BRANZ

External Research Report

Report ER55 [2020]

Construction sector performance measurement: Learning lessons and finding opportunities

Charlotte Brown, Puck Algera, Richard Ball, Rod Cameron, Sophie Horsfall, Eirini Konstantinou, Kristen MacAskill, Joanne Stevenson

Project LR12087
Resilient Organisations, Kin Strategy, University of Cambridge, funded by the Building Research Levy

1222 Moonshine Road
RD1, Porirua 5381
Private Bag 50 908
Porirua 5240
New Zealand
branz.nz

Funded from the Building Research Levy

ISSN : 2423-0839

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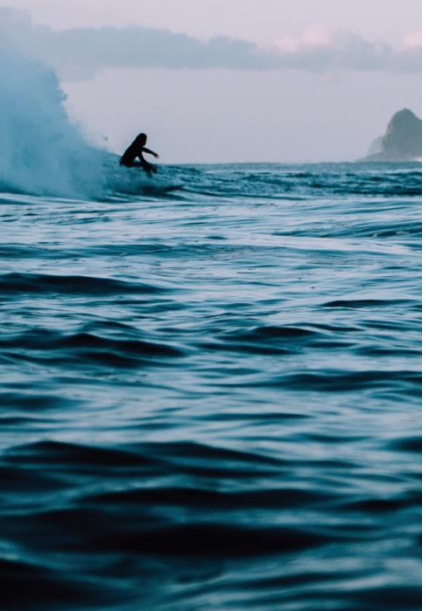

Construction sector performance measurement:

Learning lessons and finding opportunities

July 2020

Authors

Charlotte Brown, *Resilient Organisations*
Puck Algera, *Kin Strategy*
Richard Ball, *Resilient Organisations*
Rod Cameron, *Independent*
Sophie Horsfall, *Resilient Organisations*
Eirini Konstantinou, *Laing O'Rourke Centre for Construction Engineering and Technology, University of Cambridge*
Kristen MacAskill, *Laing O'Rourke Centre for Construction Engineering and Technology, University of Cambridge*
Joanne Stevenson, *Resilient Organisations*

BRANZ Funded from the Building Research Levy

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Acknowledgements

We would like to thank BRANZ for co-developing this project and funding it through the Building Research Levy. This project demonstrates the Building Levy being applied to better support not only the safety of our buildings but to enhance the wellbeing of the construction sector and the community the sector serves.

We are also grateful for the time and insight offered by industry practitioners, peak body representatives, government officials, and researchers that have contributed to this research. We hope that this project contributes toward a more sustainable and resilient future for the construction sector.

Contents

Executive summary

New Zealand's construction sector is a major contributor to the national economy and plays a significant role in delivering higher living standards for people living in this country. The Construction Sector Accord brings this role to the fore in its vision of "A high performing construction sector for a better New Zealand. The wellbeing of New Zealanders is supported by safe and durable homes, buildings and infrastructure, built by a productive, capable, resilient, and proud sector."

Being able to track and demonstrate progress towards that vision is vital to ongoing commitment and belief in the vision by stakeholders inside and outside of the sector. An effective performance measurement system can 1) track progress over time; 2) identify issues or challenges; 3) inform policy and decision-making; 4) help to set measurable targets for performance improvement; and 5) help drive behavioural change amongst sector members.

With better performance data the sector will be better prepared to manage volatility and provide a more stable working environment for organisations. Increased stability will give confidence to construction sector organisations to invest in capability development and innovation. A more financially stable construction industry will be better placed to make improvements in environmental and social outcomes.

This research was commissioned by BRANZ. It draws on international and cross-sectoral learnings to inform development of an effective construction sector performance measurement framework. In particular this research aimed to identify ways the performance of the construction industry could be better measured to reflect the sector's contribution to the country's health, economic stability, security and social cohesion. It also sought to understand how a performance measurement system could be designed to help drive improvement in the sector.

Sector measurement frameworks and practices within two international construction sectors and three other industry sectors in New Zealand were reviewed for the project:

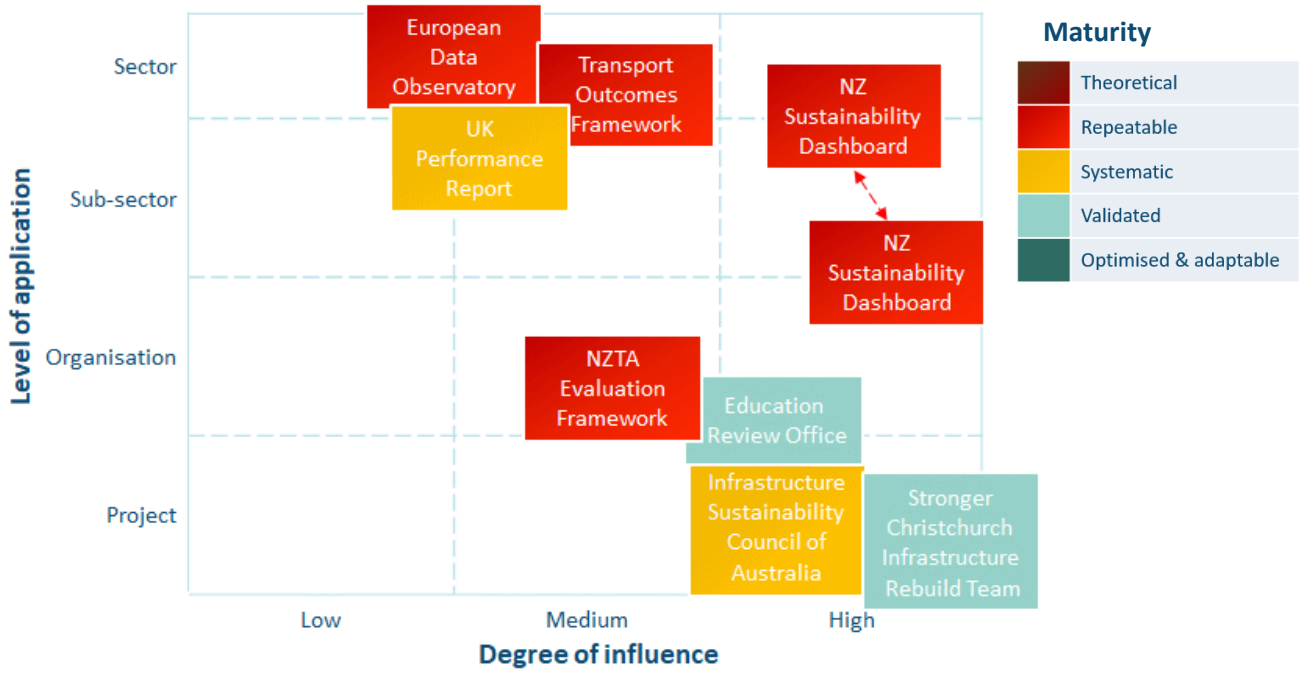
- UK construction sector
- Australian construction sector
- New Zealand transport sector
- New Zealand education sector
- New Zealand agricultural sector

Three other specific measurement frameworks were also reviewed:

- European construction sector observatory
- SCIRT (Stronger Christchurch Infrastructure Rebuild Team) performance framework
- A New Zealand property developer

The case studies ranged in their: level of application (i.e., project, organisation, or sector level); ability to influence behaviour amongst users; and maturity. The breadth of frameworks, in addition to reflections

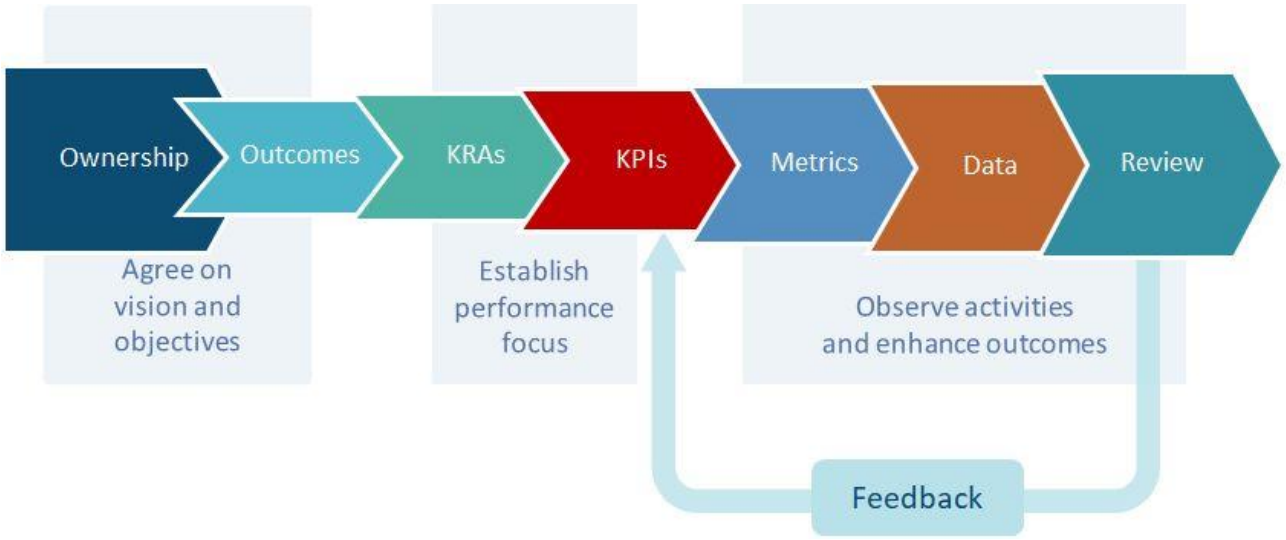
from interviewees on why some historic performance measurement attempts have or have not been successful, have provided some important performance measurement lessons for the construction sector.



Application, influence, and maturity of case study performance measurement frameworks

Across the case studies a set of 12 principles were identified that are key to the development and implementation of an effective and sustainable sector performance measurement system. These are listed below.

The key principles have contributed to the creation of a guide to sector performance measurement.



Sector Performance Measurement System Process

Fundamentally, the principles and the guide demonstrate it is vital that there is agreement across the sector about the **purpose** and **value** of performance measurement and that sector members feel a sense of **ownership** of the measurement system.

The challenge now is to extend the work being done by MBIE and the Construction Sector Accord to **develop a measurement culture amongst sector members**. Performance measurement first and foremost needs to serve the needs of its participants. Therefore, to supplement any national level measurement framework and reporting, it is important to facilitate and build capacity for sub-sector groups to take ownership of their own performance measurement and to design measurement systems that **align to their drivers**. Construction businesses need to be able to see cause and effect linkages between the data they collect, the actions they take, and the performance (profitability and long-term viability) outcomes for their business.

Sector performance measurement will be a long journey of creation and engagement that requires adaptation and innovation over time.

Key sector performance measurement principles

Develop strong engagement
Engage with sector stakeholders in a meaningful and collaborative way. Engagement is an ongoing and evolving process.

Establish clear ownership
A sector measurement system needs a 'home', a budget, a clear commitment, and a need and/or desire from relevant stakeholders to maintain system measurement.

Define a clear purpose
Clearly articulate why you are measuring performance and what you hope to achieve through the application of a measurement system. Refine the purpose in collaboration with sector stakeholders.

Focus on outcomes
Clearly define the desired outcomes of optimal sector performance with stakeholders. Identify outcome indicators where possible, and supplement with activity/practice indicators where necessary, and where there is a clear causal link.

Start with what you have
Use measures that are currently being collected to get started. But be prepared to review and adapt to ensure the measurement system is delivering what you want it to.

Understand sector drivers
Design the sector measurement system to work with diverse motivations and drivers across sector members to encourage performance measurement, facilitate data provision, and drive sector improvement.

Empower subsector groups to measure performance
Allow and facilitate sub-sectors (plumbers, surveyors, horizontal construction etc) to take ownership of and design their own measurement systems. Once a sector measurement framework is defined, focus on developing a measurement structure and principles for sub-sectors to adapt.

Incentivise performance measurement
Incentivise performance measurement through contractual arrangements, accreditation schemes, and benchmarking.

Mandate data collection where necessary
Regulatory compliance will be needed in some cases to collect data or generate behaviour change that is vital at sector level.

Keep it simple
Entities are more likely to engage with a system that is easy to contribute information and simple to interpret.

Cultivate a culture of learning
Create a culture of learning by putting measurement systems into the hands of those that can drive change in the sector.

Commit to continual improvement
Performance measures should be dynamic and reviewed over time to ensure indicators are still relevant to the sector, measuring the outcomes sought, fulfilling the desired purpose. Measurement is a journey and not a destination.

1. Introduction

New Zealand's construction sector is a major contributor to the national economy and plays a significant role in delivering higher living standards for people living in this country. The Construction Sector Accord brings this role to the fore in its vision of "A high performing construction sector for a better New Zealand. The wellbeing of New Zealanders is supported by safe and durable homes, buildings and infrastructure, built by a productive, capable, resilient, and proud sector," (Construction Sector Accord 2019, p.7).

Across the country there are a number of initiatives coalescing that call for stronger alignment between sector activities and performance and societal outcomes and supporting frameworks to measure progress towards enhancing societal outcomes. A December 2019 New Zealand Infrastructure Commission /Ernst Young report notes the need to make infrastructure investment decisions that are driven by long term public value, rather than focusing on project-level outcomes (Ernst & Young 2019). It also recommends moving from a focus on what is being to delivered to how it is being delivered. The National Infrastructure Commission[1] is currently consulting on measures to assess performance of infrastructure at a system level (i.e. how it contributes to wider economic, business, social and environmental objectives of the government). Both initiatives coincide with the shift of the New Zealand Government to a wellbeing framework underpinned by the Treasury's Higher Living Standards. The Higher Living Standards framework brings a sharper focus to non-monetary benefits of government policy interventions.

Internationally, there is a movement towards more comprehensive performance measurement (multi-capital, whole of life) across numerous sectors. For example, the UK's Infrastructure and Projects Authority[2] (IPA) has developed *Best Practice in Benchmarking* guide and there is a dedicated team within the organisation now leading the benchmarking initiative (Infrastructure and Projects Authority, 2019). In March 2020 CIRIA, in partnership with the Laing O'Rourke Centre for Advanced Technology and Construction at the University of Cambridge, UK, published a *Methodology for quantifying the benefits of off-site construction* (Jansen van Vuuren and Middleton, 2020) which includes societal level benefits.

Being able to track and demonstrate progress towards the Construction Sector Accord vision is vital to ongoing commitment and belief in the vision by stakeholders inside and outside of the sector. An effective performance measurement system can 1) track progress over time; 2) identify issues or challenges; 3) inform policy and decision-making; 4) help to set measurable targets for performance improvement; and 5) help drive behavioural change amongst sector members.

With better performance data the sector will be better prepared to manage volatility and provide a more stable working environment for organisations. Increased stability will give confidence to construction sector organisations to invest in capability development and innovation. A more financially stable construction industry will be better placed to make improvements in environmental and social outcomes.

This research was commissioned by BRANZ, with funding through the 2019-2020 Research Funding Levy. Our task was to draw on international and cross-sectoral learnings to inform development of an effective construction sector performance measurement framework. In particular this research aimed to identify ways the performance of the construction industry could be better measured to reflect the sector's contribution to the country's health, economic stability, security and social cohesion. It also sought to

[1] The National Infrastructure Commission was set up to provide impartial, expert advice to the government on long-term infrastructure challenges.
[2] Considered as the UK government's centre of expertise for infrastructure and major projects.

understand how performance measurement systems can be best designed to help drive improvement in the sector.

In this research we have systematically reviewed a selection of international construction sector performance measurement systems and other industry sector performance systems to see what cross-sectoral lessons can be learnt.

In Section 2 and 3 of this report we provide background on the NZ construction sector and recent efforts to improve performance. Section 4 provides background into performance measurement and Section 5 briefly describes the project method. In Section 6 we review the key performance measurement frameworks that we reviewed. Section 7 provides a summary of the key observations across the case studies and measurement frameworks reviewed – these principles form the basis of our recommendations. In Section 8 we reflect on how these principles and frameworks apply to the New Zealand construction sector. Last, in Section 9, we discuss the challenges and opportunities ahead.

2. New Zealand construction sector context

Pre-COVID19, New Zealand's construction sector was growing, and pre-2020 forecasts projected continued opportunities for growth through to 2023 (MBIE 2019, Teltrac Navman 2019). In 2016, construction was the 5th largest sector by employment in New Zealand, and construction and related services contributed 8 percent of total GDP in 2015 (PwC 2016). The sector has one of the largest multiplier effects in the economy. Every dollar invested in the construction sector generates around $2.80 of total economic activity (PwC 2016). Between 2011 and 2017 construction GDP grew 23% or 5.2% per year, driven by both the rebuild required following the Canterbury earthquakes and strong demand for new housing in Auckland (Curtis 2018). In 2019 New Zealand's total construction sector value was $39 billion (MBIE 2019).

Sector-wide challenges are stopping the sector from keeping pace with growing needs (Construction Sector Accord 2019). Profit margins have tightened over the last two decades, with construction industry input prices growing faster than output prices (Curtis 2018, Page & Norman 2014a). The BDO 2019 Construction Survey Report found that construction businesses are increasingly facing downward pressure on prices due to competition as well as rising costs and inconsistent cashflow. This is contributing to a growing solvency issue across the industry (BDO 2019). Competition across the industry means that some businesses are not adequately pricing risk, leaving businesses vulnerable to disruption (BDO 2019).

There is a reported ongoing shortage of qualified workers in the construction industry. In a 2014 survey, nearly 80 percent of businesses in the construction industry reported vacancies and 58 percent noted that they had "hard-to-fill" vacancies. There are acute shortages of people with trade-related skills, management or supervisory skills, and professional or technical skills (StatsNZ 2017).

Quality is an ongoing issue within the sector. The need to cut costs and move quickly to increase margins in addition to ongoing skill shortages, contributes to lowered quality and the necessity for rework (BDO 2019, Gordon & Curtis 2018, Rotimi et al. 2015). Additionally, fragmentation of the industry can cause unclear responsibilities and poor communication, this along with poor product standardisation and familiarity with products leads to more frequent errors (Gordon & Curtis 2018, Rotimi et al. 2015) and is a source of emergent project risks (Chang-Richards et al. 2019).

Slow growth in productivity and volatility across the industry are two of the most complex and significant issues facing the sector. Across all traditional measures of productivity including labour[3], multi-factor[4], and capital[5] productivity there has been little growth in the New Zealand construction sector since the 1990s (Page & Norman 2014a). The sector has lower productivity compared to other sectors in New Zealand and compared to construction sectors in other countries (Allison & Parker 2013, Curtis 2018, PwC 2016).

Several factors contribute to slow productivity growth, including:

- Limited improvement in the skill-level of workers (Curtis 2018, Page & Norman 2014a),
- Slow integration of technological innovation (Curtis 2018),
- Failure to pass on price increases to customers (Page & Norman 2014a),

[3] Labour productivity is measured by the following: *labour productivity = (GDP generated by the industry/ paid hours of work by industry)* (Curtis 2018).

[4] Multi-factor productivity measures changes in total productivity that is not caused by changes in the number of labour or capital units (*MFP = GDP generated by industry/ (capital units + labour units by industry))* (Curtis 2018).

[5] "Capital productivity shows how efficiently capital is used to generate output. It reflects the joint influence of labour input per unit of capital used and multifactor productivity (MFP); the latter reflecting the overall efficiency of production." (OECD 2020).

- Small average firm size which limits the ability to scale to emergent needs (Becke et al. 2019, StatsNZ 2013),
- High proportion of residential construction which has lower labour productivity than other sectors (Page & Norman 2014a).
- Poor risk management practices (Chang-Richards et al. 2019)

Additionally, volatility and uncertainty over workloads cause many of the behaviours that limit productivity (Page & Norman 2014a). Volatility refers to the variation in demand for construction over time, and the corresponding changes in employment and annual growth in GDP across the industry (PwC 2016). When there are drastic changes in demand (i.e., the boom-bust cycle) it makes long-term planning difficult. Volatility can be a disincentive for firms investing in training, capital equipment, and innovation, which in turn limits productivity improvements across the industry (StatsNZ 2013).

The construction sector is more sensitive to the business cycle than other industries, with higher rates of business births and deaths of firms in response to economic change compared to the general population of businesses (StatsNZ 2013, Page & Norman 2014a, PwC 2016).

These problems are driven by systemic issues, such as the nature of contracting and procurement processes, which hinder flexibility and innovation. The drive for low-cost procurement reduces allowances for design and project management tasks which again limits productivity (PwC 2016, Chang-Richards et al. 2019). Government policies on infrastructure spending, poor communication and information sharing throughout the industry (i.e., lack of transparency in procurement processes), and short-term profit seeking behaviour in some segments of the industry exacerbate volatility (Allan et al. 2008, PwC 2016). Additionally, the way businesses respond to volatility (hoarding workers during downturns despite insufficient work available and the proliferation of new small businesses in periods of high demand) further decreases productivity (Page & Norman 2014a).

Problems across the sector are not only compromising the ability of the construction sector to meet demand, they also affect the wellbeing of workers in the industry and of vulnerable people in New Zealand's communities. A 2019 review of 300 case files of New Zealand construction workers who died by suicide between 2007 and 2017, notes that risk factors associated with the construction industry have been linked to higher rates of suicide. These include long working hours, job instability, and transient working conditions among other things (Bryson et al. 2019). The construction industry responds to changing workloads by adjusting its employee numbers, which leads to chronic job insecurity in some segments of the industry (Bryson et al. 2019, Curtis 2018). Teltrac Navman (2019) reports that 97% of respondents to their construction industry survey have concerns about staff mental health and 40% feel unprepared to deal with mental health issues.

The construction sector faces constraints to its ability to contribute positively to community wellbeing. For example, tight margins create a significant disincentive for construction firms to build low cost housing (StatsNZ 2013). In general, residential construction tends to be smaller scale and there is a demand for bespoke design, which limits the extent to which scale efficiencies can be made (PwC 2016). This has led to a chronic shortage of affordable housing across the country.

Quality issues have also impacted the wider community. The leaky homes syndrome has contributed to financial and health impacts within communities (Howden-Chapman et al. 2012). Quality issues in the residential repair programme following the Canterbury earthquakes have similarly impacted residents and the economy (Chang-Richards et al. 2013, Simons 2016).

The construction industry also plays a key role in the fight against climate change and progress toward reduced carbon emissions. The built environment contributes up to 20% of New Zealand's greenhouse gas

emissions. In a 2019 report the New Zealand Green Building Council identified the potential to reduce the industry's carbon emissions by 40% (Gamage et al. 2019). MBIE have established a Climate Change programme to reduce building emissions during construction and operation and to consider the impacts of climate change on buildings (MBIE 2020). Progress towards this must be measured.

3. Pathways to improvement

In recent years there has been a concerted effort to improve the construction sector in New Zealand. Many of the initiatives are driven by the construction industry, either independently or in conjunction with government. Local and national government bodies also have a significant vested interest in construction and are putting resources into mapping a pathway toward a more resilient and effective construction sector.

The Industry Transformation Agenda (ITA), a BRANZ led project, was released in 2017 to address problems across the industry and to guide the industry into the future. The ITA started an industry-wide conversation about strategic improvement (Salesa 2019). In April 2019, Government and Industry leaders launched the Construction Sector Accord. The overarching vision of the Accord is to have a high performing construction sector that supports the wellbeing of New Zealanders with safe and durable homes, buildings and infrastructure (Construction Sector Accord 2019).

The Accord lists nine priority work areas designed to address some of the problems facing the sector. The Accord assigns the priorities as industry led, government led, or shared (Table 1).

Table 1 Construction Sector Accord 2019 Priorities (Construction Sector Accord 2019, p.4)

Leader	Priority work areas
Industry	*Enhanced industry leadership, collaboration, and organisation*
	Better business performance
	Improved culture and reputation
Government	*Better procurement practices and improved pipeline management*
	Improved building regulatory systems and consenting processes
Shared	*Workforce capability and capacity growth*
	Better risk management and fairer risk allocation
	Improved health and safety at work
	More houses and better durability

Also in 2019, the Government released their first Wellbeing Budget. The Wellbeing Budget is a Government initiative to prioritise spending to maximise the capacity of people in New Zealand to feel good and function well. The Wellbeing Budget is underpinned by the Living Standards Framework (LSF) developed by The Treasury. The LSF is designed to capture a more complete view of the values that underpin policy advice and decisions – notably that the New Zealand Government should be focused on improving the lives of residents across a number of dimensions, not just material wealth (e.g. GDP growth) (Karacaoglu 2012, The Treasury 2019a). The Living Standards Framework provides the theoretical underpinnings for the Wellbeing Budget. It includes the 12 domains of wellbeing outcomes, the four capital stocks that support wellbeing, and links to risk and resilience factors that may influence the four capitals (Figure 1).

Figure 1 The Living Standards Framework (The Treasury 2019a)

The Wellbeing Budget distributes funding to five priority areas that will enhance wellbeing outcomes for people living in New Zealand (New Zealand Government 2019). Two of the five priority areas in the Wellbeing Budget "Building a Productive Nation" and "Transforming the Economy" involve the construction sector directly. Construction sector businesses are central to delivery of the priority to reduce infrastructure deficits across the country, including significant capital investment in schools and classrooms, the health sector, transportation, defence, and the provincial growth fund (New Zealand Government 2019).

It is expected that the Wellbeing Budget's new approach to funding allocation with its "rolling four-year funding envelope" will provide an element of clarity and stability for the construction sector (New Zealand Government 2019, p. 100). The Government is developing a capital pipeline, which will eventually include all central government agencies, and major projects from local government and the private sector (New Zealand Government 2019). The multi-year capital allowance in Budget 2019 is designed in part to allow the construction sector to prepare and invest in the capacity and capability needed to deliver on these large works programmes (New Zealand Government 2019).

The Government has also created the NZ Infrastructure Commission -Te Waihanga, a new independent infrastructure body tasked with developing a 30-year infrastructure strategy and creating the Infrastructure Pipeline (Infrastructure Commission 2019). Despite the promise of the Pipeline, the sector is likely to continue experiencing skills and material shortages in part due to a strong pipeline of infrastructure projects in Australia (The Treasury 2019a).

Performance improvement in the construction sector needs to be considered within the industry and national policy context formed by The Construction Sector Accord and the Wellbeing Budget. Construction sector businesses are working to improve their long-term viability. Construction businesses and peak body

sector organisations are striving to meet the priorities laid out in the Accord by enhancing workforce capability and cross-industry collaboration among other things. At the same time the Government, through the Wellbeing Budget and the Infrastructure Pipeline are trying to enhance the performance of the construction sector with the goal of enhancing wellbeing outcomes for people living in New Zealand.

The importance of measuring performance improvement within the construction sector and thinking about that performance in terms of societal wellbeing is demonstrated by the theory of change model (refer Figure 2**Error! Reference source not found.** adapted from Brooks et al. 2014). The desired 'change' is improved performance of the construction sector. The ultimate purpose of this change is to enhance the wellbeing of people in New Zealand (i.e., desired impact). The Construction Sector Accord's vision of a high performing construction sector and the associated priorities are the outcomes that need to be achieved so the wellbeing of New Zealanders is supported by the construction sector (Construction Sector Accord 2019, p.7).

A high performing construction sector is composed of high performing construction businesses that are both productive and viable long-term (i.e., the outputs). Completing the cycle, these businesses require inputs that in many cases are influenced by Government policy, such as skilled workers and clear and dependable forward work plans.

Despite this clear connection between construction sector activities and societal outcomes, the construction sector is not currently well-placed to drive toward wellbeing outcomes without direct financial incentives. A study of construction organisations in Australia and New Zealand published in 2017 showed that, corporate social responsibility (CSR) in the sector is "narrowly focussed…immature, non-strategic, and compliance-based," (Loosemore, Teck, & Lim 2017 p.102). The authors found that most construction sector organisations did not see clear links between socially responsible behaviour and economic performance, and CSR is viewed as a marginal investment priority for most firms (Loosemore et al. 2017). This aligns with Page and Norman's (2014a) view that construction sector measurement should be clearly linked to business performance in terms of profit. It is unlikely that businesses, facing the highly competitive and volatile construction sector marketplace will be motivated to change their behaviour for the sake of achieving greater wellbeing for New Zealanders alone. The will is there in some cases (see *Performance beyond profit* below), but greater structure is required to support the movement of the industry as a whole toward the national vision of a construction sector clearly linked to wellbeing enhancement.

The project presented in this report aims to determine how performance measurement can track progress towards the sector vision of contributing to the wellbeing of New Zealand, while also contributing to conversations and actions around improved performance of largely profit-driven sector-members.

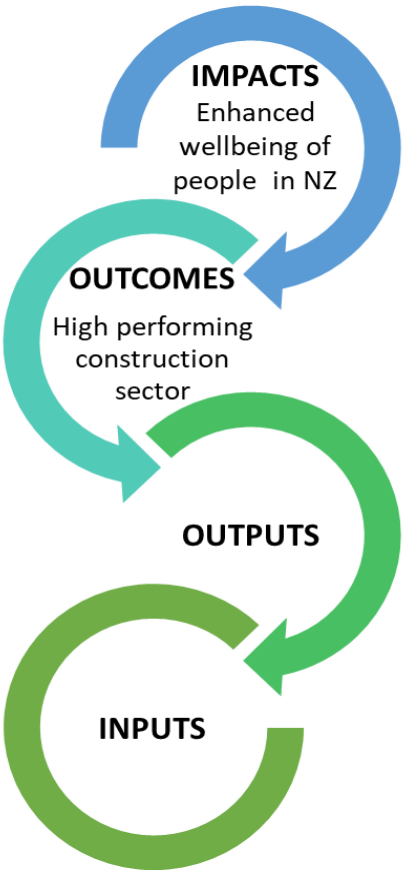


Figure 2 Theory of change model for construction sector performance

PERFORMANCE BEYOND PROFIT: NZ PROPERTY DEVELOPER CASE

Within the construction sector there are a growing number of companies that explicitly and actively focus on non-economic impacts of construction activities. We spoke to a New Zealand-based purpose-driven construction and development company focused on housing and community projects about how they measure performance.

This company exists because they care about people and the spaces they live and operate in each day, and their mission is to ensure that every family in New Zealand has access to warm, safe and affordable housing. They seek to: eradicate homelessness; create flourishing communities; value their people [staff]; deliver Homestar 6 housing; reinvest profit into charitable causes; support like-minded partners; and protect the environment.

Specific performance measures include:

- Number of people housed through their developments, and who they have built for
- Number of volunteer hours worked by staff
- Number of people supported through the charities they support
- Number of houses built overseas
- Number of people no longer homeless or now in decent housing
- Number of affordable housing units built
- Investment in or donation to charitable causes
- Homestar rating assessment of houses built, includes density and resource efficiency; energy, health and comfort; water, waste, materials and site management.

Developing measures for the wider social impact of work they do is a work in progress.

In an industry where competition is high and cost and time drive most of the decisions, it is relatively unusual for companies to adopt social objectives without the client or government requesting it. This company focuses on long term sustainability. They believe that by focusing on a wider set of objectives they will ultimately deliver better housing for clients, create better and reliable relationships with building partners, have a committed workforce and as such be more sustainable in the long run.

For further details, see Appendix 1, Algera (2020c).

4. Performance measurement

Today performance measurement and performance management practices are widespread across all sectors. These practices are seen as essential components of performance enhancement. Analyses have shown that the construction sector has been relatively slow to adopt and implement performance management systems, and there is still quite a lot to be learned about their efficacy and implementation (Deng, Smyth, & Anvuur 2012).

In the construction sector, performance has traditionally been used to describe concepts such as efficiency, effectiveness, improvement, growth and success (Hove & Banjo 2015). Consequently the concepts of productivity and performance are often incorrectly conflated. Here we define them for the construction sector as:

- **Performance:** the effectiveness and efficiency of an action, where effectiveness "refers to the extent to which customer requirements are met", and "efficiency is a measure of how economically the firm's resources are utilized when providing a given level of customer satisfaction,"(Neely, Gregory, & Platts 1995 p.80).
- **Productivity:** the outputs of an industry or business divided by its inputs (labour and capital)

For the construction sector, traditionally the central focus of productivity is output and for performance it is profitability (Page & Norman 2014b).

Performance measurement systems can only be effective for enhancing outcomes if they are integrated into a larger strategic programme that is supported by relevant stakeholders. Performance measurement is at the heart of performance management but is not a substitute for it (Neely 2005). Performance management is used to achieve goals, "through an ongoing process of establishing strategic performance objectives; measuring performance; collecting; analysing; reviewing; reporting performance data; using that data," (Maya 2016, p.67). Performance management both precedes and follows performance measurement making them inseparable parts of a larger strategic objective to enhance the performance of the system (Yadav et al. 2013).

Performance measurement, management, and benchmarking are often conflated, but are distinct concepts with specific applications. Below we define some key terms related to performance management and measurement:

- **Performance management**: A system which deploys policy and strategy, and obtains feedback from various levels in order to manage the performance of the system (Kagioglou, Cooper, & Aouad 2001)
- **Performance measurement:** The process of quantifying and communicating performance (i.e., the effectiveness and efficiency of actions) (Neely et al. 2002, Sarhan & Fox 2012).
- **Performance measurement framework:** A complete set of performance indicators and metrics derived in a consistent manner according to a forward set of rules or guidelines, (Yang et al. 2010, p. 273).
- **Indicator:** An observable measure of a factor critical to performance (CENZ 2008)
- **Metric:** A specific measurement taken over a period of time using the same measurement methodology (Choong 2013)
- **Benchmark:** The best performance achieved (CENZ 2008)
- **Benchmarking**: Comparing performance against others, and using lessons from the best to make targeted improvements (CENZ 2008)

Why measure performance?

Performance measurement frameworks are implemented with the intent of improving performance by finding areas where there are gaps in efficiency and effectiveness. While their instrumental value is centred in helping track progress toward strategic objectives, performance measurement frameworks can also be useful strategy and communication tools in themselves.

Performance measurement and management frameworks should be aligned to a vision and strategy or some other overarching strategic objective (New Zealand Government 2008). The process of developing a measurement framework can help sharpen the common vision of how strategic priorities relate to real world actions (inputs and outputs) (Stevenson et al. 2018). In many sectors, performance reporting is used to attract future investment, increase share value, and attract high calibre employees (Kagioglou et al. 2001). Performance measures at the sector level add weight to policy discussions. Graphic displays of performance indicators can increase buy-in from stakeholders who can see the progress being made (Chan & Chan 2004).

When presented as part of a benchmarking system, performance measurement can incentivise desired behaviours as companies see what is possible in their field and strive to raise their performance relative to their peers (Kärnä & Junnonen 2016). The benefit of performance measurement systems with a focus on industry benchmarking is that they have the potential to make the industry a learning organisation through information sharing and comparing projects and organisations with different performance outcomes (Kärnä & Junnonen 2016). International benchmarking systems expand the opportunities for information exchange and establishment of best practice at the sector level (Page & Norman 2014a).

In New Zealand, benchmarking has been used since 2011 for capital projects and infrastructure maintenance by a range of organisations, including leading construction firms, government departments and local authorities. The purpose of these benchmarks is to provide consistent information on customer satisfaction, conformance with standards, and other results so that a firm can improve its effectiveness and product quality (Gordon & Curtis 2018).

How should we measure?

The *process* of measurement development can be just as, if not more, important than the measurement itself (Douxchamps et al. 2017). Contextually inappropriate measurements can become irrelevant or burdensome to the organisations they are meant to serve (Ivory & Stevenson 2019, Sharifi 2016). As noted by Page & Norman in their detailed review of performance measurement in the construction industry, there is a lack of continuity for many performance measurement initiatives which is a "stumbling block to improvements in the industry" (Page & Norman 2014b, p.8).

Worse, poorly selected performance measurements can lead to negative outcomes for the organisation and the industry. For example, an exclusive focus on financial measures can lead to short-sighted focus on profitability at the expense of building good relationships with clients and developing long-term business success (Kaplan & Norton 1992, Page & Norman 2014b). Benchmarks that compare company performance have been used by governments to select preferred suppliers for regular projects without adequate context (Page & Norman 2014b). Similarly, poorly constructed or poorly communicated measures can send misleading policy messages (Saltelli 2007).

Considerable effort has been invested in performance measurement and benchmarking systems for the construction sector, but they have not been clearly linked with improvement in industry performance (Furneaux et al. 2010). These sub-optimal outcomes are, at least partly, caused by poor practice during the

development phase of the measurement system. For example, a measurement review paper for the Australian Construction industry noted that failure to involve top level coordinating agencies for the sector during the development phase corresponds with a lack of ongoing support for the measurement system (Furneaux et al. 2010).

What is measured?

Performance can be measured across many dimensions. Performance can be measured and benchmarked at the project, firm, sub-sector, and sector level (Norman, Curtis, & Page 2014). The greatest proportion of studies evaluating construction performance has historically been at the project level (Yang et al. 2010).

What kinds of indicators are used to measure performance?

A wide range of indicators are used to measure performance across the construction sector. High quality performance indicators tend to be both persistent and predictive (Mauboussin 2012).

- **Persistent:** The outcome of a given action will be similar to the outcome of the same action at another time.
- **Predictive:** There is a causal relationship between what a statistic measures and the desired outcome.

Persistent indicators focus on factors that can be controlled. The degree to which an indicator is predictive is captured by how linear the relationship is between an indicator and the outcome of interest (Mauboussin 2012). So, at an organisational level, if satisfied customers are consistently more likely to use a broader range of services from a construction firm and the use of a broad range of services consistently leads to greater revenues, then 'customer satisfaction' is both a persistent and predictive performance indicator. Understanding these causal relationships allows the measurement to reflect 'how' the performance outcome was achieved (Kagioglou et al. 2001).

Modern approaches to performance measurement almost always include a combination of financial and non-financial indicators. The inadequacy of measuring performance with financial indicators alone has been a topic of discussion since the 1980s (e.g., Johnson & Kaplan 1987). 'Balanced' measurement systems, including Kaplan and Norton's (1992) seminal Balanced Scorecard model, include a mix of financial, operational, and strategic indicators. This approach followed decades of research showing that inappropriate performance measures and incentive schemes were driving short-term decision making that undermined business longevity (Neely 2005) and is in line with the movement towards wellbeing measures (such as New Zealand Higher Living Standards Framework). Balanced approaches to performance measurement combine core outcome measures (lagging indicators), which are often financial, with performance drivers (leading indicators) (Page & Norman 2014b).

In 2014, Page and Norman released two reports through BRANZ entitled *Measuring construction industry productivity and performance* and *Potential measures of productivity and performance at the firm, grouped firm and regional level for the construction sector*. These reports and the accompanying report *A Construction Dashboard of Key Industry Measures* (Norman, Curtis, & Page 2014) are foundational pieces of work for the research presented here. This series of work identified and analysed a broad range of indicators used to measure construction sector performance. We have aggregated the indicators presented in Page & Norman (2014a,b) and Norman, Curtis, & Page (2014) in Appendix 2. The indicators are separated into four categories which reflect the main dimensions of evaluation in Kaplan & Norton's Balanced Scorecard approach (Financial, Customer, Internal business processes, Learning and growth) (Kaplan & Norton 2001).

5. Method

In this research project, a range of international construction sector and other industry sector performance measurement approaches were reviewed using a combination of desktop review and interviews. The cases were selected to demonstrate a range of different performance measurement systems and maturity of approaches. The aim was to understand what has helped and hindered the successful implementation of performance measurement systems.

We reviewed sector measurement systems and practices within two international construction sectors and three other industry sectors in New Zealand:

- UK construction sector
- Australian construction sector
- New Zealand transport sector
- New Zealand education sector
- New Zealand agricultural sector

There are numerous measurement frameworks used across each sector and this report only covers a small sub-set from each sector. We also reviewed three other specific measurement frameworks:

- European construction sector observatory
- SCIRT (Stronger Christchurch Infrastructure Rebuild Team) performance framework
- The evaluation framework applied by a New Zealand property developer

Table 2 indicates how many interviews were undertaken for each sector/measurement framework and the groups represented in the interviews. Note: the review of the European construction sector is based on a literature review only. Interviews were semi-structured. The interviews explored how performance is measured within the sector (what the system is and how it is operationalised) and how effectively the framework achieves its objectives. To assess the efficacy of the frameworks, perspectives were sought from multiple segments of the sector being investigated.

Table 2 Interviews undertaken

Case	Government	Peak body groups	Sector member organisation	Consultant or Academic
UK construction sector	2	1	2	1
Australian construction sector	1	2	1	1
New Zealand Transport sector	3	-	-	2
New Zealand Education sector	2	-	3 including teacher, principal and board member	-
New Zealand Agricultural sector	-	1	1	2
SCIRT	-	-	1	-
Property developer	-	-	1	-

6. Case study performance frameworks

Introduction

In this section we summarise a selection of the performance measurement frameworks identified in the case studies and through literature. We describe what the framework is, how it is implemented, and how effective it is in achieving its objective.

We have not profiled all the frameworks we reviewed in this section of the report. There is a separate report for each case study and the references for the reports can be found in Appendix 1. Here we have included the frameworks that illustrate the breadth of measurement processes available and where the most lessons can be learned. These case studies will be used to illustrate the key principles in Section 7.

UK construction sector – UK Industry Performance Report

The UK construction industry has been systematically collecting project and company-level performance data since 2000. The annual publication of performance data is now produced through a partnership between Constructing Excellence, Glenigan (involved since 2009) and the Construction Industry Training Board (CITB) (involved since 2014). BRE SMARTWaste also now plays a key role in collecting environmental performance data (following a merger of Constructing Excellence with BRE in 2016). 6 The report is endorsed by the UK Department of Business, Energy and Industrial Strategy. Its objective is to track trends and set benchmarks for performance in the construction sector.

Key Performance Indicators (KPIs) in the report are presented under seven headings:

- Economic - All construction
- Respect for People – All construction
- Environment – All construction
- Economic – Housing (a smaller subset of all economic KPIs)
- Economic – Non-housing (a smaller subset of all economic KPIs)
- Construction consultant (a subset relating only to client satisfaction)

The indicators and measures have evolved over time. The number of environmentally orientated indicators has increased in recent years, as have indicators related to human elements (i.e., respect for people). Contractor satisfaction is also included which sheds light on the important role of clients in the sector. The overall number of indicators has decreased with the tool's refinement. Indicators tend to be lagging, focussing on inputs and outputs (activities) and data are drawn from a range of national statistics and agencies as well as market research. Additionally, because companies are responsible for collecting data, introducing data to the database, and updating the database there are some issues with availability and validity of the data (Costa et al. 2006).

Despite the long running measurement programme, it is unclear how, if at all, the measurement process has contributed to better outcomes (either through informing policy or behaviour change within the sector). The main criticism of the KPI Model is that most of the KPIs are regarded as lagging measures that do not clearly guide change or help organisations find timely avenues toward innovation or best practice

[6] Glenigan is a specialist market analysis firm; CITB is a levy-collecting training board for the construction sector in England, Scotland and Wales; BRE is an independent research group for the built environment.

(Ahmad et al. 2016; Oyewobi et al. 2015). Because the KPIs are specific to projects they also do not offer much insight on business performance (Costa et al. 2006) or aid in internal management decision-making for construction organisations (Ahmad et al. 2016).

The one indicator that seems to have shown a substantial improvement over that time relates to sector safety performance (accident rate). The motivation for this improvement was driven by a major Construction Safety Summit convened by the Deputy Prime Minister in 2001, in light of concerns about an increase in fatality rates in the industry. The Minister challenged the industry to dramatically improve its poor safety performance record, threatening heightened regulation if the industry continued to fail to perform. The Government then required the collection of data to report on the industry's response.

For more, see Appendix 1, Konstantinou & MacAskill (2020).

European construction sector data observatory

The European Construction Sector Observatory (ECSO) is designed to keep European policymakers and stakeholders up to date on market conditions and policy developments. The ECSO, established in 2015, allows for comparative assessments across 27 EU countries and the UK. The three main objectives of the initiative are:

1. Monitor market conditions and trends, as well as evaluate progress towards national and regional strategies
2. Evaluate the effectiveness of policy interventions.
3. Encourage knowledge sharing and the replication of good practice
4. Raise awareness on policy measures and initiatives affecting the construction value chain.

While the framework mainly focusses on construction sector activity (business confidence, sales, employment, material use, innovation etc), there are some measures that are more outcome focussed (for example, access to housing and infrastructure). Some measures also cover contextual factors that act as barriers or drivers of construction sector activity (public finance, economic development etc.). Measures are drawn from a range of publicly available data sets that represent data collected at project, organisation, sector, and societal level.

The rich and diverse dataset allows for in-depth analysis of high level sector trends, which appears useful for high-level policy evaluation. We were unable to ascertain whether the ESCO was a useful tool for sector members performance improvement.

For more details, see Appendix 1, Horsfall (2020b).

Agriculture sector – New Zealand Sustainability Dashboard

The New Zealand Sustainability Dashboard (NZSD) was developed through a collaborative research project funded by the Ministry for Business Innovation and Employment (www.sustainablewellbeing.nz/nzsd). The project commenced in 2012 with the aim of developing a comprehensive framework for measuring performance within the sector – embracing both national and sub-sector perspectives.

Key drivers for the development of the framework included:

- providing evidence and credence about sustainability to overseas customers;
- supporting domestic social licence to farm;
- demonstrating regulatory compliance; and

- informing on farm continuous improvement.

The NZSD sets out a framework for compiling data at a national level, see Figure 3. The framework is then structured to enable sub-sectors to build their own performance measurement frameworks. This allows subsectors to design measurement frameworks around their drivers and goals, based on a common set of agreed principles of indicator design. This creates a sense of ownership for sub-sectors and a closer link between measurement signals and behaviours. Selected measures are then mapped back to the national framework.

The measurement systems within each subsector range from voluntary processes (e.g. organic certification systems in wine industry) through to regulatory requirements and market signals (e.g. food quality standards set by regulators or by buyers). The measurement approach taken within each subsector was guided by the sector drivers, including: market demands, societal pressures, regulatory compliance, and business sustainability.

Measures in the framework are categorised as relating to performance (outcome), practice (activities and process), and context. Context measures provide insight into exogenous factors that might impact sector performance. The aim is to have a set of indicators that demonstrate causality.

NZSD remains a work in progress in many respects, which not only demonstrates the scale and complexity of the task but highlights the on-going nature of performance management.

For more on the New Zealand Sustainability Dashboard, see Appendix 1, Ball (2020).

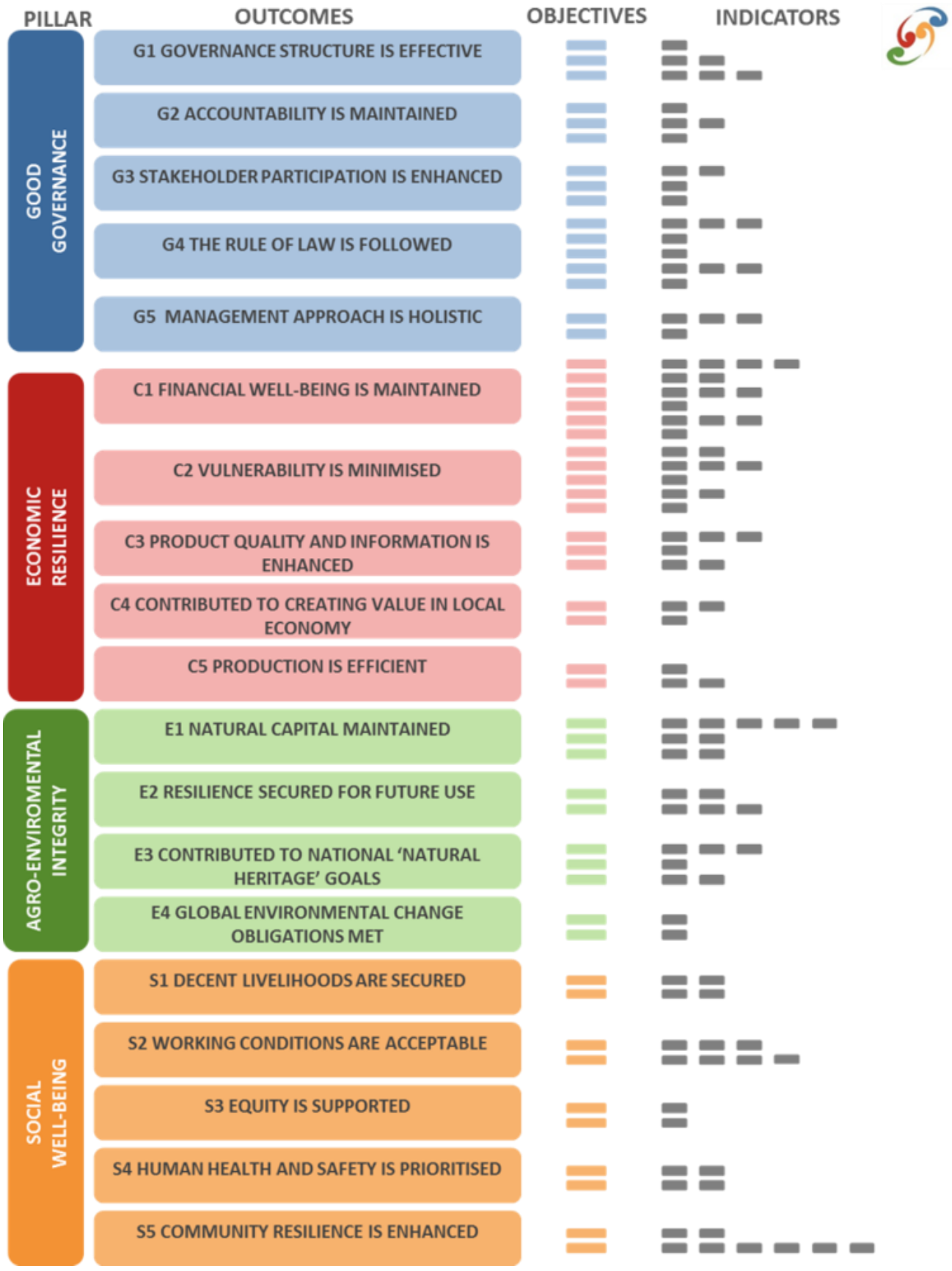


Figure 3 New Zealand Sustainability Dashboard Framework

Transport sector – Transport Outcomes Framework

The transport sector has historically lacked a system to evaluate progress toward policy priorities. As these systems have evolved it has become clear that the focus needs to be on outcomes rather than tracking activities (i.e., performance rather than productivity).

In 2018, Ministry of Transport (MOT) released the Transport Outcomes Framework (TOF), which sets out what Government is aiming to achieve through the transport system[7]. The TOF establishes the groundwork for a strategic approach to deliver a transport system that can "improve people's wellbeing, and the liveability of places" (Ministry of Transport, 2020) by contributing to five key outcomes:

- Inclusive access
- Healthy and safe people
- Economic prosperity
- Environmental sustainability
- Resilience and security

The TOF aligns the transport sector's vision and outcomes with Treasury's Living Standards Framework (LSF). To support the TOF, MOT recently produced a set of Transport Indicators to provide high-level insights into the performance of the transport system as a whole and to report on trends over time. The Transport Indicators track how well transport systems are contributing to the five key transport outcomes specified in the TOF. They are intended for use by transport and related agencies to inform policy and decision-making; and for public information (Ministry of Transport 2020).

The indicators were developed through a series of workshops that included participants from Government transport and non-transport agencies, local government, and transport stakeholders. Participants defined blue sky indicators (or 'ideal world' indicators) as well as indicators for which data were already being collected across government departments. The final list comprised 36 indicators, see Figure 4, including several indicators where new data capture methods had to be created. It is intended that the metrics used to capture these indicators will be developed over time.

Most of the indicators are lagging indicators that demonstrate outcome trends over time. There are some indicators that measure social perception (e.g. perception of safety). The effectiveness of the TOF indicators to measure performance and inform policy is unclear as they are relatively new. However, the development of the TOF and associated indicators has created a common language within the sector and this has already proven to be beneficial when working across different parties. Possible future opportunities for improvement identified by interviewees include positive framing of indicators (focussing on positive impact rather than reduced negative impact), integration of more qualitative indicators (e.g. feeling safe or measures related to wellbeing), additional outcome measures (rather than the current tendency toward output for ease of data collection). Interviewees noted that resource availability may be a barrier to ongoing development success of the frameworks and bedding in of an evaluation culture within the sector.

For more, see Appendix 1, Algera (2020b).

[7] The transport system includes: 1) the vehicles that move people and products, physical infrastructure, digital infrastructure (e.g. satellite-based navigation aids, travel apps), mobility services (e.g. public transport, bike-sharing, ride-sharing), the institutions and regulatory systems that influence how the transport system functions and develops.

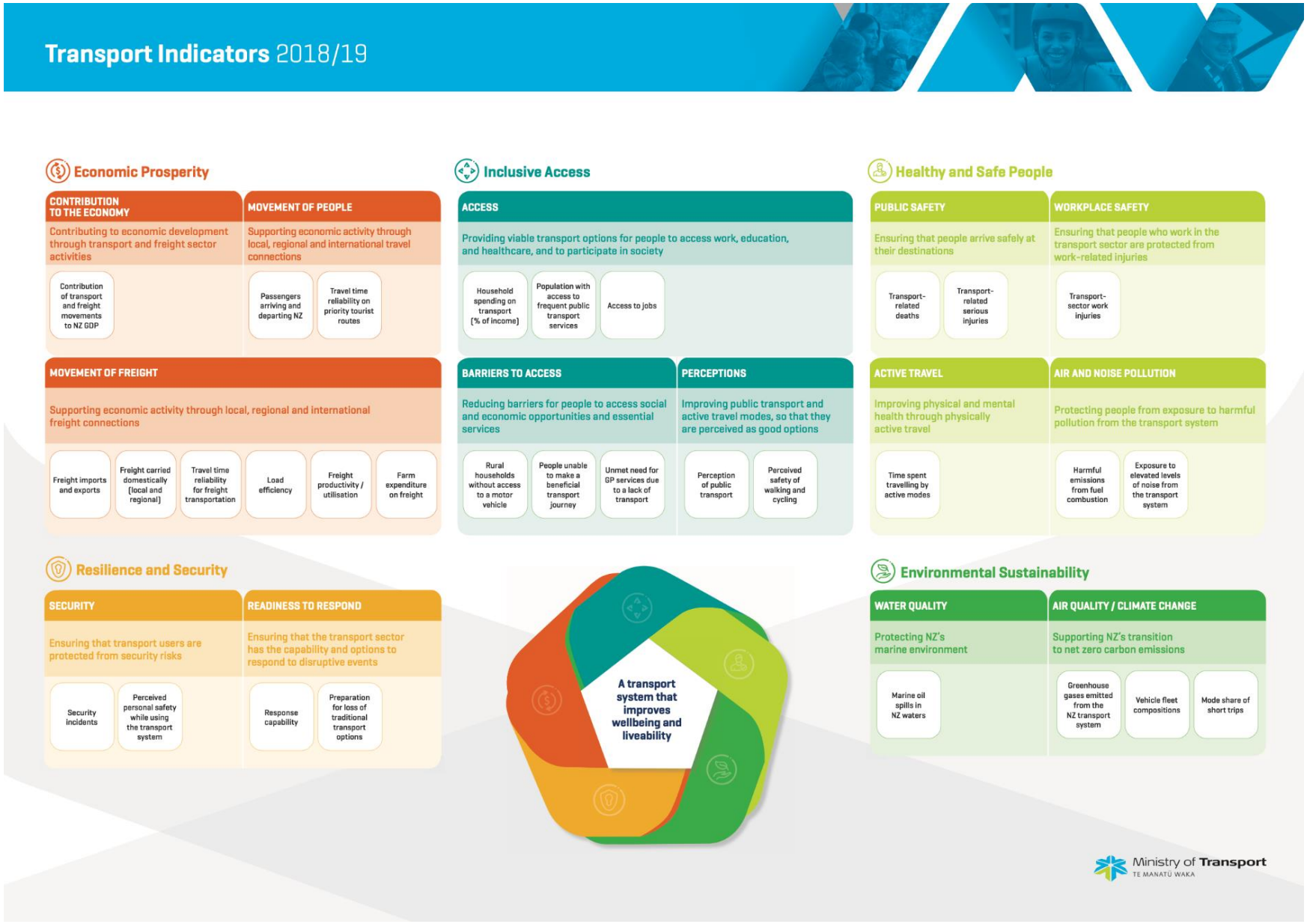


Figure 4 Transport Indicators (Ministry of Transport 2020)

Figure 5 Example Transport indicator dashboard (Ministry of Transport 2020)

Transport sector - Waka Kotahi NZTA's Investment Performance Measurement framework.

NZTA's Investment Performance Measurement framework focuses on transport planning and project delivery. The framework is used to identify metrics for use in Business Case Analyses (BCA). The framework aims to help NZTA and its investment partners to:

- Determine whether the investment has achieved its intended benefits
- Learn from past investment to improve future decisions
- Fulfil NZTA and its investment partners' reporting requirements
- Be accountable for the money NZTA spends on the public's behalf

The framework outcomes align with MOT's TOF, see Table 3. There are 54 performance measures across the five outcomes. NZTA notes that the framework "provides a structured set of measures so that users are no longer obliged to come up with on their own" (NZTA 2020). Within the framework, measures are often distinguished as a driver, pressure, state, or response measure. Driver measures relate to contextual characteristics (population, economy, technology). Pressure measures capture factors that change the state of the transport system (e.g. natural disaster, additional demand). State measures assess the transport system condition, activity or output (e.g. cost, pricing, reliability, access). Finally, response measures relate to government interventions (e.g. kilometres of new road, public transport delivered).

Table 3 Examples of measures in NZTA Investment Performance Measurement Framework (NZTA, 2019)

Transport Sector Outcome	Investment Benefit	Measure
Economic Prosperity	Financial cost of using transport: decrease/maintain	Number of pedestrians, cyclists, public transport boardings, and motor vehicles X number of people per vehicle
	Throughput freight: increase/maintain	Number of vehicles X average load per vehicle in NZ dollars
Environmental Sustainability	Biodiversity: support	User to describe (measure not defined)
	Pollution and greenhouse gases: decrease/maintain	Concentration of NO2 in µg/m3
Healthy and Safe People	Health noise: decrease/maintain	Noise level in dB
	Safety: improve/ maintain	Average annual fatal and serious injury crashes per kilometre of road section
Inclusive Access	Access – people: increase/ maintain	Perception of safety and ease of walking and cycling
	Comfort and customer experience: improve/maintain	Percentage of low floor and wheelchair accessible services
Resilience and Security	Resilience: improve/maintain	Percentage of high-risk, high-impact routes with a viable alternative
	Resilience: improve/maintain	Appropriate capacity in event of system disruption (including alternative routes/ modes/destinations)

The framework was implemented in 2020. However, early indications are that while it could be applied to all stages of investment decision-making and evaluation, it has so far been applied to assess options pre-activity. Consequently, there are few opportunities to use the framework to integrate lessons learned to improve investment decision-making. Additionally, it is acknowledged that more measures are needed that report non-monetary benefits e.g. social impact. Current social measures included in the framework focus on the ability to move people rather than assessing the impact of the transport system on community and place.

For more on Waka Kotahi NZTA's Investment Performance Measurement Framework see Appendix 1, Algera (2020b).

Education sector – Education Review Office school performance evaluation

The Education Review Office (ERO) works with Ministry of Education (MOE) to measure and manage performance of schools. ERO's main aims are 1) to ensure stakeholders have confidence in the education system, and 2) to lift performance (Educational Review Office, 2019). ERO's external evaluation approach is designed to build each school's internal evaluation capability to contribute to a cycle of ongoing improvement (Educational Review Office, 2019). Performance is evaluated through an audit based process that assesses both outcome indicators (e.g. student grades and social, cultural and emotional competencies) and process indicators (e.g. leadership, collaboration, communication). The process indicators are correlated with outcome measures. It is a subjective assessment, supported by data where possible (e.g., student grades).

The ERO assessment is very resource intensive for both ERO and schools. Schools who perform well in an ERO review are rewarded by less frequent assessments and favourable reports that are publicly available (and can contribute to school enrolment figures). Consequently, schools have an incentive to put their best foot forward during an assessment, which is not always representative of day to day performance of a school. This tends to mean that the review process works well for the poorest performing schools but has little impact on performance improvement for the majority of schools.

In 2019, ERO partnered with AskYourTeam (a New Zealand based evaluation software developer/provider) to develop a new tool and approach to better support internal self-review for schools. The system seeks the views of the school's leadership, teachers, students and parents on the school's performance against ERO's indicators and other key factors critical to effective school performance. Operationalised by the school, this tool enables schools to self-identify where they are performing well, and where there might be weaknesses or "blind spots" between principal/leadership team, staff, students, and parent community. ERO is employing this new approach in an attempt to move beyond a compliance-based model to a performance evaluation model that empower schools to measure and manage their own performance. There are no requirements for results to be communicated to MoE or ERO, it is purely for self-evaluation at this stage. 21 schools have trialled the approach and feedback has been positive.

For more details, see Appendix 1, Horsfall (2020a).

Stronger Christchurch Infrastructure Rebuild Team

SCIRT (Stronger Christchurch Infrastructure Rebuild Team) was an organisation created to manage the infrastructure rebuild following the 2010/2011 Canterbury earthquakes. SCIRT was a Project Alliance between national and local government funders and infrastructure owners and five civil contractors (SCIRT Learning Legacy, 2020).

Table 4- SCIRT Key Result Areas (KRAs) and the associated Key Performance Indicators (KPIs) and measures (SCIRT, 2016)

KRA	KPIs	Measures	Timing
Health and Safety	Measure of Safety Engagement Awareness	Quality of safety auditing	Recorded Monthly Reviewed 6 monthly
	Protection of Utility Services	Utility strikes per services passed	Recorded Monthly Reviewed 6 monthly
Environment	Legacy Achievement Goal	Monthly assessment of progression against legacy achievement goal framework	Recorded Monthly Reviewed 6 monthly
	Environmental Assurance	Quality of environmental auditing	Recorded Monthly Reviewed 6 monthly
Value	Delivery Performance	Rate of completion of projects measured by spend from 5%-95% of baseline	Recorded and reviewed monthly
	Quality of Construction	Scoring from the monthly project verification audit, values based on quality of actions recorded in a wide range of site quality control processes	Measured for one project per delivery team per month
Customer Satisfaction	Community satisfaction with communication and product	Combination of results from two surveys Community in areas where work has finished Representative sample from wider Christchurch community	KRA scores updated whenever new survey is completed
	Stakeholder satisfaction with communication and product	Identified representatives from key stakeholder organisations	Six monthly
Teamwork	Alignment and Involvement of the Team	Surveys of the team to assess levels of involvement and interaction between client, board, management team and delivery teams	Recorded Monthly Reviewed 6 monthly
	Developing a Skilled Workforce	Number of operatives enrolled in and completing NZQA qualifications pathways.	Data collected and reviewed bi-monthly

Performance measurement was an integral part of SCIRT as it was used as a mechanism to 1) improve performance across all project delivery teams and 2) ensure competition between project partners. Competition between partners was achieved through allocation of work based on performance in both cost and non-cost Key Result Areas (KRAs). Project delivery teams who performed better were allocated more work. In addition, financial gains and losses on projects were shared across alliance partners.

Consequently, there was a shared imperative to improve performance across all project teams. The SCIRT value framework provided a mechanism for assessment of non-financial performance.

The measures utilised in SCIRTs alliance agreement created a basis for organisations to monitor their own performance. In conjunction with the incentives generated between performance measures and financial reward, this led to performance improvements within delivery teams. The performance of each delivery team trended up over the six-year period. It reportedly created an environment where all delivery teams were focused on getting the job done for the best price, while maintaining value/performance across a wider set of measures.

For more details on SCIRT, see Appendix 1, Horsfall (2020c).

Australian construction Sector - Infrastructure Sustainability Council of Australia's IS Rating Scheme

Infrastructure Sustainability Council Australia (ISCA) is a peak industry body operating in Australia and New Zealand. ISCA's mission is to enhance "the liveability and productivity of our major cities and our regional communities through advancing sustainability in infrastructure planning, procurement, delivery and operation" (ISCA, 2020c). ISCA has developed an Infrastructure Sustainability (IS) rating scheme to measure sustainability of large infrastructure projects.

The IS rating tool was developed in collaboration with industry to drive and measure sustainability within infrastructure projects and assets. ISCA defines 'Infrastructure Sustainability' as infrastructure that is designed, constructed and operated to optimise environmental, social and economic outcomes of the long term. More specifically, the IS rating scheme aims to:

- Provide a common national language for sustainability in infrastructure
- Provide a framework for increased awareness of sustainability issues
- Foster innovation and continuous improvement in sustainability outcomes
- Provide a framework for consistent sustainability evaluation in tendering processes
- Scope whole-of-life sustainability risks for projects and assets
- Foster efficiency, waste reduction, and reduced costs.
- Build an organisation's credentials and reputation in its approach to sustainability

The IS rating tool evaluates the sustainability performance of the quadruple bottom line of infrastructure development: governance, economic, environmental, and social. Projects or built assets will be awarded an IS rating based on an overall score across these four areas. The rating tool reviews the lifecycle impacts of the project or asset, which includes planning, construction, and operating impacts, as well as maintenance of the asset. IS categories are include in Table 5 below. These categories and associated indicators are always in development, and the emphasis on different categories depend on the project or asset that is being reviewed and at what phase in development.

Table 5 IS rating categories (ISCA, 2020a)

	Category	Overview
Governance	Context	Includes urban and landscape design topic areas and focuses on how the project has been considered as part of its surroundings, its purpose and how it enhances liveability.
	Leadership & Management	Encourages projects to align sustainability strategy/policy/program with Sustainable Development Goals, assesses the risk/opportunity process for the project and rewards knowledge and data sharing.
	Sustainable Procurement	Includes social and environmental risks/opportunities within supply chains and rewards social outcomes (e.g. engaging social enterprises). Is aligned with ISO20400.
	Resilience	This category promotes the broader definition of resilience and looks at how infrastructure is contributing towards city, regional and community resilience.
	Innovation	Pioneering initiatives in sustainable design, process or advocacy.
Economic	Options Assessment and Business Case	Rewards the selection of sustainable initiatives using non-financial elements in decision-making.
	Benefits	Encourages projects to track the costs and benefits outlined in the business case and compares them to the real outcomes though whole life of a project.
Environment	Energy and Carbon	Rewards a reduction in energy and emissions.
	Green Infrastructure	Rewards the inclusion of green infrastructure, such as water sensitive urban design, green roofs, and all other living solutions.
	Environmental impacts	This category addresses water discharges, noise, vibration, air quality and light pollution.
	Resource Efficiency	Focuses on a circular economy approach to resource management and resourcing by reusing resources on site to finding new and innovative used for 'waste' products.
	Water	Rewards water efficiency as well as considering and using appropriate water sources.
	Ecology	Rewards the maintenance or enhancement of ecological value.
Social	Stakeholder Engagement	The Stakeholder category rewards effective stakeholder engagement.
	Legacy	Reward projects that leave a positive legacy for the community and/or environment.
	Heritage	Rewards the monitoring and management of European and Indigenous heritage.
	Workforce Sustainability	Includes education and training; wellbeing; diversity and inclusion; workplace culture; workforce planning and encourages thinking about skills needed for the future.

Reporting on these measures happens through score cards, which include open questions (e.g. what is the contamination risk of a project or asset); ratings on a scale (e.g. the ability of an asset to withstand future scenarios as a result of climate changes on a scale 1-10), or hard metrics (e.g. CO2 emissions, level of material intensity in construction or maintenance phase, or proximity of noise receivers to a project) (for examples, see ISCA, 2020b). Projects or assets are awarded an IS Rating based on the overall score, as assessed by Infrastructure Sustainability Accredited independent verifiers.

Project owners/contractors pay to be evaluated under the IS scheme and assessment is resource intensive (both for assessors and project stakeholders). Generally IS rating occurs when clients require it.

Users of the tool have indicated that it was successful in driving sustainability outcomes, including reduced costs, resource efficiency, waste reduction as well as enhancing project and contractor reputations. The tool also helps by encouraging conversations with all project stakeholders around sustainable performance and creates a common language to do so. The tool also generates a focus on the 'service to the community' that infrastructure provides.

For more on the ISCA framework, see Appendix 1, Algera (2020a).

Summary

As the above frameworks demonstrate, there are a wide variety of measurement practices. Some frameworks focussed at national sector level, while others are applied at organisation or project level. The frameworks vary in how effective they are at influencing behaviour change and enhancing sector outcomes. The frameworks also vary in maturity: some are tried and tested while others are newly developed.

To demonstrate the breadth of case studies Figure 6 classifies the frameworks in terms of 'level of application', 'degree of influence' and 'maturity', as defined below.

- **Level of application:** where the performance measurement framework is operationalised within the sector. Broadly this is either sector, sub-sector, organisation, or project level.
- **Degree of influence:** the extent to which the framework has the potential to drive improvement in user outcomes. For the purposes of this report we define three levels:

  High - Performance measurement is accepted and used willingly and regularly to inform decision-making and behaviour amongst target audience. Performance measurement and management are meaningfully integrated leading to improved performance.

  Medium - Performance measurement is recognised and understood. Measurement has some impact on decision making, behaviour, and performance.

  Low – Performance measurement has limited impact on performance.

- **Maturity:** how well tested and validated a measurement framework is. For the purposes of this report we define 5 levels based on a maturity model developed by Stevenson et al. (2015). These are:

  *Theoretical***:** Untested conceptual framework.

  *Repeatable***:** Framework that can be reliably and repeatably applied.

  *Systematic***:** Established measurement framework and tools systematically integrated into practice.

  Validated: Well-developed and tested framework.

  *Optimised and adaptive***:** Well-developed and adaptable to evolving needs.

As Figure 6 demonstrates, the frameworks that influence behaviour change the most tend to be those that are applied at organisational or project level. Sector-level frameworks tend to have a limited influence on sector performance, with the exception of the New Zealand Sustainability Dashboard.

To draw the most from these case studies we need to understand 1) what makes some sector measurement frameworks more mature and enduring than others and 2) why frameworks such as SCIRT, ISCA, ERO, and NZSD are so effective at influencing behaviour change amongst sector members, and transform those lessons to sector-level. That is the focus of the following section.

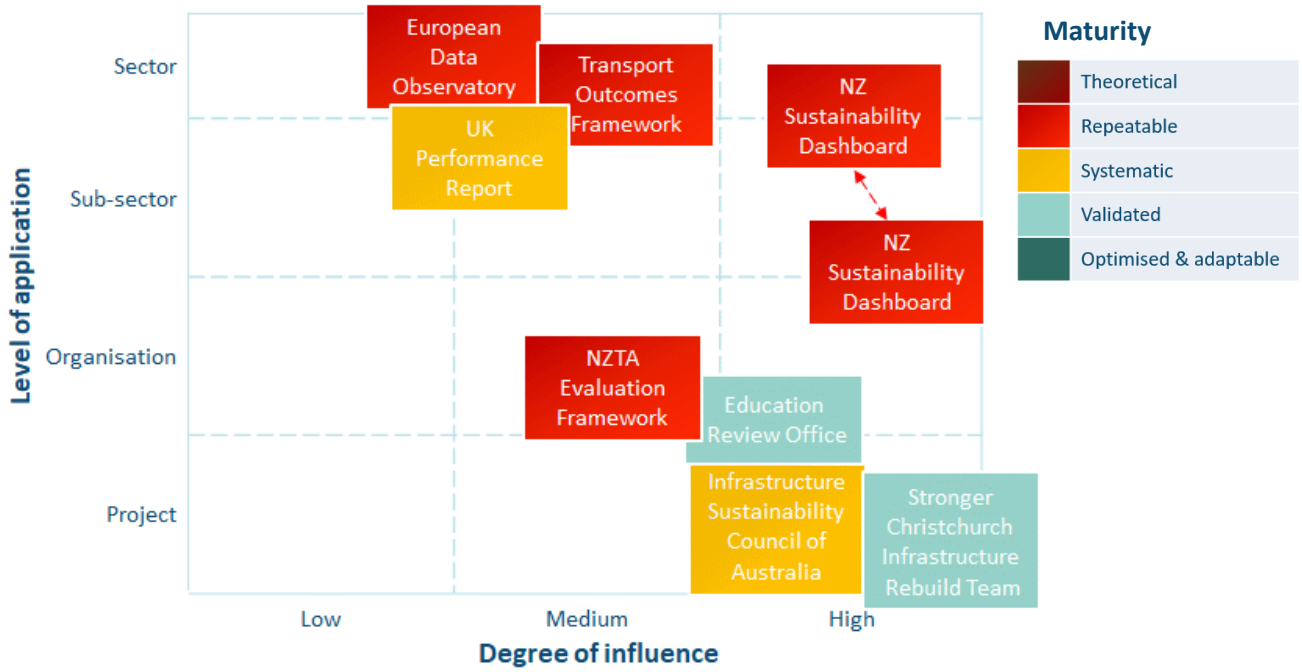


Figure 6 Application, influence, and maturity of case study performance measurement frameworks

7. Key principles

The case studies provide a wide range of approaches to measurement and, as discussed above, varying degrees of success at contributing to enhanced sector outcomes. While not explicitly discussed in the section above, our case studies also revealed examples where systematic performance measurement has proven challenging (in particular the Australian construction sector). Both the success stories and failures have provided a range of lessons that the New Zealand construction sector can learn from.

In this section we outline 12 key principles designed to guide sector leaders to develop an approach to performance measurement that can both effectively track progress and drive sector improvement toward sector goals. The principles have been derived through a combination of literature, interviewee observations, and our own analysis of the frameworks we have reviewed through the case studies.

Develop strong engagement

The process of developing a measurement framework is as important as the framework itself. Any person, group, or organisation that will be required to provide data or will be affected by decisions related to the measurement framework should be engaged in the development of the framework. One of the contributing factors for the start-up and ongoing success of ISCA, is a strong industry engagement process. Conversely, poor engagement was noted as a barrier to establishment of shared sector measurement frameworks in the Australian construction sector. Engagement is an ongoing process of information sharing, seeking feedback, and joint decision making.

Engagement should produce collective agreement on key outcomes for the sector and ensure that the framework reflects the values and goals of sector members, while leaving room for sub-sector/sector members from having their own specific goals and measurement priorities (refer *Empower subsector groups to measure performance* below). Engagement can raise awareness and build stakeholder investment in measurement (refer *Cultivate a culture of learning* below). Similarly, having sector buy-in will also help to ensure sustained measurement across political cycles.

To be effective, engagement must be meaningful and two-way. In practice engagement processes might be used to set expectations about what performance measurement can and should achieve (given finite time and resources) (New Zealand Government 2008). Stakeholders may work together to define shared outcomes (New Zealand Government 2008) and once indicators are selected to ensure measures are accepted, understood, and owned by those who must use them (Chan & Chan 2004).

Creating an effective and sustained performance measurement system relies on data sharing, which in turn relies on trust. In the Australian construction sector distrust between industry and government was cited by interviewees as one of the reasons delaying cohesive sector measurement. Similarly, in the New Zealand agriculture sector the repurposing of scientific data to justify stricter regulation has historically made some farmers reluctant to continue sharing data. Trust is not only critical between sector and government but between stakeholders within the industry. The construction industry is historically very competitive and there are many varied and competing interests. Building trust through engagement needs to be given adequate time and resourcing in the measurement development process. Engagement is an ongoing and evolving process and must be open to new entities as the sector evolves.

Establish clear ownership

One of the key reasons cited by interviewees (in particular in the Australian sector case study) and in literature (Kennerley & Neely 2002) for sector-level measurement systems being ineffective is a lack of ownership and resources for ongoing operation and development. While outcomes and strategies related to a performance framework may be well-designed and on point, unless agencies have sufficient resourcing and mandate to implement the framework, it will likely fail to reach its objectives. The frameworks that have endured over time and scored high on the maturity scale in Figure 6, such as SCIRT and ERO, have a single agency or organisation responsible for operationalising the framework that is sufficiently resourced (time, budget, personnel and mandate) to operate and maintain the measurement system.

A sector measurement system needs a 'home', a budget, a clear commitment, need and/or desire from relevant stakeholders to maintain system measurement. Data collection does not necessarily need to be carried out by government, the UK industry report is an enduring process run by private companies (albeit endorsed by the government).

Define a clear purpose

At the outset it is important to clearly define the purpose of a measurement framework: that is, to define why you are measuring performance and what the data will be used for. This will determine the breadth, depth, and nature of the measurement process.

The measurement systems reviewed ranged from systems designed to monitor progress towards goals and informing decision-making (e.g. Transport Outcomes Framework and European data observatory); to measurement systems as key tools in integrated performance management processes (e.g. New Zealand Sustainability Dashboard and SCIRT). A measurement system could be used for:

- Quality management,
- Continuous learning,
- Policy evaluation,
- Improving performance or sustainability,
- Monitoring activity or cause and effect analysis, or
- Valuing benefits of innovation.

The agreed purpose drives who should be involved in designing the measurement system, the type of indicators you will collect, who you can and should gather data from, and how important behavioural incentives are in the design of the measurement system. If behaviour change is necessary to reach performance goals, then it can be useful to develop performance measures and management systems that clearly signal and incentivise the desired behaviours (refer *Incentivise performance* below).

If there is no clear purpose, the measurement system risks becoming tokenistic and unused.

Focus on outcomes

Tightly coupled with *why* measurement is being undertaken, is agreement on 'what' needs to be measured. Our Australian interviewees noted that a lack of clear sector goals, objectives and KPIs thwarted attempts to create a cohesive sector-level measurement framework.

> "There are so many different views on what is 'value' in the industry, what is productivity, etc…..so what do you decide to measure as an industry? Cost or productivity or values?"
>
> *Australian construction sector interviewee*

Historically, construction sector measurement systems focus on activity or output; for example, kilometres of road built, number of houses built, etc. Increasingly focus has shifted to higher level outcomes: what does the sector wish to achieve for its 'customers'? In the NZ Transport sector the TOF outcomes align with NZ Treasury Higher Living Standards and includes: inclusive access; economic prosperity, resilience and security; healthy and safe people; and environmental sustainability. This shift has helped direct attention of sector agencies beyond activity to think about the outcome being created for individuals and communities. The NZSD and ISCA are similarly framed around high level societal outcomes that indicators and metrics are mapped to.

Internationally there is also a move toward outcome-based measurement, however, our evidence suggests this is still in its infancy. For example, the UK National Infrastructure Commission[8] is currently consulting on measures to consider performance of infrastructure at a system level (i.e. how it contributes to wider economic, business, social and environmental objectives of the government).

As one interviewee mentioned, this may represent a culture shift within the sector from a somewhat paternalistic approach of service provision (i.e. we build things), to a more inclusive, collaborative approach that actively and sincerely asks for customer input (i.e. what does what we build mean to the end-user?).

That said, measuring sector activity and practices is still important. Outcomes can be challenging to measure and practice measures that have causal links to outcomes can be a good proxy. Practice indicators also have the benefit of being leading indicators, which may give advance warning of potential issues. Practice indicators are used frequently in the education sector, for example, due to the challenges of measuring outcomes, including time lag between action and outcome.

Determining 'what' needs to be measured requires a strong engagement process.

[8] The National Infrastructure Commission was set up to provide impartial, expert advice to the UK government on long-term infrastructure challenges.

PUTTING EDUCATIONAL OUTCOMES AT THE FOREFRONT OF MINISTRY OF EDUCATION BUILDING CONSTRUCTION CONTRACTS

Recent efforts in the education sector have seen construction contracts being measured against an 'educational outcome brief' as well as traditional construction measures such as programme, budget, and environmental impacts. The aim of the initiative is to bring contractors along with the teaching and learning journey of the school they are building. Some contractors have become so engaged that they have donated goods and services beyond those required in their contract (for example, fit-out of a sensory room at a school). Anecdotally, this has improved contractual relationships and in turn issues such as resolution of defects.

Start with what you have

Once the purpose and objectives of performance measurement are clear, it is time to develop the indicators and metrics that will be used in the measurement framework. Rather than trying to develop the perfect indicators for each concept, interviewees advised starting with what you have and building from there. At the Government or sector level, this includes working with datasets collected by Statistics NZ, Inland Revenue and others. There are also a wide variety of stakeholders that already do, or could in the future be a source of performance measures – peak body groups, accreditation providers, ITOs, government project owners (e.g. NZTA, Ministry of Education, Kaianga Ora). Correspondingly, when collecting data from organisations, it is best to begin by working with data the organisation already collects. This allows the measurement and reporting process to be established, before embarking on new measurement requirements.

> "*Do not strive for the most perfect measurement. Strive for a measurement which is accessible, understandable, can be measured and collected easily, and which will lead to the right behaviours if it's used as a basis for a benchmark*." Don Ward, former CEO of Constructing Excellence

Starting with what you have must be balanced with the need to measure what is important rather than just what is available. Measurement systems should evolve to ensure they provide increasingly relevant insight (refer *Continual improvement* below).

Understand sector drivers

A sector measurement system will almost certainly draw on diverse data sources from across the sector. There can be a desire to impose burdensome reporting requirements on sector members to gather data for high-quality indicators that are consistent across the industry. However, unless sector members can see how the data/measurement system will help them achieve their performance goals they are unlikely to voluntarily provide data. To create a sustainable and enduring performance measurement system, that nudges sector members toward improved performance and outcomes, it is necessary to understand what motivates sector members.

During the development of the NZSD, four key drivers for sub-sector performance measurement were identified: market demands; societal desires; regulatory compliance; business sustainability. These drivers guided which indicators and measures were selected for each sub-sector group to motivate sector

members to collect and learn from data. If we understand the drivers of the various stakeholder groups within the sector then we will know how to best to advocate for performance measurement: empowerment, incentive, or mandate (refer below).

Empower subsector groups to measure performance

Of all the frameworks reviewed, the NZSD was the sector-level framework that had best potential to drive improvement within the sector. The NZSD achieved this by allowing and encouraging sub-sectors (in the case of agriculture this means forestry, dairy, wine, kiwifruit etc) to take ownership of and design their own performance measurement systems. Guidance was given to sub-sectors on design of measurement systems and indicators but they had freedom to design metrics around what is most pertinent and relevant to them. And selected sub-sector measures could then be mapped back to a national dashboard.

The personalisation of the measurement system to match with sub-sector objectives generated high levels of engagement in the process, reducing barriers to data provision. Early indications are that the approach is also contributing to improvements in sector outcomes for some sub-sectors.

In the education sector, after many years of top-down measurement, ERO has also recognised that there is now a strong need to move toward more collaborative, high-trust evaluation processes, led by sector members. The aim is to move beyond a compliance focus to self-improvement.

If the aim of a performance measurement system is to help drive sector performance, then a balance between top-down measurement needs and sector-led measurement desires is required. Consequently, a sector-level performance framework needs to both develop a national measurement framework and a measurement structure and principles for sub-sectors to adapt.

Incentivise performance measurement

Whether the performance measurement system is designed at sector or sub-sector level, data providers need to see value in measuring their performance and to see how it can help them achieve their goals. The case study frameworks that had a high degree of influence on behaviours all had elements of incentivisation. There are a number of ways to achieve this including contractual arrangements, accreditation and benchmarking.

Contractual arrangements

The SCIRT performance measurement system very clearly linked performance (measured against both financial and non-financial measures) with financial reward. This relationship was an integral part of the contractual arrangements on the project and regular reporting of data was mandated. The strong visibility and high profile of the non-financial measures, including frequent communication between management and operational teams, led to ongoing and sustained improvements in aspects such as community engagement, information management and quality. Many behaviour changes developed within SCIRT have, anecdotally, translated into practice following the disbanding of SCIRT.

Integration of performance measurement into procurement processes and contractual arrangements is already practiced by some government agencies (e.g. in the Transportation system). Systemisation of this across government, using a set of shared measurement principles, would be valuable data source for a national performance measurement framework and could help to drive sector improvement.

Accreditation

Incentives can come in the form of accreditation programmes – where there is direct market feedback through increased sales or contract awards. Interviewees in the Australian construction sector noted the key role that clients play in sector behaviour and how data provision and measurement can be incentivised through contractual and accreditation requirements. The ISCA, for example, is used by some clients to improve the sustainability performance of infrastructure projects.

Benchmarking

Benchmarking can also be used as a feedback mechanism to drive change. Benchmarking is where sector members can compare their performance against others in the sector. Benchmarking is most successful where sector members are maximisers. That is, where they are intrinsically motivated to do better than their peers.

Costa et al. (2006) review a number of benchmarking collaborations globally. Most of these benchmarking systems have a strong focus on project-level performance indicators. It is also possible to benchmark firms and entire sectors against their peers (for example, Hu & Liu (2018)), and for international comparisons (for example, European data observatory and Constructing Excellence UK/NZ comparisons (Constructing Excellence in New Zealand 2020).

Benchmarking must be conducted with care. There are a number of factors that can influence its outcomes including: firm size, geographic location, and economic context that should be considered in any comparative performance measurement (Horta, Camanho, & Cosat 2012, Page & Norman 2014).

Avoiding perverse outcomes

Where measurement systems provide a direct incentive to performance, for example a financial reward, or reputational advantage, careful design of indicators is required to avoid perverse outcomes. Practice based indicators for example, that reward a particular way of doing something, can stifle innovation. The system needs to be designed so that users are not be penalised for using or developing practices that are more beneficial in achieving desired outcomes than those being measured.

Similarly, it may be necessary to have an audit system or similar in place to ensure transparency, fairness and honesty in reporting. An audit system was in place to manage the SCIRT performance framework to validate data provided by contractors. For organisations within SCIRT, poor scores impacted the amount of work they received and profit share. Auditing is also part of the ERO assessment process. A bad ERO report could lead to lower enrolment numbers (and subsequent funding impacts) and increased reporting requirements. Interviewees reported instances of alleged result 'gaming' to avoid these negative outcomes in both cases.

Mandate data collection where necessary

Regulatory compliance will be needed in some cases where data (and performance improvement) is vital to the sector overall but that may not be in the interests of those providing data. Even where data may directly benefit the individual or business providing data, it may not be sufficiently high on their priority list to provide the data.

In the agriculture sector daily milk testing as part of food safety processes has been an effective tool in improving on-farm practices. Daily milk testing enables rapid and relevant feedback to the farmer so they know exactly when there is a problem and there is a direct penalty when milk cannot be collected.

In the 20 years of UK construction industry measurement, the most significant change in performance is as a result of a regulatory 'stick' to improve health and safety outcomes.

Regulatory compliance 'sticks', however, tend to result in compliance behaviours rather than continuous improvement. That is, entities aspire to achieve the minimum standard and nothing more. This in part has been observed through the ERO assessment process. The pass/fail nature of the ERO assessment means that it is effective at improving performance of the lowest performing schools but does not provide incentive for the majority of schools to improve.

Keep it simple

A measurement system should be as simple as possible but no simpler. It should be clear to those providing the data what they need to do and why; and data collection should be easy and low cost. It should be clear to those interpreting the data how the results relate to the sector's objectives and what they should "do" with the information. Where possible it is best to design a system that is very resource effective and produces observable short-term results (Hudson et al. 2001, Costa et al. 2006).

The two cases reviewed that have been systematically collecting performance data the longest, UK industry performance and education, have both seen a need to simplify data collection. From its inception to now, the UK industry performance report has reduced from 139 to 60 indicators. In the education sector, national performance measures are kept at a very high level, focussed on outcomes. The sector recognises that students/schools' challenges will differ based on region, ethnicity, socio-economic status, rural/urban etc. Rather than require schools to report on dozens of metrics that may or may not explain the cause of particular outcomes trends, they use the national outcome statistics to identify issues and then work with the affected community to diagnose the problem.

In the NZSD, the focus is on development a measurement structure and principles for sub-sectors to adapt. The structure is simple and adaptable to suit the diverse needs within the sector.

Cultivate a culture of learning

To achieve sustainable performance improvements, a sector-wide performance measurement system needs to be supported by a sector-wide culture of critical evaluation and learning. In many cases, the development and 'normalisation' of a measurement framework helps in the process to create a common language that promotes conversation around performance. In particular this was noted as a benefit of the Transport Outcomes Framework indicators and the ISCA performance measurement framework.

In the education sector, after years of audit-style evaluation of schools, they are currently trialling a new performance measurement system for schools. It is deliberately designed to remove government from the

evaluation process and empower schools to measure and manage their own performance. The trial uses 'AskYourTeam' an NZ software designed for organisations to rapidly and regularly check in on staff perceptions and experiences related to organisational performance. The automated results analysis capability of the tool allows organisations to interrogate responses and identify issues on an ongoing basis. This puts some control back in the schools' hands and provides a framework and language for schools to being performance improvement conversations.

The SCIRT performance measurement system was both a benefactor and contributor to a learning culture. Regular feedback between operational teams, management and board reinforced good behaviour and sent a signal that measurement was not punitive but was about continuous improvement.

Commit to continual improvement

Measurement is a journey and not a destination. Be prepared to evolve the measure system as the industry evolves (Kennerley & Neely 2002). The frameworks that we reviewed that have endured over time, such as the UK industry performance report, have evolved along with the needs/interests of the sector. Performance measures should be dynamic and reviewed over time to ensure indicators are still relevant to the sector, measuring the outcomes sought, fulfilling the desired purpose, and not creating perverse incentives or incentives for 'gaming'.

This means adequately managing and monitoring measures and refining them based on new insights, incorporating new data sources, or improving data collection and processing techniques. This includes ensuring that feedback loops are present between the strategic intent, the indicators, and data collection methods. The latter is important because indicators may incentivise behaviour that is at odds with the sector's values. Indicators in the SCIRT framework were continually reviewed and revised to ensure they delivered on the desired outcomes. For example, a waste minimisation indicator was removed from their framework due to the limited opportunities to cost-effectively reduce waste. Similarly, an interviewee in the transportation sector referred to an example where recycling (in kgs) was adopted as an indicator for sustainability in road construction. However, it was found that road workers would order a baker's dozen of bags of cement – 13 bags instead of the required 12, just so they could throw the 13th bag in the recycling. This meant that they would get the 'recycling bonus'. There were other examples of 'gaming' in the education sector.

Performance measurement systems need to be designed with continual improvement in mind – allowing for flexibility and adjustments if indicators prove unsuccessful. The careful selection of indicators, the ongoing review of indicators, and transparency in terms of what is not currently being measured, are also key in developing and maintaining an effective performance measurement framework.

8. Application to NZ construction sector

Framework

Based on the key findings in this research project, we have created a user guide to support development of a sector-level performance measurement framework. The guide aims to set out the process of establishing a sector-level measurement system (Figure 7), and provides guidance how to work with sub-sector groups to establish a dispersed measurement system and culture that will help to drive performance improvement within the sector.

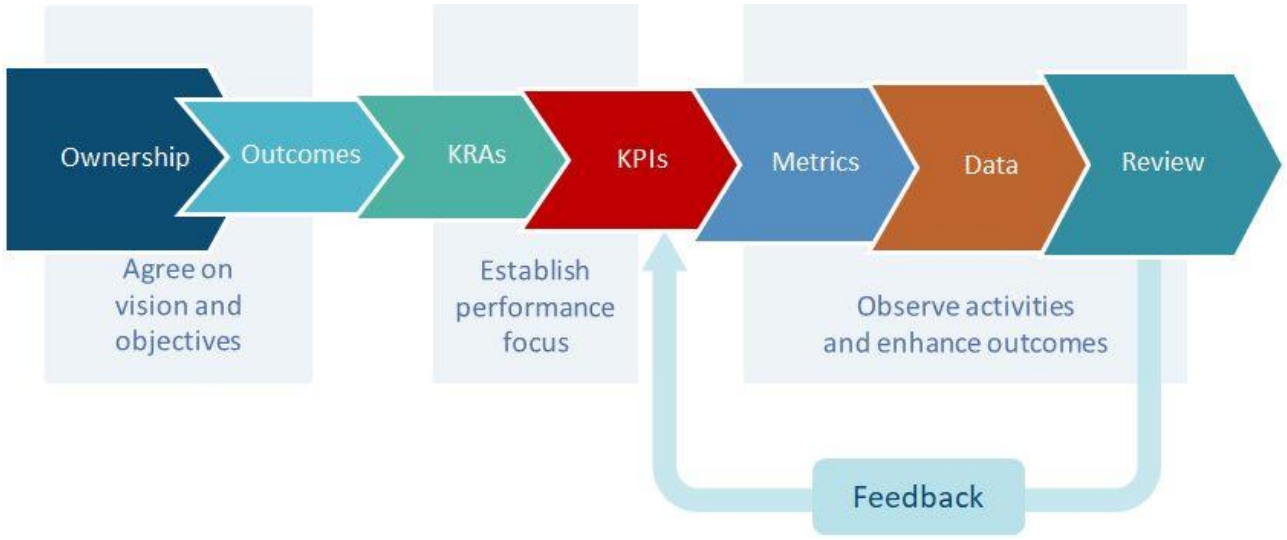


Figure 7 Sector Performance Measurement System Process

The framework is in a separate document, available at: www.branz.co.nz/pubs/research-reports/er55-a/

Indicator database

In Appendix 2, we have compiled a database of indicators, and some measures, used within the construction sector measurement frameworks we reviewed. The database contains the raw data from the respective measurement frameworks, so there is some overlap between items. Similarly, we have retained the 'category' coding used in the original framework.

Data sources examples

The ability to measure performance is often constrained by data availability and the logistics of collecting new data. Collecting data across a variety of government data sources was noted as a challenge in the Transportation case study, particularly where new data sources are required.

In this section we present a range of data sources that are available in New Zealand that may be relevant to the construction sector. The list is not intended to be exhaustive, but aims to illustrate the broad types of potential data sources available.

Longitudinal Business Database (LBD)

The LBD is a research database compiled by Statistics New Zealand (StatsNZ). It holds de-identified microdata (i.e., information about individual businesses with identifying information removed).

Page & Norman (2014b) consulted with StatsNZ regarding the best data sources available at the time for benchmarking performance in the construction industry and identified the following sources (indicators to which these sources are linked are noted in Appendix A):

- The Annual Enterprise Survey (AES)
- The IRD Tax-filed Financial Accounts (IR10)
- Linked Employer Employee Data (LEED)
- The Business Operations Survey (BOS)

The LBD has recently (2014-2016) integrated data from the National Survey of Employers (NSE) (StatsNZ 2018). The NSE collects data on workplace practices in New Zealand businesses, monitoring employer practices, workplace relations and standards, health and safety, and employing recent migrants. For some indicators MBIE and StatsNZ's Research and Development Survey could be useful. The survey was conducted regularly between 1996 and 2016, and reports on current and capital expenditure and employment in R & D at the firm level (StatsNZ 2018).

Indicators Aotearoa

Indicators Aotearoa New Zealand – Ngā Tūtohu Aotearoa is a new data collection and reporting initiative launched by StatsNZ. The final list of indicators was reported in June 2019; however, many key datasets are still in development. The indicators were selected in part to align with the Treasury's Living Standards Framework and the United Nation's Sustainable Development Goals (SDGs). As a result, the relevance of these indicators to the construction industry performance measurement framework is likely to be as outcome or impact measures. For example, indicators such as housing affordability, housing quality, and resilience of infrastructure are core indicators of current wellbeing from the "cities and settlements" measure. Similarly, future wellbeing is assessed with respect to physical capital measures, including heritage assets, and infrastructure. Of these data sets, the following are currently available (January 2020):

- **Housing affordability:** Proportion of households spending more than 30 percent of their total income on housing costs
- **Heritage assets:** Reported as number of registered historic places in NZ
- **Infrastructure:** An assessment of the quantity and quality of transport, electrical, sewerage and waste disposal, national communication systems

The frequency of data collection across the indicators varies greatly and quality may be variable as different organisations are collecting the data and have a range of processes for collecting and processing their datasets. All of this information is available at the website *Wellbeing data for New Zeala*nders (StatsNZ 2020).

BRANZ Construction Dashboard

BRANZ hosts and regularly updates the BRANZ Construction Dashboard based on the work of Page & Norman (2014a, 2014b) and Norman, Curtis, & Page (2014). The Dashboard features seven core indicators:

- Share of skills provided by training
- Liquidity ratio,
- Ability to service debt
- New residential customer service
- Workplace injury rates
- Housing affordability
- Building activity forecasts
- Changes in building quality

The indicators are displayed visually, and annual comparisons are available for each. Explanations of the indicators are available in Appendix A and in greater detail on the BRANZ Construction Dashboard Website (BRANZ 2020). Data comes from a range of mostly governmental sources.

Constructing Excellence New Zealand

Constructing Excellence NZ has been collecting KPI information on the New Zealand construction industry consistently since 2004. Previously this information was published through the Centre for Advanced Engineering supported by Building Research, BRANZ, and Constructing Excellence NZ (CENZ 2008). The KPIs capture data on client satisfaction, defects, cost predictability, time predictability, profitability, safety, and productivity and the system is aligned to the UK industry group KPIs (Constructing Excellence in New Zealand 2020). Through this system, firms are able to monitor their performance against industry benchmarks and on a project basis and compare to similar sectors internationally.

Privately collected survey data and economic analyses

Proprietary secondary data collected and held by private companies is another potential source of useful data for understanding the construction industry. Pacifecon Building Intelligence, for example, conduct construction market analysis that is used by the Ministry of Business Innovation and Employment in their annual National Construction Pipeline reports. They hold data on building consents, planned and ongoing residential, commercial, and civil construction projects. For example, their monthly Market Watch Report reports: progression of existing projects, construction starting, and cancellations (Pacifecon 2020). Infometrics produces a Regional Construction Outlook. Like Pacifecon their data is geared toward helping firms forecast and plan. As a result, their data includes (Infometrics 2020):

- Forecast residential consent and work out in place data by subtype (e.g., apartments and townhouses)
- Non-residential consent and work out in place forecasts by subtype (ranging from farms to hospitals)

BDO New Zealand has collected an annual Construction Survey since 2016. They publicly release a report summarising the results, which focuses on sentiments across the industry and market position (BDO 2019). The sample size is small and non-representative.

Industry body groups and certification programmes

There are a wide range of industry peak body groups and certification programmes that could be mapped to a sector-wide performance measurement framework.

Currently in development by Master Builders' Vertical Leaders Group is a benchmarking tool, that is ultimately intended to become an accreditation scheme for commercial contractors in vertical construction (buildings). The scheme includes measures around financial performance, operational capacity, and governance and management structure of a company (Master Builders 2020). The alignment of these emerging sub-sector schemes to a sector-wide framework provides a significant opportunity. We are also aware of other emerging schemes such as iCIRT, discussed in the Australian case study (Algera, 2020a), that may be rolled out in New Zealand.

As well as emerging processes there are a number of other entities that already collect detailed datasets such as Trade Certification programme, Construction Health and Safety New Zealand (CHASNZ), Infrastructure Sustainability Council Australasia etc.

Government procurement processes

Another potential data source, particularly for project level data, is government procurement processes. Many construction projects such as those in education sector, public housing and infrastructure (e.g. NZTA funded projects) require detailed reporting. Creating a framework and process for mapping these projects measures to a sector-level, provides a rich opportunity to get a more nuanced view of the sector.

9. Reflections and Opportunities

The Construction Sector Accord has a vision of "A high performing construction sector for a better New Zealand. The wellbeing of New Zealanders is supported by safe and durable homes, buildings and infrastructure, built by a productive, capable, resilient, and proud sector," (Construction Sector Accord 2019, p.7). This long-term vision is important for a sector that is plagued by volatility and, at times short term thinking. While a vision is important, being able to track and encourage progress towards that vision is vital to ongoing commitment and belief in the vision by stakeholders inside and outside of the sector.

While there is a lot of interest and need to create these multi-capital performance measurement systems, there are few successful systems in place in the construction sector. During our interviews with those in other sectors and internationally, BRANZ were commended for the depth of approach taken when commissioning the research. Our interviews uncovered numerous failed efforts to develop sector measurement systems. The failures ultimately boil down to lack of ownership of the process; ill-defined purpose; disconnect between measurement systems and sector member's drivers; absence of a learning culture and mistrust; and a perception that measurement is a destination rather than a journey.

Emerging sector measurement systems like the New Zealand Sustainability Dashboard are demonstrating the power of connecting both top down and bottom up measurement processes, as well as authentic engagement that drives improvement within the sector. These experiences coupled with ongoing learning in the sector such as education and transport sectors and internationally in the UK construction, provide

some valuable principles to build an effective and sustainable performance measurement and management system.

There is no ready-made performance measurement framework suitable for New Zealand's construction industry. Any measurement framework needs to be developed with construction sector stakeholders. It should be designed with the current economic, social, and policy contexts in mind, but with enough dynamic capability to remain relevant in coming years. Many of the measurement systems currently in place in New Zealand including BRANZ's Construction Dashboard and the Constructing Excellence KPI model provide a useful starting place for further development. More, however, needs to be done to develop and promote an effective sector performance measurement system.

The MBIE secretariat to the Construction Sector Accord are developing a measurement system to measure progress of the sector against the CSA goals. The measurement is focussed on tracking progress against the goals defined by the CSA, rather than providing an overarching view of the sector; however, it is really positive to see measurement being embedded into this government-industry collaboration.

To be successful, it is vital that the **purpose and value** of the measurement system is agreed by sector members and that there is **ownership** of the measurement system (with required resources).

The challenge now is to extend the work being done by MBIE and the Construction Sector Accord to **develop a measurement culture amongst sector members**. Performance measurement, first and foremost needs to serve the needs of its participants. Therefore, to supplement any national level measurement framework and reporting, it is important to facilitate and build capacity for sub-sector groups to take ownership of their own performance measurement and design measurement systems that **align to their own drivers**. Construction businesses need to be able to see cause and effect linkages between the data they collect, the actions they take, and the performance (profitability and long-term viability) outcomes for their business.

This is what will drive improvement within the sector. There are already a number of schemes and systems in place that can be leveraged (such as the work being done by the vertical leaders group, and other trade certification bodies and accreditation schemes (such as ISCA)). Together these sub-sector measures and national level metrics will help to track how well the construction industry is contributing to wellbeing priorities and inform policy and funding decisions for the sector.

Sector performance measurement will be a long journey of creation and engagement that requires adaptation and innovation over time.

Beyond this, there are two other areas that require attention but that were not discussed substantively in the literature or in the case study work: **resilience** and **emerging technologies**. Post-COVID19 there is an increased awareness of the need to be adaptable and manage uncertainty, or to be resilient. The construction sector in particular is subject to significant uncertainty and risk (Chang-Richards et al., 2019). Performance measurement systems need to not only look at how a sector is performing but also the context it is operating in and how prepared it is to manage that uncertainty. Sector and organisational resilience are concepts that may be relevant for how the sector will continue to perform through uncertainty and change. There are some existing measurement tools that evaluate resilience. The Resilience Benchmark Tool, developed by Resilient Organisations (www.resorgs.org.nz), has been in development and practice in New Zealand since 2010 and measure organisational resilience (Lee, Vargo, & Seville 2013, Whitman et al. 2013, Brown et al. 2017). Sapeciay, Wilkinson, & Costello (2019) surveyed construction firms and interviewed key industry stakeholders to assess how this 13-indicator model might be applied in the construction industry. The study concluded that resilience indicators may be useful if

integrated into frameworks that are directly relevant to the construction industry (Sapeciay et al. 2019). Development of risk and resilience indicators is challenging, as noted by their current absence in the Treasury Living Standards Framework dashboard but is vital in a rapidly changing world (The Treasury 2019b).

Relatedly, one of the rapid global changes that needs to be considered is technology. The construction sector needs to be ready and willing to adopt new, beneficial technologies in their construction work and also to take advantage of technology to improve how they manage their work – including performance measurement. Performance measurement continues to evolve, and new approaches need to be developed, so firms aren't applying solutions today for the problems of yesterday. There is growing focus on finding ways to make performance measurement systems more dynamic, so they are more responsive to changes in the external and internal environment of the organisation (Yadav et al. 2013) project or sector. For example, there is potential to improve the timeliness and speed of feedback to users of data collection systems. New passive data collection, such as computers in transport vehicles that report travel data to a central agency, and responsive IT systems, could provide real-time performance results to help reprioritise internal objectives much more rapidly (Bititci, Turner, and Begemann 2000).

Increasingly there are technology solutions to some of the measurement areas that have proved challenging in the past. For example, collection of qualitative data was identified in cases such as the Transport sector and UK construction sector as being a key challenge. There are emerging opportunities to more readily collect qualitative data through easy to use and access survey technology (such as AskYourTeam which is used widely in the public sector, and is used for applications such as assessing migrant worker conditions in the agriculture sector). Some of the social/outcome metrics, which have tended to be put in the too hard basket, need to be re-visited. Initiatives such as StatsNZ's Indicators Aotearoa are helping to pave the way but there is more that can be done.

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Appendices

Appendix 1: Case study report references and links

All case studies can be found at: www.branz.co.nz/ER55_case_studies

Algera, P. (2020a). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study Australian construction sector.

Algera, P. (2020b). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study New Zealand transport sector.

Algera, P. (2020c). Construction Sector Performance measurement: Learning lessons and finding opportunities. Performance beyond profit. Vignette of a purpose-driven construction company.

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Horsfall, S. (2020a). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study New Zealand education sector.

Horsfall, S. (2020b). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study European construction sector.

Horsfall, S. (2020c). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study Stronger Christchurch Infrastructure Rebuild Team.

Konstantinou, E., MacAskill, K. (2020). Construction Sector Performance measurement: Learning lessons and finding opportunities. Case study UK construction sector.

Appendix 2: Indicator database

Category	Indicator	Measure	Capital	Level of data	Reference
Financial	Solvency	Current assets /current liabilities; greater than 1.0 needed	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Profitability	Gross, taxable or net profit / turnover	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Return on Assets	Taxable or net profit / net assets	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Revenue growth	% change in revenue over previous year	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Profit growth	% change in profits over previous year	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Economic value added	After tax operating profit - the cost of capital / turnover	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Inventory turnover	Annual cost of goods sold /inventory on hand	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Leverage test	All debts /all assets	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Bad debts	% of turnover	Financial and physical	Organisation	Page & Norman (2014b)
Financial	Cost of defects	Hours required OR $ of labour costs OR cost as % of contract value	Financial and physical	Project	Page & Norman (2014b)
Financial	Liquidity ratio: ability to service debt	Liquidity ratio by sub-sector for the last four years	Financial and physical	Organisation	Norman, Curtis, & Page (2014)
Financial	Building activity forecasts	Residential, non-residential and heavy construction GFCF forecasts by quarter for the next five years	Financial and physical	Sector	Norman, Curtis, & Page (2014)
Customer	Formal written feedback from client	Qualitative, basic survey questionnaire	Financial and physical	Project	Page & Norman (2014b)
Customer	Call back rate	% of jobs requiring a call-back	Financial and physical	Project	Page & Norman (2014b)
Customer	Market share	% of total sales in the region for this sub-sector	Financial and physical	Sector	Page & Norman (2014b)
Customer	Time predictability across design and construction	Change in actual time / estimated time OR % of work delivered on time	Financial and physical	Project	Page & Norman (2014b)
Customer	Cost predictability of design and construction	Change in actual cost / estimated cost	Financial and physical	Project	Page & Norman (2014b)
Customer	Fixing of defects	Average days after practical completion to complete	Financial and physical	Project	Page & Norman (2014b)
Customer	Repeat clients	% of annual work value (or projects) that is repeat business	Financial and physical	Organisation	Page & Norman (2014b)
Customer	Social responsibility	Qualitative assessment	Financial and physical	Project	Page & Norman (2014b)
Customer	New residential customer service	Three measures of service compared to performance the previous year: (1) Overall level of service; (2) Likelihood of recommending builder; (3) Percentage of surveyed home owners who had to call back builders to fix defects.	Financial and physical	Organisation	Norman, Curtis, & Page (2014)
Internal business processes	Business efficiency	General and administrative expenses as % of turnover	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Degree of sub-contracting	Sub-contractor payments / turnover	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Worker turnover rate or average tenure	Average years in job per worker, (joiners + leavers)/ average staff level	Human	Organisation	Page & Norman (2014b)
Internal business processes	Job turnover rate	Jobs disestablished/ jobs filled at start of year	Human	Organisation	Page & Norman (2014b)
Internal business processes	Brain drain	Skills analysis (average qualifications per worker)	Human	Organisation	Page & Norman (2014b)
Internal business processes	Reportable accidents	Reportable accidents per 10,000 hours worked	Human	Project	Page & Norman (2014b)
Internal business processes	Workplace injury rates	Injury rates per 1,000 workers compared to other industries and to the previous year's performance.	Human	Sector	Norman, Curtis, & Page (2014)
Internal business processes	Downtime	Actual hours worked across projects in a year / hours budgeted	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	New management tools / processes	Qualitative assessment of changes	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Supply chain management	Qualitative assessment	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Employee satisfaction	Qualitative assessment	Human	Organisation	Page & Norman (2014b)
Internal business processes	Change orders	Number of individual change orders due to design or construction errors or adjustments	Financial and physical	Project	Page & Norman (2014b)
Internal business processes	Leadership	How the executive team and other leaders support and promote a culture of business excellence	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Strategy and planning	How management formulates, deploys, reviews and turns policy and strategy into plans and actions	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Resources and information management	How the firm manages and uses resources and information effectively and efficiently	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Impact on society	What the firm achieves in satisfying its local community and society	Social	Organisation	Page & Norman (2014b)
Internal business processes	Inventory management	Lag between buying materials and being reimbursed by client (absolute value)	Financial and physical	Organisation	Page & Norman (2014b)

Category	Indicator	Measure	Capital	Level of data	Reference
Internal business processes	Change management	Qualitative assessment	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Quality measurement	Use defects measures as proxies	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Cost reduction	Cost per unit of work (e.g. per square metre of housing put in place)	Financial and physical	Project	Page & Norman (2014b)
Internal business processes	Proportion of tenders / quotes that are successful	% of quotes accepted (by volume and dollars)	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Share of turnover from competitive tenders / quotes	% of work from tenders / quotes rather than direct appointments	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Marketing focus	% expenditure as a % of turnover	Financial and physical	Organisation	Page & Norman (2014b)
Internal business processes	Supplier (sub-contractor) performance		Financial and physical	Organisation	Page & Norman (2014b)
Learning and Growth	Innovation / R&D spend	% of turnover OR spend per worker on innovation or R&D	Financial and physical	Organisation	Page & Norman (2014b)
Learning and Growth	Innovation: New management tools/ processes	Qualitative assessment of changes	Financial and physical	Organisation	Page & Norman (2014b)
Learning and Growth	Prefabrication	% of value of work put in place	Financial and physical	Project	Page & Norman (2014b)
Learning and Growth	Investment in training	% of turnover OR % of workers receiving training	Human	Organisation	Page & Norman (2014b)
Learning and Growth	Technological capability	Value of Intellectual property rights , measured as patents, industrial design rights, and copyrights - could use "Intangibles" as a proxy	Financial and physical	Organisation	Page & Norman (2014b)
Learning and Growth	Investment in equipment and technology	% of turnover	Financial and physical	Organisation	Page & Norman (2014b)
Learning and Growth	HR development	% of staff receiving formal training each year	Human	Organisation	Page & Norman (2014b)
Learning and Growth	Share of skills provided by training	Expected number of apprentices and trainees completing study each year divided by the total expected demand for each skill category for that year.	Human	Organisation	Norman, Curtis, & Page (2014)
Community	Housing affordability	The BRANZ New-Build Index, which compares changes in the cost to deliver a standard 200 m2 single storey house on a 500 m2 section	Social	Society	Norman, Curtis, & Page (2014)
Community	Changes in building quality	An index of growth in the cost per m2 to deliver housing over and above changes in the price of delivering that housing.	Social	Society	Norman, Curtis, & Page (2014)
Community	Corporate social responsibility	Relative prevalence index of items in a CSR strategy focus survey	Social	Organisation	Norman, Curtis, & Page (2014)
Project	Construction time	Practical completion date minus project commencement date	Financial and physical	Project	Chan & Chan (2004)
Project	Speed of construction	Gross floor area (m2) divided by construction time (days/weeks)	Financial and physical	Project	Chan & Chan (2004)
Project	Time variation	(Construction time minus Revised contract period) divided by revised contract period x 100 percent	Financial and physical	Project	Chan & Chan (2004)
Project	Unit cost	Final contract sum divided by gross floor area (m2)	Financial and physical	Project	Chan & Chan (2004)
Project	Percentage net variation over final cost	Net value of variations divided by final contract sum x 100 percent, where net value of variations is final contract sum- base, and base is (original contract sum + final rise and fall - contingency allowance)	Financial and physical	Project	Chan & Chan (2004)
Project	Net present value	Net cash flow over time divided by (1+discount rate) for a given time	Financial and physical	Project	Chan & Chan (2004)
Project	Accident rate	Total number of reportable construction site accidents divided by total number of workers employed or man-hours worked on a specific project x 1000	Human	Project	Chan & Chan (2004)
Project	Environment Impact Assessment (EIA) Scores	Assessment based on applicable policy	Natural	Project	Chan & Chan (2004)
Project	Quality	Technical specification assessments	Financial and physical	Project	Chan & Chan (2004)
Project	Functionality	Degree of conformance to all technical performance specifications	Financial and physical	Project	Chan & Chan (2004)
Project	End-user's satisfaction	Subjective survey item	Financial and physical	Project	Chan & Chan (2004)
Project	Client's satisfaction	Subjective survey item	Financial and physical	Project	Chan & Chan (2004)
Project	Design team's satisfaction	Subjective survey item	Financial and physical	Project	Chan & Chan (2004)
Project	Construction team's satisfaction	Subjective survey item	Financial and physical	Project	Chan & Chan (2004)
Economic	Client Satisfaction - Product	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2018
Economic	Client Satisfaction - Service	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2019

Category	Indicator	Measure	Capital	Level of data	Reference
Economic	Defects	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2020
Economic	Safety - Industry	Accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2021
Economic	Safety - All Companies	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2022
Economic	Safety - Companies over £10M T/O	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2023
Economic	Predictability Cost - Design	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2024
Economic	Predictability Cost - Construction	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2025
Economic	Predictability Cost - Project	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2026
Economic	Predictability Time - Project	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2027
Economic	Predictability Time - Design	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2028
Economic	Predictability Time - Construction	% on target or better	Financial and physical	Project	UK Industry Performance Report 2005-2029
Economic	Profitability	Median % profit before interest & tax	Financial and physical	Organisation	UK Industry Performance Report 2005-2030
Economic	Productivity (VAPH Current Values)	Median value added/employee (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2031
Economic	Construction Cost	% change compared with one year ago	Financial and physical	Project	UK Industry Performance Report 2005-2032
Economic	Construction Time	% change compared with one year ago	Financial and physical	Project	UK Industry Performance Report 2005-2033
Economic	Client Satisfaction - Value for Money	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2034
Economic	Contractor Satisfaction - Performance - Overall	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2035
Economic	Contractor Satisfaction - Provision of Information - Overall	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2036
Economic	Contractor Satisfaction - Payment - Overall	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2037
Economic	Defects - Impact at Handover	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2038
Economic	Productivity (VAPE Constant 2000 Values)	Median value added/FTE employee (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2039
Economic	Gross Productivity (TOPH)	Median turnover/ FTE employee (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2040
Economic	Return on Value Added (ROVA)	Median % PBIT/ value added	Financial and physical	Organisation	UK Industry Performance Report 2005-2041
Economic	Return on Capital Employed (ROCE)	Median % PBIT/capital employed	Financial and physical	Organisation	UK Industry Performance Report 2005-2042
Economic	Safety - Contractors - All Companies	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2043
Economic	Repeat Business	Median % turnover from companies worked with previously	Financial and physical	Organisation	UK Industry Performance Report 2005-2044
Economic	Productivity (VAPE Constant 2011 Values or previous year)	Median value added/FTE employee (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2045
Economic	Productivity (Constant 2003 Values)	Median value added/FTE employee (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2046
Respect for people	Employee Satisfaction	% scoring 8/10 or better	Human	Organisation	UK Industry Performance Report 2005-2046
Respect for people	Staff Turnover - All Companies	Median % staff turnover	Human	Organisation	UK Industry Performance Report 2005-2047
Respect for people	Sickness Absence - All Companies	Median number of days lost	Human	Organisation	UK Industry Performance Report 2005-2048
Respect for people	Safety - Industry	Accident incident rate (HSE)	Human	Organisation	UK Industry Performance Report 2005-2049
Respect for people	Safety – All Companies	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2050
Respect for people	Safety - Companies over £10M T/O	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2051
Respect for people	Working Hours	Median usual hours worked / week (hrs)	Human	Organisation	UK Industry Performance Report 2005-2052
Respect for people	Travelling Time	Median travel time to work / day (mins)	Human	Organisation	UK Industry Performance Report 2005-2053
Respect for people	Qualifications & Skills	Median % of direct employees qualified to NVQ Level 2 or higher	Human	Organisation	UK Industry Performance Report 2005-2054
Respect for people	Equality & Diversity	% scoring 8/10 or better	Human	Organisation	UK Industry Performance Report 2005-2055
Respect for people	Training	Median annual training days / full-time equivalent employee (days)	Human	Organisation	UK Industry Performance Report 2005-2056
Respect for people	Pay	Median gross weekly earnings (£)	Human	Organisation	UK Industry Performance Report 2005-2057
Respect for people	Investors in People	Mean % of direct employees covered by IiP recognition	Human	Organisation	UK Industry Performance Report 2005-2058
Respect for people	Safety - Contractors & Subcontractors	Median % direct employees who left employment	Human	Organisation	UK Industry Performance Report 2005-2059
Respect for people	Staff Loss	Median % direct employees who left employment	Human	Organisation	UK Industry Performance Report 2005-2060
Respect for people	Construction Skills Certification Card	Median % direct employees that hold a CSCS	Human	Organisation	UK Industry Performance Report 2005-2061
Respect for people	Make-up of staff-women	Median % women employed & Mean % women employed	Human	Organisation	UK Industry Performance Report 2005-2062
Respect for people	Make-up of staff - People from BME	Median % people from black or minority ethnic backgrounds & Mean % people from black or minority ethnic backgrounds	Human	Organisation	UK Industry Performance Report 2005-2063
Respect for people	Make-up of staff - Aged under 24	Median % people employed aged under 24 & Mean % people employed aged under 24	Human	Organisation	UK Industry Performance Report 2005-2064
Respect for people	Make-up of staff- Aged over 55	Median % people employed aged over 55 & Mean % people employed aged over 55	Human	Organisation	UK Industry Performance Report 2005-2065

Category	Indicator	Measure	Capital	Level of data	Reference
Respect for people	Make-up of staff - Disabled People	Median % people employed who are disabled & Mean % people employed who are disabled	Human	Organisation	UK Industry Performance Report 2005-2065
Environment	Impact on the Environment (Product Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2066
Environment	Impact on the Environment (Construction Process Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2067
Environment	Energy Use (Designed) (Product Performance)	Median energy use kgCO2 / 100m2 gross floor area	Natural	Project	UK Industry Performance Report 2005-2068
Environment	Energy use (Construction Process Performance)	Median energy use kgCO2 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2069
Environment	Mains Water Use (Designed) (Product Performance)	Median water use m3 / 100m2 gross floor area	Natural	Project	UK Industry Performance Report 2005-2070
Environment	Mains Water Use (Construction Process Performance)	Median water use m3 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2071
Environment	Waste (Construction Process Performance)	Median waste removed from site m3 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2072
Environment	Commercial Vehicle Movements (Construction Process Performance)	Median movements onto site / £100k project value	Natural	Project	UK Industry Performance Report 2005-2073
Environment	Impact on Biodiversity (Product Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2074
Environment	Impact on Biodiversity (Construction Process Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2075
Environment	Impact on Biodiversity (Product Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2076
Environment	Whole Life Performance (Product Performance)	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2077
Environment	Energy Use (Designed)- Housing SAP Rating (Product Performance)	Median SAP rating	Natural	Project	UK Industry Performance Report 2005-2078
Environment	Area of Habitat - Created/Retained (Product Performance)	Median change in area of habitat as % of site area	Natural	Project	UK Industry Performance Report 2005-2079
Environment	Energy Use (Constant previous year's Values) (Construction Process Performance)	Median energy use kgCO2 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2080
Environment	Mains Water Use (Constant previous year's Values) (Construction Process Performance)	Median water use m3 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2082
Environment	Waste (Constant previous year's Values) (Construction Process Performance)	Median waste removed from site m3 / £100k project value	Natural	Project	UK Industry Performance Report 2005-2083
Environment	Commercial Vehicle Movements (Constant previous year's Values) (Construction Process Performance)	Median movements onto site / £100k project value	Natural	Project	UK Industry Performance Report 2005-2085
Construction Consultant	Client Satisfaction - Overall Performance	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2087
Construction Consultant	Client Satisfaction - Value for Money	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2088
Construction Consultant	Client Satisfaction - Quality of service	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2089
Construction Consultant	Client Satisfaction - Timely delivery	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2090
Construction Consultant	Client Satisfaction - H&S awareness	% scoring 8/10 or better	Human	Project	UK Industry Performance Report 2005-2091
Construction Consultant	Training	Median annual training days per FTE employee	Human	Organisation	UK Industry Performance Report 2005-2092
Construction Consultant	Profitability	Median % profit before interest & tax	Financial and physical	Organisation	UK Industry Performance Report 2005-2093
Construction Consultant	Productivity (Current Values)	Median value added per UK FTE employee (£000s)	Financial and physical	Organisation	UK Industry Performance Report 2005-2094
Construction Consultant	Productivity (Constant 2002 Values)	Median value added per UK FTE employee (£000s)	Financial and physical	Organisation	UK Industry Performance Report 2005-2095
M&E Contractors	Client Satisfaction - Design	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2097
M&E Contractors	Client Satisfaction - Installation	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2098
M&E Contractors	Client Satisfaction - Service	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2099
M&E Contractors	Client Satisfaction - Quality O&M Manuals	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2100
M&E Contractors	Defects	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2101
M&E Contractors	Predictability - Cost	% on cost or better	Financial and physical	Project	UK Industry Performance Report 2005-2102
M&E Contractors	Predictability - Time	% on time or better	Financial and physical	Project	UK Industry Performance Report 2005-2103
M&E Contractors	Profitability	Median % profit turnover	Financial and physical	Organisation	UK Industry Performance Report 2005-2104
M&E Contractors	Productivity (Current Values)	Median value added / M&E operative (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2105
M&E Contractors	Productivity (Constant 2001 Values)	Median value added / M&E operative (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2106
M&E Contractors	Safety - M&E Contractors - All Companies	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2107
M&E Contractors	Safety - M&E Contractors - All Companies with 60 staff or more	% achieving zero accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2108
Construction Products Industry	Product Quality (Customer Satisfaction)	% scoring 8/10 or better	Financial and physical	Organisation	UK Industry Performance Report 2005-2110
Construction Products Industry	Delivery Reliability (Customer Satisfaction)	% scoring 8/10 or better	Financial and physical	Organisation	UK Industry Performance Report 2005-2111
Construction Products Industry	Sales Advice (Customer Satisfaction)	% scoring 8/10 or better	Financial and physical	Organisation	UK Industry Performance Report 2005-2112
Construction Products Industry	After Sales Service (Customer Satisfaction)	% scoring 8/10 or better	Financial and physical	Organisation	UK Industry Performance Report 2005-2113
Construction Products Industry	Value for Money (Customer Satisfaction)	% scoring 8/10 or better	Financial and physical	Organisation	UK Industry Performance Report 2005-2114
Construction Products Industry	Energy (Environment)	Median energy consumed KgCO2 / 10 tonne of production output	Natural	Organisation	UK Industry Performance Report 2005-2115

Category	Indicator	Measure	Capital	Level of data	Reference
Construction Products Industry	Water (Environment)	Median water used m3 / 10 tonne of production output or Median tonnes of waste leaving site as a % of total production output	Natural	Organisation	UK Industry Performance Report 2005-2116
Construction Products Industry	Transport (Environment)	Median number movements / 10 tonne of production output	Natural	Organisation	UK Industry Performance Report 2005-2117
Construction Products Industry	Packaging (Environment)	Median tonnes of packaging bought as a % of total production output	Natural	Organisation	UK Industry Performance Report 2005-2119
Construction Products Industry	Safety at work (Environment)	Mean accident incidence rate	Human	Organisation	UK Industry Performance Report 2005-2121
Construction Products Industry	Sickness Absence (Environment)	Median number of days lost per employee	Human	Organisation	UK Industry Performance Report 2005-2122
Construction Products Industry	Training (Environment)	Median annual training days / full-time equivalent employee	Human	Organisation	UK Industry Performance Report 2005-2123
Construction Products Industry	Qualifications (Environment)	Median % of full-time employees qualified to NVQ Level 2 or higher	Human	Organisation	UK Industry Performance Report 2005-2125
Construction Products Industry	Equality & Diversity (Environment)	% scoring 8/10 or better	Human	Organisation	UK Industry Performance Report 2005-2127
Financial	Profitability (ROS)	Median % profit before interest & tax	Financial and physical	Organisation	UK Industry Performance Report 2005-2129
Financial	Productivity (VAPH)	Median value added/employed (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2130
Financial	Gross Productivity (TOPH)	Median turnover/employed (£000)	Financial and physical	Organisation	UK Industry Performance Report 2005-2131
Financial	Return on value added (ROVA)	Median % PBIT/value added	Financial and physical	Organisation	UK Industry Performance Report 2005-2132
Financial	Return on capital employed (ROCE)	Median % PBIT/capital employed	Financial and physical	Organisation	UK Industry Performance Report 2005-2133
Client Satisfaction	Client satisfaction - Product	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2135
Client Satisfaction	Client satisfaction – Service	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2136
Client Satisfaction	Client satisfaction - Defects	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2137
Client Satisfaction	Environment Impact - Product	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2138
Client Satisfaction	Environment Impact - Process	% scoring 8/10 or better	Natural	Project	UK Industry Performance Report 2005-2139
Client Satisfaction	Client satisfaction - Consultants	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2140
Client Satisfaction	Client satisfaction - Contractors	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2141
Client Satisfaction	Value for money - Consultants	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2142
Client Satisfaction	Value for money - Contractors	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2143
Client Satisfaction	Value for money - Project	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2144
Client Satisfaction	Client would use consultants again	% answering Yes	Financial and physical	Project	UK Industry Performance Report 2005-2145
Client Satisfaction	Client would use contractors again	% answering Yes	Financial and physical	Project	UK Industry Performance Report 2005-2146
Contractor Satisfaction	Contractor Satisfaction – client	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2148
Contractor Satisfaction	Contractor Satisfaction - consultancy team	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2149
Contractor Satisfaction	Provision of Information - client	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2150
Contractor Satisfaction	Provision of Information - consultancy team	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2151
Contractor Satisfaction	Payment - accuracy of interim valuations	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2152
Contractor Satisfaction	Payment - overall satisfaction	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2153
Contractor Satisfaction	Payment - accuracy of interim valuations	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2154
Contractor Satisfaction	Payment - timeliness of valuation of change orders and inclusion in interim valuation	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2155
Contractor Satisfaction	Payment - timeliness of release of retention monies	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2156
Contractor Satisfaction	Payment - timeliness of agreement and payment of final account	% scoring 8/10 or better	Financial and physical	Project	UK Industry Performance Report 2005-2157
Construction market	Number of enterprises		Financial and physical	Sector	European Construction Sector Observatory (2019)
Construction market	Production (volume index of production)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Construction market	Gross value added		Financial and physical	Sector	European Construction Sector Observatory (2019)
Productivity	Labour productivity (GDP per hour worked is calculated as a real output per unit of labour input (measured by the total number of hours worked) rather than per person employed)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Productivity	Analysis of government policies/commitments that enhance productivity		Financial and physical	Sector	European Construction Sector Observatory (2019)
Turnover and profitability	Turnover (total of all sales)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Turnover and profitability	Gross operating surplus		Financial and physical	Sector	European Construction Sector Observatory (2019)
Turnover and profitability	Gross operating rate (indication of sector profitability)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Turnover and profitability	Construction costs		Financial and physical	Sector	European Construction Sector Observatory (2019)

Category	Indicator	Measure	Capital	Level of data	Reference
Turnover and profitability	Construction cost index (cost of labour, materials and plant and overheads)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Turnover and profitability	Input prices for materials		Financial and physical	Sector	European Construction Sector Observatory (2019)
Employment	Total workforce		Human	Sector	European Construction Sector Observatory (2019)
Employment	% of Migrant workforce		Human	Sector	European Construction Sector Observatory (2019)
Employment	Employment by specific occupation (included self-employed workers)		Human	Sector	European Construction Sector Observatory (2019)
Economic development	GDP change		Financial and physical	Society	European Construction Sector Observatory (2019)
Economic development	Consumer price inflation		Financial and physical	Society	European Construction Sector Observatory (2019)
Economic development	Inflation rate		Financial and physical	Society	European Construction Sector Observatory (2019)
Demography and employment	Total population		Human	Society	European Construction Sector Observatory (2019)
Demography and employment	Migration		Human	Society	European Construction Sector Observatory (2019)
Demography and employment	Working age population		Human	Society	European Construction Sector Observatory (2019)
Demography and employment	Ageing population		Human	Society	European Construction Sector Observatory (2019)
Demography and employment	Unemployment rate		Human	Society	European Construction Sector Observatory (2019)
Demography and employment	Youth unemployment		Human	Society	European Construction Sector Observatory (2019)
Public Finance	Government expenditure		Financial and physical	Society	European Construction Sector Observatory (2019)
Public Finance	General government deficit		Financial and physical	Society	European Construction Sector Observatory (2019)
Public Finance	Government gross debt		Financial and physical	Society	European Construction Sector Observatory (2019)
Public Finance	Global competitiveness report rank		Financial and physical	Society	European Construction Sector Observatory (2019)
Entrepreneurs hip and access to finance	Government Acts and policies that support entrepreneurship		Financial and physical	Society	European Construction Sector Observatory (2019)
Entrepreneurs hip and access to finance	European Commission rank for Entrepreneurship and access to finance		Financial and physical	Society	European Construction Sector Observatory (2019)
Entrepreneurs hip and access to finance	Starting a business (how many procedures and how long it takes to complete the process)		Financial and physical	Society	European Construction Sector Observatory (2019)
Business confidence	Consumer confidence indicator		Financial and physical	Society	European Construction Sector Observatory (2019)
Business confidence	Industry confidence indicator		Financial and physical	Society	European Construction Sector Observatory (2019)
Business confidence	Construction confidence indicator		Financial and physical	Sector	European Construction Sector Observatory (2019)
Business confidence	Investment ratio		Financial and physical	Sector	European Construction Sector Observatory (2019)
Business confidence	Investment per worker		Financial and physical	Sector	European Construction Sector Observatory (2019)
Business confidence	Future business activity (next 12 months)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Domestic sales	Most domestically sold construction products		Financial and physical	Sector	European Construction Sector Observatory (2019)
Domestic sales	Domestic sale value		Financial and physical	Sector	European Construction Sector Observatory (2019)
Domestic sales	Changes in product value		Financial and physical	Sector	European Construction Sector Observatory (2019)
Domestic sales	Share in construction product domestic sales		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Most exported construction products		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Value of exports		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Changes in product value		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Share in construction product export sales		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Exported construction services		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Imported construction services		Financial and physical	Sector	European Construction Sector Observatory (2019)
Export of construction-related products and services	Trade deficit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Access to finance in the construction sector	Lending/funding/access to finance for SMEs (e.g. bank loaning)		Financial and physical	Sector	European Construction Sector Observatory (2019)
Access to finance in the construction sector	Net lending		Financial and physical	Sector	European Construction Sector Observatory (2019)
Access to finance in the construction sector	Government schemes/initiatives and resources available		Financial and physical	Sector	European Construction Sector Observatory (2019)
Access to housing	Number of households		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Population spread		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Mean equivalised net income		Social	Society	European Construction Sector Observatory (2019)
Access to housing	House price index		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Outstanding residential loans		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Mortgage interest rates		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Residential construction activities (number of dwellings completed)		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Housing crisis government schemes 0 housing deficit		Social	Society	European Construction Sector Observatory (2019)

Category	Indicator	Measure	Capital	Level of data	Reference
Access to housing	Percent of income spent on housing		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Home ownership (mortgage/no mortgage)		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Home ownership rate (income)		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Share of tenants		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Housing affordability issues		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Housing cost overburden rate		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Overcrowding rate		Social	Society	European Construction Sector Observatory (2019)
Access to housing	Sever housing deprivation rate		Social	Society	European Construction Sector Observatory (2019)
Infrastructure	Global Competitiveness Report ranking for Infrastructure		Financial and physical	Sector	European Construction Sector Observatory (2019)
Infrastructure	Efficiency of infrastructure		Financial and physical	Sector	European Construction Sector Observatory (2019)
Infrastructure	Quality of infrastructure		Financial and physical	Sector	European Construction Sector Observatory (2019)
Infrastructure	Pipeline of infrastructure projects		Financial and physical	Sector	European Construction Sector Observatory (2019)
Company failure	Company births		Financial and physical	Sector	European Construction Sector Observatory (2019)
Company failure	Company deaths		Financial and physical	Sector	European Construction Sector Observatory (2019)
Company failure	Insolvencies		Financial and physical	Sector	European Construction Sector Observatory (2019)
Company failure	Bankruptcy		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	OECD ranking of high-income countries in terms of getting trade credit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Domestic credit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Trade covered by trade credit policies		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Trade credit as financing practice in supply chain		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Other sources of finance compared with trade credit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Trade credit risk		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Applications for trade credit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Trade credit	Availability of trade credit		Financial and physical	Sector	European Construction Sector Observatory (2019)
Late payment	Payment record		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	Outstanding invoices		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	Causes for late payment		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	Payment method and timeframe		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	European Payment Risk Index		Financial and physical	Sector	European Construction Sector Observatory (2019)
Late payment	Cash retention value		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	Cash retention reasons		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Late payment	Government schemes/bills implemented		Financial and physical	Sector	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	World Bank's Doing Business ranking for 'dealing with construction permits'		Financial and physical	Project	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	Number of procedures to obtain building permits and licenses		Financial and physical	Project	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	Time length to obtain permits and licenses		Financial and physical	Project	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	Cost of process		Financial and physical	Project	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	Number of procedures, time length and cost compared to the OECD high-income average		Financial and physical	Project	European Construction Sector Observatory (2019)
Time and cost of obtaining building permits and licences	Licensing requirements		Financial and physical	Project	European Construction Sector Observatory (2019)
Skills shortage	Job vacancies		Human	Organisation	European Construction Sector Observatory (2019)
Skills shortage	Number of tertiary students in engineering, manufacturing and construction		Human	Sector	European Construction Sector Observatory (2019)
Skills shortage	Adult participation in education and training		Human	Sector	European Construction Sector Observatory (2019)
Skills shortage	Labour shortages		Human	Sector	European Construction Sector Observatory (2019)
Skills shortage	Skilled workers reaching retirement age in the next ten years		Human	Organisation	European Construction Sector Observatory (2019)
Skills shortage	Job creation in the next 5 years		Human	Organisation	European Construction Sector Observatory (2019)
Skills shortage	Annual need (including non-construction professionals)		Human	Society	European Construction Sector Observatory (2019)
Skills shortage	Appeal of a construction career in young adults		Human	Society	European Construction Sector Observatory (2019)
Skills shortage	Availability of skilled workers		Human	Sector	European Construction Sector Observatory (2019)
Skills shortage	Skilled shortage gap		Human	Organisation	European Construction Sector Observatory (2019)

Category	Indicator	Measure	Capital	Level of data	Reference
Skills shortage	Annual need of skilled workers		Human	Organisation	European Construction Sector Observatory (2019)
Skills shortage	Subsector growth performance		Human	Organisation	European Construction Sector Observatory (2019)
Skills shortage	Government initiatives/training programs		Human	Sector	European Construction Sector Observatory (2019)
Material efficiency and waste management	Construction and demolition waste generated as a portion of total waste generated		Natural	Project	European Construction Sector Observatory (2019)
Material efficiency and waste management	Non-hazardous waste		Natural	Project	European Construction Sector Observatory (2019)
Material efficiency and waste management	Waste recovery rate		Natural	Project	European Construction Sector Observatory (2019)
Climate and energy	Emissions of greenhouse gases of construction and real estate activities (by sub-sector)		Natural	Project	European Construction Sector Observatory (2019)
Climate and energy	Gap in as-built energy and design carbon performance of buildings		Natural	Project	European Construction Sector Observatory (2019)
Innovation performance	Ranking on European Innovation Scoreboard for innovation		Human	Sector	European Construction Sector Observatory (2019)
Innovation performance	Human resources: new doctorate graduates		Human	Individual	European Construction Sector Observatory (2019)
Innovation performance	Human resources: population 25-34 with completed tertiary education		Human	Individual	European Construction Sector Observatory (2019)
Innovation performance	Human resources: population 25-64 involved in education and training.		Human	Individual	European Construction Sector Observatory (2019)
Innovation performance	Attractive research systems: international scientific co- publications		Human	Society	European Construction Sector Observatory (2019)
Innovation performance	Attractive research systems: most cited publications,		Human	Society	European Construction Sector Observatory (2019)
Innovation performance	Attractive research systems: foreign doctorate students.		Human	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Innovation-friendly environment: broadband penetration among		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Innovation-friendly environment: measuring the degree to which		Financial and physical	Individual	European Construction Sector Observatory (2019)
Innovation performance	Finance and support: availability of finance for innovation projects by		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Finance and support: the support of governments for research and		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Firm investments: R&D investments that firms make to generate		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Firm investments: Non-R&D investments that firms make to generate		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Firm investments: efforts enterprises make to upgrade the ICT skills of		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Innovators: share of firms that have introduced innovations onto the		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Innovators: marketing and organisational innovators,		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Innovators: SMEs that innovate in-house.		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Linkages: innovation capabilities by looking at collaboration efforts		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Linkages: research collaboration between the private and public sector		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Linkages: extent to which the private sector finances public R&D		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Intellectual assets: Intellectual Property Rights (IPR) generated through		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Intellectual assets capture different forms of Intellectual Property		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Intellectual assets capture different forms of Intellectual Property		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Employment impacts: employment in knowledge-intensive activities a		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Employment impacts: employment in fast-growing firms in innovative		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Sale impact: exports of medium and high-tech products		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Sale impact: exports of knowledge-intensive services		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Sale impact: sales due to innovation activities		Financial and physical	Society	European Construction Sector Observatory (2019)
Innovation performance	Business enterprise R&D expenditure (BERD)		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Total R&D personnel (FTE)		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Innovation performance	Construction related patent applications		Financial and physical	Sector	European Construction Sector Observatory (2019)
Innovation performance	Research activity		Financial and physical	Sector	European Construction Sector Observatory (2019)
Eco-innovation and digitalisation	Digital tools available		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Penetration of insurance		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Employers liability insurance		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Professional indemnity insurance		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Contractors all risk cover		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Product liability insurance that covers risks caused by products		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Contractors all-risk insurance		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Collateral warranty		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	Terrorism insurance		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Insurance and liability related regulations	New insurance programs in development		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Investment conditions and volumes	Total investment by the broad construction sector		Financial and physical	Sector	European Construction Sector Observatory (2019)
Investment conditions and volumes	Total investment in construction		Financial and physical	Sector	European Construction Sector Observatory (2019)
Investment conditions and volumes	Investment index		Financial and physical	Sector	European Construction Sector Observatory (2019)
Investment conditions and volumes	Household renovation spending		Social	Society	European Construction Sector Observatory (2019)
Skills	Construction Industry Training Boards (CITB) funding		Human	Sector	European Construction Sector Observatory (2019)
Skills	Apprenticeship levies		Human	Sector	European Construction Sector Observatory (2019)
Skills	Training hubs		Human	Sector	European Construction Sector Observatory (2019)

Category	Indicator	Measure	Capital	Level of data	Reference
Skills	Reforms to Vocational Educational and Training (VET)		Human	Sector	European Construction Sector Observatory (2019)
Skills	Students enrolled in VET		Human	Sector	European Construction Sector Observatory (2019)
Skills	Employment rate of VET students		Human	Sector	European Construction Sector Observatory (2019)
Resource efficiency/Sustainable construction	Energy consumption (final and primary)		Natural	Society	European Construction Sector Observatory (2019)
Resource efficiency/Sustainable construction	Carbon reductions against regulatory obligations		Natural	Society	European Construction Sector Observatory (2019)
Single market	Score of the EU Single Market Scoreboard		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Internal market information system		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Public procurement		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Transposition of law		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Infringements		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Technical regulations information system		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Points of single contact		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Postal services		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Trade in goods and services		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Foreign Direct Investment (FDI)		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Proportion of goods and services government purchases from SMEs		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Trade integration in the single market (Scoreboard - % GDP)		Financial and physical	Society	European Construction Sector Observatory (2019)
Single market	Construction workforce demographics – e.g. % foreign-born, % European, locally born, age (pre-retirement)		Financial and physical	Organisation	European Construction Sector Observatory (2019)
Single market	Employment on-site foreign labour		Financial and physical	Project	European Construction Sector Observatory (2019)
Single market	How many of skilled workers are from abroad		Financial and physical	Organisation	European Construction Sector Observatory (2019)
International competitiveness	Global Competitiveness Index ranking		Financial and physical	Society	European Construction Sector Observatory (2019)
International competitiveness	Internationalisation of SMEs (SMEs that export internationally)		Financial and physical	Society	European Construction Sector Observatory (2019)
International competitiveness	Trade gap between total exports and total imports for construction products and materials		Financial and physical	Sector	European Construction Sector Observatory (2019)
International competitiveness	Availability of export finance		Financial and physical	Sector	European Construction Sector Observatory (2019)
International competitiveness	Availability of export insurance		Financial and physical	Sector	European Construction Sector Observatory (2019)
International competitiveness	Industry partnerships that enable international competitiveness		Financial and physical	Sector	European Construction Sector Observatory (2019)
Health and safety	Measure of Safety Engagement Awareness	Quality of safety auditing	Human	Project	SCIRT (2016)
Health and safety	Protection of Utility Services	Utility strikes per services passed	Human	Project	SCIRT (2016)
Environment	Legacy Achievement Goal	Monthly assessment of progression against legacy achievement goal framework	Natural	Project	SCIRT (2016)
Environment	Environmental Assurance	Quality of environmental auditing	Natural	Project	SCIRT (2016)
Value	Delivery Performance	Rate of completion of projects measured by spend from 5%-95% of baseline	Financial and physical	Project	SCIRT (2016)
Value	Quality of Construction	Scoring from the monthly project verification audit, values based on quality of actions recorded in a wide range of site quality control processes	Financial and physical	Project	SCIRT (2016)
Customer satisfaction	Community satisfaction with communication and product	Combination of results from two surveys - Community in areas where work has finished - Representative sample from wider Christchurch community	Social	Project	SCIRT (2016)
Customer satisfaction	Stakeholder satisfaction with communication and product	Identified representatives from key stakeholder organisations	Social	Project	SCIRT (2016)
Teamwork	Alignment and Involvement of the Team	Survey of the team to assess levels of involvement and interaction between client, board, management team and delivery teams	Financial and physical	Project	SCIRT (2016)
Teamwork	Developing a Skilled Workforce	Number of operatives enrolled in and completing NZQA qualifications pathways	Financial and physical	Project	SCIRT (2016)