Commentary

Growing a Culture of Technological Stewardship

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Daily headlines stress the ways modern technologies disclose their most dystopian possibilities; this magazine is replete with examples of innovative technologies that prompt considerations of their unethical applications. Numerous approaches have already been proposed to advance critical thinking about the social, cultural, environmental, and economic implications of tech innovation, such as tech literacy and philosophy of technology. What these intellectual traditions have shown is that while the negative effects of technological innovations may be unprecedented, they can be foreseen, and, more importantly, mitigated through more intentional and skillful engineering. Nevertheless, systematic efforts to address these impacts remain peripheral to the engineering profession, with technological artifacts deemed value-neutral, and intervention often seen as luddite and unenforceable [1]. While this situation suggests a need for systemic changes across academic and industry contexts, it also points to an immediate need to address the uptake of critical thinking about the implications of tech innovation within the engineering community.

Recent efforts to re-center the culture of engineering around a vital ethical consciousness, such as the Tech for Good movement [2], or the Improving Undergraduate STEM Education (IUSE) framework and Professional Formation of Engineers (PFE) initiative: REvolutionizing engineering and computer science Departments (IUSE/PFE: RED) program [3], point to the way industry and academia alike have sought to engage professional and budding engineers to think critically about the technologies they design and use. The need for the engineering profession to embrace a more substantial stewardship responsibility has been a primary focus for the Canada-based Engineering Change Laboratory (ECL). Through six years of pilot projects and network building—including deep engagement with more than 350 leaders at 150 organizations, and broader engagement with over 10,000 individuals within and beyond the engineering community—ECL has identified a set of overarching behaviors, which it terms Technological Stewardship (TS), that involves taking a value sensitive approach to embedding ethics, sustainability, and equity, diversity, and inclusion (EDI) principles into the practice and culture of engineering [4]. Though calls for these skills are growing in industry [5], and particularly in professional engineering domains [6], they are not widespread among engineers or engineering-focused organizations [7]. However, a TS mindset, which links ethics and values to the skilled and intentional design, development, and deployment of tech innovation, is crucial for engineers and technologists to drive technology adoption that is beneficial for all.

Reframing the culture of engineering toward TS will require a tipping point effect, with broad uptake of TS principles among students, faculty, and professionals. Based on experimental evidence showing that 25% consensus is needed to tip a minority viewpoint into the majority [8], the engineering community should strive to achieve 25% of its community

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practicing TS by 2030 in Canada. Interdisciplinary collaboration is essential for ensuring that innovation is achieved responsibly and ethically [9], and the adoption of this culture change requires meaningful participation from an interdisciplinary community best suited to adapt these ethical principles to their unique cultural and institutional idioms [10]. Strengthening knowledge exchange and community connections across formerly siloed disciplines and industry domains will contribute to a thriving community of interdisciplinary tech stewards that hold these ethical principles as fundamental rather than supplemental [11, p. 78].

To offer a sense of how Technological Stewardship can be scaled in engineering culture, ECL's approach is to engage leaders working to foster technological stewardship at three levels: personal, organizational, and system. Community-building is accomplished through three interconnected offerings: 1) supporting organizational consulting offerings that provide direct support to a select group of innovative and high-profile organizations to fully incorporate Technological Stewardship into their culture and systems and serve as role models for others to follow; 2) cross-organizational systems-level initiatives focused on shifting key sectors like engineering education and consulting engineering; and 3) the TechStewardship.com platform that acts as a hub for these efforts, promoting the concept of Technological Stewardship, supporting individuals' practices, and connecting them to leading organizations and initiatives.

By changing the culture of engineering toward a proactive and intentional engagement with technology, the results will extend across social, economic, and technological domains, amplifying the positive societal benefits of tech innovation while equipping engineers to anticipate and circumvent its potential negative impacts. ■

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