

Building a Humanitarian Engineering Community of Practice

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Introduction

Demands of Contemporary Engineers

The changing role of engineering for the 21st century has been widely highlighted across the globe through reports such as the US National Academy of Engineering (NAE) *The Engineer of 2020: Visions of Engineering in the New Century* (NAE 2004) and the UK Royal Academy of Engineering (RAE) *The Universe of Engineering a UK Perspective* (RAE 2000). These articulate the broader contexts and greater complexity for engineering including global, societal, environmental and economic links and factors. Extending this, in 2010 the first, and so far only, United Nations Educational, Scientific and Cultural Organization (UNESCO) World Engineering Report documented the role of engineering for global sustainable development (UNESCO 2010). Engineering and technology are embedded within, and are required to achieve, the 2015 UN Sustainable Development Goals (SDGs) which seek to eradicate poverty by 2030 (RAE 2016), highlighted by the focus on the SDGs for the 2019 World Engineers Convention in Australia.

In Australia, the recent Australian Council of Engineering Deans (ACED) *Engineering Futures 2035 Stage 1 Report* (ACED 2019) includes recommendations to make engineering education in Australia appropriate for the graduates of 2035. This starts by highlighting the role of contemporary engineering at the interface between science, technology and human needs and that engineering “has profound impacts, good and bad, on human well-being, the global economy and environmental health” (ACED 2019, p12). This covers the triple-bottom line of social, environmental and economic sustainability, similarly emphasised in Engineers Australia’s (EA) Code of Ethics which commits engineering to “deliver outcomes that do not compromise the ability of future life to enjoy the same or better environment, health, wellbeing and safety as currently enjoyed” (EA 2018). These reports and dialogue emphasise the need for engineers to work within social contexts as part of multi-disciplinary teams and understand the impact of their work on communities at a global scale.

Humanitarian and Development Engineering Globally

Parallel to, and in many cases pre-dating, the demands on engineers to focus on complex global challenges and human well-being has been the emergence of areas of engineering specialising in humanitarian and development action. The traditional humanitarian and development action sectors have focused on a range of responses across the humanitarian-development spectrum. Along this spectrum, responses to short-term disasters are considered *humanitarian* action while *development* is undertaken over longer time-frames in a range of contexts and settings potentially with a focus on improving health, economic, environmental or human development outcomes (Greet 2014). The commonality across the two is a focus on meeting basic human needs and enhancing human welfare in areas of acute short- or chronic long-term distress (OCED 2017).

The first dedicated organisations to explicitly bring engineering to bear on these situations emerged in the early 1980’s. This included the first Engineers Without Borders in France, Ingénieurs Sans Frontières, with a focus on development, and RedR in the UK, which worked in humanitarian action. Throughout the 1990’s and early 21st century further organisations with a range of missions and specialisations emerged across Europe, North America and Oceania (Smith et al 2019). Alongside these, education programs emerged in

the late 20th century, and now number in at least the dozens around the world (Smith et al 2019). Encapsulating the different focus and specialisations, organisations and programs may be referred to as *humanitarian engineering* (Muñoz and Skokan 2007, Passino 2009, Reed and Fereday 2016), *development engineering* (Dzombal et al 2016), *engineering in emergencies* (Davis and Lambert 2002), or *engineering for developing communities* (Amadei and Wallace 2009, Parsons 1996). Reflecting the traditions of the existing aid sectors and national understandings, these terms can refer to work in short-term humanitarian action, long-term development, both, and with an international and/or domestic focus. Regardless of the term used, all these have a focus on bringing the expertise and benefits of engineering to improve human well-being in times of acute or chronic distress.

Humanitarian Engineering in Australasia

In Australia and New Zealand (NZ), Humanitarian Engineering (HumEng) has emerged as the term to cover engineering with a specific focus on addressing human distress including short- and long-term contexts both domestically and internationally (Turner et al 2015). This has been led by organisations such as RedR Australia and Engineers Without Borders Australia (EWB-A), who are both involved with program delivery and education and training programs. Since 2015, education opportunities at universities have increased dramatically with several universities now offering dedicated majors or minors (Thomas et al 2017, Smith et al 2017, Smith et al 2019). This encouraged the development of an ACED position paper on Humanitarian Engineering Education, which included priorities for further evolution of the field. These include recognition and support of academics working in the area, development of a shared understanding of HumEng as an area of practice, and engagement with professional and practitioner organisations (ACED 2018). More recently, the ACED (2019) Futures Report lists HumEng as one of several “specialisations” alongside aerospace, biomedical and renewable energy engineering with EWB-A’s programs, including the EWB Challenge and EWB Humanitarian Design Summits, listed as exemplars for bringing a focus on the human dimensions of engineering.

With this expansion of HumEng in Australia, particularly in higher education, there are opportunities for HumEng to contribute to the development of engineers who are able to effectively operate within the emerging contexts for engineering for the 21st century. HumEng can demonstrate leadership for the engineering profession, highlighting the positive impact engineering can achieve, including across the triple bottom line. However, to support this, dialogue and engagement across practitioner organisations, professional associations, community groups, tertiary and other education and training providers, and government organisations is required to ensure appropriate and quality practice in the field (Reed and Fereday 2016, Smith et al 2019, ACED 2018).

Humanitarian Engineering Community of Practice

Motivation

To foster the dialogue, support, leadership and engagement required to further develop HumEng in Australia, a dedicated Community of Practice (CoP) was proposed to the EA College of Leadership and Management (CLM) National Board by the Canberra and Sydney Committees of CLM. CoPs are well-known and widely used structures for individuals and networks to come together to build relationships and a shared understanding of a specific area of practice or body of knowledge which can support practice improvement and quality (Roberts 2006, Star et al 2014). They have been used to support knowledge management activities and domain expertise for SMEs (du Plessis 2008), engineering practice (Stapleton et al 2005) and faculty development in higher education (Pimmel et al 2013, Teeter et al 2011) among other areas. CoPs can be used to shape and form identity particularly for areas that span disciplinary boundaries where a body of knowledge is not formed (Teeter et al 2011). Handley et al (2006) give participation, identity-construction and practice as the

three core concepts for the effective development of a CoP while Roberts (2006) identified power, trust and predispositions to existing knowledge and assumptions as potential limitations for their operation. Providing guiding definitions and understanding the broad context of a CoP are seen considerations to achieving their outcomes.

Developing a dedicated CoP for HumEng was considered appropriate and suitable as it would allow EA members and non-members to come together to engage and discuss HumEng as a field of practice while linking to all EA Colleges, technical societies and special interest groups. Considering the history of HumEng in Australia above and in Smith et al 2017 and ACED 2018, the timing seems appropriate to establish a CoP due to the recent emergence of the area. There is a need to establish an identity for practitioners and educators as well as agreed knowledge with HumEng spanning multiple disciplines within engineering and beyond. Proposing the CoP through CLM aligned with the cross-discipline nature of CLM and its focus on leadership. As per the understanding in Australia, HumEng builds from a core engineering discipline, and hence CLM, with its cross-discipline focus, is an appropriate place to nurture the area rather than being housed within a single discipline College. The proposal was endorsed by the CLM National Board in mid-2019, which then enabled engagement with EA to develop the initial aims, structure and operations of the CoP. Two other CoP's have been supported by EA recently; the Internet of Things (IoT) and Risk Engineering Body of Knowledge (REBOK).

Aims and Vision

Driven by an assessment of stakeholder expectations, the following statement of intent for the CoP to guide its establishment was developed:

Foster the application of Professional Engineering disciplines to the leadership, management, design and delivery of humanitarian undertakings

The ultimate aims of the CoP and its efforts are competent practitioners committed to humanitarian principles. For this, the following stakeholders and their potential expectations or engagement with the CoP have been articulated, to be tested and validated as the CoP develops during 2020.

CoP Members

- A resource enabling the development and deployment of relevant skills and knowledge.
- Appeal to a significant group of potential members who see value in EA recognition of their current engineering-based skills and experience in humanitarian and development work.
- Membership to enhance networks which will support career development of members.
- Recognition of HumEng work by the professional body (EA) of as engineering and its role in continued professional development (CPD).

EA

- Increased emphasis on the application of engineering disciplines and professional characteristics to broad societal challenges and positive impact.
- The opportunity to have a group of humanitarian leaders and operatives who see EA as their professional "home".
- Clarity around the domain content of HumEng.

Established Humanitarian and Development Organisations

- Alignment of professional recognition with sector needs and demands.
- Two-way dissemination and sharing of best and emerging practice.
- Links to training programs offered.

Universities and Education Providers

- Engagement and clarity around HumEng domain content.

- Leadership, learned society and accreditation roles as for other recognised fields of engineering practice.
- Share best practice for education design, delivery and evaluation.
- Research collaborations and dissemination.

Community at Large

- Demonstrated support of the triple bottom-line for enterprises and organisations to achieve stakeholder needs, return on investment, enhancing livelihoods, environmental outcomes and the needs of society and the community.
- Contribution to UN Sustainable Development Goals.
- Engineering support and expertise for community-identified and led initiatives.
- Benefits through engineers' initiating opportunities and support in line with community expectations and demands.

Structure

The structure of the CoP is shown in Figure 1, combining the common structures of CoPs with the organisation of EA, highlighting links to allied organisations and the public at large. This encapsulates the initial proposal that HumEng sits across all the existing EA discipline Colleges. This structure will be subject to change as it is established and self-identified leaders, rules and regulation emerge as occurs with CoPs (du Plessis 2008).

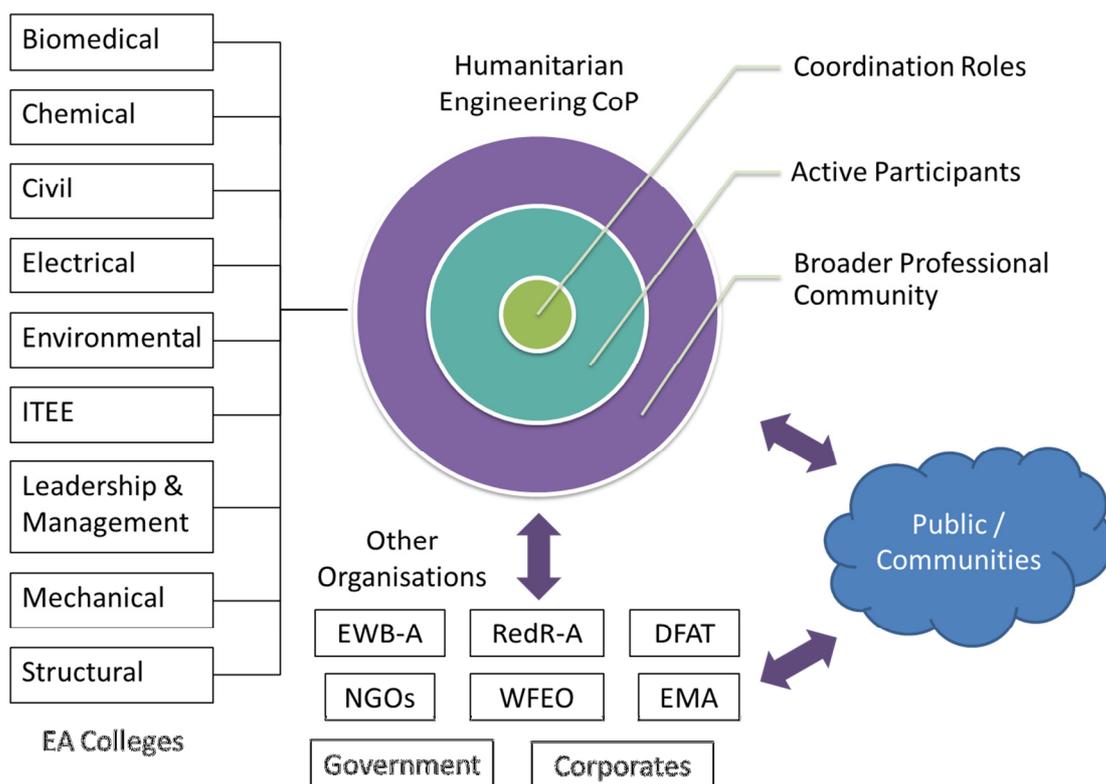


Figure 1: Structure of the HumEng CoP (where ITEE is Information, Telecommunications, and Electronics Engineering, WFEO is World Federation of Engineering Organisations, EMA is Emergency Management Australia, DFAT is Department of Foreign Affairs and Trade)

Operations and Activities

Combining a network view associated with CoPs (Sarirete et al 2011) with an engineering perspective, the potential operations are shown in Figure 2. Here, coordination roles and active participants of the CoP drive the core processes: stakeholder engagement,

professional development, knowledge management, advocacy and institutional support. Operations and activities occur largely, but not exclusively, via a CoP webpage on an ICT platform hosted by EA. This will be accessible to EA members and non-members with membership being at no cost. This means discussions and the knowledge base developed will be publicly accessible. Processes for the governance, management and moderation of online resources and discussions will need to be established, with the two existing EA CoP's providing some lessons, although these are also relatively new.

Building from other CoPs and the need to provide structured yet flexible engagement (Sarirete et al 2011, Teeter et al 2011) the platform will provide:

1. A discussion forum capable of handling multiple, segregated discussion threads.
2. A knowledge base to manage accumulation of material relevant to HumEng and its associated knowledge domains as well as internal documentation.
3. Contacts directory for CoP members.
4. Teleconferencing/webinar capabilities:
5. Calendar for listing events and activities, both for the CoP as well as those interest to members from other organisations.
6. Social media with a particular focus on promoting engineering within society at large.

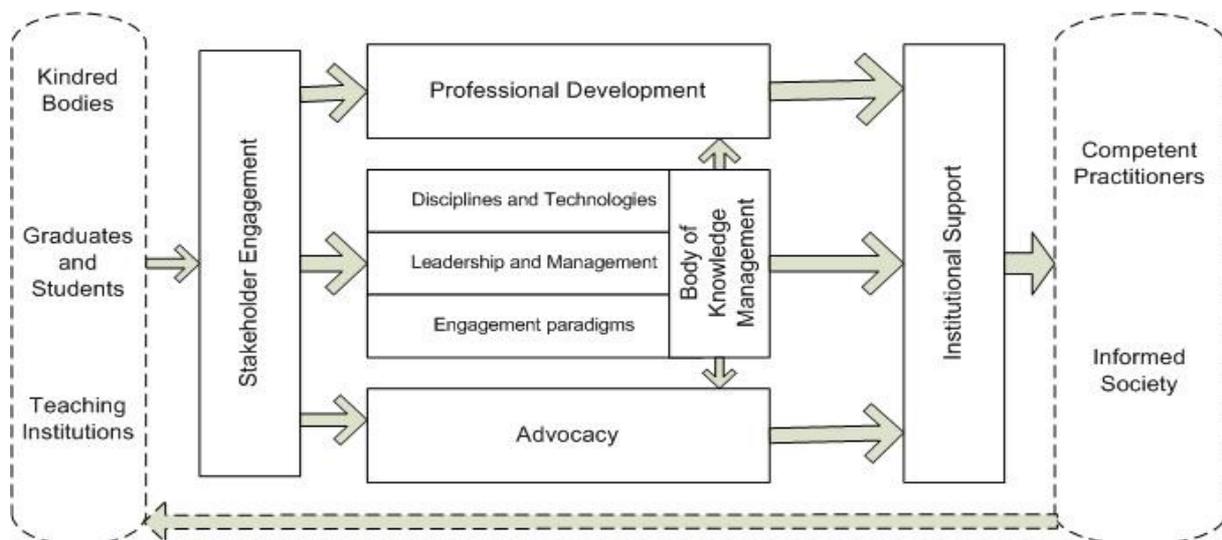


Figure 2: Operations flow of HumEng CoP

Challenges and Opportunities

Immediate challenges in the early stages of operations are the engagement of key stakeholders and the establishment of a mode of operation suitable to the needs of participants. As highlighted in Handley et al (2006) and Roberts (2006), this may include discussions of expectations and notions of practice, participation and identify. Once in place, opportunities for collaboration to build knowledge, enhance professional development, and advocate for recognition of the discipline will follow.

A significant role for the CoP is promoting engineering and its positive human impacts to the profession and society at large, as stated in numerous reports. The Royal Academy of Engineering (RAE) in the UK highlighted that the central role of engineering, “to solve technical problems to improve our well-being and to tackle society’s challenges” is not visible to the public (RAE 2014). The ACED Futures Report included three recommendations for ACED to undertaken along with other organisations. The first of these was “ACED continues to engage with and endorse organisations and programs to improve the public profile and awareness of engineering and its contribution to society and human well-being” (p6). It was suggested that this “include a stronger emphasis on ‘humanising

engineering' and using societal impact in relation to improving public perceptions and understanding of engineering." Similarly, the UNECSO Engineering Initiative (UEI) "seeks to increase the public's understanding of engineering, and its effective contribution to the socio-economic development of societies" (UNECSO 2017). In doing so, it seeks to address the global shortage of engineers by increasing interest in careers in the profession, with an emphasis of addressing the underrepresentation of women in the profession in many countries. By capturing and highlighting the practice of HumEng in Australia, the CoP can contribute to these goals which seek to bring about change in the engineering profession for the 21st century, addressing challenges of supply, diversity and inclusion.

One key area it is hoped the CoP can drive and support is broad engagement and dialogue to develop an identified common body of knowledge for the field, for which the engineering education community would play a significant role. This could incorporate a process such as the Define Your Discipline (DYD) approach which brings educators and practitioners together to identify practice domain knowledge, contexts and competencies. This has been used in Australia to help identify the knowledge and competencies required for areas such as environmental engineering (Dowling and Hadgraft 2012). Another example that could be adapted is based on the development of a Humanitarian Action Qualifications Framework (HAQF), a competency-based framework designed to provide quality assurance for practitioners in the humanitarian sector (Aardema and Muguruza 2014). This was developed by the European Humanitarian Action Partnership as part of the European Universities on Professionalization on Humanitarian Action project. The strong existing university interest, commitment, and networks for HumEng in Australia would provide a starting point for such approaches, with the CoP an appropriate place for discussions, review, input, storage and dissemination of outcomes which can support educators in the appropriate design, delivery and evaluation of education initiatives.

The HumEng CoP would provide opportunities to critique the practice of HumEng and the field itself. This can build from existing research and work that has explored potential risks and limitations of the area. For example, VanderSteen et al (2010) considered the appropriateness of international placements for student engineers while Nieuwsma and Riley. (2010) explored the role of engineering in international development from a social justice perspective and the potential for engineering to reinforce structural injustice. Such critiques are essential to avoid mistakes that have been, and continue to be, made in development and HumEng (in all its forms and names) and ensure the highest levels of ethical and appropriate practice, in line with community expectations of engineering and codes of ethics.

To ensure this self-critique, as well as ensure creativity, collaboration and innovation, a key requirement for the CoP is diversity across its members, perspectives, and allied organisations. While HumEng in Australia has demonstrated greater gender diversity in education initiatives (Smith et al 2017, 2019), there is less diversity across all measures for the profession as a whole. Similarly, building from the understanding of HumEng as the application of an existing discipline, the CoP will need to ensure a wide variety of discipline backgrounds are present. It will need to avoid limitations of predisposition to existing preferences, language and assumptions highlighted in Roberts (2006) to ensure open learning and discussion.

The approach developed here can provide an example for other specialisations within engineering in Australia that may not align well with existing EA discipline colleges. As highlighted in ACED (2019) "Modern engineering encompasses a broader range as ever before of areas of practice, specialisations and interfaces with other disciplines and professions." This requires approaches to articulate quality practice and trust, with CoPs a potential avenue to nurture early discussions and dialogue within new areas.

Conclusion and Further Work

To support the continued growth of Humanitarian Engineering in Australia, a dedicated Community of Practice (CoP) is being established with Engineers Australia, supported through the College of Leadership and Management at both national and divisional levels. This aims to provide a forum for continued engagement and discussion around the development of HumEng as a field of practice including knowledge development, sharing and promotion, and advocacy. Priorities for the first year of operation in 2020 are finalising the structure of the CoP in EA platforms, identifying central coordination roles and active participants, and forging relationships with a range of allied and kindred organisations. Through this engagement and work, it is hoped to demonstrate leadership for engineering in Australia by bring a human dimension to the profession, a focus that is required for the demands of contemporary engineers and the challenges of the century. Such endeavours have not been identified in other countries and hence this provides an opportunity for the Australian engineering profession as a whole to show leadership on an international scale.

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Acknowledgements

The authors acknowledge those who provided additional input and comments to this paper as well as the discussions and documents for proposing the CoP itself.

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