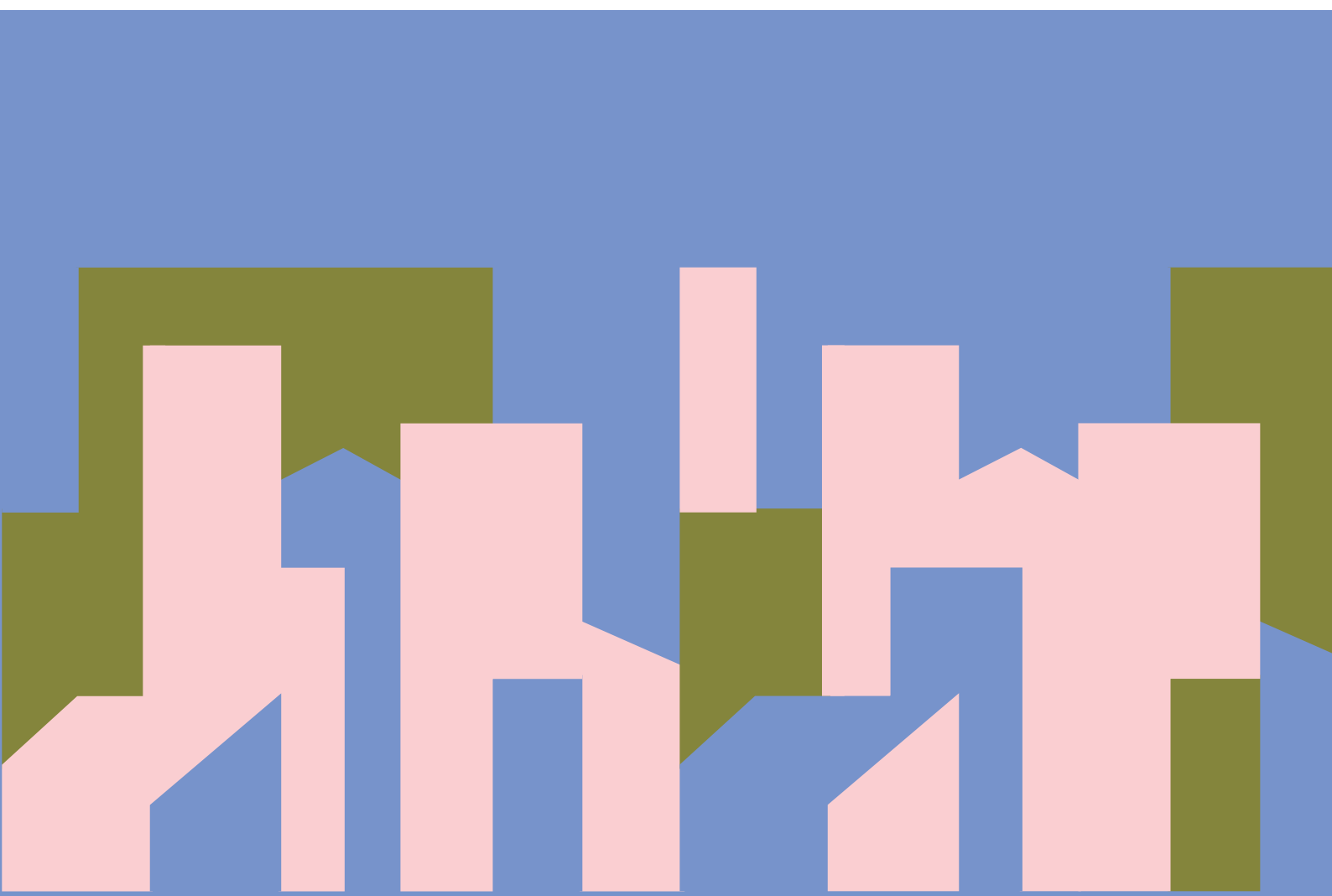


Next-Generation Construction in Ireland

Education, Research and Training as Key Enablers

Report from a one-day conference held in the Royal Irish Academy on 24 November 2022



EXECUTIVE SUMMARY

The construction sector worldwide is undergoing a significant transformation and disruption as a result of the adoption of new technologies, such as modern methods of construction and digital adoption, and as a result of the challenges of climate change and the need to improve sustainability. It is critical that construction in Ireland keeps pace with this transformation, to improve competitiveness and in particular to meet the construction and sustainability targets of the €165 billion National Development Plan and associated Climate Action Plan.

The Royal Irish Academy, in collaboration with the Construction Industry Federation, hosted a one-day conference on 24 November 2022 to consider some of the key factors around the competitiveness of the Irish construction sector and the changing nature and requirements of education, research and training as key enablers for next generation construction in Ireland. The conference involved talks from leaders in industry, academia and the public sector and interactive panel sessions, including strong audience participation across the many disciplines involved in construction. Along with some important outcomes, this report summarises some of the background issues and informing principles of the conference along with the approach taken on the day. A wide range of key findings and recommendations emerged from highly productive sessions and these are discussed in more detail in the report. A number of overarching themes emerged, including some which will impact government policies, in addition to specific issues relating to the different elements of the construction industry and the associated research and education/training sectors.

There is a risk that some critical objectives in the National Development Plan will not be met, such as Housing for All and mandated carbon emission targets, due to a shortage of sufficiently well-trained personnel at all levels to support the construction sector and to drive the transformation required. Many SMEs¹ in the construction sector in particular are struggling with change and the ability to adopt new technologies. The development in recent years of a number of national initiatives aimed at supporting the construction sector is seen as a critical building block for the future of the industry: the Construction Sector Innovation and Digital Adoption Group and two new construction related centres (BuildDigital, ConstructInnovate). However, greater effort is required on the research side, particularly in the form of applied, market-ready, high TRL² activities.

It is clear that the industry is moving to respond to disruption, creating the challenge for academics of ensuring that education and training programmes keep pace with changes. There is a need to put in place a mechanism, by way of an appropriate forum, to provide for sustained dialogue and cooperation between a range of stakeholders from the construction industry, education and training sectors, along with the relevant professional bodies, statutory agencies and government departments. Such a mechanism is needed to ensure that the construction related elements of education and training evolve and adapt over the coming years to provide a sustained human capital pipeline which is best suited to supporting the response of the construction industry.

¹ Small to Medium Enterprises.

² Technology-Readiness Level.

BACKGROUND AND CONFERENCE THEME

Worldwide, construction as an industry sector has undergone major change over the last decade with the arrival of disruptive technologies, a more complex regulatory environment, a re-organisation of traditional project structures and the requirement for a wide variety of new competencies. The transformation of the sector is being driven by the need to improve competitiveness, to address climate change and environmental challenges, and to dramatically improve sustainability.

In 2019, the government through the Department of Public Expenditure and Reform commissioned a KPMG / Future Analytics / TU Dublin report on The Productivity of the Irish Construction Industry. The report published in June 2020 found that the Irish construction industry was fragmented by comparison to equivalents in other countries in Europe as it consists of 95% small to medium enterprises (SMEs) and only some fifteen large contractors. It was found that the sector was low-tech in terms of uptake of digital technology and innovation, and had significant skills and training deficits. The report's overall conclusion was that the construction sector in Ireland needed to evolve to meet the major challenges that lay ahead.

Over the next decade, the National Development Plan (NDP) envisages a spend of €165 billion on new housing and infrastructure to help meet the objectives of Project Ireland 2040, to accommodate an additional one million people on the island. The ability of the construction sector to deliver on the NDP and on a large increase in the housing stock is critically dependent on the availability of suitable human capital for the sector, at all levels, across a very wide range of disciplines.

Accordingly, the Royal Irish Academy and the Construction Industry Federation hosted a one-day conference entitled 'Next generation construction in Ireland: education, research and training as key enablers' on 24 November 2022. The overarching conference theme focused on the changing nature and requirements of education, research and training as key enablers for next generation construction in Ireland. Underpinning this theme was the need for the provision of a sustainable human capital pipeline, which is vital to the success and development of the construction sector in Ireland over the coming decade and beyond. The specific objectives of the conference included:

- To assess the likely evolution of the construction industry in the coming years, thus enabling the identification of the key skills, knowledge and research needed to underpin this evolution.
- To provide a platform for the sharing of knowledge and practice, focused on the conference theme, among professionals from across education and industry.
- To develop a series of key recommendations on how best the education, research and training sector in Ireland can support the emergence of a vibrant next generation construction industry in Ireland.
- To develop and disseminate recommendations for action to industry, higher education, policymakers, government, industry representative organisations and professional bodies.

CONFERENCE STRANDS AND FORMAT

Based on the overarching conference theme and the rationale above, the conference addressed three broad areas:

Modern methods of construction: Modern methods of construction (MMC) has been identified as one of the key areas that will transform the productivity and efficiency of the construction sector in Ireland. It can include off-site design, premanufacturing and modularisation, site-based material, and process innovation. Integrated with building information management / modelling (BIM) and other digital technologies, MMC can reduce labour costs and cycle time, while enhancing on-site health and safety and improving quality control.

The conference explored these and other linked issues, with the aim of identifying how education and research in Ireland can best respond to the latest MMC technologies and strategies that need to be implemented by construction firms (large and small), thus improving the productivity and competitiveness of the industry.

Digital adoption: Digital adoption is defined as the utilisation of a range of digital technologies to undertake construction more efficiently with higher quality and with less waste. It is well known that the construction sector has lagged behind most other industrial sectors in its take-up of digital technologies. Digital adoption for construction covers a range of interrelated technologies such as BIM, augmented reality, machine learning/AI, and robotics. Digital adoption offers a potential means to help the construction industry deal with challenges such as sustainability, the need to increase productivity and reduce financial pressures.

This conference examined the current state of digital adoption in the Irish construction sector and included experiences from a number of success stories in digital adoption, along with an examination of the challenges faced by companies, particularly SMEs, in adopting digital technologies.

Policy future for construction in Ireland: As Ireland implements the new National Development Plan 2021 – 2030, the Housing for All Strategy and the Climate Action Plan, we are moving to a new era for construction in Ireland. The three main pillars of transformation are productivity, digitisation and sustainability.

The conference explored the current policy plans for Project Ireland 2040, including the national plans mentioned above, to determine the priority needs that would best enable the Irish construction industry to continue to build innovation and delivery capacity towards 2040.

Conference format

The conference began with a keynote presentation from P.J. Rudden, who set the scene regarding the current state of the construction industry in Ireland, which is in a phase of rapid transformation. He highlighted the crucial significance of both MMC and digital adoption to the industry and the role that the education and research sectors must play in support of the industry's evolution.

This was followed by sessions devoted to the three key strands. Each session consisted of two talks, with expert speakers drawn from industry, academia and government agencies. Each session was rounded off with a comprehensive panel discussion, where the speakers were joined by other experts. There was a strong emphasis on audience participation for these discussions. The day concluded with a final open session where the chairs highlighted the key issues that had emerged during the conference.

KEY OUTCOMES AND FINDINGS

In this section, the authors have summarised the key conclusions and recommendations arising out of the conference. The first seven points are overarching comments while the remainder are specific to the industry, education, training and research sectors. Where appropriate, the authors have also presented related actions for some of the recommendations.

Overarching conclusions and recommendations

1. The principal agents of sectoral transformation are the widespread introduction of modern methods of construction and integrated digital adoption, including BIM, as a means to control quality, programme, cost, carbon emission reduction and project whole life cycle costing in order to optimise productivity.

Related actions: Promote increased integration of work plans by the key actors in this area to provide the sector with integrated, digital MMC solutions³ that are market-ready, demonstrably fit-for-purpose for clients, and adaptable for use on a wide range of scales and types of project, particularly by SMEs.

Beyond formal education and training, there is a need to raise awareness and understanding of MMC and digital adoption among clients, SMEs.

2. There was strong agreement that education, research and training are key enablers in the growth of the construction sector, the importance of which must be reflected in actions.

³ Digital Modern Methods of Construction

Related actions: Convening of a unified tertiary forum for education, research, and training actors across higher and further education and private provision focused on construction, including funding agencies and accrediting organisations and professional bodies, to:

- a. Deliver construction industry focused research.
 - b. Develop and promote a comprehensive portfolio of education and training programmes to meet industry needs towards 2040.
 - c. Increase support for ‘lifelong learners’ in the construction industry. In order to better suit the time constraints of employees, training and education must be delivered more flexibly, with a focus on timely learning via bite-size items that can build towards accredited qualifications over time.
 - d. Raising awareness and understanding of MMC and digital adoption among prospective students.
3. There is a risk that some critical national objectives will not be met in the future, such as Housing for All and mandated carbon emission targets set for 2030 and 2050, due to a shortage of sufficiently well-trained personnel at all levels across construction related professions including engineering, architecture, surveying and construction management.
 4. The development in recent years of several national initiatives aimed at enhancing the construction sector was seen as a critical building block for the future of the industry. These initiatives include the Construction Sector Innovation and Digital Adoption Group (CSIDAG) which has seven priority pillars of work, along with the creation of two new construction-specific technology centres (Build Digital and ConstructInnovate).

Related action: Drive continued strong interaction and aligned working between the seven CSIDAG pillars and the two centres. Improvement of the visibility of the roadmaps, outputs, and outcomes is required, particularly for small scale sectoral participants, i.e. micro SMEs.

5. There is a need to continue industry/government/academia dialogue to support the development of a more connected construction technology ecosystem. This can be achieved by bringing the various actors together in a forum to advise on the changes needed in education to support the construction sector. As programmes in almost all areas related to construction are accredited by national professional bodies, such as Engineers Ireland and the Royal Institute of the Architects of Ireland, all of the relevant professional bodies must be included as stake-holders in such a forum.
6. A lot of positive actions are already happening across the broad construction sector, but there is a need for greater coordination and a sustained effort to connect stakeholders and initiatives at all levels.

7. There were some concerns expressed that the industry is moving more slowly on digital adoption; in particular SMEs who make up a large proportion of companies in construction in Ireland. One reason for this is a shortage of people with the necessary skillsets which, along with other limitations, is impeding companies in engaging with and embracing new technologies. Additional and appropriate government supports will definitely help to fill this gap.

Related action: Comprehensively map existing Government supports for digitisation, particularly for SMEs, and link with the education, research, and training forum (point 2 above) to fill gaps and collectively deliver a sectoral uplift.

Sector specific conclusions and recommendations

For the research sector:

8. The challenges faced by the construction sector require significant increases in the level of RDI⁴ undertaken in this country. In the past, construction RDI has not been as strongly prioritised nationally by comparison to other sectors and there is a need for government to increase the support provided. This is particularly important in the context of the projected spend on the NDP and the overall long-term evolution of the construction sector in Ireland.
9. Construction technology research is gaining increasing attention, while still at an earlier stage of maturity than many other sectors. There may be lessons for construction in the development of the med-tech research platform, which has proven central to Ireland's economy over the last 40+ years.

Related action: Investigation of and adoption of the lessons learned from previous RDI development journeys in Ireland.

10. The competitiveness of the sector, particularly as more companies diversify their activities into international markets, will become increasingly dependent on the ability of companies to undertake RDI. Higher education in turn must provide research graduates who can help companies increase the level and sophistication of RDI they undertake.

Related action: Creation of a freely available and up-to-date library of construction-related RDI outputs, coupled with strong promotion and easy access to new RDI, particularly collaboration-based activities.

⁴ Research, development and innovation.

For the education and training sectors:

11. Crucially, the delivery of a sustainable pipeline of talent for the construction sector is not just about delivering the requisite numbers and types of personnel. Of equal importance is delivering personnel with the appropriate skillsets and knowledge needed for the future. For example, currently there is relatively little consideration of MMC and digital adoption in third level and other training programmes, such as craft apprenticeships. The industry is changing and the challenge for academics is to ensure that education and training programmes keep pace with these changes.
12. The higher education and training sectors need to continually evolve to ensure programmes deliver graduates who have the necessary skills and knowledge to keep pace with modern and emerging methods of construction, along with the role and use of digital technologies in construction and the policy and regulatory framework within which construction operates. However, while it is important to ensure that educational programmes relevant to the construction industry meet the needs of that industry, it should be recognised that many programmes⁵ serve a broad range of industry sectors, not only the construction industry. Where programme content is adjusted to improve alignment with the needs of the construction industry, a balance must be struck to ensure that programmes continue to serve a range of industries as appropriate.

Related actions: Educational providers should consider their provision of construction-related options on appropriate programmes to increase the availability of graduates with relevant and up-to-date knowledge and skills, while still allowing programmes to serve their broader remit. Professional bodies that accredit programmes would need to be consulted and to cooperate with such developments.

Liaise with further and higher education providers to identify opportunities for taster or cross-skilling content on a wide range of aligned programmes. Engage with professional bodies to ensure that opportunities are provided for flexible entry routes from non-accredited programmes.

Develop a consortium-led apprenticeship on MMC. This is an industry-academia collaborative model to meet an identified skills gap. The apprenticeship could follow the model of the manufacturing engineering apprenticeship and the forthcoming civil engineering apprenticeship.

Create an online repository for MMC case studies that could be used for education and for raising awareness. Some work has already been done on

⁵ For example, while graduates from mechanical engineering programmes do find employment in the construction sector, many graduates from such programmes enter other sectors, such as manufacturing, which are not related to construction. In contrast, some programmes, for example construction management, are more directly focussed on the construction sector.

compiling an informal database (projects, suppliers etc.) that could be hosted on an online platform and expanded.

13. In seeking to ensure that educational programmes serve the construction industry, for professional programmes at NFQ Level 8 and beyond, it will be important to maintain the appropriate balance between fundamentals and technology in curricula, to best serve the short- and long-term needs of both learners and industry.
14. While a number of high-profile research collaborations have been noted, there has not been a similar trend in the areas of education and training. This may be related in part to the institution-specific nature of many education and training programmes.
15. It is clear that the sector increasingly relies on multidisciplinary between construction professionals at all levels, from the broadest range of disciplines. While individual programmes will continue to focus on providing graduates with the skills and knowledge appropriate to a given discipline or profession, the educational experience of the students must incorporate substantial multidisciplinary activities and learning to prepare the graduates for their careers. This, and the need for curriculum change, will challenge both the design of academic programmes and their accreditation by professional and regulatory bodies.
16. Given the rapid pace of change in the construction sector, lifelong learning and the ability to adapt to change is a vital skill for all. Education and training programmes at every level must equip students with the learning and skills needed and a clear understanding of the need to improve their ability and knowledge at all stages in their careers. Education providers need to consider how people are formed for the new way of thinking, moving away from some of the silos that currently exist.
17. In an ongoing dialogue between industry/government/academia, examples of best practice and successful initiatives in other countries should be examined to inform decisions and actions in the future, aimed at ensuring the best support for the construction sector from the education, research and training sectors.

ACKNOWLEDGEMENTS

The authors and the Royal Irish Academy wish to thank the speakers and chairs of the Next Generation Construction in Ireland conference, all of whom are listed in the conference programme in Appendix I for their expert inputs. Thanks also go to the attendees of the event who made thoughtful and challenging contributions to the discussion.

This report is produced on behalf of the Engineering & Computer Sciences and Geography & Geosciences Committees of the Royal Irish Academy in collaboration with the Construction Industry Federation. The views expressed are the Committees' own and do not necessarily reflect the opinion of the Royal Irish Academy.

The following authors made significant input into the development, research and writing of this report:

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Dr Avril Behan, SOLAS and RIA Geography and Geosciences Committee

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Next-Generation Construction in Ireland

Education, Research
and Training as
Key Enablers

ONE-DAY CONFERENCE / 24 NOVEMBER 2022

Royal Irish Academy, 19 Dawson Street, Dublin 2

Programme

9.30–10.00 Registration

10.10–10.45 **OPENING SESSION**

Welcome from President of the Royal Irish Academy
Brian Norton MRIA, Secretary for Policy and International Affairs

Keynote address

PJ Rudden, Aengus Consulting and Chair of Innovation and Digital Adoption,
Construction Sector Group

Introduction by Conference Chair

Orla Feely MRIA, Vice President for Research, Innovation and Impact and Professor of Electronic
Engineering, University College Dublin; Past-President, Engineers Ireland

BREAK

11.00–12.30

SESSION I: MODERN METHODS OF CONSTRUCTION (MMC)

Chair: Professor Aoife Ahern, Dean of Engineering University College Dublin

Speaker 1

Professor Richard Buswell, Professor of Building Systems and Engineering and Hybrid Concrete Printing Group lead, Loughborough University

Speaker 2

Martin Searson, Founder and CEO Quality Positive Ltd

Panel discussion with above speakers plus panellists

- Claire Lane, Associate Director, LMC Group Ltd
- Professor Gerry Byrne, UCD
- Justin Kinsella, CEO, Harcourt Technologies Ltd

LUNCH

13.30–15.00

SESSION II: DIGITAL ADOPTION FOR CONSTRUCTION

Chair: Sean Downey, Construction Industry Federation

Speaker 1

Dr Tara Brooks, School of Natural and Built Environment, Queen's University Belfast

Speaker 2

Joseph Mady, CEO, Digital Construction Technologies Group

Panel discussion with above speakers plus panellists

- Dr Elisabeth O'Brien, Digital Academy for the Sustainable Built Environment, Technological University of the Shannon: Midwest
- Emma Hayes, Managing Director, Digital Built Consultants
- Dr Cormac Flood, Coady Architects

BREAK

15.15–16.35

SESSION III: NEW TECHNOLOGIES AND POLICIES FOR ENHANCED SUSTAINABILITY

Chair: Brian Norton MRIA, Head of Energy Research, Tyndall National Institute; Research Professor, University College Cork; Professor of Solar Energy Applications, TU Dublin.

Speaker 1

Orla Coyle, Head of Energy and Sustainability, Savills Ireland

Speaker 2

Sarah Miley, Apprenticeship and Public Policy Partnering, Department of Further and Higher Education, Research, Innovation and Science

Panel discussion with above speakers plus panellists

- Professor Jamie Goggins, Co-director, Construction Technology Centre, Established Professor, University of Galway
- Lorraine Fitzgerald, Head of Sustainability, Glenveagh Properties PLC
- Mark Courtney, Managing Director, House2Home Refit Ltd

16.35–17.00

CLOSING DISCUSSION: SUMMARIES, KEY THEMES AND OUTCOMES

Led by the Conference Chair and Session Chairs

CONFERENCE CLOSE

This conference is organised by the RIA Engineering & Computer Sciences and the Geography & Geosciences committees and the Construction Industry Federation and sponsored by the Higher Education Authority, SEAI and Enterprise Ireland.



APPENDIX 2: ROYAL IRISH ACADEMY MULTIDISCIPLINARY COMMITTEES

Engineering and Computer Sciences Committee

The Engineering and Computer Sciences Committee is an all-island multidisciplinary committee formed in September 2014. Committee members represent academia, industry and government. The main functions of the committee are to address issues of national and international concern through a programme of works, advise the Academy on policy formation and act as the national adhering organisation for the international unions – the International Union of Theoretical and Applied Mechanics (IUTAM) and the International Union of Radio Science (URSI). The committee has a varied programme of works including lectures, publications and special events focusing on important issues. This work enables the committee to engage with the wider scholarly community, policymakers and the general public. Membership of the committee is available [here](#).

Geography and Geosciences Committee

The Geography and Geosciences Committee is an all-island multidisciplinary committee formed in September 2014. The purpose of the multidisciplinary committee is to advise the Academy on the development of policy, address issues of concern through a programme of works and act as the national adhering organisation for the International Union of Geodesy and Geophysics (IUGG). Its membership represents academia, industry and national organisations. It is the first Academy committee to participate in the Parliamentary Pairing scheme. The committee's participation in the scheme to date has been very successful, with strong links being established between politicians and researchers. A list of members of the Geography and Geosciences Committee is available [here](#).

