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Skills and competencies for sustainable construction: Perspectives of architects and designers

Amy Knight, Casimir MacGregor and Orin Lockyer

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Disclaimer

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Authors

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Abstract

This report examines the skills and competencies architects and designers need to support sustainable construction. It is part of a broader research initiative aimed at accelerating workforce development for sustainable building practices in Aotearoa New Zealand. The study combines qualitative interviews with more than 60 industry professionals and a nationwide survey of 308 construction sector workers. Findings highlight gaps in zero-carbon knowledge, particularly in embodied carbon, life cycle assessments and sustainable material selection. Architects and designers recognise the need for better training, regulatory support and collaboration across disciplines. The report calls for improved education programmes, stronger policy frameworks and industry-wide efforts to integrate sustainability principles into everyday practice. Architects and designers see themselves as key influencers in driving change but emphasise that government regulations, client demand and education providers also play crucial roles. Lessons from international best practice underscore the need for Aotearoa New Zealand to adopt more comprehensive sustainability policies and training initiatives to meet its climate goals.

Keywords

Zero carbon, sustainability, skills, practices, training, technical education, vocational education.

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Key insights

- Knowledge and practices of sustainable construction, especially zero carbon, need to be improved across the workforce.
- Architects and designers see building knowledge and awareness for zero-carbon design and construction such as understanding key concepts as essential for the workforce.
- Architects and designers emphasised the need for better tools and guidance to support the design and construction of high-performance buildings.
- Architects and designers believe that better integration and collaboration between disciplines, especially design and construction teams, is essential.
- Architects and designers understand they are key agents of change to help advance sustainable construction and that a unified approach by all construction stakeholders, especially clients, is important. There was also a strong consensus that regulations are required to mandate sustainable construction.
- Our research demonstrates the importance of comprehensive education and training programmes, robust regulatory frameworks and strong leadership to drive sustainable practices. By fostering collaboration and integrating sustainability, especially zero-carbon principles across all disciplines, the building and construction industry can effectively contribute to the nation's climate goals and ensure a sustainable future.

Access the core competencies and learning outcomes and a climate action checklist for architects and designers in *Skills and competencies for sustainable construction: The role of architects and designers* at www.branz.co.nz/environment-zero-carbon-research.

1. Introduction

This report outlines research from *The Future of Work: Accelerating skills development for zero-carbon construction*, a project funded by the Building Research Levy and ConCOVE Tūhura and led by BRANZ as part of the *Transition to a zero-carbon built environment* research programme. The aim of this project is to provide the construction sector with the necessary resources, knowledge, skills and competencies to make effective zero-carbon decisions and accelerate skills development for sustainable construction.

The report concentrates on the skills and competencies required for sustainable construction from the perspectives of architects and designers. Throughout this report, the term 'sustainable construction' is used to encompass the process of designing and building zero-carbon and environmentally friendly buildings. While some in the construction sector interpret 'zero carbon' as solely reducing carbon emissions, this report also delves into the broader skills and competencies involved in the entire building life cycle.

This report outlines the challenges and opportunities for developing skills and competencies for sustainable design, especially addressing the knowledge and practices to reduce greenhouse gas emissions from construction. The research outlined in this report underscores the importance of knowledge, practical tools and collaboration, while also highlighting the complexities of these skills and competencies and the need for better integration of sustainability and zero-carbon design across disciplines. To support the change that is needed, the emphasis needs to be on creating environments where collaboration and communication are key attributes. Furthermore, we highlight that greater leadership is needed from government and the sector for improved regulation and skills standards that promote sustainability and decarbonisation within construction in order to help drive change in the sector.

1.1 Research aims

The Future of Work research project focuses on three key questions:

- What expertise (knowledge, skills and competencies) is required to deliver zero-carbon buildings throughout their life cycle?
- Does the building and construction industry currently possess the necessary expertise to deliver zero-carbon buildings? If not, what are the barriers to developing and deploying this expertise across the industry?
- How should this expertise be provided to ensure effective implementation?

2. Methodology

2.1 Interviews

We conducted qualitative semi-structured interviews with more than 60 architects, designers, builders and representatives from professional organisations. Our participants represented a diverse range of construction trades and levels of experience – from apprentices to sector leaders in sustainability.

The key interview questions focused on:

- understanding each participant's skills, training and experience
- gathering views on who holds responsibility for sustainable construction projects
- assessing participants' knowledge of zero-carbon practices within the construction process
- exploring participants' experiences with projects aimed at reducing carbon emissions
- critically reviewing the draft skills and competencies for sustainable construction
- self-assessing how participants' skills, knowledge and experience align with the draft skills and competencies
- discussing experiences and challenges related to upskilling, particularly in skills and competencies for sustainable construction
- identifying sources of advice on sustainable construction
- highlighting barriers faced by construction trades in acquiring sustainability and zero-carbon skills and competencies
- determining the most effective methods for upskilling in sustainable construction skills and competencies.

2.2 Data analysis

All data was de-identified, and participant codes were stored in separate electronic files. Thematic analysis was conducted using inductive reasoning, guided by Gibbs' (2007) framework:

- Transcription, familiarisation and immersion into the data.
- Code building.
- Dis/confirmatory theme development.
- Data consolidation and interpretation.

The researchers discussed and reviewed the emerging codes and organisation of themes. Based on Gibbs' framework, key themes emerged from the data, which have structured this report.

2.3 Ethics

A BRANZ human research ethics application (ER13203b) was submitted for this research project and received ethical approval on 11 December 2022, following a review in accordance with the BRANZ Ethics in Our Work Involving Human Participants Policy. Ethical conduct was maintained throughout the research process. All participants provided informed consent to take part in the study. Non-organisational participants were compensated with a $100 Prezzy card for their time and travel expenses.

3. Background

To meet the 2050 greenhouse gas emissions reduction targets outlined in the 2016 Paris Agreement on climate change, the construction sector must develop the skills and competencies necessary to design, build and recycle/reuse buildings to achieve net-zero greenhouse gas emissions. Our research indicates that, while technical skills remain crucial for the transition to sustainable construction, these emissions reduction targets will be unattainable unless current weaknesses in vocational education, training and qualification structures are addressed or reconfigured to include greater sustainability, especially zero-carbon knowledge.

Enhancing sustainable skills and competencies within the building and construction industry will improve collaboration among construction teams, helping Aotearoa New Zealand to meet its zero-carbon goals and ensuring that sustainable construction practices become standard within the sector.

3.1 Nationwide survey about sustainable construction

This research project aimed to understand the current knowledge and experience of sustainable construction within Aotearoa New Zealand's building and construction industry. The 2022 nationwide survey investigated:

- awareness of climate change among construction professionals
- knowledge and practical experience related to sustainable construction skills
- preparation for the transition to sustainable construction, including education and preferred learning methods (Lockyer & MacGregor, 2023).

Of the 308 individuals participating in the survey, representing a diverse range of occupations and experience levels, 41% had more than 20 years' industry experience, 31% had 10–20 years' experience and 28% had less than 10 years' experience. In terms of participants' main occupations, 45% were in construction trades, primarily working on residential stand-alone buildings; 28% were architects, designers or engineers; and 20% were educators, sustainability managers, government officials or involved in infrastructure-based trades (Lockyer & MacGregor, 2023).

3.2 Awareness of climate change

One aim of the survey was to assess the level of climate change literacy among construction professionals in Aotearoa New Zealand. Climate change literacy refers to the sector's understanding of how construction activities contribute to greenhouse gas emissions. International research and initiatives have highlighted the importance of climate change literacy in driving positive change within the building and construction industry.

Survey participants were asked to rank the emissions produced during different stages of a building's life cycle from highest impact (1) to lowest (6). These rankings are presented in Table 1, alongside BRANZ's rankings of life cycle stages based on carbon emissions from life cycle assessment reference buildings. The survey participants most commonly ranked embodied carbon – the carbon released during the life cycle of building materials, including extraction, manufacturing, transport, construction and materials – as having the highest impact. This was followed by carbon released during the construction process. Emissions related to building operation were generally ranked lower.

Table 1. Ranking impact of emissions during the life cycle of a building.

	Ranking by BRANZ's life cycle assessment	Ranking by survey participants
1 (highest emissions)	Operational carbon	Embodied carbon
2	Embodied carbon	Construction
3	Maintenance	Waste
4	Operational water use	Operational carbon
5	Waste	Maintenance
6 (lowest emissions)	Construction	Operational water use

These rankings indicate a gap in understanding of building-related emissions. BRANZ research undertaken by Dowdell and others (2021) has shown that operational carbon typically has the highest impact, while construction carbon has the lowest.

When participants were asked about their awareness of policy changes proposed by MBIE's Building for Climate Change programme, most were unaware of some or all of the proposed changes. Those working in construction trades were twice as likely as other occupational groups to be unaware of these policies. Despite this lack of awareness, 86% of participants supported MBIE making changes to address climate change.

3.3 Skills and experience of sustainable construction

The survey also aimed to assess the sector's current skills and experience as well as future needs regarding sustainable construction. Most participants acknowledged the importance of developing new skills and knowledge to address climate change such as:

- understanding how their work connects with other trades (96%)
- knowledge of general building, architectural and engineering principles (93%)
- awareness of the environmental impact of greenhouse gas emissions and climate change (83%).

When evaluating the sector's current skills, participants considered the building and construction industry to be either very competent or competent in the installation (58%) and maintenance (41%) of the building envelope. However, 41% of the sample rated the building and construction industry as not at all competent in understanding embodied carbon.

Overall, survey participants did not view themselves as experts in any area. Notably, there were significant experience gaps, with over half of the participants having no experience in calculating greenhouse gas emissions (75%), developing transition plans (60%) or carbon footprinting of design (58%).

3.4 Training for sustainable construction

The nationwide survey also assessed participants' satisfaction with current building and construction industry education and training on zero-carbon and sustainable construction. Most participants were either neutral (40%), somewhat dissatisfied (34%) or extremely dissatisfied (15%) with the available options. They expressed a desire for more information and training through professional development workshops, seminars and trade talks to support their zero-carbon journey.

Findings from our survey indicate that the construction sector is ready for change, with practitioners largely supportive of actions to address climate change. Participants also showed a keen interest in and eagerness to acquire the skills and knowledge needed for the transition to zero-carbon construction.

While there is a clear desire for change, survey responses revealed a significant lack of knowledge and experience across the building and construction industry regarding sustainability, especially zero-carbon skills and competencies. The current education and training programmes and opportunities available to the building and construction industry in this area are limited. To meet our zero-carbon targets, a substantial effort from the education sector will be required to provide resources through channels that suit the various professions within the sector.

3.5 Competency profile for architects and designers

To ensure global warming does not exceed 1.5°C, we need to reduce carbon emissions from new residential buildings by 72% (McLaren et al., 2020). The construction sector faces significant challenges due to limited experience with sustainable design and construction. Upskilling the workforce is essential, requiring a substantial effort from the education and training sector to provide guidance and resources across all parts of the building and construction industry.

To better understand the challenges in implementing sustainable construction, we conducted interviews with architects and designers, as well as various construction trades, focusing on the skills and competencies needed for sustainable design and construction. This report outlines the main findings and a competency profile for sustainability skills for architects and designers. A separate report outlines the perspectives of the construction trades.

The key focus areas for architects and designers are:

- zero-carbon knowledge
- zero-carbon practice
- material selection
- operational carbon
- retrofit
- circularity and waste
- adaptation and resilience
- ecological awareness
- water use
- designing for performance – closing the performance gap
- zero-carbon practice with clients and colleagues
- legal requirements
- personal capability, such as communication and collaboration skills.

4. Results: What architects and designers told us

The qualitative semi-structured interviews built on the findings of the nationwide survey (Lockyer & McGregor, 2023), including the zero-carbon skills and competencies profile developed from that survey (see *Skills and competencies for sustainable construction: The role of architects and designers* at www.branz.co.nz/environment-zero-carbon-research).

4.1 Skills and competencies profile for sustainable construction

Architects and designers found the skills and competencies profile comprehensive and acknowledged the importance of the listed skills and knowledge areas. They appreciated the effort to outline the necessary competencies for sustainability, especially zero-carbon design and construction, and recognised the need for such a framework in the building and construction industry.

4.2 Key priorities

Architects and designers identified three key priorities from the skills and competencies profile.

Knowledge and awareness

Architects and designers emphasised the importance of building knowledge and awareness about sustainable construction. They noted that understanding the basics of carbon emissions, life cycle assessments and the impact of different materials is crucial.

> "At the moment, it's just knowledge, isn't it? Because nobody knows about this stuff. You've got to build the knowledge."
> (Senior architect with extensive experience in sustainability)

Materials selection and waste management

Architects and designers highlighted the importance of selecting materials with lower embodied carbon and designing out waste effectively. They noted that using recyclable materials and reducing waste on construction sites and across the building life cycle were key areas to focus on.

Practical application and tools

Architects and designers stressed the need for practical tools and resources to apply the competencies in real-world projects. They mentioned the importance of having user-friendly tools for life cycle assessments and carbon calculations.

> "There's a lot of information out there that actually supports the standard way of building, but there isn't the support for the high-performance architects and designers."
> (Architect)

4.3 Challenges and gaps

Architects and designers also identified three key challenges facing the sector in its journey to sustainable construction.

Complexity

Some architects and designers found the skills and competencies profile overwhelming due to its length and detail. They suggested that it might be challenging for individuals new to the field to grasp all the competencies at once.

Concrete and structural knowledge

There were specific gaps identified in the knowledge of concrete mixes and structural implications of using alternative materials. Architects and designers emphasised the need for more information and guidance in this area.

Integration and collaboration

Architects and designers highlighted the need for better integration and collaboration between different disciplines. They mentioned that zero-carbon construction requires a holistic approach involving various stakeholders.

> "Until all those people in their silos start talking to each other, I don't think we're ever gonna get a proper or holistic approach."
> (Architect)

4.4 Preferred learning approaches

When asked about their preferred learning methods, many architects and designers reported they liked learning through webinars and seminars, especially those that provide practical, hands-on information.

> "Webinars, seminars, classroom. A formal environment for me to learn because it's not something that's subjective that I'm learning."
> (Architect)

Interviewees also emphasised the importance of learning through practice and real-world application. They found it helpful to work on projects and use tools to solidify their understanding.

> "I like learning through practice … I listened to the webinars and then went away and worked with the spreadsheets to try and make a bit more sense of them."
> (Architect)

Overall, what architects and designers told us about the draft zero-carbon skills and competencies profile was their potential to guide the industry towards more sustainable practices. They highlighted the importance of knowledge, practical tools and collaboration, while also noting the challenges of complexity and the need for better integration across disciplines.

4.5 Who is responsible for driving sustainable construction skill development?

Most architects and designers agree that the responsibility for driving sustainability and zero-carbon practices in construction is shared among various stakeholders. These

stakeholders include not only architects and designers themselves but also clients, builders, local councils and government bodies.

There was a strong consensus that legislation and regulatory frameworks are crucial for promoting sustainable behaviours within the construction sector. Many architects and designers highlighted the role of legislative bodies such as local government and central government in driving these changes to the Building Code. This ties back to the long-standing argument that cost considerations often outweigh the perceived benefits of sustainable practices.

> "Until it's either legislated, or it's the easiest path to follow, no one's going to do it because cost will always – or the way we've always done it – will always win."
> (Architect)

Architects and designers also see themselves as key drivers of change within the construction industry. They view their role as educators and influencers, guiding clients and other stakeholders towards more sustainable decisions. Additionally, many architects and designers have access to extensive internal resources on zero-carbon practices, which further supports their role in promoting sustainability.

> "I think everyone [has responsibility], but we as designers have a critical part to play, and I think there's a lot of work to be done around upskilling the design fraternity."
> (Architect)

Education providers were also identified as having a significant role in equipping industry professionals with the necessary knowledge and skills to implement sustainable practices. By incorporating sustainability into professional learning and training programmes, they can foster a culture of continuous improvement and innovation.

Furthermore, individuals with significant influence such as clients and investors who fund projects were recognised as pivotal in adopting zero-carbon practices. Their decisions and priorities can have a significant impact on the direction and success of sustainable construction initiatives.

> "People who have the most influence are the people who are funding projects … they can change the attitude of the client and the design team from the beginning of the project."
> (Architect)

Ultimately, achieving sustainable construction requires a collaborative effort from all stakeholders. The insights and perspectives shared by architects and designers in these interviews emphasises the importance of a multifaceted approach to driving sustainable construction practices, highlighting the need for education, legislation and collective action.

4.6 Aotearoa New Zealand versus elsewhere

Architects and designers expressed concern over the noticeable lack of stringent regulations and incentives for sustainable construction in Aotearoa New Zealand. They felt the primary focus had been on operational carbon, with embodied carbon only recently receiving attention.

> "New Zealand hasn't even tackled that issue yet. This is probably half of the challenge. We need to design only what we need and use spaces efficiently, instead of building large, sprawling subdivisions."
> (Designer)

Other countries, however, have had regulations in place for years.

> "[The Swiss Government] put this new rule in saying, OK, you're building, like the life span of a building – was 50 years for us, right? So you needed to do the carbon emissions for a 50-year lifespan, and then it's not like you had to meet this requirement, you still had the option to say [no, but] if you meet this requirement, you pay no tax. If you're below the requirement, we give you a cheque. If you're above that requirement, you can pay."
> (Architect)

This disparity highlights the critical need for Aotearoa New Zealand to adopt more comprehensive regulations and incentives if it is to achieve significant progress in sustainable construction.

4.7 Education for all – architects, designers and clients

In Aotearoa New Zealand, architects and designers reported the demand for sustainable buildings is often driven by clients who are already environmentally conscious.

> "Most of the buildings that we would build, it would be the clients that would be pushing for the energy efficiencies of the buildings, and carbon, carbon stuff."
> (Architect)

In contrast, in places like Switzerland, the market demand is higher due to regulatory requirements and financial incentives.

> "In Switzerland, for example, we needed to do a carbon analysis of the building. That was 2009. And then, at the time, you know, that was kind of a new thing."
> (Architect)

This contrast emphasises the need for Aotearoa New Zealand to establish robust regulations and incentives to drive market demand for sustainable buildings, ensuring that the push for sustainability comes not just from environmentally conscious clients but from all sectors.

Furthermore, architects and designers we interviewed believe there is a lack of education and training in New Zealand around sustainable construction.

> "There is a gap in the education and training of architects and builders regarding [carbon-zero] construction. Most of the learning is self-directed or through international resources."
> (Architect)

In contrast, European countries have integrated zero-carbon principles into their architectural education and professional development.

> "In Europe, everything is interconnected. Here, we still think by silo, right? So we think about carbon emissions here, we think about material here, but like, we need to really connect all together." (Architect)

These comments highlight the need for resources tailored to an Aotearoa New Zealand-based context. Such resources should cater not only to technically minded architects and designers but also to homeowners and clients who may have less experience with technical terms. This way, everyone can learn what to look for in a sustainably built building.

5. Conclusion

The transition to sustainable construction in Aotearoa New Zealand requires a unified effort from all the stakeholders within the construction sector. This report has highlighted the critical need for enhanced skills and competencies for architects and designers, particularly in areas such as embodied carbon, material selection and life cycle assessments.

Architects and designers interviewed for the research expressed the importance of having comprehensive education and training programmes as well as robust regulatory frameworks and strong leadership to drive sustainable practices in Aotearoa New Zealand. There was acknowledgement that some overseas countries are doing it better than us. We therefore should not reinvent the wheel but learn from overseas experiences.

The insights gathered from these architects and designers provide a valuable roadmap for achieving these objectives, emphasising the need for continuous learning, practical tools and a holistic approach to sustainable construction.

These findings demonstrate the importance of comprehensive education and training programmes, robust regulatory frameworks and strong leadership to drive sustainable practices. By fostering collaboration and integrating sustainability – especially zero-carbon principles across all disciplines – the building and construction industry can effectively contribute to the nation's climate goals and ensure a sustainable future.

References

Dowdell, D., MacGregor, C., Jaques, R., Berg, B., & Butler, J. (2021). The greenhouse gas emissions of standalone residential houses in New Zealand: Challenges and opportunities. In L. Grant, H. Viggers & P. Howden-Chapman (Eds.), *Improving buildings, cutting carbon* (pp. 39–48). Steele Roberts Aotearoa.

Gibbs, G. (2007). *Analyzing qualitative data*. Sage. https://doi.org/10.4135/9781849208574

Lockyer, O. & MacGregor, C. (2023). *The Future of Work: Equipping construction professionals with the skills to transition to zero carbon – a national survey* (BRANZ Study Report SR477). BRANZ Ltd. https://www.branz.co.nz/pubs/research-reports/sr477/

McLaren, S., Chandrakumar, C., Dowdell, D., Bullen, L., & Jaques, R. (2020). Application of absolute sustainability assessment to New Zealand residential dwellings. *IOP Conference Series: Earth and Environmental Science*, *588*, 022064. https://doi.org/10.1088/1755-1315/588/2/022064