

## Models for the construction sector

The construction sector can be viewed from different perspectives and the following three approaches are based on the management of projects; the players and their interactions in projects; and a quantifiable model, capable of identifying capacity and capability of the sector. Each is presented in summary terms, with minimal explanation.

Each of these models can be further customized and expanded depending on the specific needs of a project or organization taking part in projects, to varying degrees of sophistication.

### Project management model

#### Project Initiation:

- Define project objectives and scope.
- Conduct a feasibility study and site assessment.
- Establish a project team and assign roles and responsibilities.
- Secure necessary permits and approvals.

#### Planning and Design:

- Develop a detailed project plan, including a timeline and budget.
- Collaborate with architects, engineers, and designers to create construction drawings and specifications.
- Procure materials and equipment.
- Identify and assess potential risks.

#### Resource Allocation:

- Allocate labour, equipment, and materials based on the project plan.
- Ensure compliance with safety regulations and quality standards.
- Monitor resource utilization and adjust, as necessary.

#### Construction Execution:

- Begin construction work according to the project schedule.
- Supervise the workforce and subcontractors.
- Implement quality control measures and conduct inspections.
- Monitor progress and make necessary adjustments.

#### Cost Management:

- Track project expenses and compare them to the budget.
- Identify cost-saving opportunities and control expenditures.
- Manage change orders and variations.

#### Risk Management:

- Continuously assess and mitigate project risks.
- Implement safety protocols and emergency response plans.
- Monitor environmental impact and compliance.

#### Communication and Reporting:

- Maintain regular communication with stakeholders, including clients, contractors, and regulatory authorities.
- Provide progress reports and updates on key performance indicators.
- Address any issues or concerns promptly.

#### Quality Assurance and Control:

- Conduct regular inspections and quality assurance checks.
- Ensure compliance with building codes and industry standards.
- Implement corrective actions when necessary.

#### Project Closeout:

- Complete all construction activities and inspections.
- Conduct a final walkthrough and ensure client satisfaction.
- Hand over the project to the client, including all relevant documentation and warranties.
- Perform a post-project evaluation to capture lessons learned.

#### Post-Construction Services:

- Provide maintenance and support services if required.
- Address any warranty claims or defects promptly.
- Maintain a long-term relationship with the client.

#### Continuous Improvement:

- Analyse project data and performance metrics.
- Identify areas for improvement in future projects.
- Adapt and refine the construction management model based on lessons learned.

## Players and interactions model

The construction sector involves a complex network of players who interact throughout the lifecycle of a construction project. The following description identifies players and interactions, emphasizing the collaborative nature of construction projects. The need for effective communication and coordination among stakeholders should be obvious to the reader:

### Client/Owner:

- Initiates the construction project.
- Defines project requirements, objectives, and budget.
- Engages with other stakeholders to select a project delivery method (e.g., design-bid-build, design-build, construction management).
- Approves project milestones and payments.

### Design Professionals:

- Architects, engineers, and designers responsible for creating project plans and specifications.
- Collaborate with the client to understand their needs.
- Develop detailed drawings and design documents.
- Coordinate with regulatory bodies for permits and approvals.

### Contractors:

- Construction firms responsible for executing the project.
- Prepare bids and proposals in response to client's requirements.
- Manage construction activities, labour, equipment, and subcontractors.
- Ensure project is completed on time, on budget, and in compliance with specifications.

### Subcontractors:

- Specialized tradespeople and firms hired by the main contractor to perform specific tasks (e.g., electrical work, plumbing, HVAC).
- Work under the direction of the contractor.
- Deliver their expertise within the project timeline.

### Suppliers and Manufacturers:

- Provide construction materials, equipment, and supplies.
- Deliver products on time and ensure quality.
- Collaborate with contractors to meet project specifications.

### Regulatory Authorities and Inspectors:

- Enforce building codes, zoning regulations, and safety standards.
- Conduct inspections to ensure compliance.
- Issue permits and approvals.

#### Project Managers and Construction Managers:

- Oversee day-to-day operations.
- Monitor progress and budget.
- Coordinate communication among stakeholders.
- Mitigate risks and solve issues that arise during construction.

#### Financial Institutions and Investors:

- Provide financing for the project.
- Assess the feasibility and financial viability of the project.
- Monitor project progress and financial performance.

#### Legal and Insurance Professionals:

- Provide legal counsel, contracts, and dispute resolution services.
- Ensure compliance with legal requirements.
- Arrange insurance coverage for the project.

#### Consultants and Advisors:

- Offer specialized expertise (e.g., sustainability, LEED certification, cost estimation).
- Assist in decision-making and risk analysis.
- Provide recommendations for optimizing the project.

#### Community and Public:

- Residents and businesses affected by the project.
- May have concerns about noise, traffic, and environmental impact.
- Engage in public consultations and outreach efforts.

#### Technology Providers:

- Supply construction management software, BIM (Building Information Modelling) tools, and other technology solutions.
- Enhance project planning, communication, and data management.

#### Interactions:

- Clients interact with design professionals to convey their vision and expectations.
- Design professionals collaborate with contractors to ensure design feasibility.
- Contractors and subcontractors work together to execute construction tasks.
- Suppliers and manufacturers provide materials and equipment to contractors and subcontractors.
- Regulatory authorities steer designers, issue permits to owners and contractors, conduct inspections, and maintain records.
- Project managers and construction managers coordinate activities and report to clients.
- Financial institutions monitor project financials and disburse funds.

- Legal and insurance professionals deal with contractual and legal matters.
- Consultants offer advice and expertise to various stakeholders.
- The community may engage in public meetings and consultations.
- Technology providers support efficient project management.

## CanConstructNZ quantifiable model

CanConstructNZ is multi-party research and development programme, led by Massey University School of built environment, to establish a tool for reliable views of sector workload streams and the capacity and capability of the sector to deliver against them.

It will gather supply and demand information, incorporating shocks and stresses uncertainties, able to make demand and supply information and predictions for a variety of users.

To enable the comparator mechanism to work, a functional, quantifiable model of the sector is needed. The model described is work in progress in November 2023, to be reviewed and progressively refined by research, interviews of practitioners and data sourcing.

Note this model is for the New Zealand sector, within a national population of some 5,000,000 people, and a GDP of the order of NZD225B and a sector turnover of about NZD45B. The sector has limited access to external resources, which are ignored pending research.

### Sector framework

- Organisations in the sector are grouped into four tiers, defined by bands of annual turnover, differing for vertical and horizontal construction.
- The number of organisations in each tier are assumed, ditto.
- The turnover within each tier is split between in-house and that subcontracted to others, the total of which is the sector turnover. Work sub-contracting to others is ignored to avoid double counting of values.
- Differing splits are assumed for each tier and for vertical and horizontal construction.
- Assumptions made for each of the preceding leads to an estimate of turnover of the sector and numbers of employees that is of similar order StatsNZ publications. That is, we have the right order of estimation within the model, to be confirmed by research.

### Additional identifiers

Additional identifiers are needed to describe individual organisations within the sector, to allow summing for specific demand/supply queries:

#### Sector organisations

- Unique identifier, preventing duplication of data (created and maintained within CanConstructNZ).
- Location by LG region, for geographic analysis and comparisons of demand and supply.

- Specialisation from one or more of the following assumed categories: Civil, Commercial, Environmental, Housing, Industrial, Institutional, Utilities.
- Role, one or more of: Investigation, Design, Advice, Management, Supply, Construction, Maintenance.
- The range of deployment is assumed as Tier 1 nation-wide, Tier 2 North of North Island, or South of North Island or South Island, Tier 3 cover 5 adjacent LG regions, and Tier 4 works within its LG region.

#### Capacity

- It is assumed that all organisations are currently fully employed with no capacity to take on more work. However as current work is completed more can be absorbed to replace it, from 20% of current turnover in 6 months to 100% in 6 years, for all organisations, with current resources. This will be reviewed with research findings.
- In addition to the preceding it recognised that some excess capacity may be achievable from up-sizing within two years, varying from: none for one third of organisations, to some (20% more) for one third, to significant (40% more) for the remaining third. This is assumed to apply equally to all tiers pending research findings.
- Downsizing is not covered within organisations but covered by shocks and stresses.
- The project pipeline is assumed based on construction cost, whereas the sector is assumed to be split related to construction as: Investigation 5%, Design 15%, Advice 2%, Management 5%, Supply (20% of construction), Construction 100%, Maintenance 10%.

#### Secondary identifiers

- Experience of organisations is assumed equal, pending research based on acceptable (<3 years established), moderate (3-6 years), or very experienced (>6years).
- Reputation is assumed equal, pending research to confirm satisfactory (<2 references/annum), good (2-5/annum), or very good (>5/annum).
- Bidding success is assumed equal at 1 in 5, pending research based on poor 1 in 12, satisfactory 1 in 8, good 1 in 4.
- Hunger for new work is assumed equal to excess capacity, subject to research on none, some or high.