DIGITAL GUIDANCE SUITE:
AOTEAROA | NEW ZEALAND 2023

THE VALUE CASE
FOR 'DIGITAL FIRST'

A Proposed Roadmap to Digital Maturity
in the Built Environment

CONSTRUCTION
SECTOR ACCORD

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ACKNOWLEDGEMENTS

ENQUIRIES

New Zealand Institute of Building:
email: info@nziob.org.nz
website: www.nziob.org.nz

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SECTION 1

EMBRACING 'DIGITAL FIRST'

1 – EMBRACING 'DIGITAL FIRST'

Having confidence in delivering construction and infrastructure projects on time, on budget, and to the required levels of quality is no longer a luxury; it is a necessity. Everyone involved, whether that is in the design, construction, delivery, and maintenance of infrastructure or the broader built environment, needs to work more with data and embrace digitally enabled methods of working.

Why? Because a 'digital first' approach not only ensures high-value outcomes throughout a project or asset life-cycle, but also delivers long-term benefits for all businesses involved in delivering Aotearoa New Zealand's built environment. They include safer project delivery and ongoing operations, alignment with net-zero goals, enhanced community engagement, improved productivity, and a more capable workforce.

This Value Case describes what success looks like for digital delivery of construction and infrastructure projects in Aotearoa New Zealand and explains how individuals and organisations of all sizes can contribute to future-proofing the built environment through digitally enabled processes.

Improved communication and interactions, not just better tools, are integral to this Value Case. The premise is simple: when digital comes first, a better built environment follows.

A. VALUE CASE CONTEXT

This document responds to an opportunity to improve Aotearoa New Zealand's built environment sector through a 'digital first' strategy by looking closely at the case for change.

'DIGITAL FIRST' MEANS MOVING AWAY FROM AD-HOC AND ANALOGUE INFORMATION FLOWS TO COLLABORATIVE DIGITALLY IMPLEMENTED PRACTICES.

'Digital first' means moving away from ad hoc and analogue information flows to collaborative, digitally implemented practices.

A 'digital first' approach aligns with the Construction Sector Accord's vision of "a thriving, fair and sustainable construction sector for a better Aotearoa New Zealand."[1] It also comes at a time when central government is recognising the urgency of building resilience into the nation's communities, considering the industry's carbon contribution, and providing certainty on construction and infrastructure pipelines, along with an imperative to extract more value from existing assets and drive innovation in the delivery of built assets.

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[1] Construction Sector Accord. 'The Accord' (2023).
See https://www.constructionaccord.nz/the-accord/

Construction Sector Accord Vision

'Digital first' refers to a vision of a construction and infrastructure sector that is future-fit, adaptable, resilient, and thriving, and transformed by project information that is digitally communicated and exchanged throughout delivery lifecycles. Its implementation involves establishing standardised processes in which data is lodged once in the system in order to be exchanged many times – and this in turn enables the optimisation of investments in automation, technology, and data standards, and the development of new capability requirements for workers.

The 'digital first' vision acknowledges that there are offshore exemplars of mandates for digital technology use in construction and infrastructure projects. There are also published recommendations for priority activities, organisational responses, and commitments to broader industry digital maturity goals through a commitment to uptake. This document consolidates these examples of excellence to create a proposed 'Roadmap' framework for a 'digital first' approach at a national scale that seeks to remove barriers to entry for small firms and provide a clear and consistent pathway to maturity for asset owners and large organisations alike.

The Construction Sector Accord is working on this initiative with the NZ Institute of Building (the Institute), with the latter managing the project on the Accord's behalf, and the BIMinNZ Steering Group, which has scoped and is leading the workstreams with input from industry stakeholders. These workstreams aim to build on previous publications and support the future activities of the BIMinNZ Steering Group to encourage digital enablement.

ULTIMATELY, A 'DIGITAL FIRST' STRATEGY IS UNDERSTOOD BY ALL THREE ORGANISATIONS TO RESULT IN A LIFT IN PRODUCTIVITY AND PERFORMANCE IN THE BUILT ENVIRONMENT ACROSS THE COUNTRY.

B. VALUE CASE RELEVANCE

This document has been produced for construction and infrastructure industry people who make decisions relating to procurement, design, and delivery of projects. It provides guidance to those responsible for specifying digital products and services. It is also intended to support investors, businesses, delivery practitioners, and suppliers who use data to help shape the nation's built environment. Importantly, it provides a case for using the 'digital first' approach for major projects and alliances where multiple partners have traditionally struggled to collaborate, and where gaps have long been recognised between the phases of design, construction, and handover.

> **AT ITS HIGHEST LEVEL, THE 'DIGITAL FIRST' STRATEGY RELIES ON ALIGNMENT, COMMUNICATION, TRANSPARENCY, AND TRUST BETWEEN AND ACROSS THE MULTIPLE ROLES INVOLVED IN DELIVERING CONSTRUCTION AND INFRASTRUCTURE PROJECTS.**

It requires clearly defined roles, and both recognition of and respect for the benefits that 'digital first' activities offer to others.

The message for leaders and practitioners involved in the design, construction, and maintenance of built assets is to be visibly active in championing 'digital first' strategies. This includes using a consistent and standardised language for 'digital first' from the outset, and adopting a consistent, national-scale approach to data stewardship, management of information, and common data standards that enables better data quality and reliability.

C. VALUE CASE APPROACH

A multitude of organisations and individuals have been responsible for bringing the 'digital first' strategy to life. They include:

01
Digital, technology and innovation practitioners

02
Design, engineering, project, and cost consultants

03
Construction and infrastructure contractors and specialist trades

04
Product, materials, and equipment suppliers and technology vendors

05
Asset and facilities managers, maintainers, and operators

06
Owners and investors

This Value Case aims to help asset owners and organisations to recognise the importance of their leadership roles in enabling 'digital first' across the sector, and to be confident that others are also investing in change. It should provide an impetus to get started for those who have not, and encouragement to continue for those who have already begun.

The Value Case describes the outcomes and transformational activities that must be considered. Guidance for practitioners on conducting these activities is provided in the accompanying New Zealand BIM Handbook (v4, 2023) as part of the DigiGuide suite of material.

D. VALUE CASE CONNECTIONS AND CONTENTS

This Value Case is a connector to broader initiatives that are already underway in the sector, including work to update the 'New Zealand Construction Industry Council Guidelines' for engaging designers in vertical construction projects. It is also connected to the updating of the 'New Zealand Standard NZS 3910:2013: Conditions of contract for building and civil engineering construction'.

In addition, the Value Case has been produced in the context of work underway within central government to develop a framework for accelerating specific initiatives such as data standards and a national digital twin project.

SECTION 01
provides the context and digital definitions.

SECTION 02
explores the specific benefits of 'digital first'.

SECTION 03
presents a proposed Roadmap framework, indicating a way forward for industry to travel collectively towards digital maturity, including how organisations can get started.

SECTION 04
outlines future steps and the areas that need further research and development.

The broader **DigiGuide suite of digital guidance** into which this Value Case fits:

VALUE CASE
DIGITAL FIRST
ROADMAP
CASE STUDIES

NZ BIM HANDBOOK V4
2023

APPENDICES
PROCUREMENT OVERVIEW
ROLES + RESPONSIBILITIES

FUTURE ROADMAP
INITIATIVES
FUTURE R+D

VISION

BIM HANDBOOK

NEXT STEPS
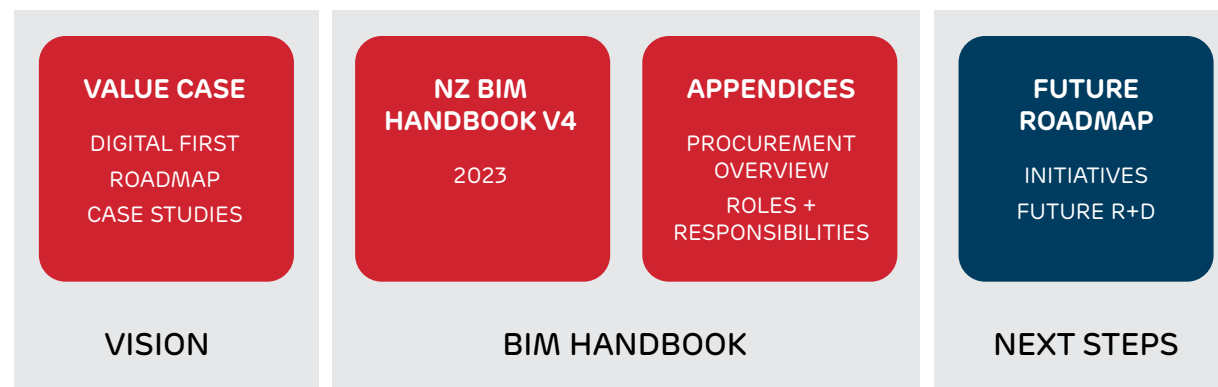
Links to the DigiGuide suite can be found at:

- BIMinNZ Steering Group: www.biminnz.co.nz
- Construction Sector Accord: www.constructionaccord.nz
- New Zealand Construction Industry Council: www.nzcic.co.nz
- NZ Institute of Building: www.nziob.org.nz

For direct assistance with the DigiGuide or future updates, contact the NZ Institute of Building in the first instance, at info@nziob.org.nz.

E. VALUE CASE TERMINOLOGY

Internationally, there is a commonly accepted terminology for digital design and construction processes, including as **Building Information Modelling (BIM).** BIM is a collaborative set of processes to deliver projects, supported by digital technology. It includes information on asset planning, design, budgets, sequencing, safety, construction, operations, and maintenance. The intention is that information created in one phase can be reliably passed on to the next phase for further development and reuse, thus preventing the loss of information that typically occurs at handover between project phases.

BIM is a defined term in ISO 19650 Building Information Modelling. Topics covered include the specification, procurement, creation, and verification of, and exchange of information on, the entire lifecycle of an asset.

> **ITS USE IN PROJECTS IN NEW ZEALAND GREW FROM 34% IN 2014 TO 70% IN 2021, ACCORDING TO SURVEYS CONDUCTED FOR THE FORMER BIM ACCELERATION COMMITTEE.[2]**

Recently, the concept of **Digital Engineering (DE)** has gained currency on infrastructure projects in Australia and New Zealand as another way of describing a broad methodology for the inclusion and transfer of digital information across the entire lifecycle of a built asset. DE is best viewed as an all-encompassing, multidisciplinary capability that builds on the BIM concept.[3]

Both DE and BIM are commonly used, but they are not interchangeable terms. The absence of a universally accepted language for DE creates challenges for developing literacy and nurturing capabilities in this area. This Value Case document uses 'digital first' as the terminology for a common approach.

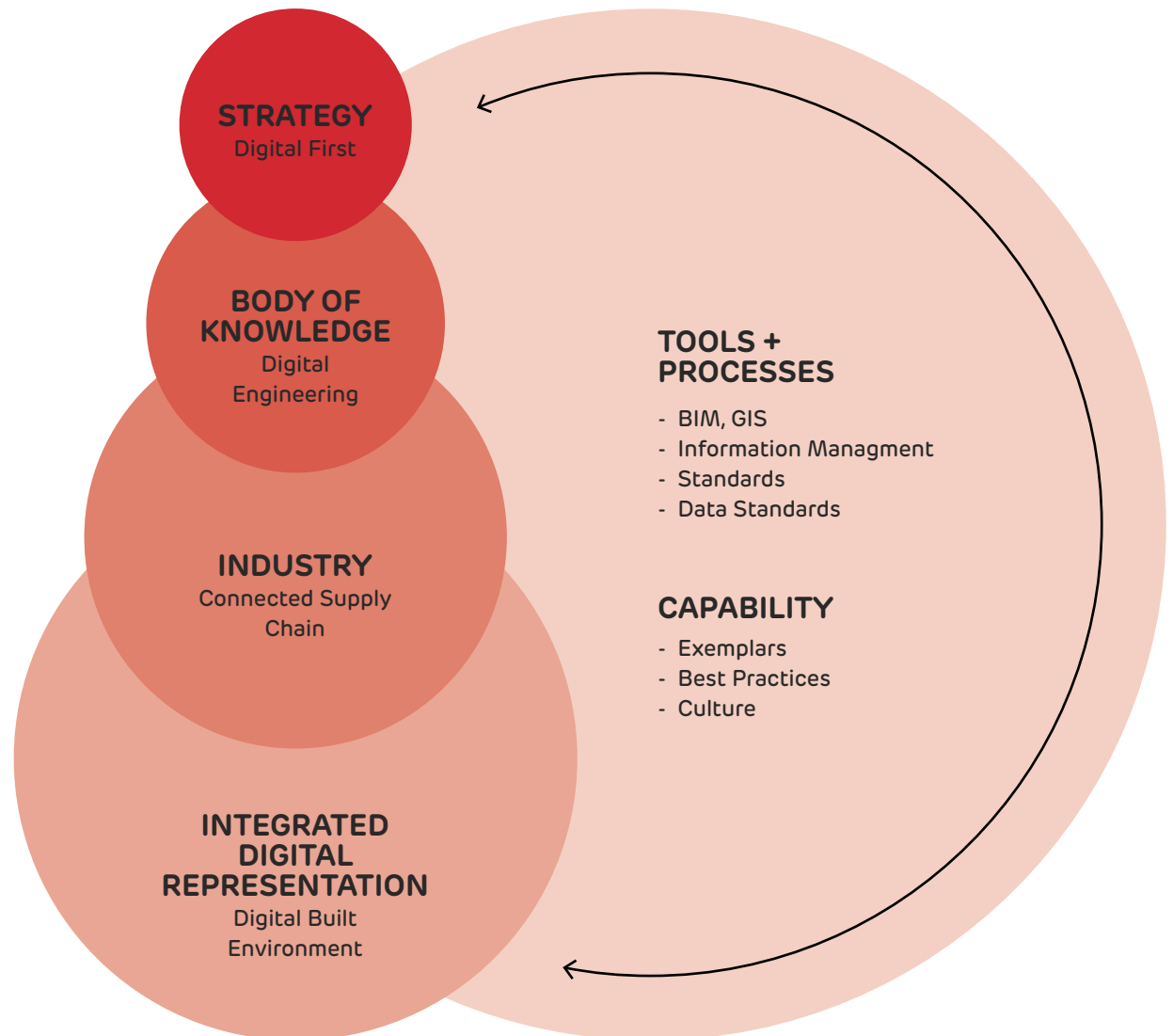[2] Eboss, 'BIM Benchmark Survey' (2021). See https://www.eboss.co.nz/bim-in-nz/bim-benchmark-survey-2021

[3] Standards Australia, 'Digital Engineering' (2023). See https://www.standards.org.au/engagement-events/strategic-initiatives/digital-engineering

The overarching outcome of a 'digital first' approach is a construction and infrastructure sector that is informed by a common language, enabled by DE, and implemented via digital practices such as BIM.

The **potential future state** of the construction and infrastructure sector as our 'digital first' approach matures is a fully integrated digital representation of the built environment, which spans the full lifecycle of an asset, retains a data connection to the real world, and can be used effectively for analysis, prediction, and scenario development. A 'digital first' approach can evolve into or provide the basis for a National Digital Twin. The hierarchy of terms below represents a journey towards a digitally mature state.

STRATEGY
Digital First

BODY OF KNOWLEDGE
Digital Engineering

INDUSTRY
Connected Supply Chain

INTEGRATED DIGITAL REPRESENTATION
Digital Built Environment

TOOLS + PROCESSES
- BIM, GIS
- Information Managment
- Standards
- Data Standards

CAPABILITY
- Exemplars
- Best Practices
- Culture

02

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SECTION 2

A VISION FOR 'DIGITAL FIRST'

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2 – A VISION FOR 'DIGITAL FIRST'

The built environment touches every aspect of our lives, from where we live, work, learn, and play to the services we use, the products we consume, and the transport and communication networks that connect us.

Increasingly, severe weather events are directly affecting our communities and damaging our infrastructure, reminding us all of the multiple challenges we face, including the impacts of climate change and the urgency of reducing carbon emissions as we rebuild, replace, and recover.

A. 'DIGITAL FIRST' IS IMPORTANT IN INCREASING PRODUCTIVITY

The construction sector is a major contributor to New Zealand's economy. In 2022 it generated 6.7% of the country's real gross domestic product and supported 12.6% of all businesses.

Today, New Zealand is facing a construction and infrastructure crisis. Existing assets, particularly roading and rail infrastructure, and including those providing lifeline access to our communities, are ageing, and new infrastructure must be built to sustain growth and create resilient networks.

The built environment sector has a critical role in delivering and maintaining our infrastructure assets and provides employment opportunities for approximately 300,000 workers (10.5% of New Zealand's total workforce). Rather than this being an advantage, it is well known that the sector has been dogged by low productivity and been slow to adopt technology and embrace innovations that could radically influence both capability and capacity.

Productivity is slowly improving, but there is now a disparity between vertical and horizontal (or civil) construction, with building construction improvements surging ahead of civil. As identified in a Te Waihanga | NZ Infrastructure Commission Research Insights report, 'Economic Performance of New Zealand's Construction Industry', between 2000 and 2020 labour productivity increased by 23% in building construction, 25% in construction services, and only 5% in civil construction.[4]

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[4] Te Waihanga, 'Economic performance of New Zealand's construction industry' (2022).
See https://media.umbraco.io/te-waihanga-30-year-strategy/fsbjr2fh/economic-performance-of-new-zealands-construction-industry.pdf

> The October 2021 report from Te Waihanga | NZ Infrastructure Commission notes New Zealand's infrastructure challenge is an identified shortfall of around $100 billion in our current infrastructure needs. This could grow to more than double that in 30 years if investment in renewals and future demand remain at the current rate.[5]

This is backed up in the 2022 Te Waihanga report on construction sector performance, which addresses why productivity growth is important. "Theory and evidence suggest that productivity growth in construction can help to bring down the cost to deliver infrastructure and make it easier to address our infrastructure challenges."[6]

Improved productivity enables more to be delivered, for less time and money. Creating a capable, digitally literate workforce contributes to our ability to build quality infrastructure and make good decisions on how it is designed and built. Quality information needs to be standardised if it is to be optimised, and we need to work together using agreed data standards if we are to benefit fully from innovation.
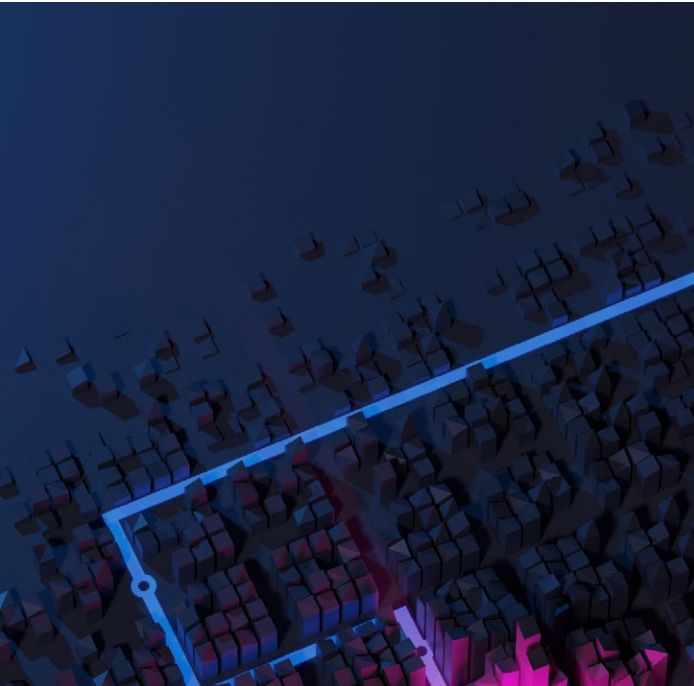
A **'digital first' approach** creates an opportunity to bring supply chains together for the full asset life-cycle and blend multiple disciplines with a digital ecosystem that is supported by standardised, transparent data, connected by consistent processes and enabled by widely agreed-on technology.

A 2021 KPMG report on the value of information management in construction, where "potential returns on investment are in the order of six-to-one or greater if information management is undertaken effectively during design and construction"[7], highlights and explains the **potential to realise opportunities through 'digital first'**. It says this leads to direct savings in labour and material costs as well as fewer risks overall, which could translate to savings of up to 18% on the operational life of a built asset.

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[5] Te Waihanga, 'New Zealand's infrastructure challenge: quantifying the gap and path to close it' (2021). See https://media.umbraco.io/te-waihanga-30-year-strategy/lhhm5gou/new-zealands-infrastructure-challenge-quantifying-the-gap.pdf

[6] See 4.

[7] KPMG, 'The value of Information Management in the construction and infrastructure sector' (2021). See https://assets.kpmg.com/content/dam/kpmg/uk/pdf/2021/06/cdbb-econ-value-of-im-kpmg-atkins-main-report-new.pdf

B. 'DIGITAL FIRST' IS IMPORTANT RIGHT NOW

A suite of digital-focused strategies, roadmaps, and action plans to accelerate progress in the built environment was recently released, urging industry to respond to and resolve the infrastructure deficit.

In response to 'Rautaki Hanganga o Aotearoa | New Zealand Infrastructure Strategy 2022-2052'[8] and in recognition of the need to increase the rate at which New Zealand is future-proofing the construction industry, the Construction Sector Accord released its 'Transformation Plan 2022-2025'[9].

The Plan provides goals in several key digital skill areas, with the sixth being an aspiration to drive increased productivity through innovation, technology, and an enabling regulatory environment, and states that BIM and a shared digital environment are priorities.

Additionally, the 2023 'Infrastructure NZ Digital Position Paper'[10] delivered key recommendations on procurement, metadata standards, and governance that are at the heart of a 'digital first' strategy.

Papers have been written, the imperative has been recognised.

THE TIME TO ACT IS NOW

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[8] Te Waihanga, 'Strategy Forword' (2023).
See https://tewaihanga.govt.nz/the-strategy/foreword

[9] Construction Sector Accord, 'Transformation Plan (2022).
See https://www.constructionaccord.nz/transformation-plan/

[10] Infrastructure NZ, 'Position Paper: Digital' (2023). See https://infrastructure.org.nz/wp-content/uploads/2023/08/Infrastructure-NZ-Policy-Postions-Digital.pdf
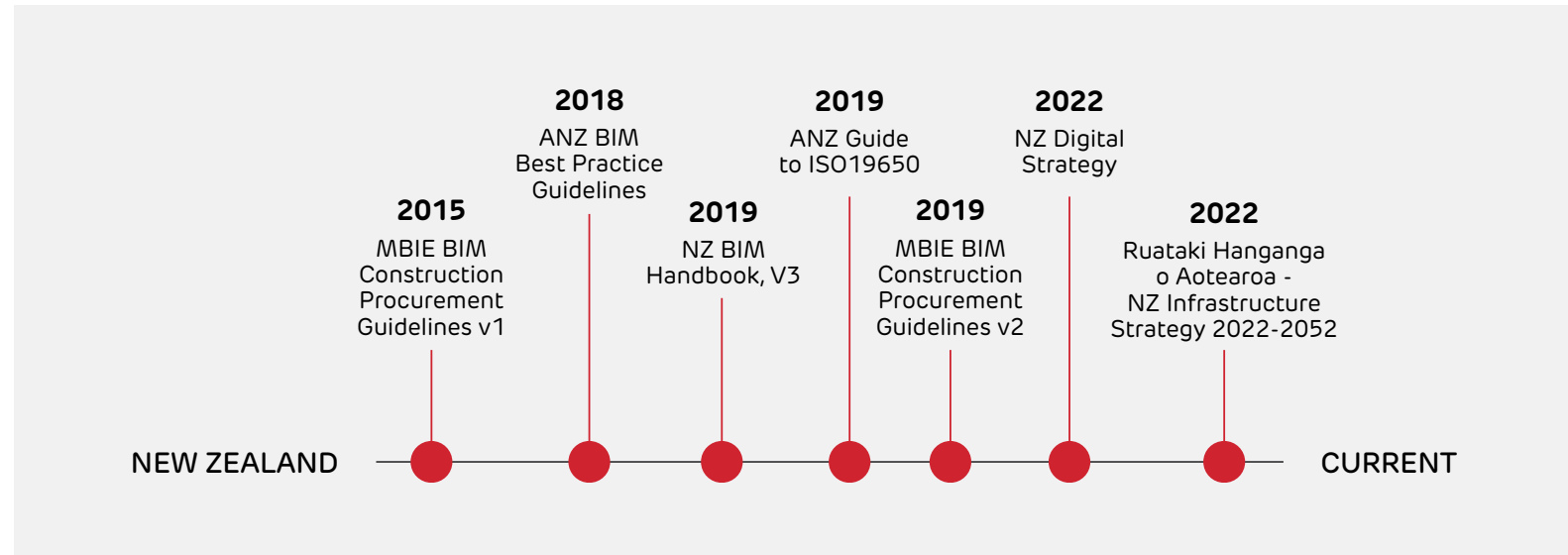
C. TOWARDS 'DIGITAL FIRST' IN NEW ZEALAND

As can be seen in the graphic below, many steps have been taken towards a 'digital first' Aotearoa New Zealand since it was first mooted in the early 2000s, with various guides, guidelines, and strategies advocating its use in construction and for the adoption of information management.

Several major projects and alliances have been created in response to natural disasters, largely in documenting and sharing approaches to recovery and rebuild. For example, lessons learnt from the Stronger Christchurch Infrastructure Rebuild Team's (SCIRT's) work on restoring the city's underground infrastructure following the 2010-2011 Canterbury earthquakes provided three important value foundations for the design and construction phases:[11]

1. Doing the right work
2. Doing the right work in the right order
3. Progressively getting better at what we do

2015 MBIE BIM Construction Procurement Guidelines v1

2018 ANZ BIM Best Practice Guidelines

2019 NZ BIM Handbook, V3

2019 ANZ Guide to ISO19650

2019 MBIE BIM Construction Procurement Guidelines v2

2022 NZ Digital Strategy

2022 Ruataki Hanganga o Aotearoa - NZ Infrastructure Strategy 2022-2052

NEW ZEALAND ● ● ● ● ● ● ● CURRENT

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[11] SCIRT, 'Value of SCIRT' (2015).
See https://scirtlearninglegacy.org.nz/the-scirt-model/value-of-scirt/

Doing the right work required access to the right data, together with an ability to interpret and analyse information. Doing the right work in the right order required coordination tools such as the National Forward Works Viewer (through which users uploaded planned work programmes to one central map that was accessible to different organisations, creating a single, authoritative repository of mapped forward works programmes) and the use of BIM for sequencing[12].

The lessons from SCIRT enabled a rapid mobilisation post the Kaikōura earthquake in 2016, and a data-led approach for the North Canterbury Transport Infrastructure Recovery alliance. Multiple digital data innovations enabled both informed stakeholder communication and engagement and work on the design and construction to continue during the COVID-19 disruption.

In the United Kingdom, BIM has been mandated for use in particular circumstances, with a view to its delivering specific, defined benefits. Those benefits have been well documented, and transformation programmes in the past decade have referenced BIM's cumulative value in relation to capabilities, efficiency, and productivity.

Through examining international experiences, we can gain valuable insights into how barriers to participation can be overcome, and how both organisations and industry can unlock the full potential of DE and BIM for holistic, multidisciplinary approaches that foster innovation, efficiency, and success for New Zealand's built environment.

TWO INTERNATIONAL EXAMPLES:

The UK's 'Gemini Principles' report[13] was published by the Centre for Digital Built Britain in December 2018. Its intention was to create alignment on an agreed approach to information management across the built environment, *as establishing agreed definitions and principles from the outset* would make it easier to share data in the future.

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The UK's Infrastructure Client Group in partnership with Institution of Civil Engineers, the World Economic Forum and the Civil Engineering Contractors Association launched Project 13 to set out *an agreed enterprise model for infrastructure delivery*. Digital Transformation is one of the Project's five pillars[14].

Learning from offshore documented in Appendix 1: Case Studies.

Alongside these lessons regarding valuing data and collaboration, it is important to recognise the pace at which enabling digital technology continues to evolve, and how commonplace technologies such as BIM and geospatial technology are today. Cloud-hosted digital engineering platforms are often the norm, and it is becoming more common to implement best practice standards, such as ISO 19650. Industry has the tools to collaborate and work digitally.

The key shift now required of organisations is to embrace the potential to adopt these technologies in their projects, and to support people and teams as they learn and implement these new skills.

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[12] National Forward Works Viewer. See https://www.forwardworks.org.nz/

[13] Centre for Digital Built Britain, 'Gemini Principles' (2022). See https://www.cdbb.cam.ac.uk/DFTG/GeminiPrinciples

[14] Project 13, 'About' (2023). See https://www.project13.info/about-project13/

D. 'DIGITAL FIRST' IS ADDING VALUE

The definition of value will always be contextual. Priorities differ between organisations, people, and projects, and the perception of value is influenced heavily by clients who invest.

At a high level, a 'digital first' approach to planning, design, construction, and operations and maintenance is important for **improving productivity**. At a national level, this means delivering better service using existing and new infrastructure, at a higher quality, and for less cost. This will help in addressing the infrastructure deficit and contribute to the transition to a more circular, sustainable, carbon-neutral economy.

For the value proposition to be compelling, outcomes need to be aligned with an organisation's key strategic and business drivers. Organisations often seek specific investment opportunities with **demonstrated value in both time and money**, especially when investment benefits and outcomes align directly with core organisational or project strategies. Investment decision-makers require incremental changes to be justified by sound business cases.

The value measures, outcomes, and enablers in the Value Table below provide a starting point for assessing value at three levels: the industry, the organisation, and the project or programme.

For example, Watercare measures the impacts, or returns on investment, of all strategic activities and investments against its 40:20:20 organisational vision: reduce infrastructure carbon by 40%; reduce cost by 20%; and gain a 20% year-on-year improvement in health and safety outcomes)[15].

40%

INFRASTRUCTURE CARBON REDUCTION

20%

COST REDUCTION

20%

GAIN YEAR-ON-YEAR IMPROVEMENT IN HEALTH AND SAFETY OUTCOMES

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40:20:20 organisational vision

15 Watercare, 'About' (2023).
See https://www.watercare.co.nz/About-us/Who-we-are/Sustainability

VALUE TABLE

VALUE MEASURE	OUTCOME	ENABLER
Organisation Level		
Reduction in the cost of information management for assets over whole-of-life	Better-performing assets Improved decision-making on assets over whole of life	High-quality, standardised, and relevant asset data Standardised asset-specification templates Automated to integrate as-built data Improved analytics
Lower cost of delivery	Levels of service improved or maintained at reduced cost	Better design and construction through digital coordination
Model (3D delivery)	Automated consenting Less rework Engaged stakeholders	Common data environment Common standards Common processes Better procurement processes
Ability to share knowledge and benchmark performance against best practice	Improved levels of service and project delivery	Standardised performance data
Risk	Reduced risks in all aspects of a project	'Digital first' approach to risk management and procurement processes
Skills	Capable workforce with relevant skills Clarity on roles and responsibilities	Formalised training plans
Project or Programme Level		
Risk reduction	Improved coordination and visibility at all stages of a project or programme Less rework	Common data environment Common standards Common processes Better procurement processes
Cost control	Visible and real-time planning and cost estimates at every phase Fair incentives and returns for all parties	Digital tools with integrated design, carbon accounting, scheduling and quantity surveying processes

VALUE TABLE

Return on Investment	All parties can see the value of appropriate investment in people, plant, digital tools, and information management	Common standards Common processes Better procurement processes
Standardised delivery	Scalability and adaptability to draw on suppliers equipped with digital capability to deliver challenging and complex work Adjacencies between industries	Developing standard object libraries Common procurement processes
Industry Level		
Productivity	More projects delivered on time for less cost	Digitised standardised processes
Pipeline certainty	Lower risk for investment by limiting the boom/bust cycle	National Forward Works Viewer Shared work programme data
Workforce capability and capacity	Highly skilled, capable, valued, and stable workforce with good retention rates and opportunities for progression	Digital Engineering Workforce Plan National training programmes at certificate, diploma, and degree levels and ongoing industry training Professional recognition of Digital Engineering capabilities
Health and safety	Zero harm	BIMSafe[16] Better design and construction through digital coordination
Consent times	Reduced cost and risk due to timely consenting processes	BIM for consenting Improved access to geospatial data and tools for planning
Reduced carbon footprint Reduced waste Improved circularity	Improved sustainability	Digital tools with integrated design, carbon accounting, scheduling, and environmental impact capabilities
Leveraging innovation across adjacent industries	Accelerated innovation through learning	Ability to leverage manufacturing insights into the built environment

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[16] BIMSafe NZ, 'Canterbury Safety Charter- Working Safely Together'.
See https://bimsafe.nz/

03

SECTION 3

A ROADMAP TO DIGITAL MATURITY

3 – A ROADMAP TO DIGITAL MATURITY

A Roadmap to digital maturity should be built on solid principles – for example, the UK's eight 'Data and Digital Principles for Project Success', which were developed by the Infrastructure Client Group and Project 13 Adopter community.[17] Practical and well considered, they can be valuable compasses for practitioners, stakeholders, and organisations in framing and developing a holistic Roadmap.

01
THE PURPOSE PRINCIPLE
Focus on achieving outcomes.

02
THE CULTURE PRINCIPLE
Put people at the heart of the digitalisation process.

03
THE COLLABORATION PRINCIPLE
Encourage collaboration using shared data.

04
THE PROCESS PRINCIPLE
Create clear, consistent processes.

05
THE VALUE PRINCIPLE
Manage information as a valuable asset.

06
THE DATA PRINCIPLE
Protect project data, ensuring its effectiveness.

07
THE SECURITY PRINCIPLE
Build security into the project from the beginning.

08
THE CHANGE PRINCIPLE
Approach digitalisation as an ongoing journey.

McKinsey and Company[18] have similarly identified several stages and principles to guide digital maturity, from defining value in the first place to launching and accelerating change and finally scaling up. 'Defining' means securing senior management commitment, setting clear yet ambitious targets, and securing investment. Accelerating means creating trial projects, creating a launch team, working in agile ways, and nurturing the digital culture. Scaling means prioritising uptake for a return on investment, building in-house capabilities, and adopting new operating models.

This section outlines a high-level Roadmap framework to support individuals and organisations starting their journeys towards digital maturity, while simultaneously increasing their participation in the broader industry ecosystem by investing in them as key enablers.

A. ROADMAP FRAMEWORK

The Roadmap framework has several dimensions, as shown in the graphical representations below — x-axis for timeframes, y-axis for thematic environments, arcing horizons for organisation size, and 'x' symbols for projects and initiatives. These are explained in this section, with the combined layers shown in Appendix 2: Roadmap Diagram.

The x-axis indicates timeframes for the digital maturity journey, from enabled to optimised, then accelerated and finally achieving a fully competitive state. The y-axis indicates the three key priority themes or environments; they are sequenced from design to bid, project delivery and asset management.

THEME ONE: Tech

Establishing a technical environment with clear baselines and data standards

THEME TWO: Contract

Developing team digital capabilities and creating a clear contractual environment with agreed scopes, clear information requirements, and procurement rules and contracts matched with the development of digital capability (people, processes, tools)

THEME THREE: Legal

Enabling the development of a legal environment with clear risk-management frameworks, ownership liabilities, and intellectual property transfer.

The environments relate to organisation size or horizons. Within these environments, horizons, timeframes, and digital maturity dimensions, it is possible to plot a series of current and planned projects and initiatives. See the multi-layered framework in Appendix 2: Roadmap Diagram.

ROADMAP STRUCTURE (AXIS)
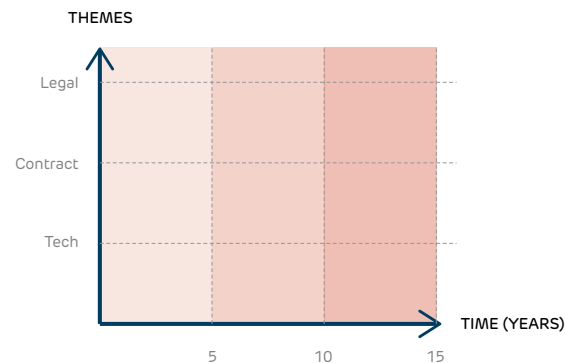
ROADMAP HORIZONS (ORG ROLES, SIZES)
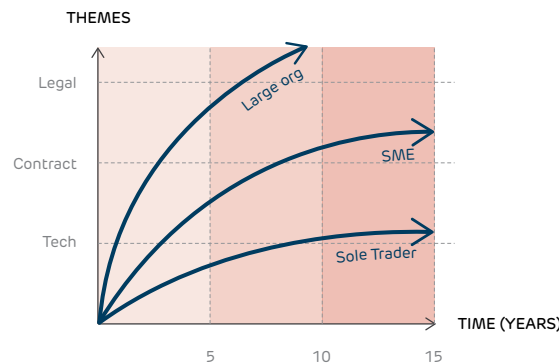
ROADMAP PROJECTS (INITIATIVES IN PROGRESS, PLANNED)

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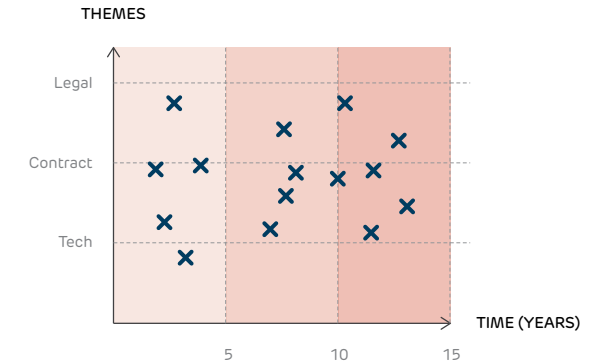
[17] Project 13, 'Data and Digital Principles for Project Success' (2023). See https://www.project13.info/library/resources/data-digital-principles-for-project-success-r64/

[18] McKinsey, 'A roadmap for a digital transformation' (2017). See https://www.mckinsey.com/industries/financial-services/our-insights/a-roadmap-for-a-digital-transformation

B. ROADMAP ACTIONS

The Roadmap framework specifies the timeframes, priority themes, and organisation sizes and roles in which to locate key projects and initiatives at various stages of completion or planning. The table below provides further detail on the key projects and initiatives, which are classified according to their intent or workstreams. It also includes focus areas, enabling actions, interdependencies, and associated roles and responsibilities.

The four general workstream areas are:

1. People Development

2. Leadership

3. Knowledge

4. Ecosystem

ROADMAP ACTIONS TABLE

(Refer Appendix 2: Roadmap Diagram)

WORKSTREAMS	FOCUS AREAS	ENABLING ACTIONS	KEY STEPS	INDUSTRY CHAMPION
People Development				
	Capability Development: Digital competency training	Maturity assessment (digital capability) and gap analysis tools for industry	Agreement on maturity model and current-state assessment	Industry level for use by organisations at each scale (individual and Small and Medium Sized Enterprises (SMEs))
		Skills development BIM Education Curriculum[19]	Maturity assessment

Standard BIM models for training | Individuals, SMEs, staff members, students, trades |
| | | Short courses: Information Management, BIM, Safety in Design with BIM, Machine Controlled Construction, Common Data Environments/ Digital Ecosystem | Tertiary and polytechnic courses

Research institutes

Suppliers/Technology service providers | Project managers, designers, trades equipment suppliers, software and technology vendors |
| | | Career pathway – professional body recognition | | NZ Institute of Building, NZ Institute of Quantity Surveyors, Association of Consulting and Engineering, Engineering NZ, NZ Institute of Architects |
| | Change Management | Communities of practice (eg. UK BIM4Groups concept) | Professional body policies

Trade representation bodies | NZ Institute of Building, NZ Institute of Quantity Surveyors, Association of Consultinging and Engineering, Engineering NZ, NZ Institute of Architects, Civil Contractors NZ, Registered Master Builders Association NZ |
| | | Leadership Academy: training business leaders in digital transformation

Asset management maturity | Government policy, Investor Confidence Rating requirements

Procurement and contracts (including maintenance and operations) | |

	Resourcing	Immigration settings		
		Cadetship/Internship programmes		
	Communication and awareness building	Stakeholder engagement		
		Communication plan (awareness building, culture of collaboration)		
Leadership				
	Industry-level leadership and strategies	Government as a client and procurement policies (for clear information requirements)	People development/ capability development	
	Client leadership to develop a culture of collaboration and trust	Business strategies (and examples of what good looks like)		
	Value Case	Proposed Roadmap for industry collaboration Areas for future investment	Construction Sector Accord with NZ Institute of Building collaboration	
	Incentives and intelligent risk transfer (for sharing model information end to end)	Insurance industry, legal and professional body engagement	Industry and Insurance Council support	
		Test different incentive models, risk transfers, and forms of contract	Information protocol	
	Measuring value	Use cases (relatable messaging)	Pilot projects Communication and awareness	
		Key performance indicator development – measuring value for SMEs		
		Industry surveys	Communication and awareness	

Knowledge (commons)				
	Industry guidance	NZ BIM Handbook and ISO 19650, Asset Management Data Standards guidance		
	Procurement and contracts	Pilot the application of the 'Information Protocol' to consultant and contractor procurement and contracts	Risk transfer model, NZ BIM Handbook, NZ Construction Industry Council Design Guidelines, NZS 3910	
		Asset owners to engage with suppliers, insurers, and construction lawyers to develop a coordinated suite of procurement and contracting guidance that aligns with the 'digital first' approach		Construction Sector Accord, Asset owners, Society of Construction Law NZ, NZ Construction Industry Council
	Policy and standards	Alignment of standards: asset management and information management (ISO 55000 and ISO 19650)	Government agency policies for the use of information to support asset management Clear information requirements across the asset lifecycle	
		Development and workflows for the use of Asset Management Data Standards (eg. Three Waters, Buildings), Geographic Information Systems, subsurface utilities		
		Digital tools with integrated design, carbon accounting, scheduling, and environmental mpact capabilities	Government agency Digital Twin vision	
Ecosystem				
	Innovation	National Digital Engineering Framework		
		Support for dedicated Innovations and R&D	Innovation Fund R&D tax incentives Callaghan Innovation	
		Digital Twin pilots	Digital Twin Partnership, industry and Government guidance	
	Investment in automation and efficiency	Technology and systems: Artificial Intelligence, Internet of Things, dashboards, automation tools and computer-controlled equipment, sensors and instruments	NZ Digital Strategy, Te Waihanga Infrastructure Commission	Equipment suppliers, software and technology vendors

C. ROADMAP ROLES AND RESPONSIBILITIES

The Roadmap framework and Actions Table set out what needs to be done. The next step is to allocate roles and responsibilities to all industry players. The responsibility for this Value Case document is allocated to responsible parties. Digital experts hope for an approximately three-yearly cycle for updating the DigiGuide, including the New Zealand BIM Handbook, with leadership from the BIMinNZ Steering Group and enablement from the NZ Institute of Building, working in collaboration.

A RACI table identifies a range of construction and infrastructure industry roles that are Responsible (R), Accountable (A), Consulted (C) and Informed (I). The RACI table in Appendix 3 is proposed as a conversation starter for industry and government to discuss 'digital first' maturity. Use the table by locating the relevant organisation type in the left-hand column then checking the resulting understanding of digital roles in the corresponding row. See Appendix 3: RACI Table.
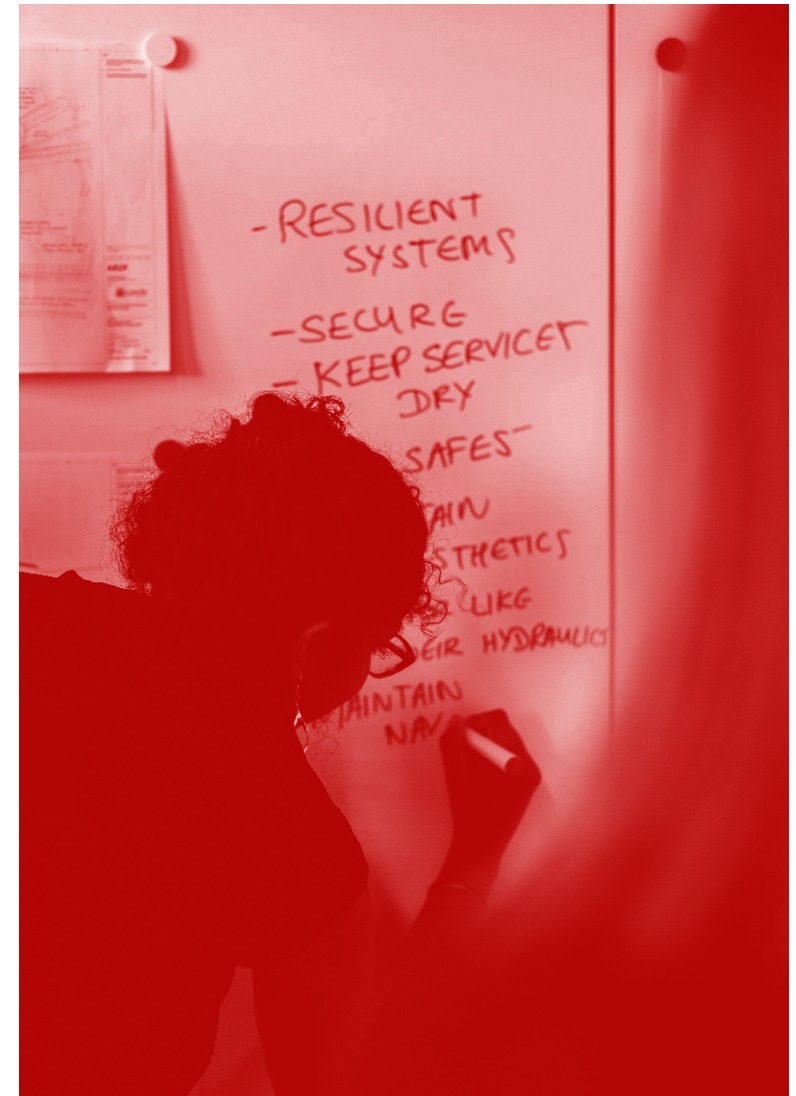
Large organisations, consultancies, and main contractors

Large organisations have a responsibility to lead, be early adopters, be visible, and share learnings with the rest of their industries. They have a part to play as visible role models to others: suppliers, clients, consultants, and to the broader ecosystem.

01
A CUSTOMER-CENTRIC APPROACH

Creating consistent practices that have clients at the heart.

02
EDUCATING CLIENTS

about creating clear requirements for suppliers and consistent guidelines for data coordination.

03
ASSET OWNERS NEED TO ENSURE...

that data outputs from construction are fit for asset management and asset maintenance needs.

04
CLEAR DIGITAL DELIVERABLES

for the end of the project to be set in contractual formats at the project inception – particularly for large construction and infrastructure projects.

05
INVESTMENT IN TRAINING ALL PARTIES DELIVERING THE PROJECT,

including partners in the supply chain for larger projects.

Specific areas to focus on include:

- Clear and agreed communication terms, expectations, and data standards.
- Improving trust in shared data by agreeing sharing methods.
- Insurance responsibilities agreed and reasonable risk transfer clarified.
- Contracts and procurement specify data requirements.
- Helping clients to be smart buyers through awareness building.
- Educating clients about the digital information they need and why.
- Requiring data investment and deliverables from partners and suppliers.
- Upholding agreed data standards on final delivery and handover.

THERE IS ALSO A RESPONSIBILITY TO FLOW THIS DOWN TO SMALLER INDUSTRY ORGANISATIONS SO THEY ARE INCENTIVISED TO INVEST IN TRAINING AND NEW TOOLS.

SMEs, consultants in design and engineering, and mid-sized contractors

Specific areas to focus on include:

- Sub-trades becoming more automated, with education to enable succession, continuity, and smooth knowledge transfer.

- Agreed data and information flow and sharing.

- Increasing the knowledge and capability of material, product, and equipment suppliers.

- Learning quickly to identify new opportunities, pilot new practices, and invest in people's digital skills and new tools where there is identified value.

- A civil contractor example could be when a traditional civil works contractor is asked by their client to use machine controls as part of delivering safely. Their digger supplier may have access to a specific technology and be able to provide the organisation with full technical support to pilot this on an agreed project. This would demonstrate immediate value through increased efficiency and safer practices.

- An architect example could be when productivity improvements are made by adopting new technology. This may result in faster turnaround times on design concepts and designs that are more understandable for clients. This could then help to improve communication, trust, and transparency, as well as make timely decisions.

Sole traders, from digital technologists to sub-contractors

Specific areas to focus on include:

- Engage with peers, suppliers, and industry groups and draw on their learnings.

- Form a cluster with other companies in the supply chain to share the costs and benefits of an improved process.

- Identify one new capability, such as a skill, tool or workflow, that can make processes more efficient.

- Invest in the key worker.

- Pilot new ways of working.

- Be targeted by innovating specific aspects and using them in the right places.

ALL ORGANISATION SIZES BENEFIT FROM PLANNING, GETTING TEAM MEMBERS ON BOARD, BEING ADAPTABLE, AND STAYING FOCUSED ON THE DIGITAL MATURITY FRAMEWORK.

04

SECTION 4

THE VALUE CASE FOR 'DIGITAL FIRST' HAS BEEN MADE. WHAT HAPPENS NEXT?

4 – WHAT HAPPENS NEXT?

The Value Case for 'digital first' is laid out. The BIM Handbook has been updated. There is more coming in the DigiGuide suite to create further digital guidance for Aotearoa New Zealand's built environment sector. **There are opportunities to be involved.**

As members of the construction and infrastructure industry, everyone has a critical role to play in making the 'digital first' change in culture. **We are all part of the solution.**

This Value Case provides a common language for a 'digital first' approach that enables and empowers clients, practitioners, contractors, and suppliers to take actions that will deliver value. The Roadmap framework and suggested actions, roles, and responsibilities are put forward for wider industry discussions, decisions, and prioritisation. The Roadmap is where we plot the great work that is either currently underway or planned for. **Together, we map the future.**

The Accord and collaborators are interested in receiving feedback on the Roadmap framework, and to finetune the next phase of work to the needs of the sector. We know there is more mahi to do to create trust and move forward together. **This will require a joint effort from all of us. Please contact the collaborators directly via info@nziob.co.nz.**

> **'DIGITAL FIRST' MEANS MOVING AWAY FROM AD-HOC AND ANALOGUE INFORMATION FLOWS TO COLLABORATIVE DIGITALLY IMPLEMENTED PRACTICES.**

FUTURE PROJECTS AND INITIATIVES

The digital landscape continues to change. At the time of writing, there were associations putting out their digital position papers, large organisations creating their digital strategies, and coordination across government and industry to create better digital alignment.

The three key entities leading this document have the following in their sights:

CONSTRUCTION SECTOR ACCORD:

- Digital Twin and ecosystem mapping across government to clarify responsibilities and test for a common vision.

- Digital asset owners and client groups across government brought together to agree and action procurement recommendations.

BIMINNZ STEERING GROUP:

- BIM Handbook updates and awareness raising to increase understanding across the industry.

- Regional communities to support the uptake of BIM around the country.

- Subject matter expertise towards presentation and discussion topics for the two-yearly DigiCom conference hosted by the Institute of Building.

NZ INSTITUTE OF BUILDING:

- Strategic focus on innovation (including digital), and encouragement and inclusion of next-generation members into life-long participation in the Institute.

- Hosting digital conversations across the industry, such as the DigiHui group, with representatives of BIM and digital-focused committees, to explore ongoing 'digital first' initiatives, including agreed clarified procurement guidance.

- Delivering the 'DigiCom: building a digital community' conference two-yearly (on odd years) alongside the BIMinNZ Steering Group as subject matter experts.

- Developing the 'BuildUP: building productivity, people and performance' conference biannually (even years), focusing on sharing lessons in productivity through 'digital first'.

Infrastructure NZ is the industry association for infrastructure organisations. Its 2023 'Digital Position Paper'[20] recommends these three next steps:

- The New Zealand Government **Procurement Rules** for infrastructure include a requirement to return data to client agencies at the end of project delivery and to ring-fence ongoing operating expenditure to procure software to access the data. Capability in government agencies will need to improve if this data is to be used effectively.

- The ongoing development of **metadata standards** for infrastructure is properly resourced and implemented.

- Clear **governance arrangements** are established, with Te Waihanga in a coordinating role, to champion the collaboration required between the public and private sectors.

In New Zealand there are many opportunities that we should be exploring as springboards for digital innovation. Here is a list of proposed further research and development:

1. **Digital Twin –** Leveraging the work in the UK and Australia to look at how New Zealand can move towards a coordinated approach and a clear role for Digital Twins.

2. **Raising awareness** of the work being done by SMEs to adopt a 'digital first' approach, and the value it is bringing to those businesses.

3. **Tracing pilot projects** and initiatives on major projects – cyclone recovery, transportation projects, and commercial building projects.

4. **Digital assets –** Creating standard guidance for digital asset handover.

5. **Digital consenting –** Leveraging the work done by the Ministry of Business, Innovation and Employment and BRANZ and looking to a future state of digital building consenting and compliance practices.

6. **Digital Transformation Plan –** Clarify key performance indicators and timeframes linked back to the Construction Sector Accord's 'Industry Transformation Plan'[21].

7. **Digital Champions –** Create industry Digital Champions to lead in specific areas, such as water, roading, and infrastructure, that represent 'digital first' and BIM progression in these areas.[22]

8. **Contract documentation terms and procurement processes –** Undertake a cross-disciplinary review of the ways that risk management can be allocated intelligently and equitably between contracting parties. Assess the commercial models that provide corresponding incentives for managing risks. The goal is to further encourage a sharing of digital information and break down siloes.[23]

9. **Leveraging the health and safety benefits being identified in the BIMSafe project.**

10. **Create a digital leaders academy –** This would be for all levels of leadership, from the technician to the executive, and build on the pockets of excellence exemplified by the BIMinNZ community.[24]

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20 Infrastructure NZ, 'Position Paper: Digital' (2023). See https://infrastructure.org.nz/wp-content/uploads/2023/08/Infrastructure-NZ-Policy-Postions-Digital.pdf

21 Construction Sector Accord, 'Transformation Plan' (2022). See https://www.constructionaccord.nz/transformation-plan/

22 See https://ukbimalliance.co.uk/communities

23 See https://www.heskethhenry.co.nz/insights-opinion/how-to-load-a-magic-bullet-legal-considerations-to-facilitate-bim-building-information-modelling

24 BIMSafe NZ, 'Canterbury Safety Charter – Working Safely Together'. See https://bimsafe.nz