastructure costs.

Reports have found that improving infrastructure delivery presents an opportunity for savings of around 15-30% in infrastructure spending [3]. We know the way the New Zealand government traditionally goes about building our infrastructure is expensive.

The response presented from overseas lessons is clear – there is a need for a new approach to delivering government infrastructure. One that encourages innovation, produces better outcomes, and reduces waste. The key features of this approach are integrated, collaborative arrangements between government clients, partners, advisers and suppliers.

Drawing from the vast library of work that exists both locally and internationally, Te Waihangā has identified the following principles to guide infrastructure clients towards best practices when delivering infrastructure in a complex world.

Principles for delivering better value and better outcomes

These principles have been designed to be applicable across a variety of organisations and sectors, however their application will be dependent on the specific circumstances and the specific solutions an organisation seeks to deliver.

Infrastructure clients are encouraged to adopt any single, all, or combination of principles for their infrastructure projects, programmes, or portfolios.

⁴ In complete contracts there are no ex-post renegotiations. The winning bid fully reveals the bidder's revenue expectations ex-ante [9].

Becoming a more sophisticated client of infrastructure

The way forward starts in-house – we must lift the capability of our infrastructure clients and become more sophisticated clients of infrastructure⁵. Infrastructure clients must build upon a foundation of effective asset management in order to become sophisticated clients of infrastructure. Through this, they can correctly define the outcomes they seek and their investment requirements.

- **Principle #1 – Take a whole-of-system approach**
Complexity is best addressed through the lens of systems thinking⁶, recognising that infrastructure delivery occurs within complex and related regulatory, market and political environments.
- **Principle #2 – Deliver outcomes, not just outputs**
Outputs may be needed, but sometimes they're not sufficient by themselves to get the desired outcome.
- **Principle #3 – Establish a robust framework for determining value**
Make better decisions by improving how benefits and costs are determined through cost intelligence and benchmarks to define what good looks like, and lift the performance of infrastructure delivery through continuous improvement.

Changing how we engage our supply chains

New collaborative models exist in many forms – often as hybrids of models that have come before.

- **Principle #4 – Create aligned commercial relationships**
Create a win-win commercial environment which allows partners to invest in skills, staff retention and innovation – supporting the drive to improve productivity.
- **Principle #5 – Develop integrated teams**
Effective and collaborative delivery approaches have three key streams of integration: organisation, information, and process.
- **Principle #6 – Embark on digital transformation**
Data should be the foundation, with digital adoption offering significant opportunities to improve efficiencies across the development, construction, and operation of infrastructure assets.
- **Principle #7 – Adopt a production system mindset**
Learning from the manufacturing sector, identify repeatable tasks and project elements that can benefit from standardisation and optimise process and interfaces to reduce waste.

A roadmap for change

Becoming a 'sophisticated client of infrastructure' is a journey. It starts with a client organisation understanding where they're at and, from this, deciding where they want to go and how to get there.

There's no one size fits all approach, and no singular structure, delivery model or contract form will incorporate all best practice principles or offer permanent delivery success across all projects.

Learning from others is an important aspect of this journey. In Section 6 we explore what success looks like through projects that have adopted a new approach and leveraged one or more of the best practice principles to deliver tangible results.

⁵ Recommendation 38 from *Rautaki Hanganga o Aotearoa New Zealand Infrastructure Strategy 2022-2052*.

⁶ Systems thinking is a way of making sense of the complexity of the world by looking at it in terms of wholes and relationships rather than by splitting it down into its parts. It has been used as a way of exploring and developing effective action in complex contexts.

Purpose of this report

This report is based on the opinions of industry practitioners (reflecting local and international experience) about how infrastructure clients can engage the market, through procurement, to deliver better value and better outcomes. To do this, infrastructure clients need to build their capability to understand their assets and the outcomes they are seeking from investment. This is necessary regardless of how they choose to procure / engage the market.

However, in some cases infrastructure clients may also benefit from considering how to engage the supplier market in a more collaborative way. The report outlines three principles for how to be a more sophisticated client of infrastructure and four principles to guide procurement through non-traditional procurement (if that is the best approach).

The report recognises that in many cases 'traditional' procurement and contractual frameworks can and will deliver good outcomes when applied and administered well. Part of being a sophisticated client of infrastructure is recognising when different contract models will perform best.

This report is intended to stimulate discussion on a complicated and nuanced topic. It is not guidance on procurement process or contract forms, which should be informed by detailed planning and an understanding of project-specific circumstances.

Who should read this report

This report has been prepared to inform organisations who provide infrastructure – primarily in the central and local government sectors but is also suitable for private sector organisations.

It is aimed at individuals within these organisations who manage, plan, deliver, and maintain infrastructure – particularly decision-makers responsible for or involved with procurement decisions and/or supply chain management.

This report will also be of interest to suppliers and advisors of infrastructure client organisations.

1. Introduction

The traditional way for both central and local government to deliver infrastructure is to contract design, construction and maintenance activities to the market. This approach has become commonplace as clients shifted to favour outsourcing services over in-house capability. A similar approach also occurs in the UK and almost all advanced economies [2].

However, this has led to some issues which affect the cost and value we get from the infrastructure assets we deliver:

- As more and more of the design, construction, and maintenance activities are delivered by external providers from the market, there has been a steady decline in the technical capability within client organisations. This has shifted them toward being ‘solution takers’ rather than ‘solution makers’ – meaning they do not possess the in-house expertise for the rigorous thinking to connect strategies to solutions to meet infrastructure needs.
- Domestically, infrastructure (construction particularly) continues to be subject to boom-bust cycles and uncertain pipelines of work. As has been reported by Infrastructure New Zealand [4] [5], this inhibits businesses from investing into developing its workforce, systems and technologies to improve productivity [5]. This has resulted in a construction sector with limited market depth, capability and competitiveness within New Zealand’s relatively small economy.
- The traditional way public infrastructure is contracted, coupled with an uncertain pipeline, has led to some larger contractors taking on more risk to compete for work. This has contributed to some firm failures and disincentivised investment in skills, with potentially an impact on market and market depth.

We have an infrastructure challenge

Our infrastructure networks are under pressure due to rising demand from population growth, rising quality expectations, and the need to address future challenges like achieving net zero carbon emissions. On top of this, we have not been spending enough on looking after our existing assets – creating a backlog of maintenance and renewal needs [6].

By the end of 2024, we had over \$200 billion worth of committed and planned projects in the National Infrastructure Pipeline⁷ – work including looking after what we have as well as building what we will need in the future.

If the services to deliver this large-scale investment will be procured from the market, we must ensure it is done efficiently to best utilise our workforce and financial resources.

We don’t get good value, and costs are rising

New Zealand spends a similar amount on infrastructure as other high-income countries⁸, however in terms of the value⁹ we get from this we’re near the bottom 10% of these countries [2].

New Zealand has experienced long-term growth in the inflation-adjusted cost of infrastructure, and this is expected to continue. Two trends at work here are:

- Construction wages are rising faster than the value they produce. This is because, for some years, construction productivity lagged behind general workforce productivity. So, to attract workers, the construction industry has to match the pay of other, more productive industries. This is particularly

⁷ <https://tewaihanga.govt.nz/the-pipeline>

⁸ World Bank’s 2020 definition of high-income countries as countries with per-capita GDP greater than US\$12,536.

⁹ Value in this context refers not only to the cost paid, but also benefits delivered by a given investment.

the case for 'horizontal' construction. If this had matched 'vertical' construction, we estimate that prices would be about 10% lower, the quantity and quality of new infrastructure construction would be about 5% higher, and workforce requirements would be about 11% lower [7].

- Over time, service level expectations have grown and will continue to grow – as people expect smoother roads, cleaner water, and more.

Other factors affecting the present and future costs of what we build include:

- materials costs are rising at a higher rate than inflation
- consenting costs and time to consent projects have been rising (consenting averages around 5% of major project costs)
- New Zealand is less efficient at building some infrastructure: for instance, international benchmarking shows that Europe builds road tunnels more efficiently than we do
- our communities and infrastructure are vulnerable to a wide range of shocks and stresses¹⁰ which are exacerbated by a changing climate, rising sea levels, and the interconnectedness of our infrastructure.

The size of the prize

Given the challenge ahead, we must either realise more benefits from our investments, or reduce the cost we pay for them, or ideally, both.

Mckinsey Global Institute has estimated that by following proven best practice in selecting, designing, delivering and managing infrastructure we could see productivity increase by 50 to 60 percent [8].

¹⁰ New Zealand has the second highest natural-disaster-loss-risk in the world at 0.66% of GDP [17].

2. How we deliver infrastructure - the traditional approach

Figure 1 shows the process that large public infrastructure investments should follow.



Figure 1 The investment life cycle (source: New Zealand Treasury)

In this process, the Investment Planning phase primarily concerns developing the business case¹¹, and Investment Delivery comprises construction related activities. The traditional approach employed in New Zealand sees procurement of services from the market occurring during these two phases.

With procurement, infrastructure clients consider three key dimensions of procurement choices [9]:

1. **The delivery model**, which defines when and for what scope parties are engaged.
2. **The bidder selection process**, which defines how we decide which party to enter into a contract with.
3. **The basis for remuneration (or incentives)**, which defines how strong the rewards or penalties are to manage performance (such as performance against time and/or cost).

2.1. What is the traditional approach?

Clients define the scope and contracts are agreed with the market to deliver

Clients define their investment intentions, then often engage consultants to develop business cases to define the scope. Design and Project Management consultants are then engaged to design the projects, after which contractors are engaged to build them. The contractors then engage further parts of the wider supply chain. This is the Design-Bid-Build delivery model.

While variations to this delivery model exist, including engaging parties at various stages and for varying scope¹²; the traditional approach sees parties selected through competitive tender¹³, with remuneration through either fixed fee or price, or cost reimbursement mechanisms.

Whichever variant is used, the traditional approach is characterised by:

- individual transactions and contracts between parties
- a contractual obligation to deliver against a defined scope
- a focus on lowest cost at the tendering stage
- suppliers and advisors often not having direct relationships with the client
- remuneration not directly linked to the value provided
- parties seeking to transfer risk to 'downstream' parties through contract conditions.

¹¹ Treasury Better Business Case process prepares business cases in the following order: Indicative Business Case (IBC), Detailed Business Case (DBC), and then Implementation Business Case (ImBC). A Single Stage Business Case process may be used which combines the three business cases into one.

¹² For example: Design & Construct, Early Contractor Involvement, etc.

¹³ Referred to as Auctions in auction theory.

Consequently, a traditional approach usually creates highly transactional relationships where a contract is the main means of achieving the tendering party's objectives, and where value-for-money is measured by lowest initial price and maximum transfer of risk. This often means that risk and lowest price focus get pushed down the supply chain¹⁴.

The traditional approach can deliver good results

When adopting this traditional approach, infrastructure clients must define the contracted scope to ensure investment intentions are met. The value derived from investments depends how well the project is scoped as well as the price paid.

Conditions where the traditional approach is expected to work well are:

- **Low complexity and low uncertainty**
 - Limited optionality of solutions provides clients a clear link between their investment intentions (or outcomes sought) and the required scope to realise them.
 - Allows for complete contracts¹⁵, where the scope is well defined and price becomes the primary determinant of an optimal result [9].
 - Risks can clearly be identified, communicated, and apportioned through contract provisions, and these can then be priced efficiently by the market.
- **There is market experience and good competition within the market for the procured scope**
 - The market has the required capability and capacity to deliver the scope.
 - The 'true cost' can be assessed by tendering parties.
 - Competitive tendering (based on a complete contract) allows the most efficient party to win.

Where these conditions do not exist, it is less likely the traditional approach will deliver good results.

2.2. Why doesn't the traditional approach always work?

Planning and delivering infrastructure is hard

To build infrastructure that delivers value in a complex and uncertain environment requires an understanding of the interconnectedness between investment intentions, the technical solutions available, and the market's capability and capacity to provide these solutions.

This places a huge demand on any one individual organisation.

Focusing on outputs (scope) may not deliver the desired outcomes

Identifying a project's outcome is the single most important step in maximising the value obtained from investment in infrastructure.

Focusing on outputs through the traditional approach may limit opportunities for parties to consider how outcomes can best be delivered, potentially resulting in inefficient solutions or desired outcomes not being realised.

OUTPUTS VS OUTCOMES

Outputs are the actions or items that ideally contribute to achieving an outcome, such as a wastewater pump station or roundabout.

Outcomes are what the business wants or needs to achieve, such as improving community resilience.

¹⁴ Note that it's not unusual for 80% of a project's total value to be sub-contracted [1].

¹⁵ In complete contracts there are no ex-post renegotiations. The winning bid fully reveals the bidder's revenue expectations ex-ante [9].

It is difficult for consultants to acquire the knowledge and expertise needed to develop the right solution through the business case process without being involved in a client's operations or service delivery. Additionally, without in-depth knowledge of the supply chain it is difficult for clients to know what the market can deliver efficiently.

By focusing on outcomes, opportunities through the development of solutions can be realised for:

- non-built solutions
- utilisation of new technologies
- new/innovative construction methodologies.

The incentives of clients and the suppliers may not be aligned

The traditional approach can create misaligned incentives. Misaligned incentives foster adversarial conditions and can create the conditions for gaming. This can erode value.

Infrastructure clients must deliver value for money from their investments. Under the traditional approach, maximising value for money is achieved by delivering more output for lower cost.

Suppliers must balance risks and are incentivised to maximise profit margins. Depending on the basis for remuneration, increased profit margins can be achieved by:

- **fixed fee/lump sum** – by reducing the cost to produce outputs¹⁶, or strategic pursuit of variations (over-recovery of variation costs).
- **cost recovery/cost-plus** – by increasing the quantity of outputs delivered or the base cost to produce outputs.

Consequently, behaviours can occur that do not support the desired outcomes due to a fear of worsening one's position under the contract.

Not considering the longer-term can erode ability of the market to deliver

The traditional approach has contractors competing on price to win jobs and, in the process, often taking on more risk than is prudent¹⁷. The financial performance of a group of UK contractors showed that since 2007 their margins from construction work ranged from 0% to 4% and since 2010 the net profits generated by construction operations had reduced almost to zero [1].

This contributes to an unwillingness and/or inability to reinvest into improving productivity e.g., taking on or developing staff (which in turn impacts the capacity and capability of the sector to deliver future projects) or adopt new technologies which can improve productivity, etc.

These same key issues were identified in a New Zealand report into public infrastructure procurement challenges¹⁸ and is evidenced by contractors entering liquidation even during 'boom' periods of construction.

The potential for short-term gains must be considered against the long-term costs.

¹⁶ Through innovations that improve efficiency of delivery (which weren't accounted for at the time of tendering) or reducing the outputs delivered (quantity or quality).

¹⁷ This effect is termed "the winners curse" where the lowest bidder wins but may have undervalued the project.

Meyer, W. G. (2014). The effect of optimism bias on the decision to terminate failing projects. *Project Management Journal*, 45(4), 7-20.

¹⁸ *Creating value through procurement: A report into public sector procurement of major infrastructure projects*. Entwine. 2018. <https://infrastructure.org.nz/wp-content/uploads/2021/08/Infrastructure-NZ-Procurement-Study-Report-FINAL.pdf>

3. The international context

New Zealand is not alone. Many – if not most – countries around the world are grappling with low construction sector productivity and escalating infrastructure costs.

In 2010, the United Kingdom government investigated how to reduce the cost of major infrastructure projects¹⁹ and found that higher costs resulted from a combination of many issues, largely in the pre-construction phases. including:

- stop-start investment with a poor pipeline of guaranteed future works
- projects often starting before design is complete
- perception that 'contingency' is part of the overall budget
- over-specification and use of bespoke, rather than off-the-shelf design solutions
- overly complicated bidding processes
- lack of strategic thinking by the supply chain
- lack of investment in skills and training.

The report also found that increased fragmentation of the construction industry and a shift towards greater use of sub-contracting had also led to cost increases. The report considered there was an opportunity for savings of around 15% in infrastructure spending.

Similar reports with similar findings have been published from many jurisdictions around the world, including New Zealand.

3.1. Responses to the infrastructure challenge

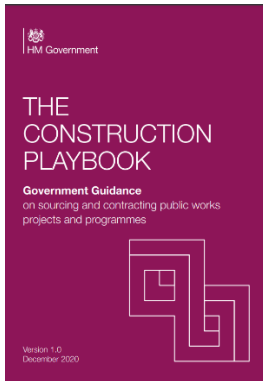
Other jurisdictions have produced a range of policy documents and industry guidance in response to these challenges that aimed to lift the performance of their infrastructure sector. Some examples of these are highlighted below:



Transforming Infrastructure Performance (UK Government)

Transforming Infrastructure Performance (TIP), updated by the Infrastructure and Projects Authority in 2022, provides a longer-term direction for infrastructure. It calls for integrated teams to work together to deliver the required outcomes, adopting delivery models that enable greater collaboration. TIP outlines the UK government's view that this is the route to greater adoption of technology and modern construction methods, and ultimately greater productivity.

¹⁹ Infrastructure Cost Review: Main Report. 2010. Infrastructure and Projects Authority, HM Treasury.
<https://www.gov.uk/government/publications/infrastructure-cost-review>



Construction Playbook (UK Government)

The Construction Playbook, which was recently updated by the UK government, underwent extensive industry consultation to develop clear guidance on how government believes programmes should procure and deliver infrastructure and services. The playbook promotes a collective focus on delivering the outcomes required from the investment, using longer term supplier relationships that enable modern and more productive methods of construction, and more balanced and sustainable contracting relationships.



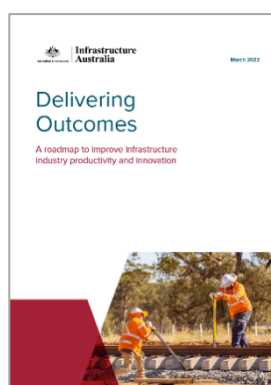
Shaping the Future of Construction (World Economic Forum)

The World Economic Forum have promoted more collaborative approaches to infrastructure delivery. They have supported this view by researching leading projects and identifying common themes. By reviewing a diverse range of projects, they have identified that more integrated models, the application of digital technology, shifting from project thinking to portfolio thinking, and production-oriented delivery through standardised components are all methods to improve user outcomes.



From Transactions to Enterprises (Project 13, Institution of Civil Engineers)

Project 13 is a global initiative that brings together organisations who are already adopting delivery arrangements involving integrated and collaborative teams with a collective focus on delivering outcomes²⁰. Project 13 principles come from research conducted into exemplar projects. The proposed new approaches focus on a broader understanding of value and see clients, contractors and suppliers incentivised on value rather than volume or time.



Delivering Outcomes (Australian Government)

Infrastructure Australia's Delivering Outcomes report undertook both wide ranging consultation and research of global best practice to establish a roadmap to productivity improvement. It sets out a series of enabling changes, including infrastructure investment driven by economic, social and environmental outcomes; managing infrastructure as a system to deliver optimal solutions; digital transformation to drive productivity and innovation; collaboration and integration across the supply chain to drive sustainable high performance; and people wellbeing and resilience.

These reports suggest there is an opportunity for New Zealand infrastructure clients to adopt a new approach to delivering infrastructure – one that encourages innovation, produces better outcomes, and reduces wastage.

²⁰ Within the Project 13 community, these are referred to as "Enterprise Models".

4. Principles for delivering better value and better outcomes

Drawing from the work that exists both locally and internationally, we have identified seven principles to guide infrastructure clients towards best practices when trying to deliver infrastructure.

These principles are applicable across a variety of organisations and sectors. However, their applicability will depend on the specific undertaking and environment in which an organisation seeks to deliver.

Infrastructure clients can adopt any single, all, or combination of principles for their infrastructure projects, programmes, or portfolios.

4.1. Becoming a more sophisticated client of infrastructure

This way forward starts in-house. To get better outcomes, we must lift the capability of our infrastructure clients and become more sophisticated clients of infrastructure²¹.

Fundamentally, infrastructure clients must know their assets and the service they deliver. That is to say – the infrastructure network, its age, and condition; along with its customers, the service levels they expect, and what they can afford.

Therefore, infrastructure clients must build on a foundation of asset management in order to become sophisticated clients. Through this, they can correctly define the outcomes they seek and their investment requirements.

²¹ Recommendation 38 from *Rautaki Hanganga o Aotearoa New Zealand Infrastructure Strategy 2022-2052*.



Principle #1 – Take a whole-of-system approach to infrastructure

Infrastructure assets, networks and communities are highly connected, interdependent and complex. Our infrastructure needs are impacted by responses to broader infrastructure networks, pricing, the economic environment, affordability and other preferences. This complexity is best addressed through the lens of systems thinking.²²

Systems thinking shifts consideration to the whole of a given system – understanding the structures, patterns and relationships which exist, allowing us to intervene with longer-term solutions to problems.

Systems thinking for better decision-making

Current application of the business case process may not effectively consider an investment's impact on the broader system and instead focuses on individual projects and engagement with the market at the project level. Little recognition is given to system opportunities or impacts.

More integrated and collaborative investment planning processes and delivery models that appropriately engage the market can enable more effective investments by:

- leveraging the combined capability and capacity across the infrastructure delivery system²³
- identifying solutions to achieve desired outcomes
- aligning infrastructure solutions with delivery system capabilities and capacity
- assisting in avoiding silo-based planning decisions
- enabling new interventions and solutions to be better integrated with the existing system.

²² Systems thinking is a way of making sense of the complexity of the world by looking at it in terms of wholes and relationships rather than by splitting it down into its parts. It has been used as a way of exploring and developing effective action in complex contexts.

²³ This covers infrastructure managers, their full supply chains (consultants, contractors, and suppliers), and other system participants.

Current state

Infrastructure is viewed as a series of discrete and independent physical assets. This is underpinned by current planning, appraisal and delivery processes that consider infrastructure investment as a series of distinct, individual projects.

The market – including consultants, contractors and suppliers – are only engaged to deliver projects. As such, they have limited opportunities to use their capabilities to develop system optimisation and intelligent solutions, which could integrate digital solutions, technology and engineering.

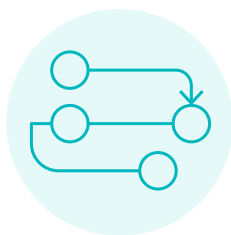
Solutions come to market which aren't fully aligned with current capability and/or capacity, nor support the market to grow capability and/or capacity.

Future state

Infrastructure investment is founded on good asset management and progressed as interventions on the system.

Infrastructure clients have an in-depth understanding of all parts of their supply chain, leveraging the value that this system can provide to the efficiency and realisation of the outcomes to be delivered.

Active market engagement allows infrastructure clients to develop an understanding of market capacity and market appetite, which is used to shape the model and timing of the project. This develops a feedback loop which supports the growth and development of market capacity and capability.



Principle #2 – Deliver outcomes, not just outputs

Outputs are needed to produce outcomes, but sometimes, these are not sufficient by themselves. In some cases, the link between the chosen output and the desired outcome is weak²⁴. Outcomes define the absolute purpose and objectives for investing in infrastructure. An outcomes focus should extend right through delivery, including as success measures and performance indicators.

By focusing on outcomes, infrastructure clients can leverage input from across the supply chain – bringing together engineering, technology and innovation to deliver intelligent and cost-effective solutions to unlock our ability to:

- integrate new solutions (including non-built) into the existing infrastructure system
- realise greater potential and value from existing infrastructure
- enhance the resilience of existing infrastructure systems
- more effectively engage with iwi and local communities
- realise the full value of the supply chain in delivering desirable outcomes.

Current state

Current planning and delivery processes typically focus on delivering outputs on discrete, sector specific assets, rather than outcomes. For example, outcomes may only be defined at the earliest stages of the investment lifecycle, after which options and solutions are developed. The solutions (outputs) become the focus of the investment and the outcome is often forgotten by the time the investment is delivered.

Infrastructure clients define the outputs for the market to deliver. This assumes the best output for any given outcome is known by the client.

This does not create the environment for engaging with the market on how outcomes can be delivered most effectively.

Future state

All infrastructure system interventions are focused on the core role of infrastructure, to deliver outcomes for people and places.

Outcomes provide the focus for projects and programmes and are recognised as the ultimate measure of success. Projects and programmes are driven from the outset by a clear articulation of desired economic, social and environmental outcome, rather than as a predefined scope.

The focus on outcomes enables the development of solutions that optimise existing infrastructure systems through the development of intelligent solutions rather than a default to the addition of new assets.

²⁴ For example: a section of State Highway may be unsafe, resulting in deaths. Rather than focusing on outputs such as installing crash barriers (which don't address a root cause) or straightening a section of road (which can be very expensive), clients should instead clearly articulate the desired outcome e.g., reduce deaths along that section of State Highway by half. In this way, interventions (or combination thereof) can be selected to best achieve the desired outcome.



Principle #3 – Establish a robust framework for determining value

Ideally, expected value for money is determined through a Cost-Benefit Analysis²⁵. This approach is useful for supporting decision-makers to know whether an investment is of value and to prioritise investments – but only if benefits and costs can be accurately estimated.

However, for long-lived infrastructure, value extends beyond the moment in time when an investment decision is made. Value is dependent on how well benefits are realised, costs managed, and long-term sustainability²⁶. We must be also able to answer the question “did this investment provide value?” which can be done through ex-post appraisal and benefits realisation reviews²⁷.

As such, infrastructure clients must put in place a framework to determine whether investments are:

- **Economic:** Can the investment deliver value for money? Is the investment affordable?
- **Effective:** How well are the required outcomes are delivered? Are the full scale of expected outcomes realised?
- **Efficient:** Is the investment delivered within cost baselines? Are productivity improvements being realised over time? Baselines should be derived using cost intelligence and benchmarks e.g., Reference Class Forecasting or Should-Cost modelling.

Determining benefits must be repeatable and comparable

Identifying and quantifying benefits is often complex and nuanced – often leading to disagreements, undermining decision-making and ultimately impacting how effectively infrastructure is delivered.

Sophisticated clients of infrastructure should develop a framework for identifying and evaluating benefits associated with their investments. These frameworks should adopt a broader and more consistent evaluation of benefits which are then applied consistently across projects.

While some benefits are easier to quantify on an absolute scale (e.g., travel time benefits in the transportation sector), by consistently applying the framework less tangible benefits²⁸ can be determined on a relative scale – thus simplifying comparisons and value determined through cost-efficiency metrics.

Understanding cost is critical²⁹

Investment decisions can only ever be as good as the accuracy of the cost estimates they are based on. The accuracy of cost estimates requires good estimation practices but is also affected by what eventuates during delivery e.g., risks materialising, or changing market conditions or changes to scope.

²⁵ Recommendation 43 from *Rautaki Hanganga o Aotearoa New Zealand Infrastructure Strategy 2022-2052*.

²⁶ For example, financial sustainability - is the asset able to be maintained and/or operated over the long term.

²⁷ Recommendation 45 from *Rautaki Hanganga o Aotearoa New Zealand Infrastructure Strategy 2022-2052*.

²⁸ Examples of 'less tangible benefits' can be found in NZTA's *Monetised benefits and costs manual*.

<https://www.nzta.govt.nz/assets/resources/monetised-benefits-and-costs-manual/Monetised-benefits-and-costs-manual-v1.7.2.pdf>

²⁹ Recommendation 46 from *Rautaki Hanganga o Aotearoa New Zealand Infrastructure Strategy 2022-2052*.

Projects almost invariably suffer cost escalations, particularly when baselined against forecasts early in the investment lifecycle. And recent history has shown that much improvement is necessary. There are two key factors which account for forecasting inaccuracy [10]:

- **Optimism bias** – a cognitive predisposition to judge future events in a more positive light than is warranted by actual experience i.e. we underestimate what is required, how long it will take, or how risky it is.
Where familiarity is low (i.e. high complexity, and/or carried out infrequently), optimism bias is more likely to be high.
- **Strategic misrepresentation** – deliberately and strategic overestimation of benefits and underestimation of costs to increase the likelihood of gaining approval and funding.
Where there are many principle-agent relationships or high political pressure, strategic misrepresentation is more likely to be high.

By better utilising cost intelligence and benchmarks, sophisticated clients can adopt approaches such as Reference Class Forecasting and Should-Cost modelling to:

- better forecast the actual out-turn costs for investments, particularly at early stages of the investment lifecycle
- help define what good performance of infrastructure delivery looks like (e.g., peer benchmarking or identifying the 'optimal delivery' case) to then drive efficiency and productivity improvements where these can be made.

Reference class forecasting

Reference Class Forecasting is a form of project cost estimation based on what has occurred on similar, previous projects. It is often referred to as a top-down approach to cost estimation.

This involves creating a reference class of past, similar projects and using their actual costs and characteristics to forecast the cost of your current project. The approach develops a total estimate which is based on the actual performance of similar, past projects, and involves three key steps:

- identify a reference class of past, similar projects
- establish a probability distribution for the selected reference class for the parameter being forecast
- compare the specific project with the reference class distribution, to establish the most likely outcome for the specific project.

A reference class cost forecasting process is required for large infrastructure projects in the United Kingdom and guidance documents provide reference classes for different types of projects. The approach has enabled the cost of projects to be more accurately forecast. Further information on reference class forecasting can be found at [\(PDF\) Curbing Optimism Bias and Strategic Misrepresentation in Planning. Reference Class Forecasting in Practice](#) [10].

Should-cost modelling

Should-Cost models are a bottom-up approach to cost estimation.

They break a proposed project down into its constituent elements, then use benchmarking data to calculate the cost of each element and add these up to a total 'should cost'.

These models incorporate the whole of life costs, and risks associated with different options and scenarios – which can enhance understanding of the impact of risk and uncertainty on both cost and schedule.

The approach can help inform the appropriate commercial strategy, including methods to incentivise the supply chain to focus on whole of life cost.

More information can be found [Should Cost Modelling: Tools and Templates - GOV.UK](#) [19].

Current state

Cost-Benefit Analysis may be undertaken as part of investment planning.

Decision-makers ask the question "Will this provide value for money?", but there is little to no relation to whether value is achieved through delivery.

Measures focus on comparing the cost to deliver against allocated budget. Budgets are not set using cost intelligence or benchmarks.

Future state

Robust value frameworks drive consistent evaluation of benefits across investments, and rich cost intelligence data unlocks:

- High confidence in budget setting and expected costs to complete.
- Performance monitoring of infrastructure delivery to drive continuous improvement.

Infrastructure clients can undertake effective prioritisation of investments through transparent application of the value framework and to answer the question "Did this provide value?".

4.2. Changing how we engage our supply chains to improve infrastructure delivery

Infrastructure delivery approaches can vary considerably between projects, and a sophisticated client can deliver most projects well under almost any approach. In some situations there can be significant benefits for both infrastructure clients and supply chain partners by shifting to long-term and aligned relationships.

Implementing collaborative models with longer-term relationships is supported by international best practice, such as Project 13³⁰ and the UK Construction Playbook³¹. New collaborative models exist in many forms – often as hybrids of models that have come before. When infrastructure clients develop a collaborative model, it should be done using the following principles.



Principle #4 – Create aligned commercial relationships

Uncertainty, misaligned incentives and short-term thinking reduce collaboration, pushing up the cost of construction and undermining innovation. A more collaborative approach can enable all participants to buy into, provide input on and problem solve for a shared solution. This also allows infrastructure clients and supply chain partners to jointly create a financially sustainable project. Doing so allows partners to invest in skills, staff retention and innovation – supporting improved productivity.

Alignment begins with shared strategic goals and outcomes that then run through to programme and project outcomes. This helps infrastructure clients develop supply chain partners who share the capabilities and behaviours required to successfully deliver the required outcomes.

The benefits of longer-term collaborative relationships include:

- reducing overhead and bidding costs
- investment in skills and capability
- a greater level of trust between parties, leading to improved performance
- establishing a shared knowledge of core processes
- greater alignment, with infrastructure clients and supply chain partners having a deeper understanding of the client's business and goals
- helping to encourage knowledge exchange between supply chain partners
- allowing infrastructure clients to develop deeper understanding of the capability of the supply chain to drive better value and outcomes.

Collaboration must be supported by effective governance and underpinned by commercial models that support and drive the desired shift in behaviours. This incentivises the desired collaboration and knowledge sharing.

³⁰ <https://www.project13.info/library/resources/project-13-framework-pillars-principles-and-maturity-matrix-r3/>

³¹ <https://www.gov.uk/government/publications/the-construction-playbook>

In developing a commercial model, infrastructure clients must understand which parties are carrying risks. Experience shows that where infrastructure clients carry increased levels of risk, the best outcomes occur where there is an associated increase in cost transparency³².

Forming relationships that deliver

Sophisticated clients develop delivery approaches built on long-term, commercially sustainable relationships, but to do so they must have a good understanding of their own financial interests. Traditional hierarchical relationships which create adversarial engagements where parties win or lose, with an overall worse result, are replaced with aligned and collaborative business to business relationships enabling win-win scenarios – with a collective focus on better delivering the required outcomes. Sophisticated clients choose the *right* partners and suppliers based on technical, cultural, and behavioural capability, with integrated teams then working within incentivised value-based arrangements. The focus on outcomes provides a back-to-back alignment through all parts of the integrated delivery team.

Infrastructure clients are central to establishing an integrated supply chain. Sophisticated clients take ownership of creating a fair and equitable commercial environment allowing for the sustainability and resilience of the overall supply system. This should form the backbone of an integrated delivery model.

Sophisticated clients bring capabilities, processes, and an approach that creates an enabling environment for aligned, integrated delivery teams. This includes the ability to:

- identify and articulate outcomes required from an infrastructure system
- articulate and institute processes to ensure outcomes represent the requirements of customers, community and society
- describe the best-value way to achieve these outcomes and engage with contractors, suppliers and stakeholders in delivering this
- align participating organisations, including the supply chain, with the outcomes required from the investment
- continuously apply relationship management expertise, to develop and sustain aligned partner relationships and support the required behavioural change
- bring an openness to new ideas and innovation and an ability to create an environment that nurtures possibility and innovation
- recruit, build, and retain talent.

³² At the extreme, carrying of all risks by a client with complete price transparency has demonstrated success – refer section 5.1.25.1.2.

Current state

Infrastructure projects and programmes are procured on a project-by-project basis, with few examples of long-term, collaborative relationships.

The construction sector is globally characterised by adversarial engagements where parties win or lose, with unbalanced risk allocation and penalty-laden commercial models.

There are often misaligned and uncollaborative relationships, and an adversarial culture and work environment.

Infrastructure clients outsource their project management and relationship management requirements on a project-by-project basis and don't develop or retain capability, maturity or sophistication.

Future state

Infrastructure clients actively identify opportunities to develop long-term and collaborative supplier relationships. They maintain relationships that align with the overarching outcomes clients require.

Contractual arrangements provide the opportunity for longer-term relationships, subject to continued value and performance improvement.

Adversarial culture is mitigated by implementing models that incentivise collaboration between all parties and allows for repeat work opportunities.

The required value-adding behaviours are identified at the programme's outset. These behaviours are embedded in the design of enabling commercial and engagement strategies.

Collaboration is recognised as a significant enabler to improved performance and new ways of working. It is an enabler to better outcomes – it is not itself an outcome.



Principle #5 – Develop integrated teams

Implementing effective and collaborative delivery approaches depends on the integration of information, process and organisation across delivery teams. This integration is at the core of delivering improvements in the design and construction of infrastructure. By doing so, New Zealand can make better decisions that improve productivity, reduce cost and ensure better outcomes for communities.

Effective and collaborative delivery approaches have three key streams of integration: **organisation**, **information**, and **process**.

Organisation

Effective teams encourage the sharing of knowledge, and complementing the capabilities of each party to drive better outcomes. From the project's outset, the delivery approach should support integrated working across partner organisations. While integrated teams may be co-located, this is not always necessary and may be only one aspect of organisational integration.

Kainga Ora's Housing Delivery System, explored in section 5.1, is an example of an integrated and collaborative delivery approach.

Information

An aspirational model for data integration is a common and coordinated information standard for all major programmes, allowing access to real-time information which is comparable and harmonised with other current and past projects.

The traditional transactional delivery model tends to place barriers between organisations, making collaboration and information sharing difficult through both commercial and logistical constraints (such as using different IT systems, data standards and different reporting). Integrated teams help to address this, encouraging collaboration and helping to remove boundaries between the parties. Integrating capabilities and functions produces more effective working, as well as largely eliminating duplication of effort.

In section 5.1 we explore Highways England as an example of progressive methods of data sharing and standardisation.

Process

Traditional construction projects usually do not have integrated production processes. Typically, when a project design is received, contractors produce an outline schedule and then rely on a sub-contractor to develop the production process for each step of delivery [11].

Integrated and collaborative delivery teams develop production processes in parallel with the detailed engineering of their projects. In contrast to traditional models, clients and contractors lead process development, and interact with sub-contractors to ensure their knowledge and skill is adopted, while adhering to the project's outcomes.

Process integration also enables greater standardisation of production systems. This enables cheaper and more effective processes for repetitive tasks (like fitting-out in a block of flats) which can be refined and further optimised on future projects [11].

Industry best-practice is demonstrating the importance of establishing integrated teams to drive collaboration and achieve better outcomes. This is the model adopted by projects such as Sydney Water Partnering for Success – discussed further in section 5.1.

Current state

There is a trend for co-locating teams for infrastructure projects. However, co-located teams are not the same as 'integrated' teams. Personnel from different organisations may all sit in the same office space, but that does not mean they share a one team 'win-together' approach or have aligned objectives

Project teams generally operate as silos, with design, construction and suppliers all operating as individual teams. As a result, delivery must overcome significant interfaces and hand-offs. There is little application of 'best for task' thinking in establishing delivery teams.

Future state

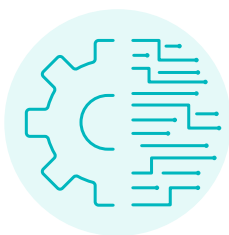
Integrated and collaborative teams are used to deliver infrastructure projects and programmes.

The industry operates with the awareness that successful projects require integrated and collaborative teams, where the interfaces and hand-offs of traditional delivery are superseded by aligned and collaborative people and organisations.

Time is invested by infrastructure clients at the outset and throughout the life of infrastructure delivery programmes to integrate people from different organisations to develop a single high-performing team with shared behaviour, processes, and practices.

A collaborative arrangement should be supported by a supply chain partnership model with integrated teams and processes. This should be underpinned by a one-team 'win together, fail together' approach.

Integrated teams, systems and tools support the creation of an environment which encourages the aligned behaviours necessary to deliver the outcomes. This includes access to shared data and common IT systems to build trust between all parties.



Principle #6 – Embark on digital transformation

Technology has the potential to transform and support enhanced productivity and innovation across the infrastructure sector. Digital transformation offers significant opportunities to improve delivery across the development, construction, and operation of infrastructure assets. Digital transformation enables a customer and user-first approach.

Being clear on the effective utilisation of digital is key to improving the performance of projects and driving better decision-making for investments. A mindset shift is required to begin treating data as a valuable asset.

The digital journey begins with a clear approach to information management, starting with the information required to deliver the investment outcomes – including ongoing service, operation, maintenance and, eventually, de-commissioning. Having this information supports better whole-of-life value.

Integrated and collaborative delivery teams should consider digital capability and a commitment to digital enhancement as part of partner selection. This is because digital transformation is catalysed by the commitment and buy-in of key players.

Current state

Project delivery is undermined by numerous interfaces and hand-offs that interrupt the flow of information. When combined with the lack of emphasis given to common information structures and processes, the platform for digital transformations is weak.

Information is not treated as an asset. This is best demonstrated by the sector's approach to the provision of information at handover, with projects focusing on the completion and handover of physical assets and information following at some later stage. This should be completely the other way round. Projects should only progress through milestones when information requirements are complete.

Digital transformation strategies often focus on the development of organisation-wide platforms as a core enabler. This leads to costly changes and a lack of exploitation of digital opportunities.

Future state

Projects are founded on clear and consistent information structures, with information managed as an asset.

Projects are enabled by clear and shared information structures, with information processes that span all stages of the value chain. These structures improve data interoperability and information sharing, enabling better decision-making.

Infrastructure clients extend these structures across infrastructure, enabling the adoption of digital twins that provide digital representations of existing systems and allow the simulation of design, construction and future operation.

All project milestones include clear information deliverables, with projects only progressing when information requirements have been validated by users, particularly at commissioning, where asset data is transferred with the physical assets.

There is clear ownership for defining a standardised national common framework of standards and protocols that enable secure, resilient data sharing across organisations and sectors. The framework should define a common approach to the collection, storage and exchange of data and be applied across the infrastructure sector for all projects in all jurisdictions.



Principle #7 – Adopt a production system mindset

A production system is the framework within which production activities take place – transforming inputs into outputs [12].

This has long been an approach adopted in the manufacturing industry to deliver substantial productivity gains. Possibly the most famous example of a production system is the Toyota Production System (TPS)³³, often considered the precursor to lean manufacturing and just-in-time manufacturing.

The main objectives of the TPS are to design out overburden, inconsistency, and to eliminate waste³⁴ which is achieved based on the principles of continuous improvement and respect for people.

Production systems generally feature activities being defined and standardised, inventories optimised, and resources more effectively planned and allocated to achieve a minimum total production time.

For infrastructure delivery, adopting a production system mindset will require a substantial shift in behaviour and process as traditional approaches adopt a siloed series of delivery steps – with each activity usually considered in isolation.

Adopting a production system mindset requires not only identifying repeatable tasks and project elements that can benefit from standardisation, but also considering all tasks/project elements required to deliver the output and optimising their interfaces to reduce waste.

A production system can be implemented across either an entire infrastructure delivery process or to certain outputs within this process.

Production systems are being observed within infrastructure delivery through the concept of product platforms/product libraries, and Modern Methods of Construction (MMC), which sees on-site construction moving to relatively later dates in the project assembly lifecycle through off-site manufacturing technologies and the adoption of design-for-manufacture philosophies.

It is important to recognise that MMC or product libraries are not an end in themselves. Infrastructure clients should consider how and to what extent the use of production systems can drive wider value and achieve the defined outcomes.

Production systems have the potential to revolutionise infrastructure delivery. Application of the TPS in New Orleans for post-Katrina rebuilding efforts saw house rebuild times and the actual amount of rework both reduce by more than 50%³⁵. In New Zealand, Kainga Ora have reported a 94% reduction in the design-to-consent phase for its houses following the implementation of production systems disciplines.

³³ Toyota Motor Corporation published an official description of TPS, stating “The TPS is a framework for conserving resources by eliminating waste. People who participate in the system learn to identify expenditures of material, effort and time that do not generate value for customers”.

³⁴ Eight kinds of waste are addressed: overproduction, time on hand, transportation, processing itself, excess inventory, movement, rework, underutilisation.

³⁵ <https://pressroom.toyota.com/toyota-helps-speed-post-katrina-homebuilding-reports-nonprofit/>

For further examples of production systems in practice we explore the Kainga Ora’s Housing Delivery System and the NZTA Taparahi bridge project in Section 5.1.

Refer also to Simplicity Living’s Productivity Hub approach, system and observed improvements in cost quality and time.

Current state

Infrastructure delivery activities are carried out in isolation with little consideration of inputs required and outputs delivered between activities.

This inevitably produces inefficiencies through low levels of task reliability resulting in poor staff utilisation (both over and under), inconsistencies in delivered quality, and large amounts of waste.

Future state

Production systems underpin infrastructure delivery. This sees each activity related to upstream and downstream activities through the lens of required inputs and outputs to allow for process optimisation across parties within the overall supply chain.

Consistency is achieved, minimising waste and delivering higher quality outputs along with greater reliability of delivery timeframes.

The production system allows for continuous improvement practices to be consistently applied, driving further enhancement.

5. Case studies

Building sophistication as an infrastructure client is a process of perpetual review, reassessment and adjustment. There is no one-size-fits-all approach. No singular approach, delivery model or contract form will offer success across all projects.

Understanding where you're at is the first step to determining where you want to go and how to get there. A good starting point for delivery teams to develop this awareness is to consider:

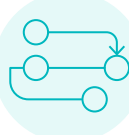
- **Organisational readiness:** What is your organisation's capability, capacity, and commitment to adopting a new delivery approach aligned with the principles set out in this report? What approach can you realistically adopt versus what change might your organisation need to undertake to adopt a new approach? Is there executive buy-in to a change in approach? Is your data and digital programme able to respond?
- **Delivery need:** What is the context for your infrastructure delivery? Are you dealing with new or existing infrastructure? How complex is your infrastructure? How long is the period of delivery?
- **Outcomes:** Is your organisation clear on its long-term asset management strategy and how each proposed project fits within that strategy? Are the project's desired outcomes well known and agreed?
- **Supply chain:** Is your supply chain ready to adopt a new approach with you? Will they need additional support in the short/medium/long term? How well do you understand your supply chain and their relationship with you?

Learning from others is an important aspect of this journey. Many organisations and many exemplar projects already embody one or more of the seven key principles. The remainder of this section sets out case studies that demonstrate successful implementation of the principles. By sharing and learning from these we can build a New Zealand-wide community of more sophisticated clients.

5.1. The new approach in practice

5.1.1. Ecosystem-based procurement – Australia

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

In 2020, Major Road Projects Victoria substantially reformed their approach to procurement, in what became known as the Programme Delivery Approach. This adopted best-practice principles, and the University of Melbourne, in an in-depth [case study](#)³⁶ of the approach, observed it delivered the following outcomes:

- improved market capacity
- rapid and efficient procurement
- increased innovation
- increased collaboration and trust
- increased actual cost certainty
- improved social outcomes.

In establishing the Approach, the roading organisation created an ecosystem with its suppliers which coves organisation/governance, the systems and tools used, and the projects themselves.

The features of the ecosystem and their interrelationship to each other are shown below. Where appropriate, features have been identified where they relate to principles discussed in this paper.

³⁶ https://law.unimelb.edu.au/__data/assets/pdf_file/0004/4759672/MRPV-and-its-Project-Delivery-Approach-September-2023.pdf

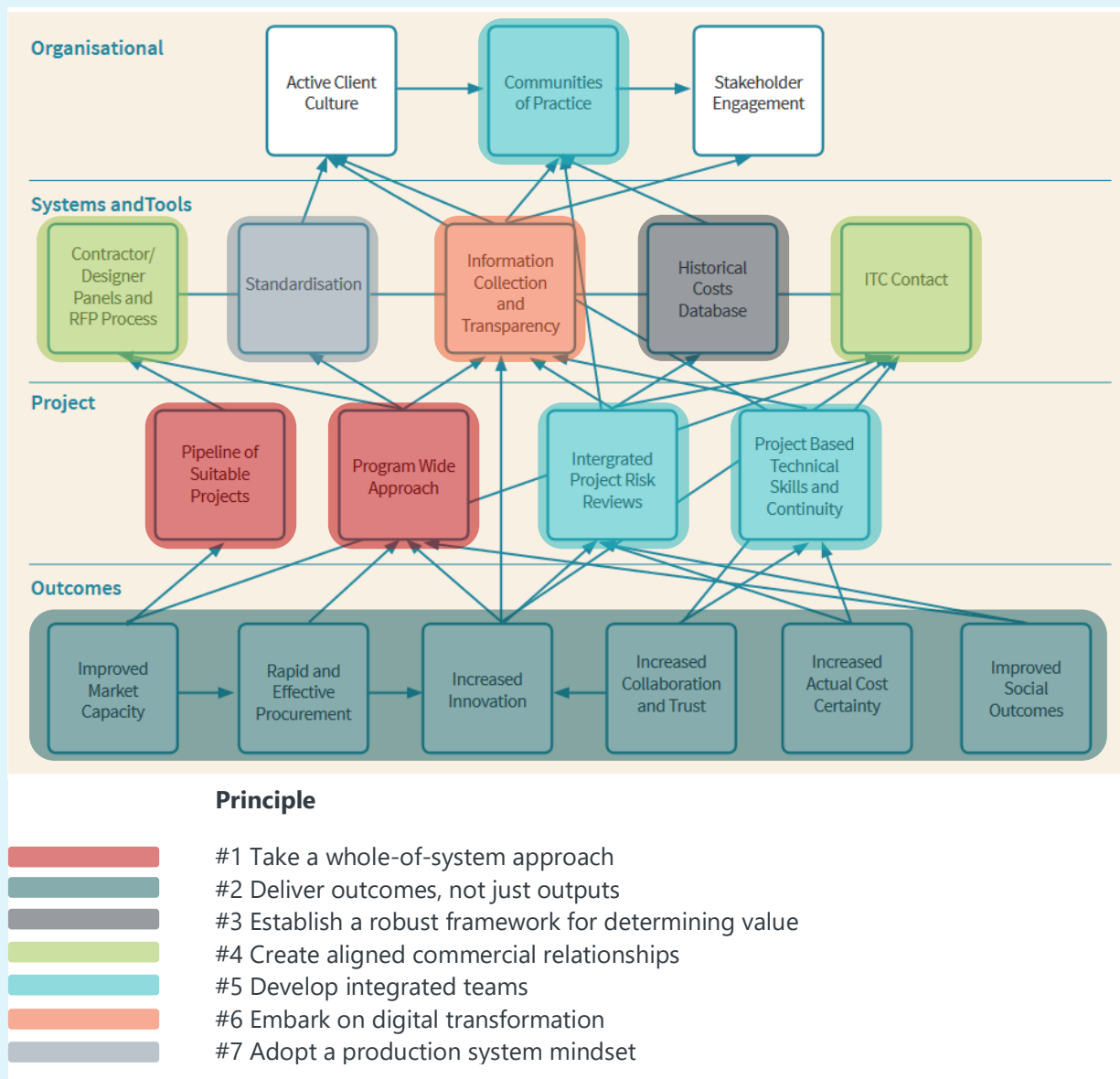
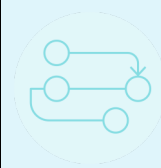
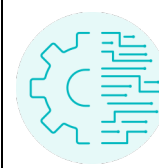


Figure 2. Overall visual map of the ecosystem features and their interrelationships (Source: UoM Case Study)

Major Road Projects Victoria developed their own form of design-and-construct contract to support the new approach. Significantly, they adopted an incentivised target cost model, taking a step further than traditional Alliancing. In this model, reimbursable costs are paid based on actual costs, whilst the margin and performance pool are adjusted (within caps) based on measured performance. Removing the fear of negative financial outcomes seemed to result in increased trust and collaboration, which flowed through into improved information transparency and problem solving between the parties.

5.1.2. Reducing costs by being a sophisticated client – United Kingdom

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

In the early 1990's, British Airports Authority was planning to deliver one of Europe's largest and most complex projects, larger than anything they'd ever undertaken before – Heathrow Airport's Terminal 5.

This programme aspired to deliver the world's most successful airport development - setting high standards of specification and conception to realise an architectural statement for the principal international gateway to the United Kingdom while dealing with challenging civil engineering problems, a very tight site, and a background of construction costs steadily rising faster than their ability to levy charges.

To find ways of reducing costs, the Authority understood they needed to adopt a different approach and embarked on a strategy to transform themselves into a capable and sophisticated project management client. This started by:

- Understanding themselves and their position as a client
- Acquiring suitably skilled and experienced personnel to lead the project
- Developing a mature approach to risk – moving to a position where they were actively managing the cause of risk and not the effect of risk
- Process improvements following the principles of safe projects, consistent process, design standards, standard components, framework agreements, concurrent engineering and pre-planning.

Following this, planning and delivery of Terminal 5 progressed under a philosophy of partnering that was enabled through a framework agreement. Its key features included:

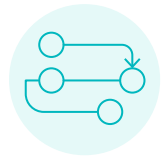
- **Engagement of their supply chain:** framework agreements were not restricted to first tier suppliers, they encompassed a wide range of services including specialist services, consultancy (design & engineering), construction, etc. While agreements may have differed depending on the nature of the service being delivered, the concept and conditions were applied consistently across all suppliers.
- **Risk ownership:** The challenging experiences in delivering the Heathrow Express project made the Authority understand that as it ultimately held the risk on the Terminal 5 programme, it might as well formally take that risk through the contract. In order to carry all risk, the Authority needed high levels of transparency and to observe the cost structures of their suppliers. By taking away the risk, the Authority took away this key commercial constraint, which enabled their suppliers to focus on technical delivery.
- **Relationships & integrated teams:** the Authority required that suppliers work together in completing projects (even those that are traditionally rivals). These project teams were co-located and fully integrated, and run akin to being their own small business with everyone taking joint responsibility for delivering the required outcome.
- **Standardisation:** The Authority constructed three World Business Centres – designing and building the first, then replicating it for the second and third, with target cost and time reductions of 10% and 15% respectively.

- **Incentivisation:** On top of fees paid (actual cost plus an agreed overhead and profit), the Authority created an incentive fund to encourage suppliers to better the agreed targets. Targets were set by the team and all shared in the success or failure. It was a team target.
- **Performance management:** Business as usual performance is not acceptable under the Terminal 5 Agreement. Therefore, the Authority carried out monthly performance management assessments to ensure transparency between contractors, sub-contractors and the Authority throughout the project. Additionally, there was a focus on consistently enforcing their working philosophy through changes to the supplier base over the project's development.

Learn more at the National Audit Office Case Study [here](#), the research paper "Learning to manage mega projects: the case of BAA and Heathrow Terminal 5" [here](#), or the Global Infrastructure Hub case study [here](#).

5.1.3. An ecosystem approach to improve quality, efficiency and sustainability – United Kingdom

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

Anglian Water is the largest water and wastewater company in England and Wales by geographic area. It serves about six million customers in the East of England and has about 4,200 employees.

In 2005, to improve quality, efficiency and sustainability when building infrastructure, Anglian Water adopted an innovative collaboration model – named the @one Alliance. This formally links Anglian Water's team responsible for the capital delivery process with six key contractors and the wider supply chain through framework agreements. Together, this alliance designs and builds the majority of their projects – worth approximately £1.2 billion every 5 years.

The Alliance emphasises collaboration and taking a longer-term perspective of their programme. This gives partners the ability to adopt a product-based delivery approach by: identifying repeatable tasks, utilising standard products, taking advantage of off-site manufacturing, and applying these on a wide array of projects.

Customer outcomes provide the collective focus to The Alliance's integrated delivery teams, who are incentivised to deliver within affordability thresholds defined by Anglian Water through a Should-Cost Model.

The Alliance has delivered a step change in performance, exceeding health and safety, efficiency, time and carbon targets. It also contributed to sustainability and community goals. Some highlights include:

- Consistently excellent health, safety and wellbeing indicators – Accident Frequency Rate reduced from 3.3 per 1,000,000 hours to 1 per 1,000,000 hours worked.
- Annual cost savings of 2-3% while increasing quality of delivery to customers.
- From 2010-2015:
 - embodied carbon reduced 54%, compared to a target of 50%
 - operational carbon reduced by 41%, compared to a target of 20%.
- Improvements in building techniques, a drive for standardisation both in terms of approach and products, and more use of prefabricated materials (which has led to a reduction in time on site).
 - An example is the sampling kiosks which are produced and installed at a cost of just 77% relative to the 2005 cost and 11% less embodied carbon and zero operational carbon.
- Efficiencies in sourcing materials, including making use of bulk buying.

Learn more about the @one Alliance in the World Economic Forum case study [here](#).

5.1.4. Improving delivery through collaboration – Australia

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

Sydney Water’s Partnering for Success is an integrated and collaborative delivery approach based on a 10-year agreement to create three regional delivery consortia for the full design, construction, maintenance and operation lifecycle of Sydney Water’s \$1.3 billion annual investment programme.

The model places an emphasis on establishing aligned longer-term relationships with ecosystem partners, such as contractors and advisors, which creates the conditions for Sydney Water and the ecosystem partners to develop more effective ways of working together.

The overall approach is highly integrated, which enables a shift from traditional in-series delivery. Ecosystem partners are incentivised to collaborate across an integrated programme and to collectively solve process and production challenges. This enables more effective delivery via much higher levels of replication, standardisation and continuous improvement. Mal Shepherd, John Holland General Manager – Water Services says the approach has:

“established a new era in the delivery of capital and maintenance services in an integrated and end-to-end operating environment across Greater Sydney, the Blue Mountains and the Illawarra...It really is bringing the very best innovations and expertise from across both the public and private sectors to one of the most important and essential services for our community.” [13]

Sydney Water Managing Director, Roch Cheroux also stated:

“These long-term arrangements have enabled the regional teams to build a pathway of skilled resources to support the needs of a growing city; with the cultural and gender diversity to build a strong integrated workforce.” [13]

Sydney Water dedicates time to working with the supply chain and investing in its capability as a sophisticated client, with a particular focus on leadership and commercial expertise.

Learn more about Sydney Water’s Partnering for Success delivery model [here](#) and [here](#).

5.1.5. A collaborative, value-based delivery model – United Kingdom

Principles applying to this case study

Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

National Highways is delivering the largest UK road investment in a generation. It procured the Smart Motorways Alliance to enable exemplar performance in terms of safety, cost, time and quality, and to drive standardisation in delivery.

The Alliance is an integrated and collaborative delivery approach, comprising National Highways and six ecosystem partners which include contractors and suppliers. It is designed to change behaviours through a collaborative, value-based delivery model where ecosystem partners and the supply chain work with National Highways as a single integrated organisation.

The outcomes provide the focus for the Alliance – such as making the network safer, improving user satisfaction and achieving efficiency. The performance framework and the commercial model all align directly with these outcomes. And the ecosystem partners are collectively incentivised to deliver them within the affordability envelope defined by National Highways.

This approach has already enabled integrated partner teams to outperform historic norms for delivery as shown below.

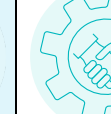
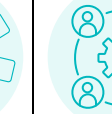
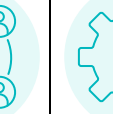
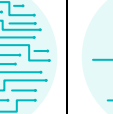


Source: National Highways Smart Motorways Alliance

Learn more about the National Highways Smart Motorway Alliance from the procurement descriptive document [here](#).

5.1.6. Speeding up the delivery process – New Zealand

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

In March 2020, Kainga Ora Homes and Communities began trialling an integrated-teams approach as part of a broader objective to speed up the design-consent-build process for new state housing.

Kainga Ora's Housing Delivery System created cross-functional professional teams that coordinate and track the thousands of tasks involved in planning and designing a home in order to schedule work more efficiently. This focussed on treating the next step in the process as a customer, they engage with one another and resolve issues directly and in real time, minimising delay and duplication of work. Every professional is together in one place from day one of the project, including architects, development and project managers, civil and structural engineers and landscape architects.

Feedback from teams notes the faster and more effective in-person collaboration, the unique opportunity to learn regularly from other disciplines, the stronger sense of teamwork and overall efficiency and speed of project delivery³⁷.

The key elements of the System identified by Kainga Ora are:

- transparency of process
- shared process and technical knowledge
- a process that gives all people in the work flow concise information and the time and work tools to be perfect first time
- an acceptance of variance as an opportunity to learn
- detailed (to the minute) project planning
- supportive and present project coordinators
- a focus on training.

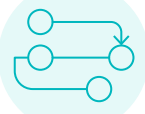
The result for Kainga Ora is a reported 94% reduction in the design-to-consent phase for its houses – from 17 months to 6 weeks and average construction times have halved from 8 months to just over 3 months. Initial cost savings realised have averaged at 13% per home, which is expected to increase to 30%.

Learn more about Kainga Ora's Housing Delivery System [here](https://kaingaora.govt.nz/en_NZ/urban-development-and-public-housing/industry-hub/housing-delivery-system-project/).

³⁷ https://kaingaora.govt.nz/en_NZ/urban-development-and-public-housing/industry-hub/housing-delivery-system-project/

5.1.7. Efficiency through modern construction and alignment – New Zealand

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

Opened in December 2023, 3 months ahead of time and \$7m under budget, the delivery of Taparahi bridge across SH25A has been lauded as a blueprint for future projects. NZTA Regional Manager Infrastructure Delivery (Waikato / Bay of Plenty) Jo Wilton says the entire project team were focused on speeding up the construction process. "We made a promise to reopen by March [2024] and we're very proud to have done better than that...keep it safe, keep it simple, get it done," she says.

The focus on outcomes proved successful. Wilton is quick to credit the project team around their commitment to a single clear outcome – getting the community reconnected by opening the bridge as quickly and safely as possible. A goal that was shared by contractors using a national and local workforce committed to working 7 days a week. NZTA supported that commitment by looking after its people - providing accommodation, meals and transport to get workers to and from site every day. Additional cost was off-set by the value achieved in delivering the programme so quickly.

Adopting a progressive approach, NZTA also applied a production mindset which utilised off-site manufacturing and an on-site assembly process. An on-site crew of 70-100 was matched equally by crews in local factories working to produce the steel beams and components for the bridge, with work coordinated simultaneously. Wilton credits coming in under budget to the time saving achieved through off-site manufacturing, saying "fabrication off-site has saved time and time is critical from a cost perspective".

An integrated team approach is also evident in the connection between good planning and achieving delivery outcomes. Enabling the production approach meant the entire NZTA team from early planning to logistics had to buy into the goal, approach and desired outcomes. Design decisions were focused on driving efficiency. NZTA adopted the details and dimensions of a bridge already designed for a different site, ensuring it was suitable for the existing ground conditions. Design also maximised the use of materials already available along with ensuring large portions could be built off-site – achieving key time savings. Aligned internal prioritisation decisions also enabled materials to be diverted from other projects.

Focused planning decisions were supported by a collaborative commercial approach. NZTA utilised the NZS standard form contract, adopting a cost reimbursement model as they recognised not enough information was available for the contractor to accurately or fairly price risk. Wilton says this approach removed unnecessary commercial tension from the relationship, enabling the team to focus on delivering solutions. NZTA retained robust cost control by appointing both an independent expert and estimator to certify resources and base rates, each being appointed in collaboration with the contractor.

Learn more about the project [here](#) or read the Infrastructure NZ case study [here](#).

5.1.8. Building new schools cheaper, quicker – Australia

Principles applying to this case study

						
Principle #1 – Take a whole-of-system approach to infrastructure	Principle #2 – Deliver outcomes, not just outputs	Principle #3 – Establish a robust framework for determining value	Principle #4 – Create aligned commercial relationships	Principle #5 – Develop integrated teams	Principle #6 – Embark on digital transformation	Principle #7 – Adopt a production system mindset

School Infrastructure New South Wales developed their Education Facilities Standards & Guidelines (EFSG 2.0) which provides information and tools required to design and build new school assets utilising a set of standard components which promotes using offsite construction methods to build infrastructure more efficiently.

The modular construction approach uses a factory-style production line in an off-site facility. Using computer-guided saws and drills and a standard 'kit' of parts they can build wall, roof and floor system 'modules' quickly and accurately, without disruptions due to weather. And having a standardised 'kit' of parts means these can be pre-ordered in bulk for further cost-savings. Once the modules are built, they're transported to the site and assembled.

This approach is commonly used for buildings that incorporate repeatable substructures – such as hotels, apartments, schools and hospitals. Its success in delivering school buildings cheaper and quicker has seen School Infrastructure New South Wales seek new industry partners for delivering its teaching spaces. On top of this, they're now thinking about how to further improve delivery, including streamlining the coordination and integration of their parts kit.

While buying construction components from an offsite manufacturer can be cheaper than building them on site, there are greater benefits to be realised when the offsite manufacturer is closely integrated with the delivery agency – such as in this New South Wales example.

Learn more about their approach to standardisation [here](#), or see how this delivery method works in practice [here](#).

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