



**NZ** CONSTRUCTION  
INDUSTRY COUNCIL **CIC**

# **CONSTRUCTION INDUSTRY COUNCIL**

# **RESEARCH AGENDA**

# FOREWORD

The Construction Industry Council, which represents 30 national organisations in the sector in New Zealand, has formulated this 'Research Agenda', and will keep it under regular review. The agenda proposes cooperative and consistent activities which blend the wants of consumers with the offerings of the industry and the needs of Government, and has a goal of making the performance of New Zealand's built environment the envy of the world by 2025.

New Zealand's social, environmental and economic well-being rely on an effective construction industry and an efficient infrastructure – buildings, roads, water, electricity and the like. National investment across the whole infrastructure sector in new work in 2005-6 has been estimated at around \$15 billion. The expenditure on operating costs of buildings alone – maintenance, water, energy, etc – has been estimated at \$8.5 billion per year.

Every New Zealander benefits from this infrastructure. It is the buildings and spaces in which every one of us lives, works and plays, and it creates for us the sense of 'home'. Whether we have a knowledge-based economy or a primary-products-based economy, our economic future as a nation depends on having an efficient built infrastructure to house workers and to create the path for delivery to market. Our built infrastructure is significantly affected by the natural environment in which it stands, and has the capacity to impact negatively on the natural environment if we allow it to.

Each of these 'triple bottom line' components – economic, social and environmental - needs new knowledge to help us address the creation of a better built environment. The national investment in research and development in the sector – both by Government and by the private sector – is low by international standards, and even where the relevant knowledge is available, we need to ensure that it is reaching the people who need it if we are to deliver this better built environment.

Our Council has stepped back from simply trying to list projects that need research, to provide a coherent industry view of the wide spectrum of new knowledge needs, and of the needs for knowledge transfer. We look forward to engaging further with the industry, with Government, and with the research community in pursuing the issues we have identified.

John Pfahlert  
Chair, Construction Industry Council

May 2006

# Construction Industry Council

## Research Agenda

### Introduction

The construction industry is a vitally important industry in New Zealand. Buildings make up a large proportion of the total capital stock of the nation, and the minimum normal design building lifetime of fifty years specified in the New Zealand Building Code means that any poor feature of the building will impact over many decades. Estimates vary, but the value of new work put in place each year in the built environment is about 10% of GDP. The capital value of New Zealand's existing built environment is approximately \$240 billion. Maintenance spend on buildings is estimated at \$4 billion p.a. Costs of electricity, water and waste in the built environment are estimated at \$4.5 billion p.a.

For the New Zealand economy to perform, and the social and environmental goals of New Zealand to be achieved, it is vital that construction-related activities are carried out to a good standard, and use the best available technologies, materials and techniques. If a building is not built for purpose or is built to substandard levels, the inefficiencies of that building are likely to create unnecessary costs to the subsequent owners, the non-owners (neighbours, community, etc) and the environment (excess use of energy, unhealthy living conditions, problematic materials e.g. asbestos, etc).

According to a BERL report commissioned by Building Research, a 10% increase in efficiency in the building practices, processes and products can raise GDP by 1%. Over the lifetime of the built structure efficiencies obtained can contribute to increased wealth, health and quality of life for the occupants and to significant benefits to New Zealand.

The organisation of the industry provides particular challenges. The building owners provide the capital for construction, and very little capital is held by those organisations providing technical services. Architects, professional engineers, and even construction companies have an annual financial turnover many times their physical capital base. The very large majority of the organisations are small to medium enterprises.

The nature of the way in which their services are purchased by relatively uninformed owners means that there is little premium possible in prices to fund R&D. Many private owners purchase services relatively infrequently and have no interest in the long term viability of the industry whose services they wish to purchase. Those owners who do purchase services regularly (developers) intend to sell the buildings as quickly as possible and, for different reasons, have an interest in building up capability of the sector and its innovation only if it lowers the initial building costs. This means that most of the organisations providing services are poorly structured to accumulate sufficient financial capital to invest in research, nor do they have R&D infrastructure.

Further, the ownership structure means that there is continuing pressure on service providers to reduce construction costs, and in such cases the difference between worthwhile innovation and a 'cheap and dirty' job is not always clear. When it may take several years for a durability problem resulting from an apparent innovation to become evident, and the person who made the critical decision has long ago sold out their interest, there is potential for problems.

There is a view that the sector is large and relatively mature. The reality, exposed since the 1991 Building Act required a performance-based regime to be implemented, is that the sector suffers from lack of skills as well as the barriers to performing research and development set out above. A general survey amongst sector leaders shows acceptance that the supply-side built environment practices, products and systems would benefit from greater rigour and that if the demand side - the community and consumer - was better informed the whole country would benefit from a better built environment.

However, the approach to research and development in and for the construction sector needs to be completely differently framed from that for other apparently similarly-fragmented sectors of the economy (such as farming or manufacturing) because of the different ownership structure, and the fact that many facets of a building are defined at time of construction and persist almost unchangeable through many decades of building life.

## **Critical Issues**

The Council vision is that the built environment will contribute to a quality of life for all New Zealanders that is the envy of the world. After extensive discussion with senior industry personnel (for more information, see Appendix 1) and a workshop (see Appendix 2), the Council (CIC) has identified five key factors that impact on the built environment, and in which research is needed to address the present and emerging issues.

These are:-

1. **Building Code and Legislation/Regulation**, which relates to:-
  - Regulations (certification, licensing, environmental friendly products and processes)
  - Public policy
  - Environment

Research informing the Building Code and the legislative/regulatory environment has a high public good component. We noted above that ownership is very often short relative to a building's useful life, and there is a major public good in ensuring that the rights of future property owners are protected. Performance based regulation needs higher levels of knowledge and understanding to underpin it than prescriptive regulation, and so the choice by Parliament to retain a performance-based Building Act in 2004 also brings a public obligation to ensure that sufficient research is undertaken to make that regime effective.

2. **Information**, which relates to:-
  - Consumer awareness and ease of access to information
  - Greater emphasis on education at all levels (includes industry, government regulatory bodies, government policy)

The sector is characterised by consumers holding little relevant knowledge to assist them to make wise decisions on what, for the private purchaser, is usually their largest purchase decisions in their lives. There is a need to ensure that purchasers and owners can both access and comprehend knowledge necessary for informed decision making.

3. **Efficiency Gains**, which relates to:-
  - Skills, capacity and capability within the sector
  - Innovation and uptake of proven technology
  - Improved procurement practices
  - Using international best practice and learning in New Zealand

Efficiency gains through innovation in the sector are important. There is anecdotal evidence that our industry has poorer productivity than Australia and other countries. This represents a long term issue, and highlights both skill shortages, and a lack of capability in the sector to take up and use innovation.

4. **Products and Services**, which relate to:-
  - Products and processes are fit for purpose and are sustainable

Innovation in products and services also presents a challenge. Approval of these is necessarily sought prior to their long term use, so predicting, for instance, any durability issues in New Zealand conditions is a vitally important need. Accelerated testing and evaluation prior to approval and roll-out is an important need.

5. **Public Good Practice**, which relate to:-
  - Urban design
  - Sustainability
  - Affordability
  - Care for the environment
  - Health and wellbeing

In addition to these aspects that impact mainly on the day to day activity of construction there are wider issues of public good practice – ensuring that the building contributes positively socially and environmentally.

For the reasons given above, this list is different from the type of list that might be developed for other industry sectors. In tackling these issues, CIC seeks an integrated approach between government agencies, the industry, R&D and the community.

The structure of the industry and its own limited ability to fund research was recognised through the passing of the Building Research Levy Act in 1969. This draws a research fund from the many small to medium enterprises, by requiring all builders entering contracts of more than \$20,000 to pay 0.1% of the contract value to this fund. Under the control of an industry-nominated Board, this fund can be applied to a wide range of scientific and technical work in connection with the sector. In addition there is public funding, where public goods are at risk, and there can be direct private investment.

Areas 1, 2 and 5 above are primarily driven by public good, and protecting the rights of future building owners and users. Area 3 benefits building owners as they benefit from efficiency gains, but the industry itself (service providing organisations) has a responsibility to contribute. Area 4 is primarily the responsibility of the promoter of a new product – they must meet the full costs of getting to market.

## **Responsibilities and Actions of Government**

The public policy actions from which the government can draw include:-

- a. Clarifying the planning environment rules and minimum standards to be imposed in the market in which buildings are traded and construction services purchased
- b. Education; investing in developing skills and capability
- c. Requiring information to be compulsorily available to the consumer when decisions are to be made, to assist cost/benefit analysis, in recognition that without that information the consumer may easily make poor decisions either for him/herself or affecting either building users or future building owners
- d. Regulating to ensure minimum standards which are satisfactory for meeting New Zealand's long term building needs are attained
- e. Changing inappropriate old behaviours by using incentives and targeted information to encourage the emergence of good practices that may exceed the minimum mandated standards

## **Responsibilities and Actions of the Private Sector**

The types of actions that the private sector organisations in the sector can reasonably be expected to undertake include:-

- Committing to meeting the full costs of testing of new products prior to product certification
- Working in partnership with the regulator to create a culture of producing quality outcomes that meet the requirements of current and future owners
- Driving for efficiency gains (but not at the expense of quality)
- Undertaking their own research and development, to the extent possible, seeking innovative products, processes and services
- Supporting more sustainable building practices

## **Desired Outcomes of R&D-Related Activity**

Outcomes required from R&D-related activity are:-

- a. The existence of an ongoing research and development programme, particularly drawing on unique properties of New Zealand materials to ensure a flow of innovative products, processes and systems for the sector

- b. The ongoing provision of high quality information to regulators so that the New Zealand Building Code and associated regulation is of a high standard and fit for purpose
- c. Technology transfer programmes to ensure that the outputs from R&D are transferred to the industry, government, community and consumer in a user friendly manner
- d. Educational programmes to introduce international best practices to the sector
- e. The development of forward looking thought leadership in industry leaders

## **A Potential Mapping Of Primary Funding Responsibilities**

To re-cap, CIC has identified five critical headline issues:-

1. Building Code and Legislation/Regulation
2. Information
3. Efficiency Gains
4. Products and Services
5. Public Good Practice

The following might be regarded as the key stakeholder responsibilities in ensuring that the new knowledge which is needed is generated and effectively disseminated:-

- Department of Building and Housing – operational research to meet the needs in Areas 1 and 2
- Foundation for Research, Science and Technology – research to inform Area 5, but also basic research underpinning Area 3
- Technology New Zealand – supporting R&D in Areas 3 and 4
- Tertiary Education Commission – recognising the needs of the sector, working with all kinds of tertiary organisation to ensure that people with the right skills are produced, from PhD to trades, and that the nature of construction-related research is well-understood, for example at PBRF Panels
- Building Research – ensuring that the industry research levy is well applied in Areas 2 and 3, and to underpin Area 4. The industry, through the levy then supports Area 3, and product suppliers take on the costs of Area 4

## **Conclusion**

Because of the transient nature of building ownership, legislation needs to establish the platform for good practices in the construction sector. The two critical factors toward a better built environment are sound legislation and investment in skills and capability that would set minimum standards for the sector. Progress on these issues is the responsibility of the government with strong support from industry, research and consumer organisations.

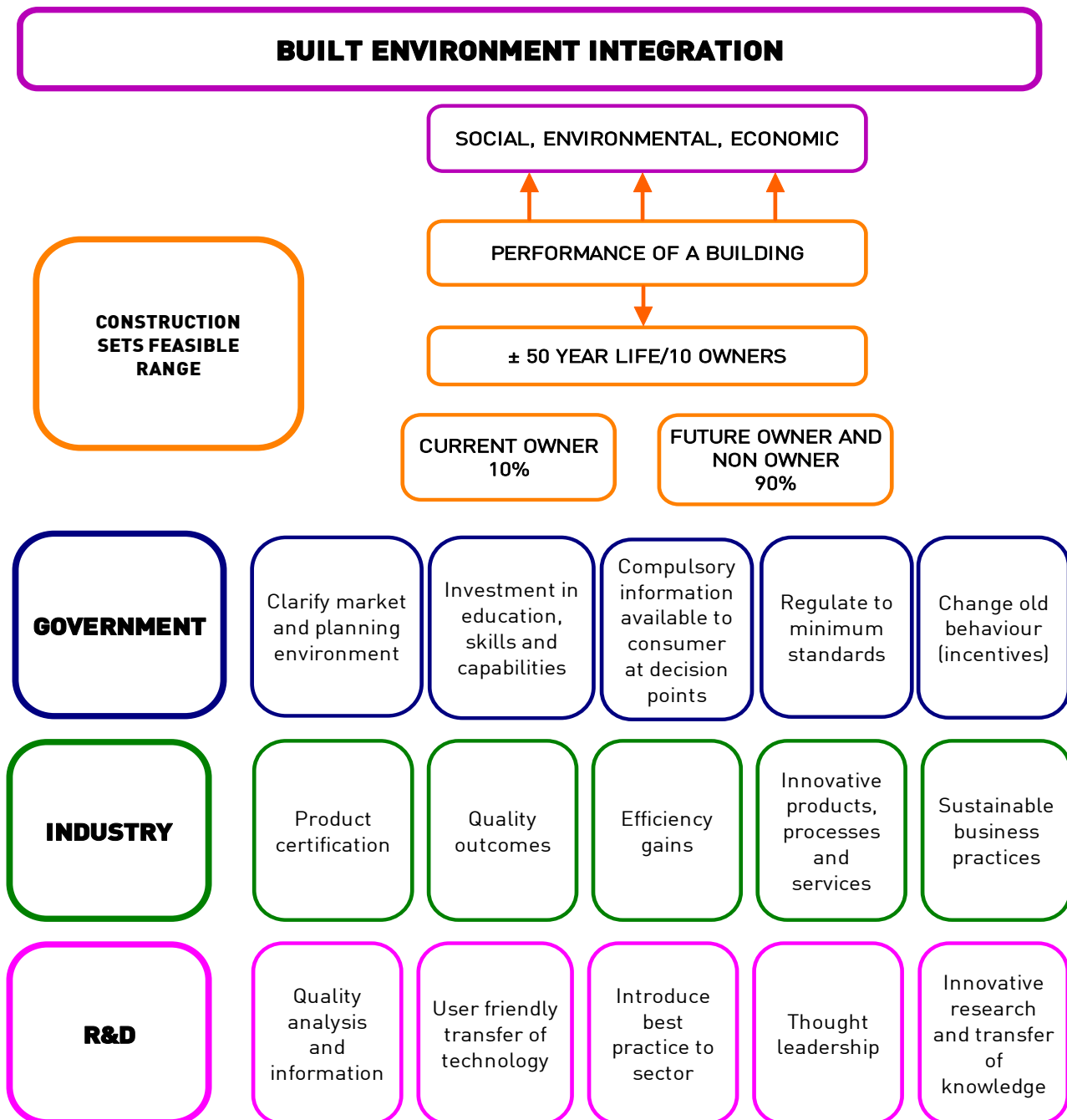
Appropriate legislation written with support from industry, education and research will lead to certification of materials, licensing of building practitioners, assurances that the consumer can be adequately informed, and assurance that innovative products, processes and systems are well developed prior to commercialisation.

Skills and capability shortages are seen as a serious threat to the sector in the medium term.

This Construction Industry Council Research Agenda is focussed toward:-

- Supporting government initiatives for sound legislation,
- Encouraging significant investments in skills and capability
- Strongly encouraging best practices
- Working toward an environmentally friendly, sustainable built environment that delivers quality of life to New Zealanders

*Sunil Vather, Andrew Cleland, Pieter Burghout, John Pfahlert,  
Cameron Bennett, John Duncan*



## APPENDIX 1:

### Industry Priorities

Building Research carried out a 'future scan' exercise with leaders in the sector in 2005. The highest priorities (in approximate rating order, from a full list of 24 headings) which this scan indicated needing to be addressed were:

ISSUE	OUTCOME OF SUCCESSFUL INTERVENTION
Low industry skills and capacity in times of rapid and far reaching changes	The New Zealand Construction Sector has a well trained and qualified workforce which meets its needs and those of its customers
Consumer Education	New Zealand building owners and tenants are well informed about buildings in terms of their desirable key technical features and building operation and maintenance
Post earthquake or post flood performance of buildings	After a major incident the existing building stock is safe and serviceable enough to provide immediate shelter to the affected population
Sustained profitability	The New Zealand construction sector is prosperous and enjoying a predictable domestic market as well as exporting building products, buildings and expertise world wide
Safety and health in houses	New New Zealand houses do not contain materials or features likely to harm their occupants, and refurbishment of existing houses also reflects this
Resistance to innovation ('only Acceptable Solutions will do')	Building officials and Building Consent Authorities generally are well educated, trained and well resourced
Structural Integrity / Durability	Customers have complete confidence in the industry's products
Building procurement	The industry and its customers work together in a cooperative professional manner to produce the buildings that the customers want
Energy use and efficiency	Energy use in New Zealand buildings is understood in both residential and non-residential construction. Building energy savings and energy efficiency are at least meeting the NEECS goals
Management and maintenance of the existing housing stock	Existing housing stock complies with the NZBC at least in terms of energy efficiency and water efficiency
Building process management	The industry and its customers work together in a cooperative professional manner to produce the buildings that the customers want
Water use and efficiency	Water use in New Zealand buildings is understood for both residential and non-residential construction. Water reuse/recycling is understood and being implemented
Safety on site	Construction site safety is an integral part of building design and site management

## APPENDIX 2:

### Potential Themes For Research In The Sector

In mid-2005, CIC and Building Research engaged a consultant to advise, from an external viewpoint, on the ideal research themes that the industry needed. His report suggested three high-level themes:

- **The Interface Between The Industry And Society**

How can existing and new knowledge be translated into the purchase of better products? The industry often already has the knowledge to produce better products than it currently does, such as low-energy buildings, roads that require less maintenance, etc. But the dynamics of the market and the industry structure are such that these goods are rarely supplied (or sought?). Can the structural barriers causing this be identified? Would it be possible through a combination of means, including education and regulation, to improve the situation?

What is the impact of society upon the activities and capabilities of the industry - the impacts of boom/bust cycles, legislative change, changing demographics? While it can be argued that this is about economics rather than science and technology, the current situation nevertheless provides a barrier to the uptake of new knowledge. For example, there is adequate knowledge within the sector to solve many of today's problems, but for various reasons it does not get applied.

- **Industry Efficiency And Effectiveness**

The BERL report estimated that 10% improvement in efficiency across the sector delivers a 1% increase in GDP, or over \$1 billion, creates an additional 1.4% of exports, costs 0.5% additional imports and lead to a drop of 1.6% in consumer prices. Whilst there is minimal definitive research, it is not unreasonable to assert that the industry is inefficient and ineffective because:-

- It works in an environment of conflict rather than collaboration
- The industry is structured such that the traditional divide of design and construction, together with the hierarchy of sub-contractors and suppliers, means that much knowledge on how to produce better products more efficiently is buried in the supply chain and not tapped into

There is a growing body of evidence, both internationally and within New Zealand that if such issues are addressed it is possible to produce better products, with greater efficiency.

- **Better Products**

How can science and technology help produce more cost-effective, beneficial and trusted products? Such products:-

- Are cost-effective over the product life cycle
- Support sustainability (energy-efficient, reduce the depletion or degradation of natural resources, can be recycled, enhance health and well-being of individuals and communities)
- Are trusted by users, through reputation, ratings or appropriate certification
- Provide flexibility with respect to changing demographics, ageing populations, climate change, rental/ownership trends, maintenance, etc.