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# Decolonizing Relationships: Moving from an Empowerment to Agency Mindset in International Engineering Interventions

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## Abstract

Given the complexity of global poverty and climate change, it reasons that engineering education has focused on “Engineers as Changemakers,” seeking to inspire engineers to tackle the world’s wicked problems. However, in practice, the desire for engineers to see themselves as changemakers eclipses the autonomy of local communities, especially in international interventions. By focusing on empowerment, engineers unintentionally reinforce themselves as the power and knowledge holders.

Inspired from works by Robert Chambers and Paulo Freire, we propose a new mindset for engineering education that shifts the focus from engineers as changemakers to engineers as facilitators and consultants. In this framework, the local community is viewed as the changemaker, affirming them as the primary acting agent of their lives. We illustrate the impact of this mindset shift in practice through the analysis of two technological case studies, both of which follow non-governmental organizations (NGOs) seeking to make long-lasting change with community members. Although the explicitly stated intentions of both groups are very similar, the NGO in one of the cases seeks to affirm the agency of community partners, referring to them as experts and drivers of the project. Meanwhile, the NGO in the other case utilizes language of empowerment, referring to themselves as the educators and providers of sustainable practices and technology. The impact of these mindsets is illustrated through qualitative data regarding stakeholder relationships and the community’s response to each project. Through these case studies, we see that liberative and collaborative technical interventions require a reimagining of the relationship between the engineer and community. As engineering educators, we are responsible for challenging the traditional, and arguably colonial, mindset with our students for true, long-lasting change to be made.

## 1 Introduction

### 1.1 Sustainable International Engineering Interventions

According to Thacker et al., (2019) 72% of the 169 targets for the United Nations Sustainable Development Goals are directly related to infrastructure. Consequently, international development organizations and engineers are often tasked with providing marginalized or “developing” communities a more sustainable and equitable way of life. The relationship between engineers and their communities plays a crucial role in whether or not these objectives are achieved. In fact, many past assessments have attributed the root cause of infrastructure failure to the *mindset* of the engineers (Matthew et al., 2016; Sowers, 1993; Arshad-Ayaz et al., 2020), as opposed to their design’s technical functionality. The mindset refers to how practitioners approach projects. It encapsulates our inherent assumptions and affects how we position ourselves as engineers in relation to client communities through our attitude in interactions and how we perceive our responsibilities and authority to the community. The mindset is beyond intent, as it acknowledges how our

subconscious beliefs influence the implementation of actions and, consequently, a community's response to us.

During the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, development discourse was encapsulated with ideas of *technological determinism* and *colonialism* (Lucena et al., 2010). Namely, societies that did not follow the European trajectory of technological advancement needed to be "saved" by the intervention of outside entities. Engineers working within these ideologies saw themselves as bearers of knowledge and social order, meaning their relationship with the community was one-sided and it tended to exclude local culture and expertise in design decisions (Lucena et al., 2010). The mindset of the engineers directly influenced their level of engagement, or lack thereof, with communities.

Academics and practitioners alike suggest that development discourse, and consequently engineering mindset, has evolved past this colonialist paradigm. Across time there have been shifts in the practitioner's approach to needs assessments, consideration of local knowledge, stakeholder connections, and level of self-reflection to push engineering towards community driven solutions (Lawson-Bulten & Witmer, 2025). The driver of this change revolves around the level of engagement of the engineer with their community (Natarajathinam et al., 2021; Acero et al., 2024). For example, UNESCO emphasizes "multi-stakeholder engagement" in their Education for Sustainable Development 2030 roadmap (UNESCO, 2020) and engineering education literature has noted a shift from merely technical course work to teaching engineers to "look beyond technology," "learn from people," and "empower communities" (Harsh et al., 2016). These shifts in objectives indicate a strong desire to integrate community perspectives into our work and have even led to social justice and equity playing a crucial role in the perceived success of engineering interventions (Chattopadhyay & Witmer, 2025). Effectively achieving these important shifts in engineering development and education demands a more specific characterization of their parts, such as a critical approach to our mindset and level of engagement.

In practice, however, engineers have not been able to fully integrate community perspectives into their work, making much of the literature narrative more aspirational than practical. In many cases, engineers collect community related information only to later neglect that information in design decision-making (Mingee & Witmer, 2025). This failure to integrate community considerations could be due to the lack of a comprehensive framework within the literature (Mazzurco & Jesick, 2017) or a belief that working with an NGO or administrative official is equivalent to broad community participation (Mattson & Wood, 2014). It could also be attributed to transient effects of the dominance of "mainstream development discourse," including neocolonial and technological deterministic mindsets (Arshad-Ayaz et al., 2020), that impede community driven systems.

In this paper, we explore frameworks and approaches based on participatory methods and apply them to engineering for sustainable development. Through this exploration we define the *empowerment mindset* vs the *agency mindset* in implementing participatory theories within the field, specifically between Western practitioners (NGOs and engineers) and their client communities in alternatively developed societies. Finally, we review two case studies that illustrate the impact that technical practitioners' mindsets have on local ownership, practitioner-local relationships and the overall sense of community/self-agency.

## **2 Alternative Approaches**

Since the discipline of engineering is relatively new to participatory methods, the literature from non-engineering disciplines offers the most relevant discussion and study to further investigate the theory and

frameworks behind practices of implementation (Mazzurco & Jesick, 2017). Although many of the models have been developed for education, community organizing, or general research inquiry, the questions asked are also constructive for engineers who seek to understand societal context and build equitable, community-driven infrastructure (Riley, 2013). Co-production approaches in which practitioners and community members work as equal collaborators, including Participatory Action Research (PAR), horizontal production methods, participatory rural appraisal, and liberatory practices, are all grouped here under the term “participatory,” as they seek to make social change through affirmation of local agency and actors.

The basis of participatory practices in the development sector stems from the work of Robert Chambers, who drew from the 1960s education-based work of Paulo Friere. Friere described a type of emancipatory education which affirms the student’s agency through active dialogue and shared learning (Mayo, 2014, Friere, 1970). Chambers emphasizes how individuals are experts within their own experience, containing knowledge that outside practitioners do not naturally acquire (1997). These approaches illustrate the difference between an *empowerment mindset*, which assumes knowledge and power are held by the practitioner (in this case, the instructor) and passed to community members (i.e., the students); and an *agency mindset*, in which the practitioner supports and affirms the knowledge and skills that are already present among community members.

Table 1: Empowerment versus Agency Mindsets

Empowerment	Agency
<ul style="list-style-type: none"> <li>● 'top-down' approach</li> <li>● Passive to historical inequity and power dynamics</li> <li>● Says “I want to give/pass power to these people”</li> <li>● Underlying assumption: the goal has not been achieved because they need me/my expertise “The Engineer as the Changemaker”</li> </ul>	<ul style="list-style-type: none"> <li>● Democratic in nature</li> <li>● Centralizes power dynamics &amp; actively addresses interpersonal imbalances</li> <li>● Says “I want to affirm the power these people have”</li> <li>● Underlying assumption: the goal has not been achieved because of systems of oppression/injustice “The Engineer as a Consultant”</li> </ul>

### *2.1 Centralizing Power Dynamics, Decentralizing the Practitioner*

An extensive literature review of co-production methods in the social sciences found that unsuccessful methods ignored or did not fully engage the interpersonal power dynamics, especially in attempts to preserve a traditional “unbiased” and scientific perspective (Turnhout et al., 2020). Engineering students are not traditionally taught about the influence they have on design, for example, resulting in engineers who believe much of the engineering process to be formulaic and pre-scripted (Lawson-Bulten et al., 2024). Additionally, researchers and students from specifically STEM backgrounds have been shown to perpetuate uneven power dynamics with behaviors that disregard the value of local knowledge (Meyer et al., 2018). This was true even in cases in which scientific researchers had stated beliefs and value systems consistent with co-production methods (Manuel-Navarrete et al., 2021; Contreras & Roudbari, 2022).

Participatory methods mirror Chambers’ assertions around centering power dynamics, underscoring the role and knowledge of the community member and deflating the role of the practitioner (Beier et al., 2017;

Jiménez et al., 2019; Kindon et al., 2009; Manuel-Navarrete et al., 2021; Mayo, 2014). PAR requires that community members engage directly in inquiry as local experts or non-academic experts, which are labels that emphasize their position in reference to traditional research roles (Kindon et al., 2009). These methods require continual self-reflection by the practitioner, calling upon them to be aware and consciously push against systemic oppressions that would silence community voices.

### 3 Contrasting Case Studies

The Contextual Engineering Research Group (CERG) specializes in engineering interventions that prioritize integrating local context into technical decision-making. Thus, the group often collaborates and consults for many “humanitarian engineering” (or similarly referred to) projects globally, especially in alternatively developed and/or rural societies. The following case studies are among the ongoing collaborations within the CERG research group and represent the work of two organizations in two different communities. Each case study has been derived from three years of direct engagement with an organization and qualitative data collection within the respective project community. For the purpose of this paper, these case studies are contrasted based on each organization’s engagement with its community and how that engagement impacts the community’s sense of agency and ownership in the project.

#### 3.1 Project Backgrounds & Objectives

Table 2: Breakdown of Case Study Information

	Zambia	Honduras
NGO Stated Objectives	Working with marginalized communities to address environmental challenges through cultivating community autonomy and ownership	Partnering with rural communities to listen first, and assist them in the areas of infrastructure, economy, health, education, community, and leadership
NGO Implementations	Fuel-efficient cookstoves, drinking water infrastructure, agricultural initiatives	Tutoring center, drinking water infrastructure, lighting infrastructure
Researcher Role	Provides insights and resources to NGO for fitting technology to local contexts but does not work on the project directly	Provide engineering consulting on infrastructure concerns, working directly on water infrastructure design
Community Background	Large peri-urban informal settlement of 20,000 households; faces challenges with deforestation and water access	Small rural community of 30 households; regularly flooded due to broken levee, lacks local school and water infrastructure. Limited job opportunities
Data Collected	Semi-structured interviews, ethnographic field observations	Semi-structured interviews, participatory mapping workshops, ethnographic field observations

##### 3.1.1 Zambia

This case study follows a for-profit startup European NGO that formed in 2022 and began onsite engagements with a community in the Ndola area of the Copperbelt Province, Zambia, in 2023. The NGO has explicitly expressed a desire to cultivate a sense of autonomy and ownership in the communities with which it works, and a willingness to take additional actions in order to achieve this. Consequently, a relationship was formed with CERG wherein we would provide insights for fitting a technology to unique

local conditions. In return, we were allowed detailed observation of NGO operations, including decision-making from the founders and technology distribution and monitoring on site. A majority of the subject Zambian community is self-employed and faces challenges with deforestation from using charcoal as a cooking fuel. Additionally, it experiences inconsistent access to clean water. The community's full history with humanitarian aid is unknown, but it has received drinking water infrastructure and water treatment assistance from NGOs Habitat for Humanity and The Red Cross in the past.

### **3.1.2 Honduras**

A Honduran non-profit was originally conceived and created by two brothers from the United States based on their personal experiences as mission volunteers in Honduras. CERG was connected to the NGO in the spring of 2022 to provide engineering consulting on water infrastructure concerns in their newest partner community. The partnership with the NGO, as well as CERG's direct work with the community, was formalized in 2022 with an initial effort to improve water infrastructure. The Honduran community is a small, rural community within the Yoro Department of Honduras. Situated along the Ulua River, the community faced regular flooding due to a broken levee over the past five years. There is limited economic opportunity as majority of residents work as day laborers in the nearby Palm or Banana fields. There is no school or hospital in the community, with the approximately 30 households traveling to nearby communities via bus (15 minutes for primary school, 1.5 hours for secondary education and hospital services). Although the community has experienced short-term engagement with international aid providers due to humanitarian responses after Hurricanes Eta & Iota, residents have had no long-term connection to organizations prior to partnering with the Honduran NGO in 2022.

### *3.2 Similar Actions, Different Mindsets*

Through researcher on-site engagements with each of the projects, qualitative data was collected regarding the actions and mindsets during technical interventions. In the Zambia case, the researcher engaged directly with the community on three separate occasions, and data was collected mainly in the form of semi-structured interviews and ethnographic observations of day-to-day operations between the NGO and the community. The Honduran case study included three separate visits to the community, completing semi-structured interviews, participatory mapping workshops, design consultations, and ethnographic observation of the community and NGO reactions. Figure 1 illustrates how each NGO implemented similar actions in line with more engaged community practices: attempting a more democratic needs assessment, acknowledging local knowledge sources, and extending moments of connection/intervention through regular community engagement. However, as Figure 1 also demonstrates, the Zambian NGO often implemented these practices under an empowerment mindset, viewing themselves as the holders of technology and sustainable practices and viewing the community as lacking those qualities and capabilities. Meanwhile, the Honduran NGO acted from more of an agency mindset, viewing the community as a crucial partner and the driver of technology implementation.

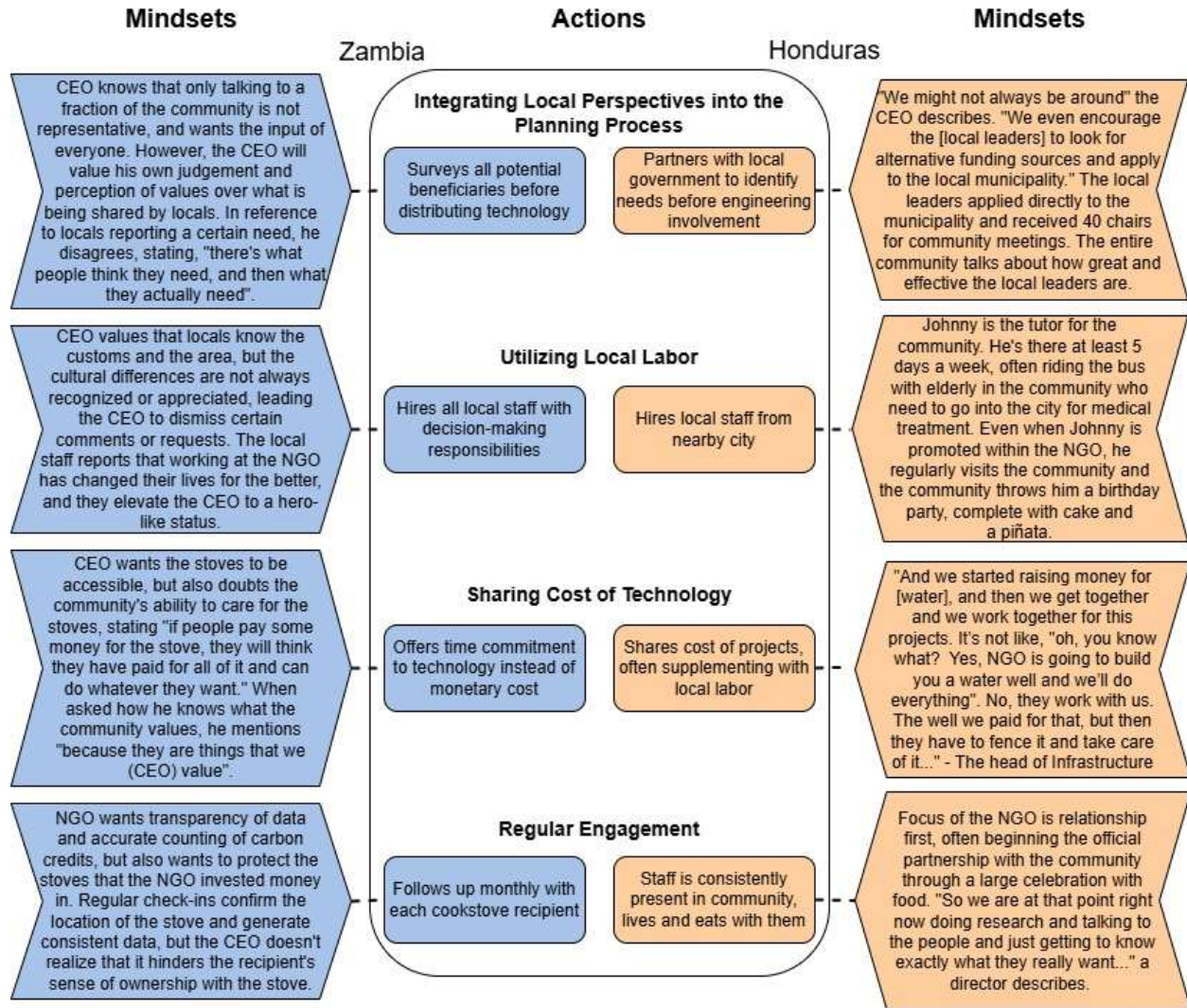


Figure 1: Actions, in boxes, taken by the NGO (Zambian in blue and Honduran in orange) and underlying mindsets, connected by dashed line, of the corresponding NGO.

### 3.3 Separate Outcomes

Although community engagement activities were similar in structure of implementation, collected qualitative data illustrates a significant difference in the mindset of the NGOs and consequently the observed outcomes of project interventions in the two communities. Table 2 illustrates for each project several examples of the respective community's response to NGO action. The Zambian community continues to see the Zambian NGO as the owner and controller of the technical intervention. Even the hired staff will not share their opinions for change with the NGO, continuing to push colonialist development rhetoric. Comparatively, the relationship built with the Honduran community and the intentional, participatory methods resulted in more open and honest communication, through which the community felt such meaningful ownership over the system that they postponed it altogether in favor of an alternate, unfunded project.

Table 3: Community Impact/Response in each project.

Zambia	Honduras
<ul style="list-style-type: none"> <li>• Cookstove recipients reporting to the researcher that they would use the stove differently if it was “theirs”</li> <li>• Locals commenting that the cookstoves are still viewed as handouts despite efforts to create buy in</li> <li>• Locally hired staff mutually observing an obstacle and not reporting it to the NGO</li> <li>• Mirrored negative rhetoric between locals and NGO founders, describing the community as ignorant and having nothing</li> </ul>	<ul style="list-style-type: none"> <li>• Community government postponing the water project and requesting a lighting project instead</li> <li>• Community members openly discussing whether they agree or disagree with NGO’s opinion</li> <li>• Expansion of visioning topics for the community and actions provided in interviews to accomplish visions</li> <li>• Residents shift from asking the researcher to bring concerns to NGO to stating they bring challenges up directly to local government</li> </ul>

One must note that the agency mindset requires continual reflection and adjustment. When the Honduran community initially refused the water project, members of the NGO – including Honduran nationals – were critical of the community government and residents. Sentiments of “They just don’t understand,” or “They’re being foolish,” were expressed in response to the community’s decision about delaying water infrastructure implementation. It was the researcher/technician who first affirmed the community’s decision and did not attempt to challenge it. Instead, the organization, researcher, and community entered into a dialogue around their concerns of a water system. Ultimately, the community expressed that they still valued a water system but were in greater, immediate need of a lighting project.

#### **4 Conclusions & Recommendations**

Findings of these comparative case studies reaffirm Chambers’ conclusions that the mindset of the practitioner – in this case the NGOs – have significant impact upon the ability of the partner community to self-determine their needs and approaches to resolving those needs. Further, intention does not necessarily determine mindset, since the case studies illustrate that comparable intentions by the two NGOs still yielded wildly differing behaviors and subsequent impacts upon community agency.

More specifically:

- Intent may not align with actions unless the NGO actor is reflective, introspective, and sensitive to the subtle dynamics that influence communications and self-perceptions.
- Implicit biases and unrecognized attitudes can subvert the intent of the relationship between NGO and community, resulting in a power imbalance that still favors the NGO as the “bestower of empowerment” upon the beneficiary society.
- Detection of and compensation for implicit biases is not inherently achievable without recognition of the impacts and processes by which these biases have come to exist. In line with Friere’s and Chambers’ assertions, engineering education should actively challenge the authority of the practitioner to know what is best for a client community much the way an instructor should challenge their own authority in directing a student’s learning.
- Terms frequently used in humanitarian engineering, such as empowerment, may have positive intent but must be recognized as having the potential to assign authority to the bestower of empowerment, which reinforces the influence of the practitioner over the community.

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