UCD Submission to DECC Research and Innovation Strategy Consultation 11th August 2023

University College Dublin (UCD) welcomes the development of the Department of the Environment, Climate and Communications first Research and Innovation Strategy to advance its goals and role as part of Impact 2030 to deliver on strategic objectives in Climate, Environment and Sustainability (including Energy), and in Digital Transformation.

Research and innovation (R&I) are acknowledged by government as important enablers for Ireland to meet its climate action goals and the necessity for research to underpin evidence-based policy to address the levers of Ireland's transition to net zero including behavioural change, organisational innovation as well as the R&I ecosystem's role in supporting the development of new products and processes and the talent pipeline to support Ireland's climate ambitions.

UCD through its broad spectrum of research centres, institutes and research programmes spanning sustainable food systems, bioeconomy, energy, biodiversity, marine, soil health, just transition and behavioural economics is supporting Ireland to respond to the challenges of climate change and to develop solutions for Ireland and the wider world's sustainability challenges together with national and international research and industry partners.

Details of UCD's leading research centres and institutes linked to these areas are located after our response to the consultation questions.

Consultation Questions

1. What gaps do you see in the Department's current research and innovation activities? How should we address those gaps in the Department Research and Innovation Strategy?

Ireland's participation in international R&I programmes is critical to realising our ambitions in the Department's areas of strategic importance, working as part of multilateral R&I programmes as well as bilateral R&I programmes. Leveraging international partnerships will help drive Ireland's international reputation as a R&I powerhouse in the green transition and support us to expand our international research networks with opportunities to integrate them as part of our diplomatic and trade efforts. The Department has been a strong supporter of international collaboration related to research and innovation including providing Ireland's National Contact Points for LIFE and environment areas in Horizon Europe including coordinating Ireland's participation in two of the Horizon Europe Missions: Climate Neutral and Smart Cities and Adaptation to Climate Change. However, we have identified several areas that could support Ireland to engage from a stronger position:

- **Requirement for the development of a new national structure and associated strategy to support greater Irish participation in European Research Infrastructures associated with the Department's and Ireland's strategic ambitions.** Global science is increasingly underpinned by shared large-scale infrastructure resources. Ireland needs to identify its priority investments in sustainability here to enable its research and innovation community to optimise its engagement internationally.

- **Identification of potential new bilateral collaborative opportunities** to support the deepening of relationships with EU and non-EU countries which are mutually beneficial for research and innovation linked to the sustainability challenge and that align with other government strategies such as Global Ireland. Consideration for new bilateral research and educational relationships should be given to countries with shared values and include those with which we want to enhance our existing partnerships and those with which Ireland wishes to forge new and emerging relationships. New and enhanced bilateral R&I partnerships could be considered with the US, the UK, New Zealand and Canada. Emerging relationships should be considered with India, South Africa and other African nations developing their scientific ambitions amongst others.

- **Advancing R&I cooperation on an all-island and UK-Ireland basis through new mechanisms** including the introduction of new joint appointments on a North/South basis in target areas such as sustainability, energy, agri-food, quantum, and next generation communication technologies. In addition, through new programmes that support researcher mobility across the Island and across all career levels including new Centres for Research Training on an East-West basis. Consideration could be given for funded programmes to establish clusters in these areas on an all-island and UK-Ireland basis.

Greater coordination of government departments with national research funding agencies on funded research activities to address foresight initiatives and departmental research interests is necessary. This will ensure that the objectives of policy makers are delivered on, and best value is achieved in return for public investment. UCD assumes that the new science advisory structures proposed by government will enable this coordination to take place. These mechanisms should ensure transparency in relation to aligning research interests to optimise resources and avoid duplication.

2. What actions can the department take to identify future trends in the areas under our remit?

Consideration could be given to introducing a structure within the Department for engaging with external experts. For example, the UK Department for Digital, Culture, Media and Sport have established a 'college of experts'[1] which is made up of external experts from across academia and industry to provide a mechanism for the department to access external expertise and guidance on future trends in areas under the Department's remit.

The development of structured horizon scanning projects could be enabled by the Department or via the science advisory structures across government. Initiatives could be looked at in other countries including in the UK where several government departments/bodies have their own Futures or Horizon Scanning teams[2] and they connect with others from across the public sector with an interest in Futures through their Heads of Horizon Scanning Network as part of the UK Government Office for Science. Another example is the Singapore Centre for Strategic Futures. The publication of reports from these horizon scanning and future initiatives could take place.

[1] UK Department for Digital, Culture, Media & Sport, College of Experts, https://www.gov.uk/government/groups/dcms-college-of-experts

[2] UK Government Futures, Foresight and Emerging Technologies,https://www.gov.uk/government/groups/futures-and-foresight

3. Are there specific thematic areas relevant to the Department's remit which you would like to see more research and innovation activity in? How can this be achieved?

To realise the Department's and government's vision of a climate neutral, sustainable, and digitally connected Ireland will require significant increases in R&I investment along with greater collaboration between government departments, research performing organisations and other stakeholders.

Focus should be directed towards de-carbonisation technologies and transition strategies to fully understand the projected impacts of climate change across sectors and regions. Research in climate change adaptation strategies, combined with societal engagement and behaviour change studies, can enable effective planning and foster community engagement.

In the area of communications, the focus should be on the development, deployment, and optimisation of high-speed next generation wireless technologies to support the green transition. Another key focus should be on the development of quantum communication technologies and investment in critical national infrastructure. For example, Ireland has no national optical ground station, which limits opportunity for industry, researchers, and our defence forces.

The National Cyber Security Strategy has committed to scoping a new cyber security research centre with SFI. This should be established as a priority to close this critical gap in our R&I ecosystem supporting the development of future industry and research leaders**.**

Ireland's renewable resources are vastly greater than its energy needs and thus Ireland is primed to develop into a major international energy exporter. **To realise this, investments in test beds to trial and develop power conversion, energy storage, transmission, and integration technologies are critically needed**. This would signal clear intent and position Ireland as a global leader in energy transmission and renewables technologies, moving from being a traditional technology adopter/follower, thereby being a technology developer would result in greater indigenous capacity to develop large scale renewables and transmission technology.

Research on natural resources should focus on the use of artificial intelligence, machine learning and advanced analytics, and the generation of national datasets for geospatial/earth observation analytics to enhance our understanding of Ireland's geological resources. An excellent example of what is possible here is the UCD led CAMEO[3] collaborative research programme funded under the Disruptive Technology Innovation Fund which seeks to democratise the use of earth observation data for non-specialist users. This platform aims to become a national platform integrating a wide range of datasets to provide decision support services across a range of use-cases, spanning Climate, Agriculture and Marine.

This should be combined with the development of a true circular economy and bioeconomy in Ireland. This is a key focus of the UCD led SFI funded bioeconomy research centre, BiOrbic, which looks at renewable biological resources and converting waste into value-added products like food, feed, bio-based products, and bioenergy. Circularity is key for climate change mitigation, promoting biodiversity, enhancing resource use efficiency, and fostering sustainable economic growth. For this to be realised, research and innovation in technology, business models, and policy frameworks is urgently needed.

[3] UCD CAMEO DTIF https://www.cameoplatform.ie/

4. Have you views on the impact of disruptive technologies such as AI, Quantum and 6G as part of the digital transformation agenda and the implications of these technologies for the Department?

Several disruptive technologies are central to the Department's digital transformation agenda, including artificial intelligence (AI), machine learning (ML), advanced power technologies, digital twins, quantum technologies, and next generation wireless communications. Each will impact on the Department's strategy and will all require research investment and require critical infrastructure investment.

There is a particular opportunity with AI and ML in the consolidation of siloed national data sets combined with earth observation data to support decision-making in environmental policy, energy management, and digital infrastructure planning. The UCD led CAMEO DTIF project referenced in question 3 seeks to achieve this over the next few years. AI and ML can process vast datasets rapidly, providing key insights for environmental conservation, energy optimisation, and policy decisions. They can greatly enhance energy storage and transmission systems by optimising grid operations and predicting energy demand. Advanced analytics can process large volumes of data from various sources to provide valuable insights.

Research and innovation test beds are needed to develop and trial disruptive technologies including power conversion, energy storage, transmission, and integration to significantly improve the efficiency and resilience of our national grid and ensure optimal integration of renewables. In addition, experiential training programmes are needed to continuously upskill the Irish energy sector in these disruptive technology fields. For example, UCD's Energy Institute hosts such a testbed at its Integrated Energy Lab and could scale nationally.

Digital twins (virtual replicas of physical systems) in combination with AI and analytics, through simulation and analysis of complex systems such as the national grid can optimise energy management, predict system failures, and plan infrastructure upgrades, leading to more resilient energy networks.

Critical infrastructure investment is required to develop and trial Quantum communication technologies ensuring Irish industry and researchers can develop advanced secure communications technologies, for terrestrial use as well as for intercontinental satellite communications. C-QuEST, UCD's Quantum Research Centre, is working with the Irish Defence Forces to secure funding for a National Optical Ground Station (secure satellite communications) through the European Defence Fund.

Development and deployment of future wireless technologies such as 6G to enable faster, more reliable data transmission which is key for real-time environmental and energy systems monitoring and for enhanced digital inclusivity, requires significant research funding and infrastructure investment as well as updated regulatory frameworks. UCD is establishing a next generation wireless technology centre to consolidate expertise in this area.

5. How can the Department better communicate its research and innovation needs?

The Department could publish their research priorities annually as part of their regular strategic planning process to demonstrate research and policy interests to HEI/research sectors nationally and internationally and relay areas they will require external science advice on. This would act to ensure that there is greater coherence between government departments on research interests resulting in reduced duplication and greater opportunities for cooperation. This currently happens in Northern Ireland and in many government departments in England, Scotland, and Wales where Departmental Areas of Research Interest are published annually[4].

These areas of research interests should be updated annually and may include specific research questions. This will have the dual impact of making researchers aware of areas that government departments require external science advice on and will also inform researchers of areas of research that they could work on to support government policy development. We acknowledge and welcome the Department of Further and Higher Education, Research, Innovation and Science and its agencies has recently published their areas of research interest for 2023 to 2024 as they relate to tertiary sector policy and their operations.

To help inform these areas of research interests relevant departments could meet/ hold workshops to seek academic input to inform the new areas.

A similar approach could be used to communicate innovation needs too.

6. How can the Department work more effectively to source evidence from the national research and innovation community to support its work in policy development, policy implementation, and the uptake of new technologies?

UCD has had a long and successful history of supporting the Department in evidence-based policy making and very much values our role in the Department's policy development and implementation. For example, the EMPowER project (providing Science Advice for Irish Energy and Climate Change Strategies) led by [redacted] from the UCD Energy Institute is a good example of this. EMPowER provides analytical input to key Irish energy and climate change strategies through contracted work with the Department. Specific areas where input has been provided are in relation to the Climate Action Plan and Sectoral Emissions Ceilings. Engagement has also extended beyond DECC with a report prepared for the Department for Transport on the Decarbonisation of Passenger Cars, highlighting the importance of cross-departmental collaboration.

Consideration could be given to introducing a structure within the Department for engaging with external experts. For example, the UK Department for Digital, Culture, Media & Sport have established a 'college of experts'[5] which is made up of external experts from across academia and industry to provide a mechanism for the department to access external expertise and guidance to support work in policy development, policy implantation and the uptake of new technologies.

[4] 2019, UK Office of Science, Realising our ambition through science: A review of Government Science Capability, Guidance, November https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/844502/a_review_of_government_science_capability_2019.pdf

[5] UK Department for Digital, Culture, Media & Sport, College of Experts https://www.gov.uk/government/groups/dcms-college-of-experts

7. How can the Department engage more effectively with all stakeholders in the national research and innovation system? If you are responding on behalf of an organisation, please state how the Department could more effectively engage with your organisation.

Greater awareness in the Department of the expertise available in the research system to support policy making is necessary. A multitude of actions could be enacted to support this recommendation including the introduction of a brokerage or matching service. In addition, training in sourcing science advice needs to be developed and expanded to be more readily available for government departments/officials. UCD plans to establish more supports for researchers involved in evidence-based policy making activities to develop a stronger interface enabling policy makers to engage with UCD researchers and support interdisciplinary policy research. Equally, policy makers should ensure that experts are attributed for their input into policy which will greatly assist in the mutual capturing of data about scientific advice for policy for both policy makers and academics. Such a facility could engage directly with the Civil Service Research Network established in Q1 2023 to support the Impact 2030 Strategic Objective on 'Accessible Research Expertise' strengthening the connections between Government Departments and the public research system.

There is also a need for a greater understanding of policy design in the system. The policy challenges associated with Climate have demonstrated the benefits of involving social scientists to advise on policy design. It is critical that policy design and implementation is evidence-informed, and that policy impact is evaluated and measured by government. This would require robust evaluation of policies/interventions and meaningful collaboration between policymakers and researchers. This would have the dual impact of demonstrating to researchers involved in policy the relevance of their work and encourage HEIs and other research organisations to play an even greater role in contributing to evidence-informed policy making. This could also support how research impact in the context of policy is measured.

8. Should the Department seek to grow its capacity to carry out in-house research? If yes, how can this be achieved?

Yes, in collaboration with research performing organisations. Further enhancement of current schemes developed by research funding agencies to support researchers in policy engagement and evidence-based policy making including secondment to government and state agencies should also take place to support the Department to grow its capacity to carry out in-house research.

The recently launched UK Government Expert Exchange Programme could be an interesting model to explore.

9. Are there examples internationally of Government strategies on research and innovation in climate, communications / digital, circular economy, cyber security, energy or environment that we should examine? If so, can you provide details?

Denmark's Climate Act provides a robust roadmap for reducing greenhouse gas emissions significantly by 2030 and achieving climate neutrality by 2050, aligning with the department's climate goals.

New Zealand's Zero Carbon Act also places a strong emphasis on the role of research in climate change mitigation and adaptation.

The Netherlands' Government-wide Programme for a Circular Economy sets a leading example in aiming for a fully circular economy by 2050. This involves significant investment in research areas such as resource efficiency and sustainable product design, central to promoting a circular economy. Furthermore, the Dutch National Climate Agreement offers a substantial framework for innovation in sectors like agriculture, energy, and industry, crucial for meeting EU and international emissions reductions targets.

In communications and digital technologies, the UK's Digital Strategy underlines the importance of research and innovation in areas like AI, quantum computing and cybersecurity, pivotal for promoting investment in communication networks and enhancing citizen engagement with digital technology.

Estonia's cybersecurity strategy, characterised by a comprehensive approach to digital security, emphasises the importance of ongoing research, public-private partnerships, and citizen engagement, offering important lessons in cybersecurity and fostering digital engagement.

Singapore's Smart Nation Initiative further underscores the commitment to securing digital infrastructure and driving innovation, using AI, data science, and IoT.

Denmark's Energy Agreement 2018-2024 further provides a model for fostering innovation in renewable energy technologies, vital for ensuring a sustainable and competitive national energy supply.

Finally, regarding environmental conservation, the UK Government's 25 Year Environment Plan and New Zealand's Environment Aotearoa strategy both emphasise research and monitoring for the protection and enhancement of natural habitats. These could contribute to the sustainable management and development of inland fisheries and geological resources. The integrated approach of these countries underlines the significance of research and innovation in meeting environmental and conservation objectives.

10. Are there any other matters you wish to raise in relation to the development of the research and innovation strategy?

Dedicated funding could be ring fenced as part of specific research grants where relevant to enable evidence for policy work to be conducted by the research team.

More opportunities for sharing research reports/policy briefings beyond the Department for which it was developed would ensure wider recognition and awareness of the work. For example, UCD's EMPowER project's research in Electric Vehicle uptake was shared with both the Department of Transport and the Department of the Environment, Climate and Communications enabling cross departmental exposure of science advice.

Further opportunities for secondments between Government Departments/Agencies could be explored to enhance knowledge exchange and to strengthen collaboration, e.g., Research Fellowship programmes. By way of example the UCD Energy Institute has had strong collaboration with SEAI in recent years through the Research Fellowship Programme where researchers have been co-supervised by UCD Academics and SEAI. These fellowships in the areas of offshore wind, low-carbon, and renewable heat in Ireland to 2050, High Performance Energy Efficiency and Building Stock Transformation, Development of the Electricity Distribution System Up To 2030, Future

Technical Integrations – District Heating and Supply Systems Options, and Energy Sector Coupling in the Electricity, Heat and Transport Systems have strengthened the research collaboration with SEAI.

Consideration needs to be given for methods to recognise researchers who are involved in providing science advice to government.

Government should utilise an across departmental approach to strengthen business R&D investment through increased investment in mechanisms to support HEI-industry partnerships and collaboration in priority areas linked to Ireland's Climate Action Plan. Despite existing supports Ireland has one of the lowest rates of private investment in R&D in Europe. To sustain wealth generation and high levels of quality employment we will need to increase our ability to innovate and sell differentiated, high value products and services to global markets and we need to further elevate the transformation of Ireland's enterprise base towards one based on knowledge activities. Increasing university-industry R&D collaboration will strengthen the innovation performance and productivity of enterprises, expand the national R&D skills base and support Ireland to develop and commercially exploit new knowledge from around the world as well as our own intellectual property to support our climate ambitions.

Overview of UCD's Leading Research Centres and Institutes Linked to the Strategic Priorities of DECC

UCD Earth Institute: plays a leading role in UCD's response to global sustainability challenges and is committed to high quality interdisciplinary research to improve fundamental understanding of our rapidly changing environment and to find solutions for a sustainable future. The expertise of its 400 full and associate members, spread across 24 of the university's schools along with a wide range of collaborators and stakeholders, revolves around seven themes; water, climate, ecosystems and evolution, crops for the future, built environment, people, work, society, and sustainable communities.

UCD Energy Institute: plays an integral part in the energy transition, endorsing a net zero carbon energy system, promoting modernised integrated energy systems while empowering the citizen through education, innovation, and digitalisation. The institute is a hub of energy education, research, demonstration, and outreach with members from a range of disciplines including power system engineering, energy economics, energy in the built environment, energy management and end use, consumer behaviour, energy markets and policy, energy finance, renewable energy technologies and the energy-water nexus among others.

NexSys: the Next Generation Energy Systems programme which is funded through SFI's Strategic Partnership Programme and is an all-island, multidisciplinary energy research programme hosted by the UCD Energy Institute in partnership with eight other leading research institutions: ESRI, DCU, Queen's University Belfast, NUI Galway, Maynooth University, Trinity College Dublin, UCC, and Ulster University. 46 leading academics work in partnership with industry to tackle the challenges of energy decarbonisation, developing evidence-based pathways for a net zero energy system together with industry co-funding partners.

iCRAG: is SFI'S Centre in Applied Geosciences hosted by UCD with a team of researchers creating solutions for a sustainable society. They develop innovative science and technologies to better understand the Earth's past, present, and future and how people are connected to it and drive research in areas that are critical to society and the economy, including: sustainable discovery of

energy resources and raw materials required for decarbonisation; securing and protecting groundwater and marine resources and protecting society from Earth's hazards such as flooding and landslides.

BiOrbic: is SFI's national bioeconomy research centre, established to promote and develop Ireland's bioeconomy through excellent research and innovation and is a national collaboration of over 100+ researchers, focused on the development of a sustainable circular bioeconomy. Hosted by UCD BiOrbic works with food producers and industry to create valuable and sustainable bio-based products and services from natural resources. Researchers work on selectively separating and extracting valued compounds from renewable materials, converting those resources into novel bio-based products and processes, delivering market and industry- scalable sustainable resources.
A core purpose of BiOrbic is to engage, involve and empower the public and societal actors with the bioeconomy and our research.

UCD Institute of Food and Health: brings together expertise in food and health research from across UCD, creating a focal point for research excellence in the area and delivering scientific research that informs national and international policy, improves health, and helps future-proof global food systems. The institute works with agri-food companies of all types and sizes to deliver world-class commercially focused research for food and health and to respond to challenges facing the agri-food sector including the increased demand for food, climate change, food waste and the need for sustainable, healthy diets to protect our environment, health, and wellbeing.

UCD Geary Institute for Public Policy: is a centre of excellence for policy-relevant, theoretically informed, empirical research and brings together researchers from across the social and behavioural sciences to enable cross disciplinary collaboration and to stimulate discussion on theories, methodologies, and empirical results. They support research project applications and implementation and maximise research impact on the academic literature and on public policy including sustainability and the green transition.

UCD Humanities Institute: acts as principal hub for interdisciplinary enquiry and discussion in the humanities and between the humanities and other areas of social and scientific research at UCD. It sustains and promotes the primary functions of humanities research: generating understanding based on historical, philosophical, linguistic, and cultural knowledge, promoting critical thinking and nurturing creative capacity in areas including just transition.

Contact

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