Exploring the Global and the Local in Engineering and International Development: towards a liquid engineering approach

Journal Item

JID Special Issue on the Global and Local in Engineering & Development

'Exploring the Global and the Local in Engineering and International Development: towards a liquid engineering approach'

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Introduction

The genesis of this special issue was a JID policy arena on engineering and development, which Peter Robbins co-edited with our friend and colleague Ben Crow from UC Santa Cruz in early 2007. Ben, who had worked with Gordon Wilson and David Wield at the Open University in the 1980s, was originally to be part of this volume but sadly passed away this year, and we have dedicated this special issue to his memory. Twelve years ago, although practices relevant to engineering and development had been occurring since the dawn of the age of development, few were writing about it. There were a handful of journals (e.g. the Journal of Engineering and Sustainable Development which had its first issue in 2006), NGOs (e.g. Engineers without Borders USA was established in 2001), and Universities (e.g. the Cambridge Engineering Department established its Centre for Sustainable Development and MPhil in Engineering for Sustainable Development in 2000) active in the area. While there was growing student interest, it was not on the radar of major funders or most universities. Contributors to the policy arena included colleagues from Cambridge and MIT working on technologies like arsenic filtration systems for the poor in the Global South.

Engineering and Development: as vision, immanent and intention

Ben and Peter, sociologists, were interested in understanding engineering as part of a social change process connected with the unfolding of development. Thomas (2000) argues that contemporary policy discourse has come to be dominated by the view of 'development as practice', which hides implicit assumptions, rather than engaging with more complex understandings of development. In order to interrogate these notions, he suggests that 'development' can be conceptualised as:

> *i 'A vision, description or measure of the state of being of a desirable society;*
> *ii A historical process of social change in which societies are transformed over long periods;*
> *iii Consisting of deliberative efforts aimed at improvement on the parts of various agencies, including governments, all kinds of organisations and social movements'*
> (Thomas, 2000, p. 777).

The first notion concerns the anticipated outcome of development. For example, modernisation theorists envision a liberal capitalist society, with high GDP per capita and democratic political institutions. The second refers to immanent (inherent, pervasive) social change (Cowen and Shenton, 1996), for example the historical dynamic of accumulation, innovation and globalisation under capitalism, arising from the distributed decisions of entrepreneurs, workers and consumers. The third refers to intentional development (ibid),

and particular development projects, organised by governments or other collective groups such as NGOs, trades unions or village project groups.

So, for example, design work for a global corporation constructing a hotel, or other commercial development in a city in the Global South, constitutes work within immanent development. In this case, engineering is part of the accumulation, investment and profit-making dynamic of global capitalism. Design and construction of rural clinics for a government, or installing rural water supply for a village collective or NGO, on the other hand, is part of intentional development. In both roles, engineers may also contribute to the accretion or generation of a vision of development. They may help their clients or collaborators to envision a different society, that is, one with hotels, jobs and tourists, in one case, or one with rural clinics or water supply, in the other. Reflexivity, broadly concerned with flexible adaptation to changing conditions, and critical reflection on such adaptations, involves an awareness of these different locations (immanent, intentional, vision-making) in trajectories of social change, and their relation to one another. Thus, reflexive engineers might help their collaborators or clients locate intentional development projects by global actors in such a way that they gain momentum (finance, political support, legitimacy and innovation) from the immanent dynamics of local capitalist development. (Robbins and Crow, 2007: 76)

The local and global: engineering and development as a set of social practices

These dynamics suggest a relationship between the global and the local that must be negotiated by engineers via a set of social practices, which is what we are exploring in greater detail in this special issue. Engineers working in international development contexts strive to implement global standards, but this is often difficult due to resource and other constraints including inadequate training, lab facilities, and lack of capacity of professional engineering bodies. That said there are interesting practices that happen at the local level, where engineers often have to work, bricolage fashion, with what they are given. This also has the potential to cause tensions between the global and the local, where standards that work elsewhere for example, are inappropriately applied by external agents in local contexts, as in the case of Bangladeshi water management. The global/local dynamic provides an avenue for developing teaching and learning in engineering that meets global standards, where for example project-based learning around local engineering initiatives, is a path to fulfilling requirements for standards such as the Washington Accord. The development of these learning practices can also be achieved through North/South partnerships involving distance education.

The Special Issue

The papers in this volume are guided by a set of questions:
(1) Is there a tension between global standards and local contexts in engineering and development research, policy and/or practice?
(2) If such tensions exist how are they resolved?
(3) Does this create hybrids and/or is there mixing of the two?

It is also guided by our emerging conceptual framework that draws together ideas we have generated over the last few years on engineering and development that builds on our original policy arena (Robbins et al). Our current approach to engineering and development is that it is:

- messy and improvisational
- a borderland 'middle' (hybrid) space
- comprised of objects and practices ('doing things', keeping things working) and communities
- reflexive and evolutionary

This volume has a set of research articles, as well as a policy arena, the latter is designed to focus on practice and address more directly challenges faced by those who implement policy.

Research Articles

It opens with research articles, the first of which (Robbins et al) explores the local and global in engineering and development through a set of cases from the EPSRC/DfID USES, which is a sustainable energy programme funded by the UK engineering research council and the department for international development. It argues that the programme is a good illustration of our concept of 'liquid engineering' (engineering social practices characterised by flow, mixing and hybridity) in that EPSRC/DfID USES has facilitated interdisciplinary approaches, networks, and communities of practice that have produced inclusive innovation and capacity building of research teams both in Africa and the UK. Tensions between local and global have largely been surpassed via the dynamics of liquid engineering.

This has not been so much the case in the second paper, which explores water management techniques to control floods and address rice and shrimp production in Bangladesh (Hanlon). Here there has been a tension between global big engineering projects centred around the Dutch polder system advocated by international funders and the Bangladeshi Water Development Board and local approaches to tidal river management. However, it also represents, potentially, a story of local empowerment. Bangladeshis, through the practice of a type of liquid engineering of their own, have pooled both local knowledge and scientific expertise, and adapted historical understandings to contemporary needs in ways which promise to better respond to the challenges of climate change.

The third paper examines the tensions between global and local in a slightly different way via tertiary education, and considers ways African universities can reach towards meeting global education standards, such as the Washington Accord, by embracing problem-based learning (PBL) in their curricula. The PBL focus on real-world problems and their solutions rooted in the exploration of a diversity of cases has the potential to broaden the curriculum. This would move it beyond an industry and physical infrastructure focus, attractive to global actors such as businesses and funders, and make a closer link to aspirations with a potential local impact via a focus on the sustainable development goals. The pedagogical approach draws on key features of the liquid engineering paradigm, especially networks, bricolage and reflexivity.

The fourth paper extends the examination of PBL approaches in engineering education by considering the case of an online interaction design module that was the product of a teaching partnership between the Open University in the UK and Botho University in Botswana and taken concurrently by students in both countries. The authors set out to investigate why the Botswanan students performed less well overall than the UK students, when measures had been taken to make the curricula culturally appropriate for both groups. They found differences in the ways students encountered and conceived of problems and solutions, which suggested the curricula was better culturally adapted to the ways UK students had been taught to think and solve problems. The authors ultimately recommend an approach that is consistent with liquid engineering, in that it is rooted in flexible design and better adaptation to local context.

Policy Arena

Engineering and development can comprise a liquid, fluid set of practices where mixing (spaces, objects, disciplines) occurs. The first paper extends the educational themes developed in the last two pieces in the research article section, discussing the Royal Academy of Engineering's programmes. These seek to facilitate development of the quality and diversity of engineering education, in order to build capabilities and capacity in Africa. The strategy underpinning the RAE's activities is very consistent with liquid engineering in its desire to promote 'engaged, dynamic "glocal" communities [that] are constantly leading iterations and adaptions in our activities through a very active feedback loop'. This is also evident in the Academy's stated intention to embody a partnership that is a community of networks devoted to capacity building in more than 30 countries across sub-Saharan Africa, Asia and South America, in order to deliver on the challenges embodied in the sustainable development goals.

The second paper picks up on another sustainable development goal, SDG 6 on clean water and sanitation, to explore cases of sanitation success and failure drawn from a fifty-year career advising and/or acting in academic, government/policy, and funder communities. Muller strongly argues drawing from a variety of cases, many he was personally involved in, that from the colonial period onwards, sanitation systems in Africa have been shaped by their local socioeconomic and political contexts, and the poor have often received inadequate service, regardless of any global technical standards. He marshals evidence from case studies to support his thesis that development engineering is more likely to achieve its objectives if it is well integrated in the societal context and developed by, or in close coordination with, the operational institutions concerned. This supports a key aspect of the liquid engineering approach, which emphasises understanding and response to local context in order to achieve successful development engineering interventions.

While the previous paper focussed on the construction of sanitation system, the last focusses on the related topic of constructing shelter and settlements in the immediate aftermath of crises. Similar to Muller's paper and in line with liquid engineering, Babister argues for understanding and supporting local social, political and technical knowledge and experiences. In the immediate aftermath of such events, people affected are forced to rely on global actors, such as international nongovernmental organisations, to address their

shelter and settlement needs. In the case of shelter and settlements, the role of the global actor is to respond directly and blend with the recovery strategies of local actors, along the lines of facilitating 'self-help', which may pose special challenges for the poorest households and therefore raising issues of social justice. This may create dilemmas, as Babister observes 'On the one hand global humanitarian action can be seen as a technocracy in which engineering solutions delivered through global technical assistance have gained supremacy to the exclusion of the voice of local actors. On the other hand, social justice can be seen as opening up access to the "best" global technology in order to increase resilience and reduce poverty.' Babister argues that global actors must facilitate local ownership of shelter and settlements in order to recover successfully from crises in the short and long term.

Conclusion

We began by reflecting on development as a process of social change comprised of vision, immanent and intentional aspects, of which development engineers as actors have a key role to play in negotiating and effecting outcomes. One of the roles they play is in negotiating relations between the global and the local. We suggested a helpful way to bridge this divide might be the liquid engineering approach, which focuses on flow, hybridity, flexible adaptation and rootedness in local context[1]. Indeed, all of the papers in this special issue, in different ways, support this approach. They suggest that development engineering is at its most successful when it is embedded locally, and is informed by global standards which may be flexed or adapted to local conditions. The local can then also shape practices and capacities at globally through integration of new cases and knowledge that can inform improved practices globally.

1 Recently the Thomas conceptualisation of development has been reviewed by Thomas himself and Abbott and Wilson. They suggest that "social change is driven as much by the engagements of people that potentially develop social imaginations as it is by a dynamic of self-perpetuating capitalism" (Abbott et al 2019). The notion of social imagination comes from the American 1950s sociologist C Wright Mills and his view of reflecting and connecting local experiences with global forces of change (Mills 1959). The central idea of engaging people fits even more closely with the concept of liquid engineering.

References

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