The Cork Amendment to the Barcelona Declaration *(June 2021)*

Context:

The Barcelona Declaration emanated from the 2nd Engineering Education for Sustainable Development (EESD2004) conference in Barcelona in 2004, and sought to normatively propose the appropriate role and responsibilities of engineering education from the start of the twenty first century. The Cork Amendment was proposed as an update to the Barcelona Declaration to cohere with emerging engineering education and broader societal trends and imperatives from the 2020's and beyond. It was formulated following the 10th Engineering Education for Sustainable Development (EESD2021) conference at Cork in 2021, and was informed by a primer paper and EESD2021 delegate conference workshop, hosted by Prof. Richard Fenner and Dr Dai Morgan of the University of Cambridge.

Preamble:

The planetary systems on which our societies, economies and human well-being depend, are facing imminent grave dangers from the climate emergency and the destruction of essential life support services through the crossing of planetary boundaries. This is leading to growing risks to global health and increasing global inequalities. Efforts to address such concerns are being compromised by the breakdown of societal consensus and the resultant threats to democracy, where the spread of counter-factual information, alternative realities and denial foster division and uncertainty and where the implications of AI (artificial intelligence) are not yet fully understood. Such counter-factual narratives undermine the practice of science, as an ongoing process whereby received facts and understandings are open to and challenged by new data, theories and models. We are also witnessing challenges to international rules based systems with competing and polarised views emerging threatening the effective actions that are necessary. At the same time the notion of achieving sustainable development has become mainstream with broad awareness that things are wrong across many sectors.

Engineers must play a critical and collaborative role in *restructuring* how humanity lives on the Earth to achieve the broad societal and economic *transformation* needed. Beyond the acquisition and application of technical knowledge, engineering education must strengthen the *vision* and *values* required to create *resilient*, *flexible* and *adaptive* engineered *systems* and critical infrastructures. Engineering graduates need to learn skills to help them work collaboratively with other actors to focus on the *co-generation of solutions*, that can be successfully implemented against a daunting array of constraints. Universities must be at the heart of this transformation and need to adapt rapidly in an era where the use of digital resources is the norm for knowledge dissemination, and the pace of *radical change* needs to be urgently accelerated.

Reinforced by the 2004 Barcelona Declaration there is wide consensus across the EESD community around the skills and competencies engineers must have to contribute to these challenges. These include better problem formulation through a system awareness of all factors of influence, empathy with specific local contexts and dialogue with diverse stakeholder groups. This requires engineering practice to work beyond narrow disciplinary boundaries through transdisciplinary approaches to develop pragmatic interventions to address wicked societal problems.

However, the current process of gradual change in the engineering paradigm must dramatically accelerate to address the complex and highly uncertain future humanity faces, and to use this ambiguity as the initial condition state for all engineering design which aspires to achieve more than simply "do no harm". Greater emphasis needs to be placed on maintaining existing engineering services, whilst new competencies and perspectives should be instilled into engineering graduates such as consideration of nature based solutions, empathetic thinking and the development of inclusive products and processes that encourage diversity and equity across all users, concentrating on meeting real needs. This innovation has to be achieved while providing a firm foundation in the objective scientific principles which underpins engineering and provides the rational basis and critical thinking skills which are necessary to actively confront denial, scepticism and the spread of misinformation. Whilst new engineered technologies are required to counter global threats, engineers must be capable of honestly appraising the impacts

and risks these may present across multiple criteria and avoid being blinded by unrealistic techno-optimistic promises. Therefore, engineers should develop the confidence to go beyond understanding problems to leading the debate for effective change, and challenging orthodoxy and faith in business-as-usual where these represent damaging practices. Universities crucially must support this by focussing their programmes (and wider operation) around the delivery of the UN Sustainable Development Goals (and their successors), the Zero Carbon Agenda and humanitarian needs.

The imperative of *limits* must be acknowledged and respected in terms of the finite resources available on one planet, the extent to which technology can "solve" the problem and the degree to which reason alone can address an individual's cognitive biases. The demands of transdisciplinarity and co-creation processes require willingness to learn from others, including those with sources of knowledge and wisdom which are different from our own. An anticipatory vision of the future, and an explicit recognition of the ethical basis of the challenges this presents, will be essential in providing a focus for this realigned approach to engineering education, as well as greater outreach to offer re-training in these skills for engineers currently in practice.

We declare that:

In addition to the principles of engineering education set out in 2004's Barcelona Declaration, it is necessary that both engineering students and engineering practitioners are able to **urgently** respond to the diverse planetary risks through an understanding of six imperatives: *values, context, uncertainty, change, limits* and *vision*, by:

- Actively engaging in **rebuttal** of counter-factual information, alternative realities and denial of existing global threats
- Developing an **anticipatory future vision** which embraces the need for restructuring of how humans live on the Earth
- Delivering radical **change** through the co-generation of solutions across disciplines and with diverse Stakeholders
- Seeking **resilient, flexible** and **adaptive** engineered systems and essential critical infrastructure capable of operating within **diverse uncertainties**
- Operating within resource and technological **limits** whilst seeking innovations that go beyond "doing no harm"
- **Challenging orthodoxy** and honestly assess the risks and impacts that may be associated with some technological /scientific advances.

[Purpose of the Cork Amendment and how it might be used]

Everyone has to find their own way to operationalise sustainability and there will always be divergent views on how this can be achieved. This amendment invites both educators and engineers to engage with sustainability on their own terms, rather than present a prescriptive checklist, which must be adopted wholesale (or else!).

Therefore the document is not intended as a monolith but the tip of an iceberg in a wider debate and might be useful to engage others on that basis. This reinforces the call for engagement, empathy and dialogue rather than expressions of power and authority, reflecting the underlying calls of the EESD21 Conference.

People are free to develop their own versions and expressions of the amendment, almost like open source software].