Principles of Transdisciplinary Engineering – Version 1 (5th May 2023)

The success of the ISTE depends on having a larger and growing community focused on understanding and developing Transdisciplinary Engineering (TE) practice. We believe that by thoughtfully defining TE we can consolidate the community, give it direction, and connect meaningfully to other communities.

However, for emerging disciplines such as Transdisciplinary Engineering it is not always possible or indeed desirable to immediately implement an "absolute definition". Within this document we seek to create a "working definition", which will be regularly reviewed and updated by the members of the ISTE. In this way it helps to frame discussions, whilst allowing the opportunity for the community to reflect, consolidate and evolve it's aims and scope.

Proposed rationale for being interested in TE:

Learning to do TE is central to being a better engineer. It means understanding 'better' not in a purely technical sense, but recognising that better can mean creating designs, processes and technologies that help more people than originally intended, create fewer harms and participate in bringing about better outcomes both inside and outside any individual project.

Proposed characteristics of TE

Below we set out a table which aims to characterise traditional engineering (TradE) work with TE work to provide clear boundaries between the two. These differences are rooted in basic concepts underpinning TE:

- **Systems thinking** (using concepts from systems analysis such as elements, connectedness, feedback and so on to understand an issue and identify design options)
- **Collaborative** (working together equally to resolve challenges and overcome obstacles in doing the above to execute the project effectively. E.g., to integrate the work from different communities – this could include:
    - **Inclusive practice** (actively collaborating with non-engineers in practice by working with non-disciplinary/industry/community groups.)
    - **Interdisciplinary practice** (seeking active collaboration with non-engineering disciplines to select and apply sensibly ideas, methods, etc)
- **Reflexive critical thinking** (reflects on the role of themselves as an engineer in a project and to what extent they are contributing to better outcomes in industry and/or society)

Understanding what this means for practice

The main distinction between TradE and TE is the willingness of the engineer to 'open up' design and management decisions to a wider set of people, criteria and ideas and spend time and thought reflecting on and resolving any conflicts arising inclusively.

Traditional Engineering	Transdisciplinary Engineering
Solves the problem presented as an engineering only problem	Asks how the problem fits into wider social/environmental systems, asking is this the right problem to solve?
Applies only technical criteria to identifying a good solution set	Incorporates social/environmental criteria to identify a good solution set
Designs only according to client criteria, modulated by traditional engineering criteria	Integrates wider criteria into design decisions, resolving issues of client, engineering and society via negotiation and influence
Uses maths/models alone to assess quality of approaches	Incorporates a variety of methods including those from social sciences to understand social fit
Works only within their technical team or other technical specialists	Collaborates equally with those across an organisation and seeks critical input from external bodies too
Sees only value in engineering input to design decisions	Actively seeks out and values input from non-engineers into design decisions

Transdisciplinary engineering is therefore an evolution of engineering practice that combines insight from different fields to create better outcomes in industry and society.

In contrast, traditional engineering focuses on the application of standard engineering methods in practice, rooted in standard concepts of good practice such as adhering to ISO standards, chartering standards or application of analytic methods taught in mainstream engineering degrees.

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