Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

School of Engineering Industrial Engagement Strategy 2025-2030

“Academic-Industrial collaborations foster innovation, where theoretical knowledge is applied to real-world challenges, resulting in solutions with profound societal impact.”

Message from the Director of Industrial Engagement, Professor Triona Lally

Trinity College Dublin's School of Engineering is proud to be an innovative, research-led School with a robust network of industrial partnerships and a globally recognised profile. Our faculty actively engages in collaborative research projects that tackle critical challenges across diverse fields—from sustainable energy and advanced manufacturing to health and digital technologies. By effectively bridging theory and practice, we not only push the boundaries of knowledge but also deliver tangible, real-world solutions to global problems.

This Industry Engagement Strategy aligns with the overarching Trinity College Dublin "A Living Research Excellence Strategy" and the School of Engineering Research Strategy 2025-2030. These strategic frameworks emphasise our goal to maximise our research impact in pioneering solutions to address key global challenges. The School of Engineering Research Strategy, launched in March 2025, outlines a comprehensive vision that spans a number of research areas, including energy, data, wellbeing, resources, sustainability, communities, and the environment. Our research portfolio ranges from groundbreaking discoveries to transformative innovations in real-world settings.

Recognising that industrial engagement is a catalyst for growth and opportunity, this Industrial Engagement strategy is designed to forge strong, mutually beneficial partnerships with industry leaders. Implementing the key goals of this strategy will strengthen these collaborations and deliver on our mission of achieving a measurable impact on both the academic and industrial landscapes nationally and internationally.

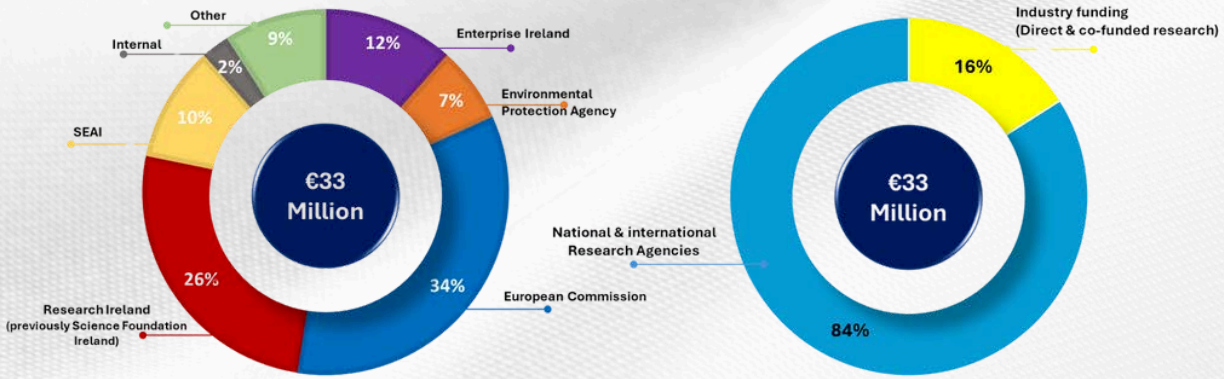
"Scientists dream about doing great things. Engineers do them"

James A. Michener

School Research Landscape

The School of Engineering Research Strategy 2025-2030, launched in March 2025, highlights the overall research vision and mission of the School. Our approach to research is firmly rooted in broader societal engagement and the School research strategy explicitly identifies industrial engagement as a key area of potential growth and opportunity within the School. The vision, mission and values of our Industrial Engagement strategy were developed to align with the School's overarching Research Strategy and help the School become an internationally recognised leader in industry-academic partnership to address global challenges.

The School of Engineering has extensive links with industry through student internships and collaborative research with 16% of the School's total annual research funding generated in collaboration with industry, or through direct funding from industry.



Research Funding Awarded 2021-2024

In 2021, an Industry Advisory Board (IAB) was established to support the School's endeavour to promote a culture of industry-academic partnership and in 2023 a new position, an Industry Liaison role, was established. Following these initiatives alone, the School has seen an increase in industry initiatives in teaching and in the number of undergraduate students going on internship from those eligible for such placements (>60% in 2023/24 compared with 45% in 2022/23).

At Trinity College Dublin's School of Engineering, we recognise the importance of building strong relationships with industry leaders and we are committed to working with Industry to address global challenges. To further support Industrial Engagement in teaching and research in the School, a new Director of Industrial Engagement role was established in 2024. The role of the Director, as a member of the School Executive, is to develop and implement the School's Industry Engagement strategy and report on industrial engagement activities within the School. The key focus of the strategy is to in**crease the School's external visibility to potential industry partners, to expand students' internship opportunities and to create additional links between our faculty and students, and industry leaders to help address key global challenges.**

Our Vision

To enhance and maintain a mutually beneficial partnership between the School of Engineering and industry stakeholders, fostering innovation, knowledge exchange, and student development to address current and future engineering challenges.

Our Mission

To develop a strategic direction for industrial engagement via a comprehensive guide, actionable implementation plan, and streamlined process to attract and grow impactful multidisciplinary industry engagement in the School of Engineering, positioning the School as a leader in academic-industry research, while aligning with the University and School's broader strategic objectives.

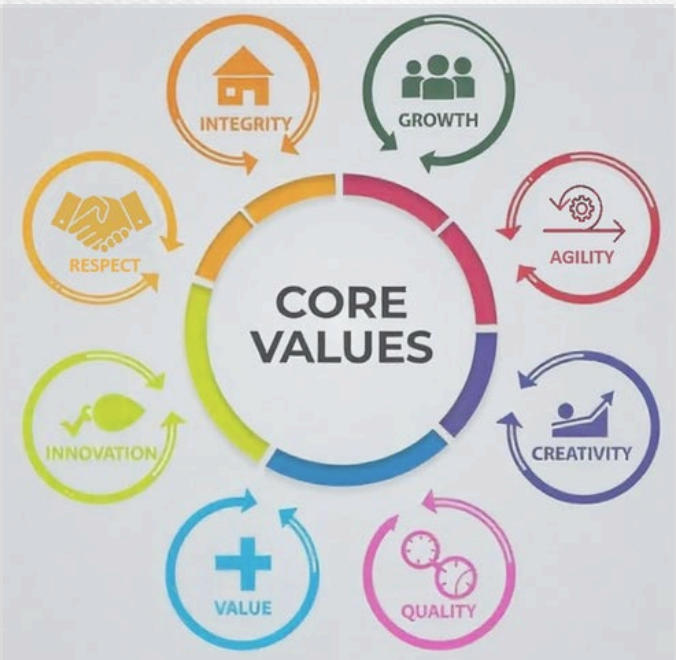
Our Values

Ethical Engagement: Prioritise collaborations with companies with a strong commitment to ethical practices and who promote fairness, respect for human rights, environmental stewardship, and positive contributions to society.

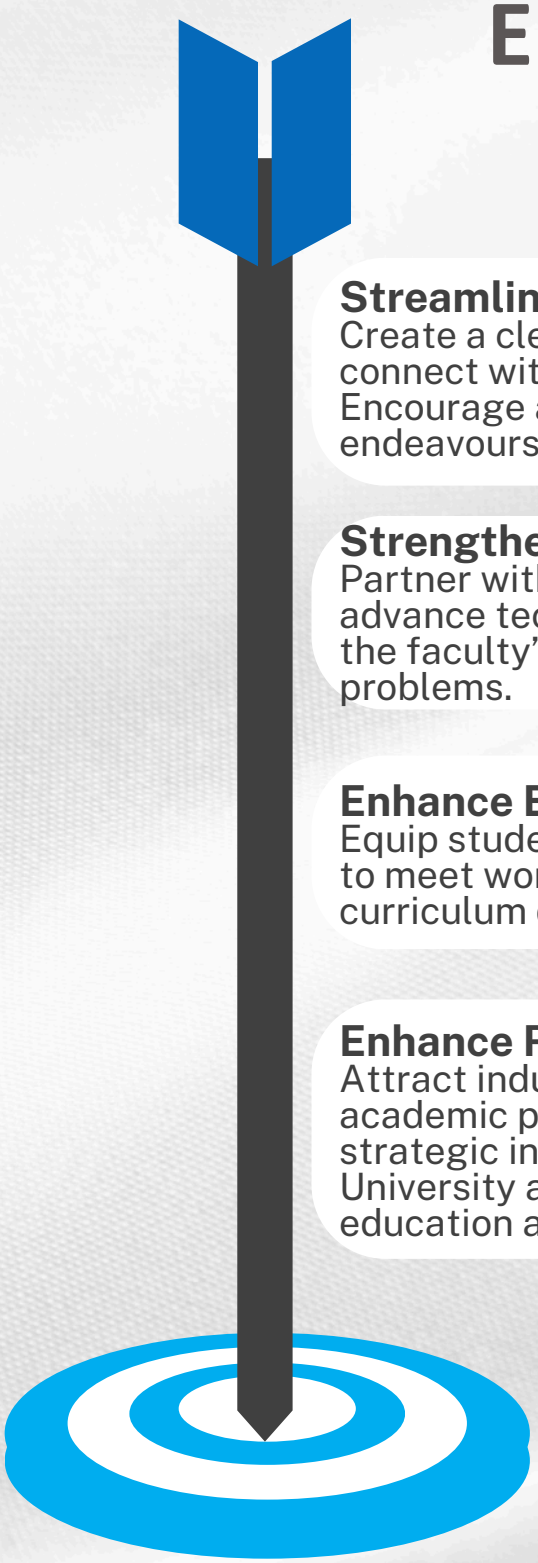
Excellence: Strive for high-quality outcomes in every engagement, setting a benchmark for impactful industry collaborations.

Integrity: Maintain honesty, ethical practices, and professionalism in all interactions to build trust and long-term relationships.

Agility: Adapt quickly and effectively to the evolving needs of industry and academic partners.



Strategic Objectives for Industry Engagement



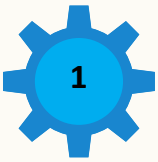
Streamline Accessibility & Foster External Engagement:
Create a clear and easy pathway for industry leaders to locate, connect with, and collaborate with the faculty in the School. Encourage and facilitate faculty in their external engagement endeavours.

Strengthen Research Collaboration:
Partner with industries on cutting-edge research projects to advance technology and innovation and maximise the impact of the faculty's research work to solve real-world engineering problems.

Enhance Employability of Students:
Equip students with industry-relevant skills and experiences to meet workforce demands through industry participation in curriculum delivery and internship opportunities.

Enhance Reputation and Generate Funding:
Attract industrial sponsorships, grants, and in-kind support for academic programs, infrastructure and research in the areas of strategic interest to the School, thereby positioning the University as a leader in industry-relevant engineering education and innovation.

Key Actions to Achieve our Strategic Objectives



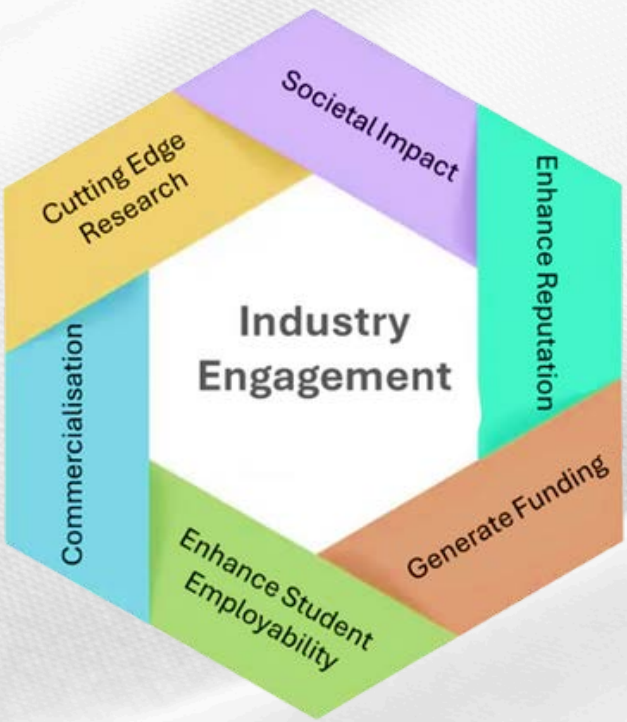
Provide a framework that makes it easy for industry to engage with faculty

- Create and share an online searchable database or virtual brochure detailing all SoE PIs. Host annual events showcasing industry relevant research and existing industry co-funded research projects to potential industry partners. Include information workshops on available funding mechanisms for co-funded industry-academic research, e.g. Research Ireland targeted calls including co-funded Enterprise Partnership and Employment based PhD programmes, Enterprise Ireland Innovation Partnerships and Innovation Vouchers, Horizon Europe Funding, Disruptive Technology Innovation Funding (DTIF).
- Promote an awareness of the mechanism of industry funded faculty positions, from Assistant Professor level to Chair/Full Professor level.
- Populate and maintain an Industrial Engagement section on the School website showcasing example industry-academic research projects. Clearly outline the main points of contact for SoE industry related matters, e.g. Industrial Liaison Officer, Director of Industrial Engagement, amongst others.
- Advertise and promote upcoming research showcase events to potential industry partners and maintain external visibility of past events.
- Establish and maintain links with the research office to provide pre- and post-award support for collaborative industry projects.
- Collaborate effectively and streamline processes within other college units, including Trinity Development and Alumni (TDA), the Careers Office, and the Trinity Innovation and Enterprise Office to engage with the School of Engineering in advancing industry collaborations.

Key Actions to Achieve our Strategic Objectives

2 Generate research outputs with significant benefits to society

- Cultivate a transdisciplinary approach to research engagement by fostering collaboration with other schools and leveraging opportunities through active participation with the Trinity E3 initiative.
- Support undergraduate and postgraduate design projects in areas of benefit to society
- Promote and share research with industrial and translational potential, e.g. Invite industry to attend and participate in our Engineering Design Showcase day/Research Days etc.



Key Actions to Achieve our Strategic Objectives

3 Student focused programmes

- Career talks
- Industry inspired and collaborative projects at all levels (BAI, MAI, MSc and PhD)
- Increased student internships and research student industrial placements
- Increased industry involvement in our educational programmes, including industry awards for students in key industry relevant streams
- Industrial mentors for students

Key Actions to Achieve our Strategic Objectives

4 Networking and Outreach

- Form and maintain a panel of industry leaders (Industry Advisory Board (IAB)), to provide strategic advice and strengthen connections with key sectors.
- Host annual Industry-Academia Conference Days: Showcase research, explore partnerships, and discuss the latest trends and challenges as well as funding opportunities.
- Input into career fairs and recruitment events and run career talks: Organise events where companies can recruit engineering students and promote career opportunities.
- Alumni Network: Leverage alumni in leadership roles to act as ambassadors for industry partnerships and maintain social channels for easy interaction with the school.

Key Performance Indicators for Successful Implementation of the Industry Engagement Strategy

This 2025-2030 School of Engineering Industrial Engagement Strategy leads us towards clear and tangible goals to achieve in the next five years. A number of goals and opportunities have been identified in this strategy and our School has ambitious targets in the next five years:

- Increase by at least 50% the number of new industry partnerships.
- Increase the direct research funding generated from industry sources by 30% per annum, in line with the School's Research strategy to increase funding from approximately €15 million to €20 million per annum.
- Increase the number of internships available for undergraduate students to accommodate all eligible students.
- Increase the number of industry linked capstone and design projects and industry placements available for postgraduate research students.
- Introduce new industry linked initiatives in educational programmes.
- Increase by 50% the number of industry invited speakers
- Increase research commercialisation by 50%
- Generate positive feedback from industry partners, faculty, alumni, and students on industry-academic initiatives.

By aligning the School of Engineering's academic expertise with industry needs, **this strategy will drive innovation, increase industry engagement, collaboration and commercialisation, and enhance the employability of our graduates.** This will help establish TCD's School of Engineering and its disciplines as key academic partners in **addressing current and future global engineering challenges** from those presented by our ageing society to climate change, and our digital world.

"Innovating Together for a Brighter Future"

Industrial Collaboration CASE STUDIES

The Sigmedia group (www.sigmedia.tv) has grown in recent years now involving 6 academics : Prof. Anil Kokaram (Video), Prof. Naomi Harte (Audio), Dr. Francois Pitie (Video), Dr. Hossein Javidnia (Video) and Dr. Nils Peters (Audio). There are currently about 17 PhD students and 4 Research Fellows in the team. It has a history of strong collaboration with Industry (particularly in the video/cinema space) starting with consulting and joint EU projects with The Foundry (https://www.foundry.com/) since 1998 and expanding to picture quality research with Google/YouTube and now the AOMeda Alliance (aomedia.org). Two spin outs from the group, GreenParrotPictures and Thrive, were acquired by Google in 2011 and 2015.

EU Project Emerald brings together six partners across Europe (including broadcasters and technology developers) to create energy efficient technologies for cinema production. At the October 2024 Society of Motion Picture and Television Engineers conference in Los Angeles, Sigmedia presented its work on Virtual Production with Disguise https://www.disguise.one/en. Virtual Production is now popular for immersing actors in realistic worlds allowing shooting the complete scene on set without greenscreen (e.g. in the making of the Mandalorian). The Sigmedia group showed that it is possible to reduce the data rates of those images by a factor of 20 without affecting the quality of the final shot! This makes the workflow faster and more energy efficient.

Sigmedia's work with the YouTube Media Algorithms team since 2011 has spanned the breadth of video quality research in media streaming. This has been sponsored by a long running donation to the laboratory since that time.

In 2024, PhD student Darren Ramsook placed 3rd in the international challenge for AI compression algorithm development. His work shows how existing video standards can be used alongside clever picture enhancement to reduce the bandwidth needed for streaming.

Engineers and Scientists from companies who have worked with Sigmedia over the years have delivered guest lectures in TCD's engineering modules. Ioannis Katsavounidis from Meta, Balu Adsumili from YouTube, Peyman Milanfar from Google, Ben Kent from the Foundry and Oliver James from DoubleNegative have all taken the time to motivate and inspire students in the study of computational science and engineering.

In response to the high levels of innovation taking place in Irish companies, the Irish Government established **Disruptive Technology Innovation Funding (DTIF)** as an agile mechanism to support research and development. DTIF projects are typically industry led initiatives, with industry receiving up to 50% grant funding. The research needs to be ambitious, requiring multiple partners and significant funding to realise the solution and it must set a clear path towards follow-on commercialisation.

"*The DTIF allowed us to realise the level of ambition we had in the development of our new Jet Electrochemical Machining technology. We had been working on this development project internally and we had sponsored PhD research in the UK, but the DTIF allowed us to put more focus and more resources into this to accelerate development. At one peak point during the project, we had 7 researchers and engineers working on the topic between the academic team and our company researchers. We had access to measurement and characterisation tools in the University, and the additional bandwidth was a game changer*"- Dr. David Gillen, MD Blueacre Technology.

DTIF projects such DEFINE-AM "Disruptive Finishing using Electrochemical machining for Additive Manufacturing" led by Blueacre Technology, together with Associate Prof. Garrett O'Donnell's team in TCD, developed a novel approach to generating engineered surfaces on 3D printed metal parts. The DTIF was initiated by Blueacre Technology, who sought expertise within the TCD School of Engineering.

DEFINE-AM platform and sample jECM machined stainless tube developed during DTIF

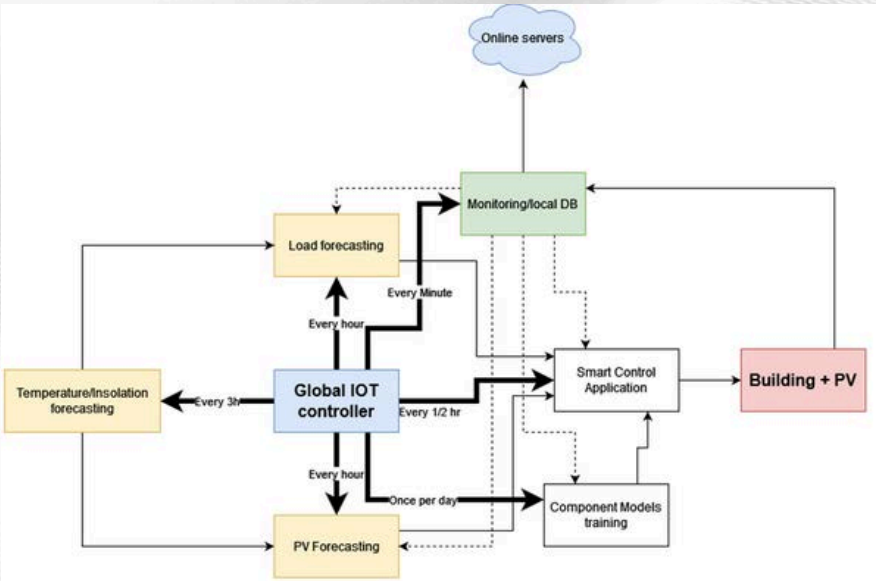
Together the team produced a **world-first robotic based jet electrochemical machine (jECM) tool.** The industry partner continued to pursue the commercialisation of this technology and a strong relationship continues with TCD. Positive impact from this DTIF project include researchers in TCD moving to the industry partner to continue their career, continued collaboration on postgraduate research in TCD and guest lectures to undergraduate Engineering students by Blueacre Technology.

A second DTIF led by HT Material Science NANOTherm subsequently engaged with Prof. O'Donnell, Prof. Robinson and TCD's School of Chemistry, to develop novel nano based cooling liquids that challenge the status-quo in HVAC, data centre and other liquid cooling applications. By bringing the best academics in their respective fields together to support industry partners in their ambition, TCD effectively provided end-to-end expertise from the fundamental nanomaterials development to testing and scale-up.

The most recent DTIF with Prof. O'Donnell's group is entitled SPRINT "Sustainable Production using Intelligent Tooling" and is a collaboration with TCD spin-out iSentioLabs, TCD Engineering (Dr. Trimble), IMR, DePuySynthes, Croom Medical and Schuf Valve Technology. SPRINT is led by iSentioLabs, a spin-out born from research work undertaken in TCD's STAM research group that focused on measurement and monitoring of machining operations. DTIF has enabled an early stage spin-out company to advance their technology with key consortium partners, putting the company on a clear path to commercialisation.

This is a collaborative PhD project, partially funded by EURAC, which aims to develop and implement an intelligent control system to optimise energy management in residential heating and cooling systems. The project aims to develop advanced optimisation methods that achieve near-global optimal performance and are able to operate in real time on constrained hardware. A key aspect of the project is the integration of dynamic programming (DP) techniques with reduced order models (ROMs) and novel approaches such as quantum optimisation.

The projected focuses initially on the development of fast, accurate component models for various parts of the heating and cooling system, like heat pumps, thermal storages, and electrical batteries. The research then explores methods for constructing these models based on laboratory testing, performance maps, and advanced forecasting techniques, see below. For example, physics-informed neural networks (PINNs) are employed to predict indoor temperatures and thermal loads, leveraging both historical monitoring data and real-time weather forecasts

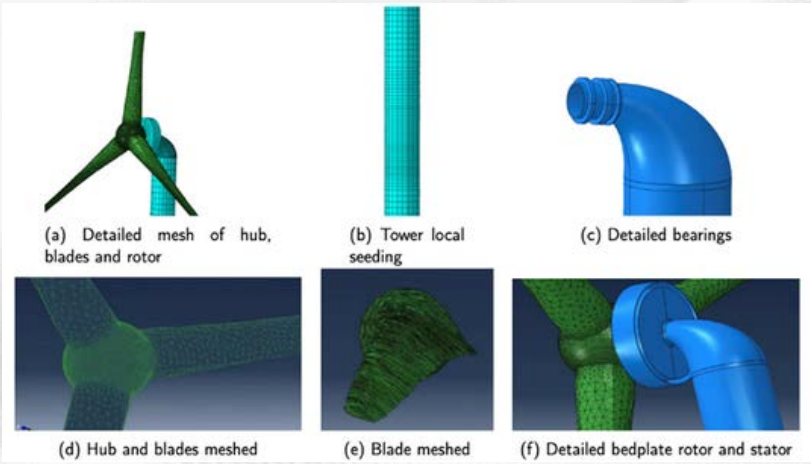


Following the modelling phase, the project focuses on designing an optimisation framework to determine the optimal control strategy. In parallel, quantum optimisation methods are explored as a potential benchmark for classical approaches. Quantum optimisation, despite current limitations in hardware, offers a promising avenue for solving large-scale combinatorial problems. This research will examine whether the component models developed for the dynamic programming framework can be adapted to quantum optimisation contexts.

Ultimately, the project will culminate in the deployment of the developed control system in a real-world residential demonstration building. Field tests will validate the simulation results and quantify the potential energy and financial savings, providing a benchmark for advanced control systems in residential energy management. These endeavours will advance the state-of-the-art in smart energy management, offering a versatile and scalable solution for modern residential heating and cooling challenges.

Windleeder, led Prof. Breiffni Fitzgerald, involves a major industry collaboration focussed on addressing the challenge of aging wind turbines in Ireland. With approximately 500 onshore wind turbines reaching their end-of-life by 2025 and 1000 by 2030, there is an urgent need for sustainable solutions. This project, conducted in partnership with Bord na Móna, ÉireComposites, and GDG, aims to develop a comprehensive decision-making tool for end-of-life wind turbines in Ireland.

This project research integrates state-of-the-art fatigue analysis methods for aging wind turbines, leveraging structural dynamics and finite element modelling. The outcomes of this project will serve as the most authoritative evidence base on end-of-life wind turbines in Ireland and establish an international benchmark for sustainable wind energy transitions.

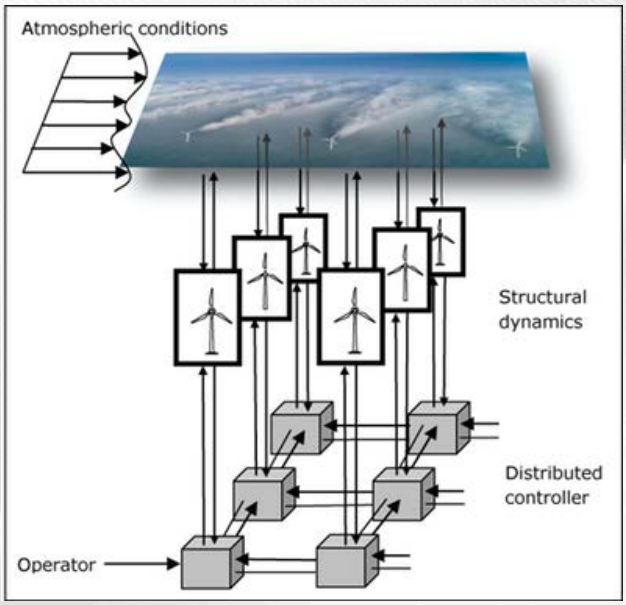


Another current project, MeLodiC, is a Research Ireland funded industry-academic collaboration that advances the emerging field of wind farm control by treating the wind farm as a holistic system to be optimized and controlled. This project funds two PhD students. A key aspect of this project is the partnership with Ørsted, a global leader in offshore wind, which provides real operational wind farm data to support the development of data-driven models.

This collaboration bridges the gap between academic research and industry needs, ensuring that cutting-edge methodologies, such as machine learning and advanced aerodynamic modelling, are grounded in real-world applications.

For industry, MeLodiC delivers innovative control solutions that enhance power generation efficiency while reducing fatigue loads on wind turbine blades, ultimately improving the longevity and financial viability of wind farms.

For researchers, direct access to industry data allows the development of models that go beyond theoretical assumptions, leading to breakthroughs in wind farm aerodynamics, wake modelling, and machine learning control.

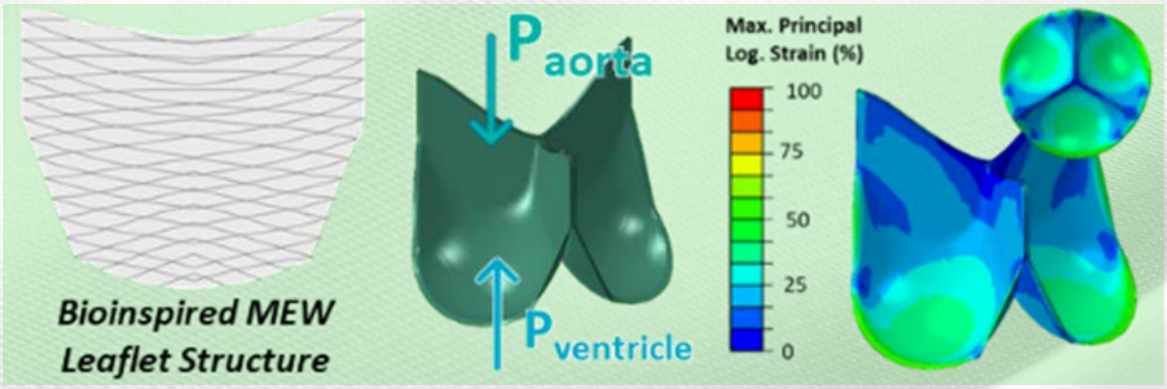


Aortic stenosis (AS) affects about 4% of people over 70 and has a 50% chance of mortality within 2 years when left untreated. Bioprosthetic heart valves are used to treat AS and can be delivered through minimally invasive surgery but their lifespan is often compromised by the long-term performance of the heart valve leaflet material. This is due to both structural damage and/or calcification in the leaflets.

Prof. Lally's research group has been working with Boston Scientific in Galway for nearly a decade to better understand the mechanisms of structural damage and calcification in bovine and porcine pericardium, the main materials used in commercial bioprosthetic heart valve leaflets. To-date this industry-academic collaboration has co-funded three Research Ireland PhD students, two postdoctoral positions and a research assistant position. Using experimental and computational approaches, the research work has identified the complex relationship between leaflet material damage and calcification and established a non-destructive laser-based method of screening these leaflet materials to improve their long-term performance.

Boston Scientific Aortic Heart Valve

In addition, Prof. Lally and her team have developed a novel in-silico framework for creating 3D-printed, bioinspired polymer leaflets with a composite fibre-embedded structure which have the potential to have superior durability to pericardial leaflets. Informed by imaging and mechanical characterisation of native porcine aortic leaflets, they have created a novel preclinical design tool to inform and optimise material selection and leaflet structure for different valve leaflet shapes and varying clinical cases. This work has the potential to inform the design of bioinspired polymer heart valves that can outperform current commercial devices and improve patient outcomes.



Computational models of fibre embedded bioinspired polymeric heart valve leaflets to establish the optimum fibre structure to be printed using melt electrowriting (MEW) 3D printing techniques

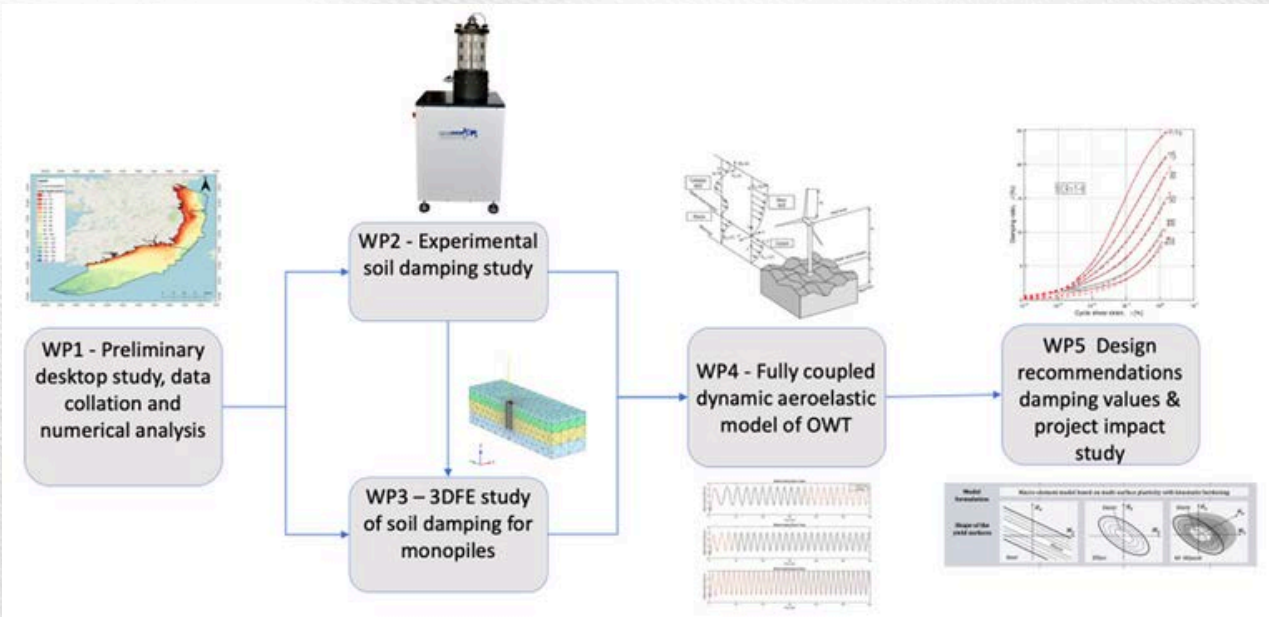
This collaboration with Boston Scientific in Galway has also resulted in a new collaboration with Boston Scientific in Clonmel supported by the SFI AMBER centre, with the aim of creating in-silico and bench-top models for the design and optimisation of a suite of 'smart' urological medical devices. To-date, Boston Scientific co-funding to Prof Lally's group has generated over €2 million in direct funding.

Ireland is on the cusp of a key change in how our electrical energy is generated. Large scale offshore wind developments will become a major part of our electricity generation infrastructure by 2030, allowing Ireland to become energy independent and potentially a net exporter of green energy. Dr. Igoe's research group focuses on Geotechnical Engineering and improving the design of offshore wind turbine foundations in order to improve viability and cost efficiency in challenging ground conditions. This research requires close links with industry to ensure any new engineering methods or models can be readily adopted by industry. Some examples of industry research projects are provided below:

Project 1: "Developing damping parameters for Irish offshore wind farms" (2020 – 2024)

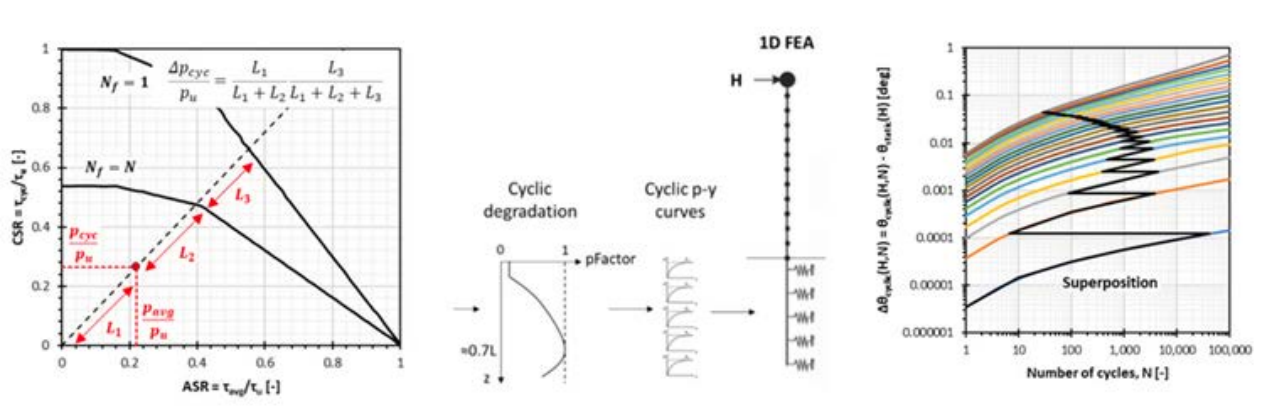
This project was funded by the Sustainable Energy Authority of Ireland (SEAI) in collaboration with Gavin and Doherty Geosolutions (GDG) and Dublin Offshore Consultants.

This project involved (1) A desktop study led by GDG to assess the geotechnical conditions in potential offshore wind farm zones around Ireland, (2) developing a database of state-of-the-art experimental soil element tests to cover a range soil types, (3) advanced 3D Finite Element analysis of wind turbines using soil constitutive models calibrated from the experimental tests, (4) advanced dynamic analysis of full wind turbine structures and (5) distilling the results into models of different complexity which could be applied at different stages of design (e.g. preliminary design, Front End Engineering Design – FEED, or full detailed design). Feedback and collaboration with the industry partners was key to ensuring suitable geotechnical conditions were targeted and that results could easily be used by offshore wind designers.



Project 2: "Cyclic Loading of Offshore Monopiles" (2019 – 2024)

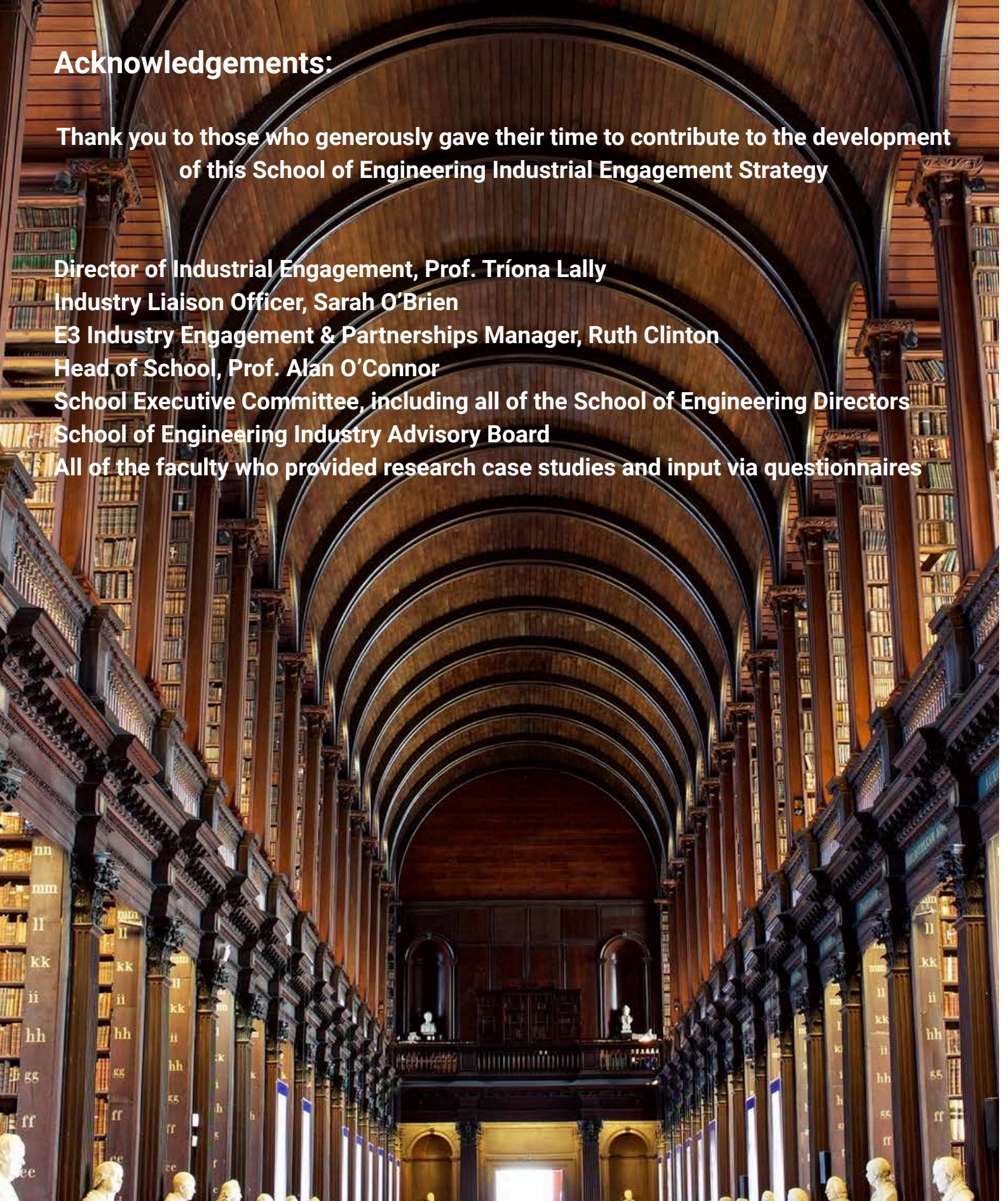
This project was a Research Ireland (IRC) funded employment based PhD which student Louis Lapastoure undertook with industry partner Gavin and Doherty Geosolutions (GDG). This project developed new experimental field tests and a new numerical method for accounting for cyclic loading of offshore monopile foundations.



Project 3: "Suction Caisson anchors for Floating Offshore Wind Farms" (2022 – 2026)

This project is an Research Ireland (IRC) funded employment based PhD which student Emma Gallagher is undertaking with industry partner Gavin and Doherty Geosolutions (GDG). This project will develop new numerical and experimental research, analysis methods and design tools for suction caissons anchors which will support the development of floating offshore wind.

(a) PhD candidate Emma Gallagher presenting her research at Wind Energy Ireland and (b) Suction caisson jacket for Seagreen offshore wind farm



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