

# Submission to National Research & Innovation Strategy 2021-27

*For the attention of Department of Further and Higher Education, Research, Innovation and Science*

16<sup>th</sup> July 2021

Engineers Ireland welcomes the opportunity to contribute to the National Research & Innovation Strategy 2021-27. Our responses below are structured according to a selection of the consultation questions posed. Engineers Ireland looks forward to contributing to later phases of this consultation and other activities led by the Department of Further and Higher Education, Research, Innovation and Science.

## **Part One: A strategic direction for research and innovation which places it at the centre of the national response to major economic, environmental and societal challenges**

Engineers Ireland's The State of Ireland 2020 report identified the **major challenges facing Ireland** post-COVID-19 as **national recovery, climate change and digitalisation**. The report advocates for a green and digital recovery for Ireland and presents a set of recommendations spanning infrastructure, technology and education.

Similarly, research underpinning Engineers Ireland's Engineering 2020 report identified **digitalisation and sustainability as priorities for engineering skills development**. Engineers Ireland asked a sample of engineering leaders and a sample of engineering academics the question: 'Over the next 10 years, what skills will engineers need to develop?'. Two of the main areas were:

- Sustainability: environmental impact, energy-efficiency, green construction, renewable energy
- Digitalisation: BIM, data management and analytics, programming, augmented reality / virtual reality, artificial intelligence, Internet of Things, Building Information Modelling (BIM)

**We recommend that sustainability and digitalisation should be central themes of the National Research and Innovation Strategy. We believe that the engineering profession has a key role to play in Ireland's response in both areas, and that the Strategy should seek to draw on the**

**profession and encourage the development of engineering skills and talent to support the economy and to deliver sustainable solutions for society.**

**To support sustainability, the National Research & Innovation Strategy should focus on the acceleration of reductions in greenhouse gas emissions, supporting Ireland's net zero target for 2050 and the potential to draw down funding through the European Green Deal.** Communities must be at the heart of this transition, involved as early as possible and receiving clear benefits from climate projects.

- Specific focus areas should include: **energy system integration and achieving 70% renewable electricity, offshore wind development, hydrogen strategy, deep retrofitting, re-engineering our transport system, land management, water, wastewater and flood risk management.**

**Developments in digitalisation pose major challenges and opportunities for Ireland, in areas such as skills, research, enterprise and innovation, areas which the National Research & Innovation Strategy should consider.** Specific focus areas should include the digitalisation of the manufacturing sector and the digitalisation of the construction sector

In the manufacturing sector, new connectivity and production technologies are ushering in a revolution in global manufacturing generally referred to as Industry 4.0 – the 4th Industrial Revolution. Engineers Ireland contributed to 'Ireland's Industry 4.0 Strategy 2020-2025: Supporting the digital transformation of the manufacturing sector and its supply chain' and we are committed to supporting its implementation for the benefit of the manufacturing industry, engineering profession and Ireland as a whole. For example, we would like to build further collaborations with research and industrial partners to raise awareness of the possibilities of Industry 4.0. We believe that **a national Industry 4.0 portal should be developed to provide information (targeting SMEs) on best practice, national infrastructure and available education and training.**

In the construction sector, analysis by KPMG/FAC and McKinsey has highlighted the need for **greater innovation and digital adoption.** Engineers Ireland is participating in the Construction Sector Innovation and Digital Adoption Group, which is developing the Build-Digital Centre and a Construction Technology Centre. Specific areas of focus include modern methods of construction, Building Information Modelling (BIM) and greatly increased use of off-site construction, which have the potential to increase housing output, quality and innovation. Moreover, **digital-focused research and innovation is required in a wide range of infrastructure sectors to support climate action,** for example: in transport to enable the adoption of electric and autonomous vehicles, in the electricity grid to support the 70% renewable electricity by 2030 target, and in water for water-use efficiency and resource management.

## **Part Two: Delivering on the vision across six areas of strategic action**

**A mission-based approach to solving grand challenges could prove useful for the National Research & Innovation Strategy.** Given their focus on the delivery of innovative solutions, these will rely heavily on engineering input. In 2008, the National Academy of Engineering in the US proposed 14 Grand Challenges for Engineering in the 21<sup>st</sup> Century ([www.engineeringchallenges.org](http://www.engineeringchallenges.org)), which provide useful models:

1. Advance personalized learning
2. Make solar energy economical
3. Enhance virtual reality
4. Reverse-engineer the brain
5. Engineer better medicines
6. Advance health informatics
7. Restore and improve urban infrastructure
8. Secure cyberspace
9. Provide access to clean water
10. Provide energy from fusion
11. Prevent nuclear terror
12. Manage the nitrogen cycle
13. Develop carbon sequestration methods
14. Engineer the tools of scientific discovery

While our list of missions will be different (and shorter) it should be similarly action-oriented. The **UN Sustainable Development Goals also act as a useful framework to tackle societal challenges.** One of our international partners, the World Federation of Engineering Organisations has specifically highlighted the need for engineers to lead the way on the goals for clean water and sanitation, reliable energy, sustainable infrastructure, manufacturing, innovation and education.

**To deliver on the vision of the National Research & Innovation Strategy and to support the needs of the research sector and industry, a sustainable funding model for higher education is urgently needed, including core funding, programmatic funding, infrastructure investment and industry-academic collaboration.** Core funding per student at higher level has decreased detrimentally in the recent period and, in some institutions, laboratory equipment and other facilities have almost become obsolete. Inadequate resourcing undermines teaching, learning and research and the ability of our higher education institutions to be globally competitive.

**A ready supply of engineers will be crucial for the delivery of National Research & Innovation Strategy as well as Project Ireland 2040, Climate Action Plan and Future Jobs Ireland.** However, the **number of students moving into third-level engineering and technology sectors needs to be much larger to meet our country's current and future needs.** Almost all (94%) engineering employers consider a shortage of experienced engineers to be a barrier to growth. The National Skills Bulletin, which informs Government employment and education policy, now recognises shortages in almost all engineering occupations. At the same time, there is a significant gender gap in the engineering profession and **additional efforts should be made to encourage women to enter and remain in engineering.**

**The skills required to perform many jobs are transforming rapidly** such that the demand for manual skills is falling while the need for analytical thinking and innovation continues to grow. The World Economic Forum has referred to a 'reskilling imperative'. For example, data is a key asset for many businesses and the right mix of skills must be developed to meet that need. Leveraging the fact that data centres are choosing Ireland to locate their businesses can encourage related data analytics industries to also locate here, requiring data analytics engineers, software engineers, cybersecurity

specialists. Similarly, the climate action agenda calls for the reskilling and upskilling of many sectors, including energy, agriculture and transport. **The National Research & Innovation Strategy should link into national skills initiatives, including ‘Technology Skills 2022: Ireland’s Third ICT Skills Action Plan’, Human Capital Initiative, Future Jobs Initiative and forthcoming revised Climate Action Plan.**

**The globalised nature of the engineering profession requires strong international collaboration in all government and industrial sectors.** Engineers Ireland is a member of the International Engineering Alliance, a global not-for-profit organisation, which comprises members from 41 jurisdictions within 29 countries. Through educational accords and competence agreements members of the International Engineering Alliance establish and enforce internationally benchmarked standards for engineering education and expected competence for engineering practice. Engineers Ireland is also a member of the European Network of Accreditation for Engineering Education, which licenses Engineers Ireland to award the EUR-ACE® label, and the European Federation of National Associations of Engineering (FEANI). These international affiliations support graduate mobility in Europe and certain other countries.

Through these international links, our industrial partnerships, our academic stakeholders and our network of Regional branches, Engineering divisions and Societies, Engineers Ireland stands ready to support the development and implementation of the National Research & Innovation Strategy.

## Engineers Ireland resources

Engineering 2021: A barometer of the profession in Ireland

<https://www.engineersireland.ie/LinkClick.aspx?fileticket=wVvyHGDSRAQ%3d&portalid=0&resourceView=1>

The State of Ireland 2020: Engineering a green and digital recovery

<https://www.engineersireland.ie/LinkClick.aspx?fileticket=g50i6d5KQZg%3d&portalid=0&resourceView=1>

Engineering 2020: A barometer of the profession in Ireland

<https://www.engineersireland.ie/LinkClick.aspx?fileticket=QIJmhwkgSs%3d&portalid=0&resourceView=1>

The State of Ireland 2019: A review of housing and infrastructure in Ireland

<https://www.engineersireland.ie/LinkClick.aspx?fileticket=SHTzZx9nDDg%3d&portalid=0&resourceView=1>

Industry 4.0: Manufacturing Industry in Ireland policy statement

[https://www.engineersireland.ie/LinkClick.aspx?fileticket=sYqemAuM\\_Tk%3d&portalid=0&resourceView=1](https://www.engineersireland.ie/LinkClick.aspx?fileticket=sYqemAuM_Tk%3d&portalid=0&resourceView=1)

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**Background to Engineers Ireland**

With over 25,000 members, Engineers Ireland is the voice of the engineering profession in Ireland. Engineers Ireland was established in 1835 making us one of the oldest and largest professional bodies in the country. Members come from every discipline of engineering, and range from engineering students to fellows of the profession.

**Our responsibility is to**

- Promote knowledge of engineering
- Establish and maintain standards of professional engineering and engineering education
- Provide opportunities for Continuing Professional Development (CPD)
- Maintain standards of professional ethics and conduct
- Ensure that professional titles are granted to qualified candidates
- Act as the authoritative voice of the engineering profession in Ireland

**Our Vision Statement**

Engineers Ireland: a community of creative professionals delivering sustainable solutions for society.

**Our Mission Statement**

Engineers Ireland is an institution that enables the engineering community progress their professional development and make a sustainable impact on society, advocates for the profession, quality assures education and encourages the future generations of engineers.