THE IMPACT OF HOW AND WHY A PROJECT BEGINS ON PROJECT OUTCOME IN ENGINEERS WITHOUT BORDERS – USA

BY

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THESIS

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ABSTRACT

Introduction

There are efforts by the Global North to improve the lives of the Global South, including small-scale engineering projects by Engineers Without Borders – USA (EWB). These efforts have been met with mixed levels of success, defined here as the ability to meet local needs and improve local capacity. According to literature, the success of these Global North efforts has been influenced by factors present in their initial stages, particularly the approaches and motivations of parties involved. The research objective of this paper is to assess the relationship between the initial stages of EWB international engineering projects (IEPs) and their outcome, specifically how EWB initially approaches IEPs as well as why stakeholders get involved in IEPs.

Methodology

An explanatory mixed methods approach was used. Surveys and follow-up interviews were administered to former and current EWB participants, ranging from project team members up to full-time EWB staff. The survey data yielded 85 usable survey responses accounting for 306 EWB IEP experiences, and the interview data yielded 10 interviews representing 16 EWB chapters and 34 EWB IEPs. Survey findings were assessed via the Mann-Whitney U test for statistical significance, and interview findings were interpreted via inductive thematic analysis.

Results and analysis

The survey analysis determined that projects selected by chapters without any criteria or particular community in mind yielded significantly lower reported rates of success (as defined above) than other projects ($p = 0.0136$). Projects where a chapter had a particular community in mind were observed to have higher reported rates of success than others ($p = 0.0769$). The

interview analysis yielded 14 themes pertaining to how EWB projects begin (eight positive influencers on success, two neutral, and four negative). Pertaining to why stakeholders enter EWB IEPs, the interview analysis yielded eight additional themes (four positive influencers, two neutral, and two negative). Themes with positive influence on project outcome included: establishing relationships with local stakeholders, readout of local circumstances, contextual awareness, projects with existing relationships and partnerships, flexibility in approach, coherent communication within EWB chapter, non-engineers in the EWB project process, EWB in-country staff, unified definitions of success, volunteer introspection, being upfront about your capabilities as a volunteer, and local initiative in local capacity building. Negative influences included: efficiency of the dual mission, approval preceding assessment, many chapters do not emphasize *go, no-go* option, issues rooted in community application, mixed understandings of short-term vs long-term aid, and ethics of the dual mission. Themes with neutral or mixed influence on project outcome included: variety of methods of first contact between EWB and partnered communities, disparity of initial approaches from chapters, variety of motivations for volunteer involvement, mixed motivations for community involvement, and outcome sometimes out of project's control.

Conclusions

Regarding how EWB IEPs begin, communicating and interacting effectively with local stakeholders was by far the most positive influencer for success. Moreover, the formal EWB process had both a positive and negative influence on IEP outcome. Regarding why stakeholders get involved in EWB IEPs, compatibility of stakeholder motivations was a crucial influencer on IEP outcome. Personal reflections on motivations were also significant influencers on IEP outcome, for both EWB chapters and the partnered communities in IEPs.

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CHAPTER 1

INTRODUCTION

1.1 Research motivation

There are ongoing efforts by the Global North to improve the lives of the Global South (UN General Assembly, 2015). Historically, these efforts have resulted in mixed levels of success and often make matters worse for the recipients (Gibson et al., 2005; Howell, 1990; Lettner and McNicholl, 2008; Schuller, 2012; Scott, 1999). This thesis interprets *success* as the ability to appropriately meet local needs and increase long-term local capacity. Between 2000 and 2020, the percentage of the Global South population with access to safely managed drinking water increased from 43.1% to 58.1% (WHO and UNICEF, 2021), though progression in the Global South is not necessarily a direct result of Global North efforts (Easterly, 2006).

Literature accompanied by decades of trial and error has observed key factors that serve as harbingers to the success or failure of these aid efforts. Though some Global North efforts fall short of success due to circumstances *during* their execution, many of these critical factors are manifested in the early stages of these efforts or even before these efforts begin. Two early-phase and complex indicators of success are *how* people initially approach these projects (Easterly, 2006; Ika and Hodgson, 2014; Lee et al., 2018) and *why* people enter these projects (Cooke and Kothari, 2001; Ebrahim, 2005; Gibson et al., 2005; Ika and Saint-Macary, 2012; Jahnke, 2020; Schuller, 2012). More details on these two indicators in context of Global North aid efforts can be found in Section 2.1.

A subset of these Global North efforts are small-scale international engineering projects (IEPs), whose scopes typically include water supply, sanitation, public infrastructure, or other community-specific needs (Amadei, 2014). Engineers Without Borders – USA (EWB) is a

nonprofit organization that designs and implements these small-scale IEPs in 39 countries and 28 U.S. states (EWB-USA, 2021e) and currently partners with communities on hundreds of IEPs with thousands of volunteers (EWB-USA, 2021f). After a 2016 internal review of the long-term impacts of 190 previously implemented projects, based on metrics of *project functionality*, *maintenance index*, and *community capacity index*, 66% of projects monitored were highly functional (≥75% functional), 66% of projects were maintained without outside assistance, and 22% of projects were not being maintained at all (Martindale, 2017).

As Global North efforts have demonstrated that how and why a project begins impacts its success, it is worthwhile to assess whether the findings on these two factors apply to the outcomes of EWB IEP efforts as well. Such findings may bear implications on the best practices for EWB chapters, for partnered communities, and potentially for EWB operations as a whole.

1.2 Research objective and questions

The objective of this research is to assess the relationship between the initial stages of EWB IEPs and IEP success. Below are the two primary research questions this thesis addresses:

1. *What is the relationship between <u>how</u> EWB initially approaches IEPs and IEP success?* This question includes the established EWB project process alongside how these procedures are followed by both EWB and local partners.
2. *What is the relationship between <u>why</u> stakeholders get involved in EWB IEPs and IEP success?* This involves the motivations behind each party's decision to invest a great deal of money, time, and energy into a project, whether it be volunteers, communities, non-government organizations (NGOs), donors, etc.

These research questions were addressed using an explanatory mixed methods approach that included a survey to former and current EWB practitioners as well as subsequent follow-up

interviews. EWB practitioners were asked to recount details on the early phases of each of the EWB IEPs they were involved in as well as report the success of each respective IEP. In context of the EWB project process, these early phases are labeled *Form Partnerships* and *Assessment*.

1.3 Terminology

EWB out of context can refer to any of 108 independent *Engineers Without Borders* organizations based around the world. In this paper, the American nonprofit *Engineers Without Borders – USA* will be what both *EWB-USA* and *EWB* refers to, though France (*Ingénieurs Sans Frontières* in 1982), Italy (*Ingegneria Senza Frontiere* in 1993), Canada (*Engineers Without Borders – Canada* in 2000), the United Kingdom (*Engineers Without Borders – UK* in 2001), and Spain (*Ingeniería Sin Fronteras* in March 2002) all founded their respective organizations prior to *EWB-USA*'s conception (June 2002) (EWB-International, 2021). *Community Engineering Corps*, host of EWB's domestic project operations, also falls under the umbrella terms of *EWB* and *EWB-USA*.

Global South will be used in reference to low and middle income nations (Hollington et al., 2016; The World Bank Group, n.d.). This term is a common replacement for *Third World countries* and *developing countries*, avoiding phrasing that may suggest a hierarchy between nations based on economic indicators alone (Dados and Connell, 2012; Pagel et al., n.d.). Conversely, *Global North* refers to countries that do not fall in this bracket.

Local capacity refers to the community and local partners' ability to take initiative and ownership of sustaining and improving their quality of life, an indicator of long-term growth (United Nations Development Programme, 2009). *Local* defaults to the perspective of the partnered community's local area. The term *local partners*, for example, refers to in-country NGOs, contractors, and sometimes local government, but they are distinct from the community

itself. *Partner* community, *client* community, *recipient* community, and *customer* community all refer to the same local community, but *partner* better parallels with EWB language and will be used most frequently.

Success in IEPs is defined differently by each stakeholder (Schreiber, 2019). As mentioned earlier, this research will interpret *success* as the ability to appropriately meet local needs and increase the long-term local capacity. A positive or negative volunteer experience may impact IEP success with respect to the dual mission of EWB, but directly these experiences will not be treated as one-to-one with this paper's interpretation of *success*.

International engineering projects (*IEPs*) are operations that involve workers in the Global North providing typically small-scale engineering infrastructure to those in the Global South, often rooted in altruism (Jahnke, 2020). Common scopes of IEP work include water/sanitation, roads, bridges, electricity, or buildings. IEP participants from the Global North are typically volunteers, working through nonprofit organizations like EWB. For simplicity, the *domestic* EWB projects will also fall under this umbrella term of *international* engineering projects. *Humanitarian engineering* is an increasingly popular term to characterize this work (Mitcham and Munoz, 2010), though the scope of small-scale IEPs that EWB takes on does not include short-term crisis and disaster relief that *humanitarian* work implies (Allen, 2018).

1.4 Thesis format

Chapter 2 provides an overview of the literature on the impact of how and why projects begin on project success in Global North efforts outside of EWB. Chapter 2 also provides literature with similar research objectives as well as a justification for the methodology used in this research. CHAPTER 3 details the mixed methods approach for both the survey and interview, whose findings are found in CHAPTER 4. The emerging data and themes from the

survey and interview are analyzed and discussed in Chapter 5. Conclusions, implications, and future research can each be found in CHAPTER 6.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews the literature pertaining to the research objective: Assess the relationship between the initial stages of international engineering projects (IEPs) conducted by Engineers Without Borders – USA (EWB or EWB-USA) and the outcomes of these projects. This objective is motivated by the historical evidence of these initial stages having an impact on success in Global North efforts outside of EWB; Section 2.1 validates this research motivation by addressing the body of literature on these efforts. Section 2.2 addresses literature pertaining to EWB, including their project process as well as documentation of the initial approaches and motivations present in former EWB IEPs. Section 2.3 discusses research methodologies from similar literature and provides justification for the methods used in this paper.

2.1 Literature on the impact of initial stages of Global North efforts on project outcome

2.1.1 Literature on the impact of initial approaches to Global North efforts on project success

This section explores the literature on how international aid projects are initially approached, consequences of these methods, and how the approach has transformed over time. This section does not include publications on IEPs overseen by EWB-USA but does include research on IEPs under Engineers Without Borders – Canada (EWB-Canada) and Engineers Without Borders – Australia (EWB-Australia), two organizations completely independent from the similarly named American nonprofit.

Publications on project methods in Global North efforts exist primarily as examinations of overall project execution or project management rather than early-phase project approach, perhaps due to the way many interpret international aid project approach as a cyclical process rather than one with a *beginning*, such as the World Bank (Baum, 1978; The World Bank Group,

2021; Youker, 1989). Nonetheless, this life cycle includes *Identification*, *Appraisal*, and *Negotiation and Approval*, phases of the project process which all fall under the umbrella of initial approaches.

Ika and Hodgson (2014) categorize approaches to project management in Global North efforts into different methods. They observe that the more traditional approach emphasizes a very technical *blueprint* style, with intellectual roots in engineering, economics, and construction. The *contingent* project management approach prioritizes people, flexibility, and context over a more rigid toolset of logical frameworks, etc., with roots in sociology and anthropology (Ika and Hodgson, 2014). These two labels on approaches, *blueprint* and *contingent*, will assist this section in categorizing top-down and bottom-up project approaches, respectively. These parallel William Easterly's notion of *Planners* and *Searchers*, where *Searchers* have a less formalized scope ahead of time and let the recipients participate in the initial scope discussions (Easterly, 2006).

It is expected that international engineering projects have historically placed considerable emphasis on the *blueprint* project management style, since the concept of project management, now ubiquitous in all disciplines, was born from engineering and construction (Morris, 2011, 2013). Warren Baum, who inspired the World Bank's project cycle, argued that no two projects are alike, but every project passes through a common cycle (1978). Under this top-down approach, project objectives are established at the beginning, and robust, methodical steps are put in place to execute these objectives, utilizing tools such as cost-benefit analyses, Logframes, the Program Evaluation and Review Technique, and other performance indicators (Ika and Hodgson, 2014; Ika and Saint-Macary, 2012). *Blueprint p*rojects are viewed as planned, time-sensitive checklists, with the technical project itself as the central focus if not the only focus (Analoui,

1989; Bond and Hulme, 1999; Brinkerhoff and Ingle, 1989). From start to finish, traditional *blueprint* international aid projects are typically executed in 3 to 5 years (Brinkerhoff and Ingle, 1989; Great Britain Overseas Development Administration, 1995).

It is observed that, with the exception of some engineering-based literature, this traditional, *blueprint*, *hard* project approach is generally agreed upon as outdated (Ika and Hodgson, 2014). Criticisms of this method include lack of flexibility in both scope (Brinkerhoff and Ingle, 1989; Rondinelli, 1983) and time (Bond and Hulme, 1999; Mikkelsen, 1996); its historical connotations with and high susceptibility to projectization, domination, imposition, and colonization (Adas, 2009; Cicmil et al., 2009; Kenny, 2008; Lovegrove et al., 2011; Lundin, 1998; Palacios, 2010); and the lack of emphasis of local stakeholders, perspectives, context, participation, and capacity (Amadei, 2014; Bartlett, 2007; Bond and Hulme, 1999; Easterly, 2006; Ika and Saint-Macary, 2012; Leydens and Lucena, 2010; Thomas and Amadei, 2010; Witmer, 2018).

On project flexibility in IEPs, Bowen and Acciaioli (2009) attributed an IEP's success with EWB-Australia in Indonesia in large part to incorporating a flexible scope into an inherently top-down project process, citing benefits to simplifying the terms of interaction before arrival, not having a strict reporting schedule, and being able to treat the recipient community as multiple stakeholders. Bartlett (2007) observed that it is people who ultimately determine the fate of an international project and suggested that the technocratic process is the problem as it inherently ignores people. On the people doing the work in this fixed setting, "it is largely a matter of luck if those people have the commitment, creativity and communication skills that are needed for the project to succeed" (Bartlett, 2007). Regarding flexibility in terms of time, Bond and Hulme (1999) noted that poverty reduction and economic growth is not likely in efforts with a time span

of 3 to 5 years and that timeframes of 10 to 20 years are more feasible. An EWB-Canada project was negatively impacted by project inflexibility when the recipient community held elections and holidays, causing almost 3 months of delay of the start of a project, which boded worse for the logistic-sensitive Global North engineers than it did for the community (Wood and Mattson, 2016).

On the emphasis of local context, Wood and Mattson (2016) detected seven common pitfalls in a review of 41 failed IEPs overseen by EWB-Canada. In descending order, the most prominent pitfalls were *lacking the contextual knowledge needed for significant impact* (28.9%), *neglecting to make a plan for or developing partners for long-term sustainability* (26.1%), and *assuming the needs of the customers being served* (23.9%). On *lacking the contextual knowledge needed*, Wood and Mattson (2016) recount a Malawi project where the engineers educated a local entrepreneur on business and supply chain management, which led him to eventually abandon his cassava factory. One engineer later learned the factory was part of a "much larger complex system of community dynamics, financial norms, interpersonal relationships, and Malawian society", and without accounting for this provided an insufficient solution to a complex problem (Lettner and McNicholl, 2008). Chisolm et al. (2014) also cites a key challenge to IEPs as "understanding community dynamics and adapting projects to their local context", commenting on international stakeholders playing a key role in non-technical parts of projects that are "often more critical to success than the technical design." Moreover, on a separate EWB-Canada project, an engineer who fundraised for a computer lab in Tanzania returned six months later to find three of the 10 computers had been stolen, two were ridden with ants, two were corrupted with viruses, and the remaining three were kept locked. The engineering group later regretted not learning in advance what they might have more

appropriately needed in their school and instead made assumptions from 8000 miles away (Hewens, 2013). Blouin and Perry (2009) also observed that treating communities like partners tends to produce better community outcomes than those who treat them like subjects or recipients.

20th century philosopher F.A. Hayek explained the *local knowledge problem* in which scientific knowledge is not the sum of all information, since any person will have more knowledge of their current time and place than anyone else could possibly calculate (Hayek, 1945). Hayek's observation on the inherent advantage of place-based knowledge embodies the core theme of Easterly's *Searchers* approach (2006a), Leydens and Lucena's emphasis on *contextual listening* (2010), Ika's *contingent* project management approach (2014), and Witmer's *contextual engineering* discipline (2020a). Contextual engineering prioritizes the nuances of local context in IEPs in terms of cultural, economic, political, educational, and mechanical factors (Witmer, 2018). Witmer further observed that the expertise of technically-fixated volunteers in IEPs was only as useful as their awareness of the local circumstances (2020a). Leydens and Lucena (2010) claim similarly how "failure to listen effectively to community perspectives" is what has historically led to a myriad of failed projects, both in IEPs and in small- and large-scale international aid as a whole (Adas, 2009; Easterly, 2006; Jackson, 2007; Scott, 1999).

The United Nations Development Programme (UNDP) has modified its approach to aid over time, from *development aid* (sending money), to *technical assistance* (designing solutions like the Global North has), to *technical cooperation* (designing more appropriate solutions), and most recently to *capacity development* (empowering the community from within to foster self-sufficiency) (Amadei, 2014; United Nations Development Programme, 2009). The UNDP

approach gradually transitioned from a blueprint initial approach to a contingent approach; the UN now preaches capacity development as the engine of human development (United Nations Development Programme, 2009).

2.1.2 Literature on the impact of motivations to begin Global North efforts on project success

This section addresses the motivations of four common stakeholders involved in these efforts (volunteers, donors, NGOs, and communities/recipients) and the influence of each of their motivations on success. Communities' motivations are partially documented but are mostly observed as a research gap, as their motivations have historically been presumed simply as *need* (Lucena, 2010).

An extensive data mining of documents from various types of stakeholders involved in IEPs demonstrated that each party holds a definitively different definition of IEP success (Schreiber, 2019). For example, an IEP intended to provide drinking water to a rural community in Honduras started making community members ill after a week, though it did not appear to be a failure to the donors, who continued to promote the project on their website (Witmer, 2018). Moreover, Witmer (2018) observed that motivations by each of these IEP stakeholders may not coincide with one other and "may result in rejection of infrastructure." This observation is made in Global North efforts outside of an engineering context as well; Murdie (2014) noted how local support of aid projects is diminished if other involved organizations hold motives contrary to theirs.

Regarding volunteer motivations, Jahnke (2020) explored college student-volunteer motivations before and after taking a two-semester applied IEP-based course. Initial reported motivations were categorized into internal (personal responsibility, guilt, background, real-world experience, future goals, and travelling); external (water as basic necessity, Global North

obligation, client needs engineering expertise, other community assumptions); and objective (benefit community, benefit country). Upon the course's completion, motivations were discussed again; many students acknowledged the value in understanding and identifying personal motivations to participating, with a few additional students admitting the ability to travel as a previously unmentioned motivation.

Lee et al. (2018) also observed that students participating in an EWB IEP were motivated to contribute "largely due to the potential for travel." Despite volunteers reporting otherwise, many have been skeptical of truly altruistic intentions to join (Butcher, 2003; Guttentag, 2009; Harrison, 2008), coining phrases like *vacation volunteering*, *voluntourism* (volunteer tourist), and *altourists* (altruism tourists) (Palacios, 2010; Sichel, 2006). Witmer (2018) has discussed this skepticism within IEPs, citing a volunteer's desire for hands-on experience being explicit over the notion of *giving back*, alongside an observed mark of seniority that boils down to volunteers flexing on one another about how experienced, cultured, and morally pure they were.

On the impact of volunteer motivations, Schneider et al. (2009) acknowledge altruistic affinity amongst EWB volunteers, but appropriately cautions students on the dangers of *engineering to help* and altruism in this field of work. The concept of helping others can create a hierarchical *us* versus *them* mindset, what Stephen Riggins refers to as *Othering*, which blurs the judgment of volunteers trying to collaborate with the intended recipient (1997). Cooke and Kothari (2001) similarly challenge all international aid practitioners to reflect on their motivations for involvement in *Participation: The New Tyranny?*, citing examples of how intentions of empowerment and participatory development often result in fruitless if not counterproductive efforts to fight inequalities. These types of outcomes have been a pattern

observed in IEPs as well as throughout the field of service learning in general (Blouin and Perry, 2009; Butin, 2003; Crabtree, 2013; Lee et al., 2018; Tryon et al., 2008).

Volunteers' notion of *doing good* is representative of their own culture, and may not be how the recipients of these aid projects see it (Kramer et al., 2018). Witmer (2018) and Jahnke (2020) both noted in their experience with IEPs that the quality of volunteer-community interaction is often an embodiment of volunteer motivations and thus plays a vital role in the execution of IEPs. An example of this can be found in an EWB-Canada project, where an engineering team presumed a community to be *resource-poor* and spent their time designing a low-resource manual food processor for them; the community, who evidently had electricity access, preferred the design to be electric (Wood and Mattson, 2016).

Like volunteer motivations, donor motivations are complex but show roots in altruism (Bradford, 2020; Sherry, 1983; Titmuss, 2019), perhaps due to their comparable Global North perspectives. Adding nuance to donor motives, donors want to see change, whether it be viewed as a form of activism (Kelemen et al., 2017; Wilson, 2000), a form of changing the status quo (Handelman and Arnold, 1999), or a simple desire to gift to society (Sherry, 1983; Strathern, 2012; Titmuss, 2019). Donors have been pushed more recently to engage in long-term social change and not just fixate on short-term success (Ebrahim, 2005), but short-term results are observed to be more appealing to donors (Bond and Hulme, 1999; Bradford, 2020).

On the impact of donor motivations, a survey of 1,210 workers for international NGOs and development agencies reported that 64 percent of donor-funded projects do not achieve their intended impact (Lovegrove et al., 2011). Allen (2018) understands how many see the justification of donating and volunteering despite all its criticisms: "Who says that humanitarianism should be set aside? It is unlikely to be those in distress." However, Ian Fisher

has direct accounts of those in distress who say otherwise in a *New York Times* article titled *Can International Relief Do More Good Than Harm?* (2001). Upon visiting the Nuba people in southern Sudan, Kowa, their leader, made it clear that "unchecked humanitarianism is another threat to the Nuba people", equating the lack of autonomy via unsolicited donations to the horrific ongoing civil war in the region. Kowa recalled a moment when an area in Sudan received food aid from donors during what is now known as the *permanent emergency*: "The people of this area are great farmers… but because there is this relief food, they do not farm for three years. I could see the difficulty. It was spoiling people. They just sleep and have food. It is very bad" (Fisher, 2001).

Gibson et al. (2005) and Catterson and Lindahl (1999) cover a wide array of additional chilling examples on disrupting local capacity building, creating dependency, and prolonging violence with morally justified aid from donors in their appropriately titled *The Samaritan Dilemma* and *The Sustainability Enigma*, respectively. Claiming only a few programs outlast donor support and even fewer appear to achieve lasting improvements, Gibson et al. (2005) observes a game theory model between Samaritan (donor) and recipient; the Samaritan always wins if the recipient needs help, so they help, and then the recipient is always better off if they do not put effort in, so they do not, ultimately resulting in more need. For example, power stations in many recipient countries only last 20% of their expected lifespan, since there is no incentive to maintain it when they know that a new plant would assuredly be built within a few years, free of charge to them (Gibson et al., 2005). Tanzania and large donors find themselves trapped in a similar, mutually unsatisfactory relationship (Catterson and Lindahl, 1999).

Regarding NGO motivations and their impacts on success, in *Help or Harm: The Human Security Effects of International NGOs*, Amanda Murdie (2014) claims NGOs are commonly

motivated by either community-shared values or simply for greed or selfish interests. Though NGOs are diverse in both size and integrity, *Killing with Kindness: Haiti, International Aid, and NGOs* (Schuller, 2012) and *Paved with Good Intentions: Canada's Development NGOs from Idealism to Imperialism* (Barry-Shaw and Jay, 2012) offer ample criticism of NGOs and their motives. It is observed that NGOs are commonly pressured to spend money just like any organization who needs to justify the next year's budget and will often seek projects solely for this reason, regardless of demand (Ebrahim, 2005; Gibson et al., 2005).

Local community motivations historically have not been relevant to whether projects begin or not; in addition to a lack of documentation of community motives, recent concepts of international aid, international development, and other Global North efforts are an ethically troubleshooted update of colonialism, industrialization, and tensions in the Cold War, where Global South communities rarely had say in these partnerships (Lucena, 2010). Existing documentation suggests that a motivation for communities to want to participate in aid-based projects is the existence of previously obtained aid, a callback to the aforementioned game theory of volunteers and recipients in *The Samaritan's Dilemma* (Gibson et al., 2005). As a consequence of decades of aid, many countries such as Haiti, Tanzania, and Afghanistan have established a dependency on aid, relying on international NGOs and visiting experts, ultimately stunting local capacity (Catterson and Lindahl, 1999; Crabtree, 2013; Diamond, 2011; Gibson et al., 2005; Murdie, 2014; Schuller, 2012).

2.2 Literature on Engineers Without Borders – USA (EWB) related to local impact

There is a great deal of literature surrounding EWB IEPs, but much of its central focus is not on local impact (Crabtree, 2013). The notion of student/volunteer experience, often from the perspective of engineering education, is a common basis for IEP literature and ties directly into

half of EWB's dual mission of providing volunteers with experience in tandem with providing for Global South communities (EWB-USA, 2021b). Given how the research objective focuses on the community outcome half of EWB's dual mission (EWB-USA, 2021b), most of the explored publications in this chapter place significant emphasis on local impact. However, this priority is not representative of the current state of literature reviewed for EWB IEPs. Volunteer-focused publications tangentially assist this research via documentation of volunteer motivations (Ba-Aoum, 2016), but IEPs with the volunteers as their nuclei have been observed to shift focus away from community impact (Blouin and Perry, 2009; Butin, 2003; Crabtree, 2013; Tryon et al., 2008), and therefore are not as emphasized in this review.

2.2.1 Literature on the EWB project process

EWB has five phases in their international community program project process, each with numerous sub-phases. In order, they are *Form Partnerships*, *Assessment*, *Implementation*, *Evaluation and Monitoring*, and *Closeout*, with details on subphases in Table 2.1. As outlined in *Engineering for Sustainable Human Development*, the main purpose of the initial assessment or *appraisal* phase of an IEP is to learn as much as possible about the community (Amadei, 2014). The author, who is also the founder of EWB-USA, emphasizes that "not recognizing the context in which a project takes place is a recipe for failure."

During *Form Partnerships*, a community submits an application for a *program*, an approximated 5-year partnership that may have multiple *projects* during its lifetime. The application is required to be filled out primarily by the community, with potential secondary help from NGOs or another party (EWB-USA, 2018). There is no way to verify the extent of community involvement in the process, with the exception of local EWB in-country offices, a recent addition to EWB that functions similarly to a local NGO (EWB-USA, 2017). An expert

committee from EWB headquarters then vets the project for potential approval (Sacco and Knight, 2014). If the project is approved, the community waits for an EWB chapter to go through its own selection process, where, upon qualification, they will pick a project from the ones available and apply for it (EWB-USA, 2020d). There is part of a web page titled *Finding the Right Unassigned Partnership for Your Team* that provides insight on which project to pick, but ultimately each EWB chapter, including the volunteers and the chapter's professional or faculty advisor, decide the method on how IEPs are chosen (EWB-USA, 2020d). There are separate stipulations in place for when a community is close to another community the chapter is currently working with, but the overall process is structured the same.

Table 2.1 EWB-USA Project Process, including required community and NGO actions (Lundborg, 2020)

Phase	**Subphase**
Form Partnerships (4-10 weeks)	Community Program Application
	Team Application
	Create Project
Assessment (19-22 weeks)	Pre-Trip Plan
	Trip Details
	Assessment Trip
	Post-Trip Report*
Implementation (47-50 weeks)	Alternatives Analysis
	Safety Plan
	Trip Details
	Implementation Trip
	Post-Trip Report*
Monitoring and Evaluation (19-22 weeks)	Pre-Trip Plan
	Trip Details
	Monitoring and Evaluation Trip
	Post-Trip Report
Closeout (5 weeks)	Closure Agreement
	Submit for Project Closure

**Includes the option to not proceed to the subsequent subphase*

EWB teaches its project process as "pretty much the same in the developed world like in the United States or in a developing context" (EWB-USA, 2021a). The first two EWB phases of *Form Partnerships* and *Assessment* are very linear; there are only two points in the formalized

project life cycle where a project can skip, go back steps, or close (EWB-USA and Fite, 2020). Between *Assessment* and *Implementation*, chapters can either proceed as usual, start the *Assessment* phase over again, or declare the project a "no-go", cancelling it entirely. The second point is between *Implementation* and *Evaluation and Monitoring*, where chapters choose to begin *Assessment* on a new project in the same community, begin *Assessment* on a new project in a nearby community, do another abridged *Implementation* phase, or move on to *Evaluation and Monitoring* (EWB-USA and Fite, 2020; Lundborg, 2020).

2.2.2 Literature on initial approaches and motivations in EWB IEPs

This section contains literature on EWB IEP stakeholder motivations and IEP outcomes, though there is an observed research gap on literature that connects these crucial early-phase EWB IEP details to project outcome. After a 2016 internal review of the long-term impacts of 190 previously implemented EWB projects, based on metrics of *project functionality*, *maintenance index*, and *community capacity index*, 66% of projects monitored were highly functional (≥75% functional), 66% of projects were maintained without outside assistance, and 22% of projects were not being maintained at all (Martindale, 2017).

EWB lists *engineering* and *community-driven* as their first and second of ten core principles of development (EWB-USA, 2021c). Regarding motivations of EWB volunteers, undergraduate students are typically the drivers of EWB efforts as student volunteers, with high motivation accompanied by formidable support and awareness for fundraising to short-term needs (Chisolm et al., 2014). Compared to students who do not volunteer, EWB participants have much stronger dispositions toward openness to experience, flexibility, a motivation for social good, and overall broader interests (Litchfield and Javernick-Will, 2015; Litchfield and Javernick-Will, 2016). Ba-Aoum (2016) collected survey data on 187 EWB-USA volunteers'

motivations for joining the organization as well as their personal values. 82.4% of respondents reported *helping people in need* to be the most important motivation to join, followed by *learning some skills* (7.5%) and *networking and friendship* (5.3%). Moreover, 79% of respondents reported that it is *a moral and professional obligation* to use their engineering expertise to help people in need (Ba-Aoum, 2016). When asked to report the most difficult challenge of humanitarian engineering work, EWB volunteers reported *communication* (36.8%) and *cultural challenge* (32.4%) as the key challenge over *other* (17.3%) and *technical challenge* (13.5%). When asked what skills were critical for IEPs, the 3 most popular choices were *communication*, *cultural awareness*, and *technical capacity* (Ba-Aoum, 2016). A study on 22 EWB-USA borehole projects claimed community engagement and pre-implementation surveys are strongly recommended toward a successful project (Kristoffersen and Knight, 2021).

Lee et al. (2018) observed a cancelled EWB project where everything appeared to have been going well until it was learned that the NGO was dishonest on the community application about how engaged the community was. Once the team found out only half the community was really in support of the project, in addition to the NGO breaking a promise to hire local community members and not outside workers, neither the team nor the community were motivated to engage in the project anymore, losing any remaining local support for the project (Lee et al., 2018). This decision by the NGO in an EWB IEP embodies the aforementioned mixed motivations of NGOs; Lee concluded by suggesting more careful vetting of NGOs and endorsed the recent trend of EWB in-country offices.

Moreover, this particular EWB team (Lee et al., 2018) only discovered this mismatch in motivations on their third trip there because the advisor with them this time was an anthropologist and not an engineer. One student in this group emphasized the challenge of

Engineers in *Engineers* Without Borders, recounting that if their engineering team continued in the original direction they were headed with the project, they would "be a lot more project focused and we might still be continuing this project… We decided to focus more on community and less on implementation, and with the anthropologist, it really helped us realize that… maybe our assessment trip was wrong and we should spend some time reassessing" (Lee et al., 2018).

2.3 Discussion of methodologies in literature

Many authors in the sections above incorporated mixed methods into their research, utilizing either a quantitative and qualitative approach or two different angles of a qualitative approach (Lee et al., 2018; Litchfield and Javernick-Will, 2015; Litchfield and Javernick-Will, 2016; Walters et al., 2017). Moreover, surveys among EWB volunteers and NGOs appeared to be a common and reliable theme of primary data gathering (Ba-Aoum, 2016; Dilts and Pence, 2006; Kristoffersen and Knight, 2021; Litchfield and Javernick-Will, 2015; Lovegrove et al., 2011; Witmer, 2020b). Multiple sources yielded findings either from other reports or from parsing through entire raw sets of data (Kristoffersen and Knight, 2021; Schreiber, 2019; Wood and Mattson, 2016). Finally, much of the literature collected data in the form of interviews (Blouin and Perry, 2009; Jahnke, 2020; Jahnke et al., 2016; Lee et al., 2018; Leydens and Lucena, 2010; Tryon et al., 2008; Witmer, 2018).

Comparing the research objectives with the methods of each of these sources, a mixed methods approach of surveys and follow-up interviews was utilized to address the research questions. Surveys provide representative data, which, independent of statistical significance, helps provide quantitative insight and guide productive follow-up questions. Follow-up interviews provide depth and context to the survey responses, yielding a more complete response to the underlying research objective than if it were addressed alone with numbers and statistics.

CHAPTER 3

METHODOLOGY

The purpose of this chapter is to provide an overview of the mixed methods approach utilized in this research as well as provide a full explanation of each of these approaches. These methods were used to assess the relationship between the initial stages of Engineers Without Borders – USA (EWB) international engineering projects (IEPs) and the success of these projects. Specifically, the two components of the initial stages that were investigated in this research were how EWB IEPs were initially approached (research question 1 or RQ1) and the motivations for stakeholders to enter EWB IEP partnerships (research question 2 or RQ2). Section 3.1 provides an overview of the mixed methods approach used. Section 3.2 covers the quantitative methods used in this research via surveys, and Section 3.3 covers the qualitative methods used via interviews.

Institutional Review Board (IRB) protocol was adhered to for both the survey and interview methods used in this thesis. However, since this research pertains to the organizational effectiveness of an organization (EWB), and its outcomes will not be generalized for other organizations, programs, or services, it was not labeled as human participation research (University of Illinois at Urbana-Champaign, n.d.). Therefore, there is no formal documentation with IRB for this thesis.

3.1 Overview of mixed methods approach

The mixed methods approach used for this research took inspiration from authors with similar research objectives who were able to gather appropriate data in the form of surveys (Ba-Aoum, 2016; Dilts and Pence, 2006; Kristoffersen and Knight, 2021; Litchfield and Javernick-

Will, 2015; Witmer, 2020b) and interviews (Blouin and Perry, 2009; Jahnke, 2020; Jahnke et al., 2016; Lee et al., 2018; Leydens and Lucena, 2010; Tryon et al., 2008; Witmer, 2018).

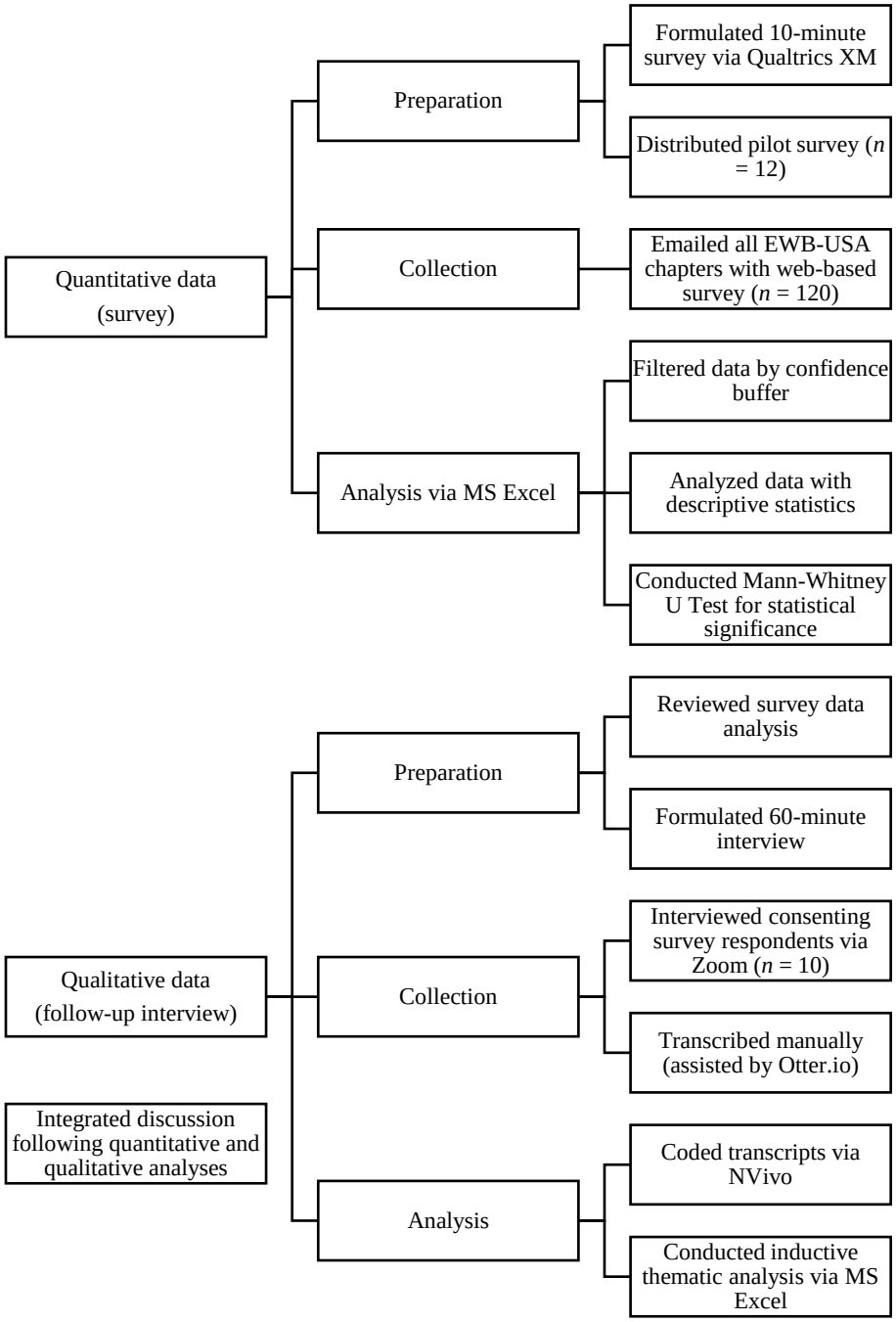


Figure 3.1 Overview of mixed methods approach. The explanatory mixed method first yielded quantitative data, then qualitative data. Following both sets of preparation, collection, and analysis was an integrated discussion.

This thesis utilized an explanatory mixed methods model; qualitative data from interviews helped explain and build on the data from the antecedent survey (Creswell and Plano Clark, 2006). The purpose of mixed methods in context of this research was to provide both a quantitative and qualitative representation of data that addresses the research objective. Though the quantitative data collected typically takes priority over the subsequent qualitative data in explanatory mixed methods, it is feasible to place equivalent if not greater emphasis on the qualitative methods (Ivankova et al., 2006); both the quantitative and qualitative implemented methods contributed significantly to this research. An overview of the methodology used for this research can be found in Figure 3.1.

3.2 Survey

This section discusses the survey preparation and collection process as well as how the data was analyzed. Using the Mann-Whitney U test and the Kruskal-Wallis test for the statistical analysis of Likert scale data, the survey intended to discern whether any significant relationships exist between EWB IEP initiation and the IEP's ability to improve long-term local capacity of the respective partnered community.

3.2.1 Preparation and data collection

The survey, titled *Survey: Initiation of EWB-USA Projects*, was created, distributed, and collected using Qualtrics XM (*Qualtrics*, 2021). A copy of the full survey can be found in Appendix A, but a list of survey questions alongside the research question addressed, type of question, and type of response is provided in Table 3.1.

A pilot survey was administered to 12 individuals, who agreed to complete the mock survey and provide feedback if they wished. The submissions and feedback from this pilot survey provided helpful insight to rephrase and reformat questions to warrant more effective

answers and therefore better address the research objective. The final version of the survey allowed for respondents to complete the survey one time for all of their EWB IEP experiences rather than one submission per IEP. Since the pilot survey questions were modified, and since the respondents of the mock survey were not anonymous, these 12 submissions were not a part of the final set of analyzed data.

The questions are classified into five types: *meta* questions, *personal* questions, *initial factors* questions, *reported success* questions, and *confidence buffer* questions. Note that questions within the survey will be referred to as Q# (Question #), in contrast to the overarching research questions, abbreviated by RQ#.

Meta questions, found at the beginning and end of the survey, contained general information about consent and anonymity (Question 1) (Q1) and the option to volunteer for a follow-up interview (Q19 and Q20). All submissions were anonymous, and consent to participate in the survey was verified in Q1. If the respondent did not opt to conduct a follow-up interview, their survey finished. For confidentiality, the survey did not ask for personal information, so if the respondent agreed to the follow-up interview, they were directed to the next question (Q20), where they were directed again to an outside form to submit their contact information. This contact form was not anonymous. Consent to fill out the form was implied via its completion (not the interview itself, just submitting the form).

Personal questions gathered background details and success priorities from the respondent. The questions include the number of EWB IEPs they worked with (Q2) and the roles they took on in these projects (Q3). For these questions, the full list of options can be found in Appendix A. For Q3, more than one option could have been selected, including an “Other” option. The last *personal* question takes the respondent’s personal conditions of success for an EWB IEP (Q12).

They are provided with four success conditions: *Volunteer/Student engagement*, *Adherence to professional (Western) engineering practices and standards*, *Community involvement in decision-making throughout project*, and *Community needs (defined by community) met*. For each of these conditions, the respondent chose the level of importance between *Nonessential*, *Somewhat important*, *Fairly important*, and *Imperative*, an implied Likert scale from 1 to 4. These responses did not depend on one another; the respondent could select "Imperative" for all conditions, for example. This question is multipurpose. Its data is helpful to the overall research objective, since metrics for success can be telling of why individuals get involved as well as how individuals will carry out projects, but more pertinently Q12 suggests to the respondent that priorities for success are subjective to the individual. Q12, alongside the *reported success* questions Q13 and Q14, served primarily to ensure the later questions about rating the IEP's success in terms of only meeting the community's needs (Q16 and Q17) were as well-understood as they could be.

Initial factors questions addressed early stages of the IEP(s): who instigated the project from the partnered EWB chapter's end, if anyone in particular (Q5); what led the chapter to choose this IEP in particular (Q6); who instigated the project from the partnered community's end, if anyone in particular (Q8); and why the community agreed to pursue or agree to assistance (Q9). Q5, Q6, and Q8 addressed RQ1 (*how*), and Q9 addressed RQ2 (why). All these questions permitted selecting more than one option for multiple projects, but the respondent was encouraged to narrow down each project to the most prominent answer, since the *reported success* questions later would be shown to the respondent based on their answers to Q6 and Q9. This way, if a survey submission had multiple projects on it, Qualtrics would be able to cross-reference which outcome related to which answers to Q6 and Q9.

Table 3.1 List of questions in *Survey: Initiation of EWB-USA Projects*

#	Question type	Question (Abridged)	RQ addressed	Type of response*
1	*Meta*	Do you consent to take part in the study?		MC, SA
2	*Personal*	How many IEPs have you been a part of?		MC, MA
3	*Personal*	What roles have you taken on in IEPs?		MC, MA
4	*Confidence buffer*	How familiar are you with how the EWB chapter adopts a project?		MC, SA (Likert 1-5)
5	*Initial factors*	Who primarily instigated the project on EWB's end?	1 (How)	MC, MA
6	*Initial factors*	How did the EWB chapter choose this project in particular?	1 (How)	MC, MA
7	*Confidence buffer*	How familiar are you with how the community enters the partnership?		MC, SA (Likert 1-5)
8	*Initial factors*	Who primarily instigated the project on the community's end?	1 (How)	MC, MA
9	*Initial factors*	Why did the community agree to enter the partnership?	2 (Why)	MC, MA
10	*Reported success*	What is the current state of projects you were or are involved with?		Input number
11	*Reported success*	What factors led to the closing of the projects you were involved with?		MC, MA
12a	*Personal*	How important is *volunteer engagement* to a "successful" IEP outcome?	2 (Why)	MC, SA (Likert 1-4)
12b	*Personal*	How important is *adhering to Western practices* to a "successful" IEP outcome?	1 (How)	MC, SA (Likert 1-4)
12c	*Personal*	How important is *community involvement* to a "successful" IEP outcome?	1 (How)	MC, SA (Likert 1-4)
12d	*Personal*	How important is *meeting community needs* to a "successful" IEP outcome?	2 (Why)	MC, SA (Likert 1-4)
13	*Reported success*	How successful (your definition) were the IEPs (given how EWB selected it)?	Both	MC, MA (Likert 1-5)
14	*Reported success*	How successful (your definition) were the IEPs (given why community entered it)?	Both	MC, MA (Likert 1-5)
15	*Confidence buffer*	Please rate your confidence in your responses to questions 13 and 14:		MC, SA (Likert 1-5)
16	*Reported success*	How successful (meet local needs) were the IEPs (given how EWB selected it)?	Both	MC, MA (Likert 1-5)
17	*Reported success*	How successful (meet local needs) were the IEPs (given why community entered it)?	Both	MC, MA (Likert 1-5)
18	*Confidence buffer*	Please rate your confidence in your responses to questions 16 and 17:		MC, SA (Likert 1-5)
19	*Meta*	Would you be interested in opting in for a potential follow-up interview?		MC, SA
20	*Meta*	(If yes to 19) Please click the embedded link to fill out your contact information.		MC, SA

**MC: Multiple choice; SA: Single answer; MA: Multiple answer*

Reported success questions are the second half of the survey. In general, data from *reported success* questions were cross-referenced with data from *initial factors* questions to evaluate the relationship between the two and thus address the research objective. Q10 asked where each of the IEPs were now, whether they were closed, in implementation, in assessment, etc. This question was intended to distinguish whether any contact with the community still existed, but it coincidentally ended up being a useful *confidence buffer* question for submissions who did not report any closed or cancelled projects. Q11 asked what led to closing the projects. A variety of options were presented (project was constructed, hostility between stakeholders, year or timeframe ended, etc.). Q12 was a *personal* question discussed earlier. Q13 and Q14 both asked to rate the outcomes of each of the projects they were involved with, in terms of how the respondent themselves defined success in Q12. For Q13, the respondent's answer(s) from Q6 (on the chapter's motivations to select the project) were created as separate rows, where the respondent can choose an option for each row on an implied Likert scale from 1 to 5, 1 being *Little success, if any*, and 5 being *Total success*. An example of this is shown below in Figure 3.2. Q14 functions identically to Q13, except instead of pulling responses from Q6, it pulled answers from Q9, their response(s) on the recipient community's initial motivations (Q9 responses). Q16 and Q17 are the same as Q13 and Q14 respectively, with the key difference regarding their metric for success; respondents are asked to rate the outcomes of their projects only in terms of meeting the community needs, not in terms of how the respondent themselves defined success. The main intention of Q12-Q15 was to help the respondent compartmentalize other definitions of success away from the community's in pursuit of more candid feedback.

Confidence buffer questions are the last type, and they were placed throughout the survey to assess the integrity of various answers. All *confidence buffer* questions were asked on an

implied Likert scale from 1 to 5, 1 being *No idea* and 5 being *Very familiar* or *Absolutely sure*, depending on the question. Q4 assessed the respondent's familiarity with Q5 and Q6, the questions on what led the chapter to choose the IEP they did and who from the EWB chapter's perspective was the instigator for this project. Q7 assesses the confidence in the respondent's answers to Q8 and Q9, which are community-based indicators for why the project was desired and who led the initiative. Q10 was not originally intended to be a confidence buffer question, but as mentioned in the *reported success* section above it incidentally became a useful buffer for the survey. Q15 assess the confidence to the answers of Q13 and Q14, and Q18 assesses the confidence to the answers of Q16 and Q17.

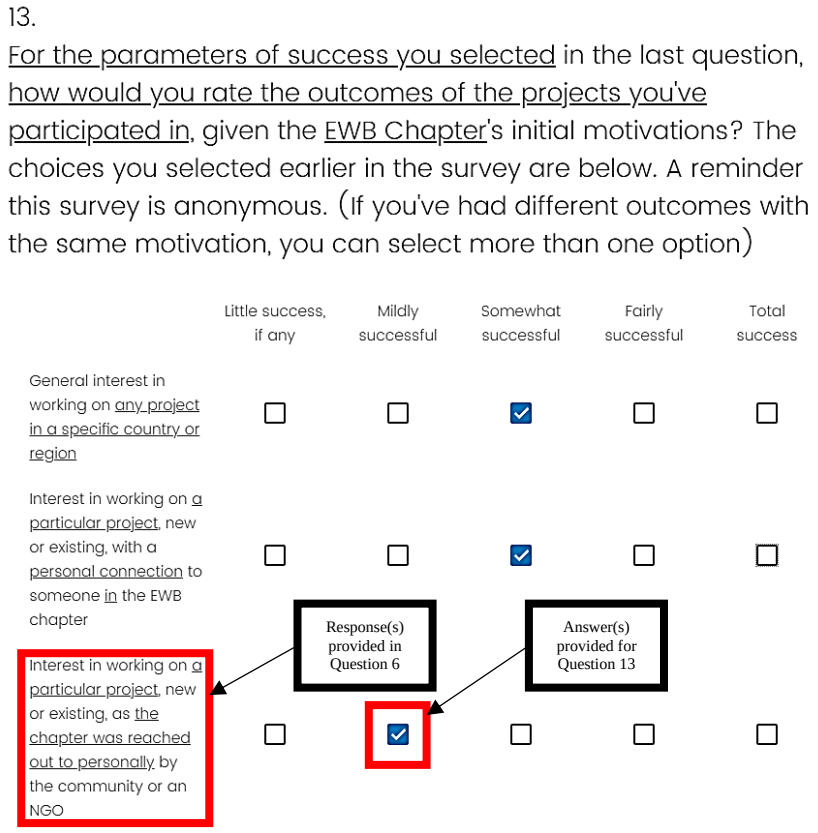


Figure 3.2 Annotated screenshot of question 13 in *Survey: Initiation of EWB-USA Projects*. An example of survey format used for questions 13, 14, 16, and 17. Questions 13 and 16 pull from the response(s) given in question 6, and questions 14 and 17 pull from the answers in question 9. The respondent may select more than one box in a row if there have been multiple projects with different successes that fall into the same answer.

After edits from the mock survey feedback, the survey was structured so that not all of the *initial factors* responses could tie data one-to-one with *reported outcome* responses. In return, a single respondent was able to report out multiple IEPs they were involved with in a single survey submission. This structure allowed participants with additional insight to only have to fill out the survey one time for all their experiences, decreasing survey fatigue at the expense of pinpointing specific outcomes to specific IEPs for more questions.

Regarding data collection, the survey gathered data from former and current EWB IEP participants on projects they were or had been involved with. For a distribution of roles these participants held, see Figure 4.1. Participants for the final survey were recruited by emails distributed out to all registered EWB chapters with an official chapter email address on file, as well as by word of mouth. Surveys were submitted between May 29, 2020, and September 2, 2020, with an average time of 10 minutes per submission. 132 surveys were submitted, 85 of which were completed through the last relevant question (Q18) and therefore able to contribute to outcome data. From the 85 usable surveys, 306 EWB IEP experiences were accounted for, 123 of which are closed. The 183 IEPs that were either yet to close or were unsure if closed could not be used in analyses between IEP initiation and success, though the data will be useful on its own by further validating a consensus on how projects begin alongside practitioner motivations and definitions of success.

3.2.2 Methods for statistical analysis

The bulk of numerical data in this survey comes from Likert scales, whose options have a rank to them but not even intervals between them. Using Q4 as an example, it was expected for the respondent to infer that *No idea*, *Vaguely familiar*, and *Somewhat familiar* have a hierarchy to them (rank), but the space between *No idea* and *Vaguely familiar* cannot be equated to the

space between *Vaguely familiar* and *Somewhat familiar* (uneven intervals). Data with *rank* but not *equal intervals* are categorized as *ordinal* data. When comparing two groups of ordinal data, the Mann-Whitney U test, sometimes referred to as the Wilcoxon-Mann Whitney test, was the most appropriate for evaluating this data (Knapp, 2017; McLeod, 2019; UC Regents, 2021). When comparing *more* than two groups of ordinal data, the Kruskal-Wallis test, a variant to the Mann-Whitney U test, was most suitable (Knapp, 2017; UC Regents, 2021). For both of these non-parametric tests, each answer was assigned a rank, and the ranks of the values were compared with one another; these tests worked primarily with the median of the data rather than the mean in order to account for uneven intervals. The null hypothesis was that there would be no difference between the medians of the data. A p-value threshold of .05 was considered for rejection of the null hypothesis. For both tests, the p and corresponding Z values came from the U coefficient, obtained in Microsoft Excel (version 16.0.14026.20294). The convenience of using medians with ordinal data came at the cost of strength of significance, however; it is considerably more difficult to pull significance from data with uneven intervals than from data with even intervals.

Table 3.2 Relationships analyzed from questions in *Survey: Initiation of EWB-USA Projects* by question type. Cells marked with an "X" indicate that this relationship was not analyzed, cells marked with a check mark indicate that this relationship was analyzed, and cells marked with "(n/a)" are duplicates of other cells on the table.

Question Type (Survey Questions)	*Meta* (1, 19, 20)	*Personal* (2, 3, 12)	*Initial Factors* (5, 6, 8, 9)	*Reported Success* (11, 13, 14, 16, 17)	*Confidence Buffer* (4, 7, 10, 15, 18)
Meta (1, 19, 20)	X	X	X	X	X
Personal (2, 3, 12)	(n/a)	✓	X	X	X
Initial Factors (5, 6, 8, 9)	(n/a)	(n/a)	✓	✓	✓
Reported Success (11, 13, 14, 16, 17)	(n/a)	(n/a)	(n/a)	✓	✓
Confidence Buffer (4, 7, 10, 15, 18)	(n/a)	(n/a)	(n/a)	(n/a)	✓

For a summary of the types of survey questions analyzed (*personal*, *initial factors*, etc.), either on their own or relative to one another, see Table 3.2. *Meta* questions were not analyzed. *Personal* questions were worth analyzing on their own to supplement the research questions, since background questions (Q2 and Q3) helped form an understanding of the respondents, and personal values (Q12) addressed both priorities (RQ1) and motivations (RQ2) for involvement in the EWB IEP. Comparing these answers to *reported success* questions or *initial factors* questions would not be feasible, however, since the magnitude of influence the respondents had on the IEPs they worked on was unspecified. For these *personal* questions, the information was too detached from outcome data to determine whether these two factors related to one another. *Initial factors* questions were related to *reported success* questions, as this relationship very directly addressed the overall research objective. *Reported success* values were compared amongst themselves and against *confidence buffer* questions. *Confidence buffer* questions on their own were also useful, since they helped provide a representation of how connected EWB participants were to both early-phase project components and community impact.

3.3 Interview

The purpose of this section is to explain the methodology of the interviews used to address the primary research objective. The survey data in the previous section was able to provide a quantitative assessment to the initial factors of EWB IEP work. However, an assessment of international project work should incorporate a considerable amount of contextual listening and human insight into its approach (Leydens and Lucena, 2010; Witmer, 2018). Interviews addressed these factors and humanized the data; this methodology was inspired by authors who took the same approach in pursuit of similar research (Blouin and Perry, 2009; Jahnke, 2020; Jahnke et al., 2016; Lee et al., 2018; Leydens and Lucena, 2010; Tryon et al.,

2008; Witmer, 2018). NVivo (*NVivo*, 2020) and Microsoft Excel (version 16.0.14026.20294) were used to conduct an inductive thematic analysis. The interview was initially intended to provide context to the findings of the survey but was expanded in its scope due to the realized value of acquiring insights of individual perspectives in this field of work.

Regarding the trustworthiness of qualitative data, this research process was conducted to optimize the transferability, dependability, confirmability, authenticity, and credibility of the interview findings and analysis, all of which are major components in trusting the integrity of qualitative data (Korstjens and Moser, 2018). The quality management of these methods is addressed throughout this section.

3.3.1 Preparation, data collection, and transcription

The interview questions were similar to those in the survey, but additional questions were included after the survey analysis to help explain the survey findings, conventional to the explanatory mixed methods approach utilized. Moreover, questions were added to better understand the processes and motivations of the surveyees and their respective EWB chapters, a detail that was difficult to gather via surveys alone. With both a distinct research objective and a need for open insight, the interviews were carried out in a semi-structured approach. There was a general list of 29 questions, but the interviewer was able to follow-up on points the interviewee talked about and skipped questions if they were already appropriately addressed. Each of the questions are shown in Table 3.3, but a blank copy of the interview questions can be found in *Appendix B.* Interviewees were told upfront about the research objectives, and consent to participate in the interview research process was implicit upon their completion of the interview.

The interview is divided into parts 0, 1, 2, and 3. Parts 0 and 1 of the interview are both unrelated to the research objective, but the answers in part 1 can help label (not identify) the

interviewees. Questions in part 2 pertain to specific EWB IEPs on which they worked. Regarding research question 1 (RQ1), there were questions on the chapter's decision to choose a project, what roles they held, how long the projects took, how long they specifically were on the project for, what they know about how the chapter chose the project, who led the chapter and the community to enter this project, the retention of EWB participants throughout the course of the project, and whether they would have changed their approach to the project. Questions pertaining to research question 2 (RQ2) included why people in the chapter got involved, why the community ended up applying for assistance, and what the respondent believed the ideal outcome of the projects to be. Pertaining to reported project outcome, the interviewer asked whether projects are complete, how successful the IEP turned out for the community, how they know this, their ideal outcome for the community, and whether they would have done anything differently in their approach to improve community impact. Questions in part 3 did not relate to any project specifically, though the interviewees certainly addressed these experiences to help support their answers. RQ1 questions in part 3 included whether the partnerships chosen were done so responsibly, alongside a scenario question that asked the interviewee how they would set an IEP up for success if they could not be involved in it once it started. RQ2 questions included their personal definitions of success for both EWB and the community. Almost all questions in part 3 pertained to interviewee perspectives on project outcome, though there were questions for advice for EWB participants as well as a catch-all for any other insight the interviewee had to offer on the research objective.

Regarding data collection, respondents of *Survey: Initiation of EWB-USA Projects* could opt in for a follow-up interview. 38 individuals provided their contact information and were

Table 3.3 Full list of questions for *Engineers Without Borders – USA Project Participants Interview*. Questions are laid out by part and labeled by which research question they address. To reiterate, RQ1 addresses the motivations and influences of parties involved, and RQ2 addresses the procedures parties go through.

Part of Interview	**Question Asked**	**Addresses How (RQ1)**	**Addresses Why (RQ2)**
Part 0: Internal	Name		
	Date of interview		
Part 1: Demographics	Field of work or major		
	How long they worked in field / What year in school		
	How many EWB projects they were involved with		
	Experience with IEPs or other aid-based work		
Part 2: Project-specific questions*	Description of IEP (location, type of work, what chapter)		
	Roles held (engineer in charge, project lead, etc.)	✔	✔
	Duration of project(s) from initial approval to closing	✔	
	How long they specifically were on the project for	✔	
	Whether they were part of the chapter's decision to choose project		
	What they know about the chapter's decision to choose project	✔	✔
	Who led the chapter to choose this project if anyone	✔	
	Why people in the chapter (them included) got involved		✔
	Who helped community apply for assistance	✔	
	Why and how community ended up applying to EWB		✔
	Whether project(s) is(are) complete		
	How successful project turned out from the EWB chapter's end	✔	✔
	How successful project turned out from community's end	✔	✔
	How they know community's perspective on project success		
	Whether EWB personnel stayed on project from start to finish	✔	
	Anything else pertaining to beginning or outcome of IEP	✔	✔
	Their ideal outcome and what would've need to happen for it	✔	✔
	Whether they would change how they approached the project	✔	
Part 3: General international engineering questions	Their personal definition of a successful IEP for EWB		✔
	Their personal definition of a successful IEP for communities		✔
	Whether projects and partnerships were chosen appropriately	✔	
	Advice for EWB participants before letting an IEP happen	✔	✔
	Scenario question**	✔	
	Any further insight on the research objective	✔	✔

**If interviewee preferred projects to be addressed one at a time, this part would be repeated*
***"If you had complete control of setting up the beginning of a project, from the organizations to the engineering team to the community interactions, but once the team started working on the project you had no more control over the project, how would you best set the project up for success?"*

subsequently sent an email to schedule an interview, where ultimately 10 people participated in an interview. Interviews were scheduled for an hour apiece and took 63 minutes on average. Information on the interview participants as well as the EWB chapters they were involved with

can be found in Table 4.2 and Table 4.3. Amid the global pandemic, all interviews were conducted via either Zoom (Zoom Video Communications, 2021) or phone call. The author conducted all the interviews. All but one interview was recorded, but notes were taken live as well. Though these notes were eventually superseded by recordings (except for one), this cross-checking helped enhance the trustworthiness of the data. Moreover, it helped the interviewer engage more effectively with points made by the interviewee by referring back to old details mentioned and therefore assisted with not taking the interviewee's insights out of context. Otter.ai (Otter.ai, 2021) was utilized as a helpful primer to transcribe the interview audio into text, and these automatic transcriptions were then manually edited to best reflect the actual interview recordings.

3.3.2 Methods for coding and inductive thematic analysis

Thematic analysis was used to interpret the interview data. Overall, its main purpose is to derive key patterns from the data by grouping codes (snippets of text from the raw transcripts) into nodes (groups of codes or groups of other nodes). These nodes are then combined to make larger and larger groups until overarching themes (core concepts) can be observed (Braun and Clarke, 2006; Clarke and Braun, 2014; Research with Dr Kriukow, 2020). The end-product is intended to resemble a tree, with the main themes branching into subthemes, which branch further into either directly coded quotes or other groupings of codes.

Thematic analysis is often categorized into two types of coding: inductive and deductive. Inductive codes are created right from the transcriptions, with the benefit of authentic, organic themes at the expense of high effort and potentially redundant coding. Deductive codes are predetermined prior to coding, with the benefit of existing structure to take advantage of at the expense of a lack of flexibility in coding and losing core themes that may otherwise exist in the

raw data (Braun and Clarke, 2006; Korstjens and Moser, 2018; The University of Sheffield, 2021). This distinction is important, since inductive analysis helps with the trustworthiness of the data to ensure quotes from interviewees are not being misinterpreted.

This research uses a combination of inductive and deductive methods to create nodes; some nodes were pre-defined, and some were grouped organically. Since the research objective and the linear EWB project process already provided a lot of existing structure, it is appropriate to approach the analysis top-down at certain points without disrupting the integrity of the findings. An example of the creation of both a deductive, top-down node and an inductive, bottom-up node can be found in Figure 3.3. For the deductive coding example, the nodes of *Volunteer motivations*, *Altruistic*, *Personal*, and *Objective* were created based on findings in volunteer motivation literature. In the inductive coding example, the node *Career building* was not prepared ahead of time; instead, it was created from codes with similar ideas from the interview transcripts. Deductive, top-down categorization was used whenever nodes could be

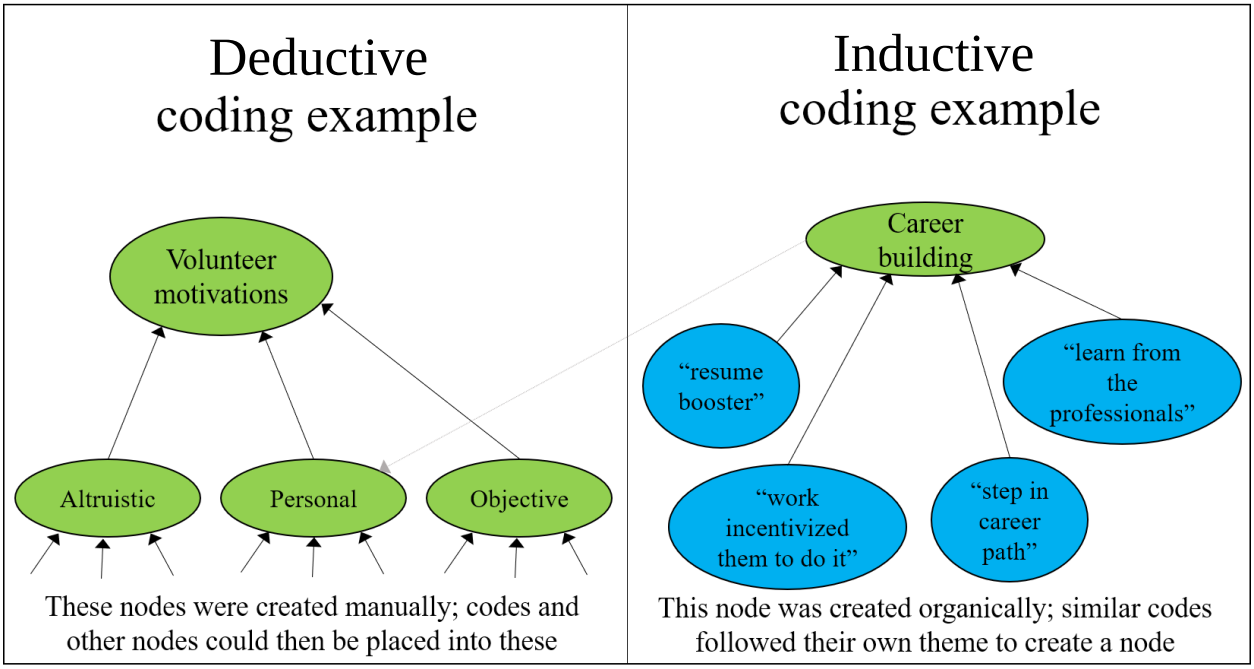


Figure 3.3 Examples of deductive and inductive coding. Inductive coding yields patterns that more strongly represent the data, but deductive coding is easier and can be useful if the themes or subthemes are predetermined or confidently assumed. A grey arrow can be seen point from *Career building* to *Personal* to exemplify how these two methods of coding can coexist in the same tree.

predetermined or confidently assumed, but inductive, bottom-up categorization yielded stronger patterns, though this process is more time-consuming. Note that in this example these methods coexist, since the *Career building* node on the right side falls into the *Personal* node on the left.

There were two phases to this thematic analysis, one in NVivo (*NVivo*, 2020) and one in Microsoft Excel (version 16.0.14026.20294). The NVivo phase generated codes from the interview transcripts and placed them into deductive nodes. The main purpose of this phase was to filter out any parts of the transcriptions that were not pressing to the research objective. Secondary purposes of this phase included gathering a representation of the workable data for the thematic analysis and organizing the data to be used in future research with peripheral research objectives. When first coding the transcriptions to nodes in NVivo, the nodes were all created beforehand from the layout of the research questions, the EWB project process, and the different EWB IEPs different interviewees were involved with. Figure 3.4 represents this first phase categorization of nodes. These nodes were revised after the first and third interviews to better reflect the data. The *file* column in Figure 3.4 represents how many interviewees spoke on behalf of the topic, and the *references* column denotes how many total quotes were coded into the node. The colors were used to label the transcriptions during the coding process. Note that there are a few projects with two interviewees coded into it; there was a slight overlap of project work between two individuals, but for the most part each interviewee had different IEP experiences to recount.

Projects	Files	References
Arizona State University Chapter	0	0
ASU Chapter - 5 projects - Kenya	2	16
ASU Chapter - 6 projects - Navajo, United States	2	14
Black Mesa Community Center	1	4
Solar Power - Shonto	1	3
ASU Chapter - Clump of projects - Ecuador	2	9
ASU Chapter - Water - Havasupai community, United States	1	4
Carnegie Mellon University Chapter	0	0
CMU Chapter - Energy Project - Zimbabwe	1	20
Pittsburgh Prof. Chapter (Feat. CMU Chapter) - Unspecified	1	1
Chapter Unknown	0	0
Unspecified - Interviewee 2 Nicaragua Projects	1	8
Denver Professional Chapter	0	0
Denver Chapter - Latrine Pit - Tanzania	1	2
Denver Chapter - Water supply - Rwanda	1	6
Gateway Professional Chapter	0	0
Gateway (Feat. SLU) - Water - Komucala, Bolivia	1	24
Harvard College Chapter (Feat. Boston Professional Chapter)	0	0
Rainwater & Dormitory - Mkutani, Dodoma, Tanzania	1	18
Harvard Chapter - Water - Kibuon, Kenya	1	22
Milwaukee School of Engineering Chapter	0	0
MSoE Chapter - Bridge - Guatemala	1	11
MSoE Chapter - Water - Guatemala	1	15
Phoenix Professional Chapter	0	0
Phoenix Chapter - Disinfection - Carlos Pinto, Santa Domingo	1	1
Saint Louis University Chapter	0	0
SLU Chapter - Water Supply - Esther House, Kenya	1	6
SMU, Rice, Dallas-FW - Interviewee 4 Projects	0	0
Bolivia - Interviewee 4 Experience	1	15
Cameroon - Interviewee 4 Experience	1	9
Dominica - Interviewee 4 Experience	1	4
Dominican Republic - Interviewee 4 Experience	1	11
El Salvador - Interviewee 4 Experience	1	4
Guatemala - Interviewee 4 Experience	1	13
Haiti - Interviewee 4 Experience	1	7
Honduras - Interviewee 4 Experience	1	6
Liberia - Interviewee 4 Experience	1	4
Nicaragua - Interviewee 4 Experience	1	4
Rwanda - Interviewee 4 Experience	1	9
Sierra Leone - Interviewee 4 Experience	1	5
Uganda - Interviewee 4 Experience	1	4
University of Illinois Urbana-Champaign Chapter	0	0
UIUC Chapter - Ecuador Water Distribution - El Duarango	1	28
UIUC Chapter - Electrification - Soppo Likoko	1	3
University of Southern California Chapter	0	0
USC Chapter - Latrine - Bolivia	1	15
USC Chapter - Water - Guatemala	1	5
Washington D.C. Professional Chapter	0	0
DC Chapter - Unspecified Project	1	1
DC Chapter - Water - Mbohkop, Cameroon	1	22

Nodes	Files	References
(RQ 1, 2) IEP Beginnings	10	263
(RQ1) Com. Procedures	10	53
(RQ1) EWB Procedures	10	42
(RQ2) Com. Influences	10	30
(RQ2) EWB Influences	10	51
Early IEP Interactions	10	87
Com.-NGO	5	9
EWB-Com.	9	38
EWB-Com.-NGO	5	9
EWB-NGO	5	12
Miscommunications	5	19
(RQ 3) IEP Outcomes	0	0
(RQ3) Long-Term IEP Outcomes	0	0
- L-T Com. Impact	3	3
+ L-T Com. Impact	5	11
0 L-T Com. Impact	4	5
Unsure L-T Com. Impact	7	15
(RQ3) Short-Term IEP Outcomes	0	0
- EWB Experience	6	24
- S-T Com. Impact	2	4
+ EWB Experience	10	18
+ S-T Com. Impact	10	18
0 EWB Experience	6	11
0 S-T Com. Impact	6	16
Context	5	8
Contextual Engineering	2	5
Cultural	5	12
Economic	5	14
Educational	3	6
Mechanical	4	5
Political	5	8
Personal Insights (& General EWB Commentary)	9	23
Advice for EWB leadership or engineers	8	17
Com. Success (Define & Measure)	10	31
Dual Mission Commentary	1	6
EWB Success (Define & Measure)	8	11
Order of Work Commentary	5	9
Scope of Work Commentary	6	15

Figure 3.4 Screenshot of NVivo which includes the complete list of nodes, separated by project nodes and research objective nodes. Note that "RQ3" here is a placeholder for the overall research objective.

The second phase of the thematic analysis was done using Microsoft Excel. From the snippets of texts from the transcripts saved in NVivo, all 558 research objective codes were placed down the leftmost excel column, preparing the data for a large, heavily inductive thematic analysis. Starting with the top code, when a new concept was introduced by a snippet of text, a

new column would be created, and the concept would be paraphrased at the top of the new column. The snippet of text would be marked with an *x* under the new column. If the next code introduced a new concept, a new column would be created, but if it entailed a concept that had already been described, it was marked in the respective column. A small example of this process can be found in Figure 3.5, where three quotes (codes 226 through 228) from interviewee 6 (labeled I6) introduced four new concepts (nodes 174 through 177). Code 226 introduced a new concept, which was placed as Node 174. Code 227 introduced two new concepts, which created nodes 175 and 176. Code 228 reiterated node 175 while also introducing a new concept, so it was marked under node 175 and a new node, node 177. As seen by this example, some codes introduced more than one node, and many codes overlapped with other codes with similar ideas. This crucial first round of code classification was applied to all 558 research objective codes, creating 474 organically produced nodes that were considerably easier to analyze than full paragraphs of codes like the ones seen in Figure 3.5.

These nodes proceeded to be further categorized via inductive and deductive analysis. Nodes were grouped by their type of insight: general project insight, insight from specific projects, or commentary on EWB operations. Nodes were then sorted by EWB IEP phase: *Form Partnerships*, pre-*Assessment*, *Assessment*, *Implementation* / technical design, stopped before *Implementation*, post-*Implementation* / outcome, or throughout IEP. Note this step of sorting was both deductive because of its usage of pre-existing EWB phases and inductive due to the existence of nodes that grouped together more appropriately before *Assessment* or after *Implementation*.

I#	Code#	Code	"Kind of odd to call success rates simply by the students in the developed world actually gaining something from it" Node 174	direct lines of communication lead to success Node 175	communication within EWB in passing on projects Node 176	consistent team schedule leads to success Node 177
I6	226	I think it's kind of odd, to call success rates simply by the students in the developed world actually gaining something from it. I feel like the whole idea of the scope maybe probably draws all the way back to the original EWB, it probably be from actually pairing them together but mostly helping the underdeveloped, just simply, it was a need of engineering	x			
I6	227	I think the most important part would probably have to be like actually giving direct lines of communication and to whom. I know, a lot of times on the passed-on project, it was very confusing as to where you got this. Like, it's not so much like you can give them all the information if you want, like you can give, obviously, don't want to fish but you gotta teach them how to fish is along the same lines, like we give all the information we wanted to the next people. But when they come across their own errors, in that natural design process, they needed to go and find those answers for themselves, which a lot of times it was pretty difficult, because that line of communication wasn't passed down.		x	x	
I6	228	So if I had to change anything to like, ensure the success of the 2nd project, it would probably would have been more effective communication across all lines, and probably a more consistent team schedule of those that we're working with.		x		x

Figure 3.5 Screenshot of Microsoft Excel showing examples of the large induction step of thematic analysis. Three quotes from interviewee 6 (I6) (codes 226 through 228) introduced four new concepts (nodes 174 through 177). Code 226 introduced a new concept, which was placed as Node 174. Code 227 introduced two new concepts, which were placed as nodes 175 and 176. Code 228 reiterated node 175 while also introducing a new concept, so it was marked under node 175 and a new node, node 177.

From here, nodes continued to be formed inductively until main themes finally emerged. The resulting themes each were succinct and independently significant, and though further sorting would have been possible, it would have oversimplified some of the core themes yielded from the interview analysis. Themes were not tailored to the research objective via deduction in an effort to capture a more authentic representation of the findings, though these themes upon their conception can be categorized into how EWB IEPs are initially launched (RQ1) and why stakeholders entered these IEPs (RQ2). There are no formal weights assigned to particular themes, though some were more pertinent to the research objective, exemplified by the emphasis of some themes by the participants as well as the number of participants who addressed each theme.

CHAPTER 4

RESULTS

This chapter provides the results of both the quantitative-based survey and qualitative-based interview used to address the primary research objective. The research questions (RQs) pertain to the key early phases of international engineering projects (IEPs) with Engineers Without Borders – USA (EWB), more specifically the initial procedures (RQ1) as well as the motivations for stakeholders to get involved (RQ2).

4.1 Survey

Figure 4.1 shows a distribution of survey respondents by how many IEPs they were involved with. Figure 4.2 and Figure 4.3 provide a breakdown of survey respondents by their roles in IEPs, the key difference being that Figure 4.3 excludes the *Project team member* and *Project team lead/Project manager* respondents who have also held a higher role in a project.

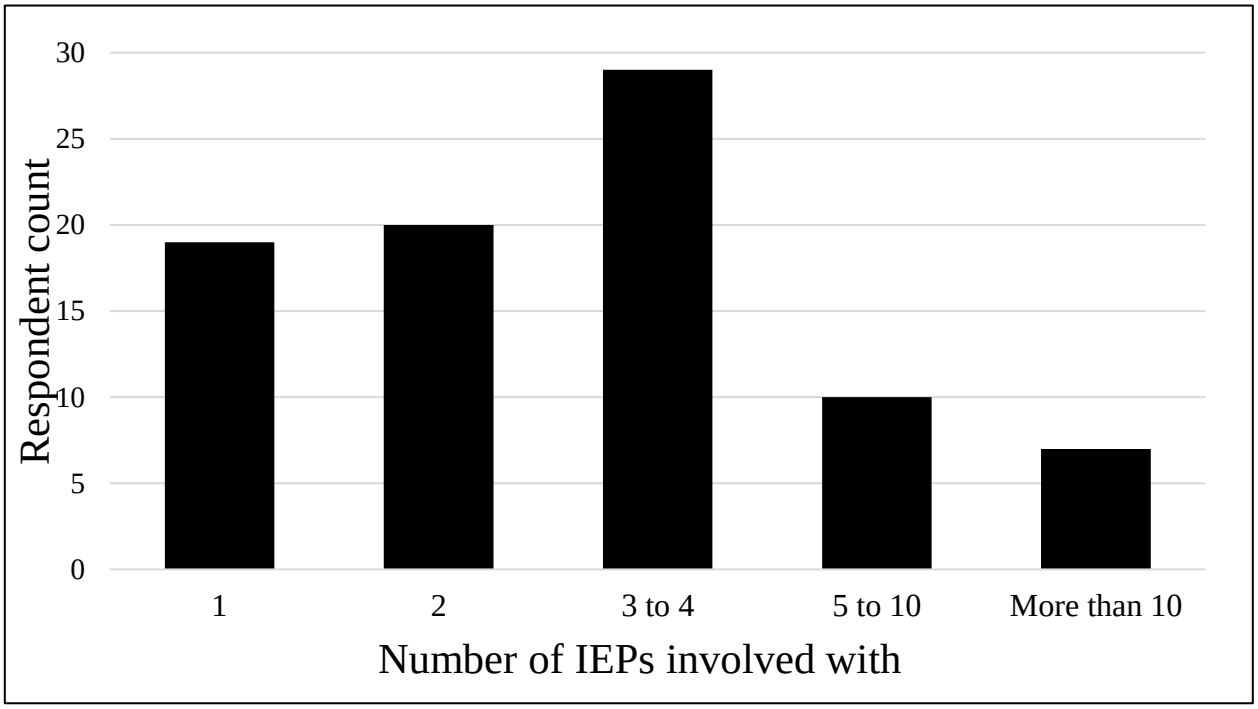


Figure 4.1 Results from question 2 in *Survey: Initiation of EWB-USA Projects*. Respondents are categorized by number of experienced international engineering projects (N = 85)

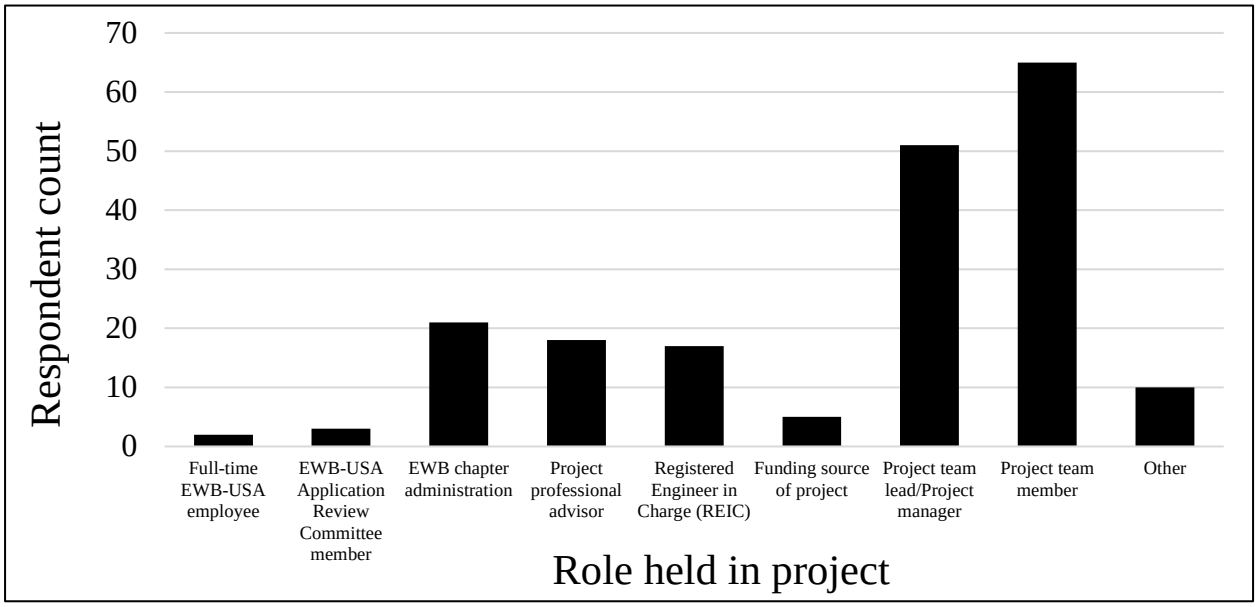


Figure 4.2 Results from question 3 in Survey: Initiation of EWB-USA Projects. Respondents are categorized by role they served in IEPs (all answers) (N = 192)

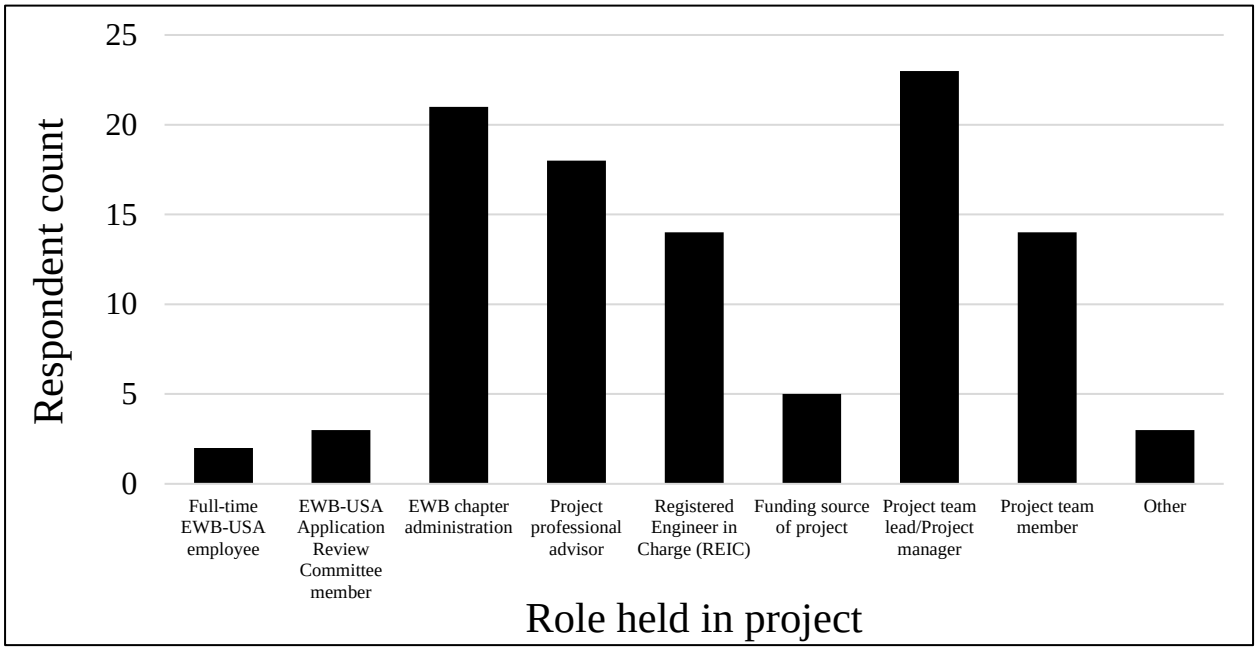


Figure 4.3 Modified results from question 3 in Survey: Initiation of EWB-USA Projects. Respondents are categorized by role they served in IEPs. This graph excludes team leads and team members who also have held higher roles to better represent volunteer-only perspectives (N = 103)

Figure 4.3 was created to better distinguish between volunteer-only perspectives and the insight of those in higher positions who likely were a base-level volunteer for an IEP at one point.

Table 4.1 is a breakdown of responses for all *initial factors* questions, with multiple representations of data categorized by how confident the survey respondents were in their

Table 4.1 Results from *initial factors* questions (5, 6, 8, and 9) in *Survey: Initiation of EWB-USA Projects*. Answers are broken down by confidence in answers, reported in questions 4 and 7 (N varies by question and confidence level)

Question Responses	All reports N	 %	Reports with ≥3/5 confidence N	 %	Reports with ≥4/5 confidence N	 %
Question 5: Primary decision-maker for instigating the projects on EWB's end?						
Head chapter sponsors	14	13%	10	11%	7	11%
Responsible Engineer in Charge (REIC)	13	12%	12	13%	10	15%
Funding source (rotary, etc.)	4	4%	4	4%	4	6%
Volunteers in the EWB chapter	62	55%	53	58%	34	52%
Other	13	12%	10	11%	8	12%
I'm unsure	6	5%	3	3%	3	5%
	112	100%	92	100%	63	100%
Question 6: Initial criteria for EWB chapter to begin this particular project?						
Any new project	33	18%	26	16%	17	14%
Any project in a specific country or region	23	12%	20	13%	17	14%
Any project in a particular field of engineering	23	12%	21	13%	17	14%
Any project in association with a particular NGO	17	9%	12	8%	9	7%
A project similar to or adjacent to a previous EWB project	30	16%	25	16%	22	18%
A personal connection to someone in the EWB chapter	13	7%	12	8%	8	7%
A personal connection to someone that reached out to chapter	17	9%	14	9%	12	10%
Reached out to personally by the community or NGO	18	10%	17	11%	10	8%
Other	13	7%	12	8%	9	7%
I do not know	1	1%	0	0%	0	0%
	188	100%	159	100%	121	100%
Question 8: Primary decision-maker for instigating on community's end?						
A local NGO	49	36%	33	37%	18	37%
An outside NGO (not EWB)	13	10%	11	12%	4	8%
A government entity	9	7%	4	4%	2	4%
A third party (an individual, church, company, etc.)	20	15%	16	18%	9	18%
The community themselves	28	21%	20	22%	12	24%
Someone else	8	6%	5	6%	3	6%
I'm unsure	8	6%	1	1%	1	2%
	135	100%	90	100%	49	100%
Question 9: Initial motivation for community to join partnership?						
Promoted by an NGO, government entity, or other third party	34	27%	23	28%	11	23%
A neighboring community received a similar partnership	29	23%	19	23%	13	27%
Curiosity in new technology	5	4%	5	6%	4	8%
Promoted ONLY by community need	45	36%	31	38%	18	38%
Other	5	4%	3	4%	1	2%
I do not know	7	6%	1	1%	1	2%
	125	100%	82	100%	48	100%

answers. Out of the responses to question 5 with confidence levels of 4 out of 5 or higher, volunteers in the EWB were observed to be the primary decision-maker for instigating projects in 52% to 58% of responses. For question 6, there was an even distribution of responses for initial criteria for EWB beginning the project. Data from question 8 indicate that local NGOs, the

community themselves, and a third party are common decision-makers for communities to join the EWB partnership. For question 9, communities were reportedly motivated to join EWB partnerships primarily out of need, though other motivations were commonly reported, particularly *Promoted by an NGO, government entity, or other third party* and *A neighboring community received a similar partnership*.

Figure 4.4 details the responses to the *confidence buffer* questions throughout the survey. Respondents averaged a 3.5 out of 5 confidence level for most questions but had notably lower confidence levels in their responses pertaining to how partnered communities began their IEPs.

Figure 4.5 compiles all of the data from question 12 (Q12), but Figure 4.6, Figure 4.7, Figure 4.8, and Figure 4.9 break down each of the four sets of responses sorted by the surveyees' roles in EWB. *Community involvement* and *Meeting community needs* were imperative to success for most respondents, averaging 3.89 out of 4 and 3.85 out of 4 respectively. *Volunteer engagement* was valued at 3.65 out of 4 for the average respondent, and *Adherence to professional standards* averaged 2.50 out of 4.

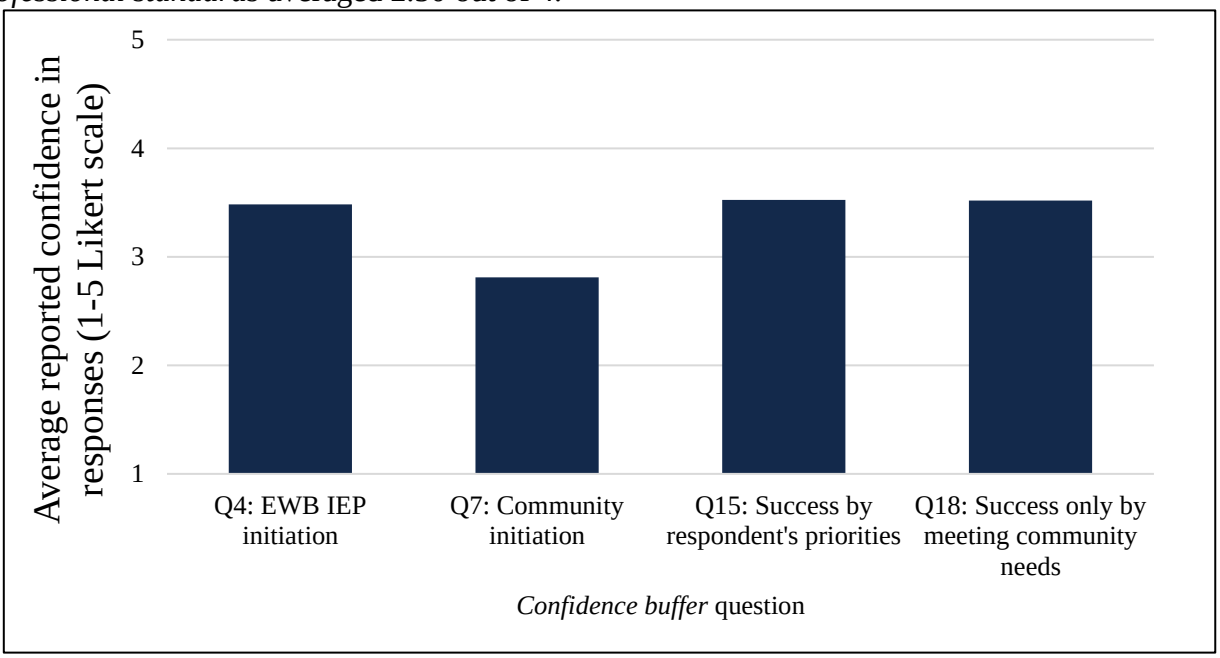


Figure 4.4 Confidence in responses by topic. These questions make up the *confidence buffer* questions. Q4 evaluated the confidence for Q5 and Q6; Q7 for Q8 and Q9; Q15 for Q13 and Q14; Q18 for Q16 and Q17.

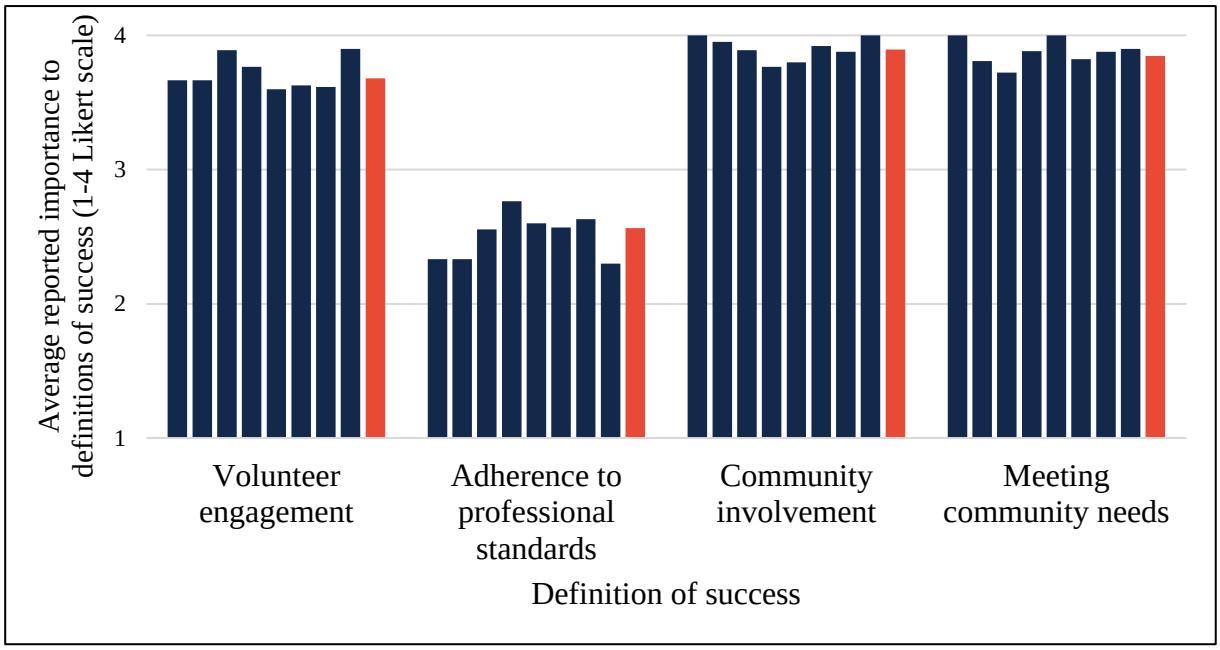


Figure 4.5 Reported definitions of success by priority. Different bars represent different roles of survey respondents, broken down in Figure 4.6, Figure 4.7, Figure 4.8, and Figure 4.9, respectively. Blue bars represent different roles, and the orange bar on the right is the average. From left to right, the blue bars are *Application Review Committee member*, *EWB chapter administration*, *Project professional advisor*, *Registered Engineer in Charge (REIC)*, *Funding source of project*, *Project team lead/Project manager*, *Project team member*, and *Other*.

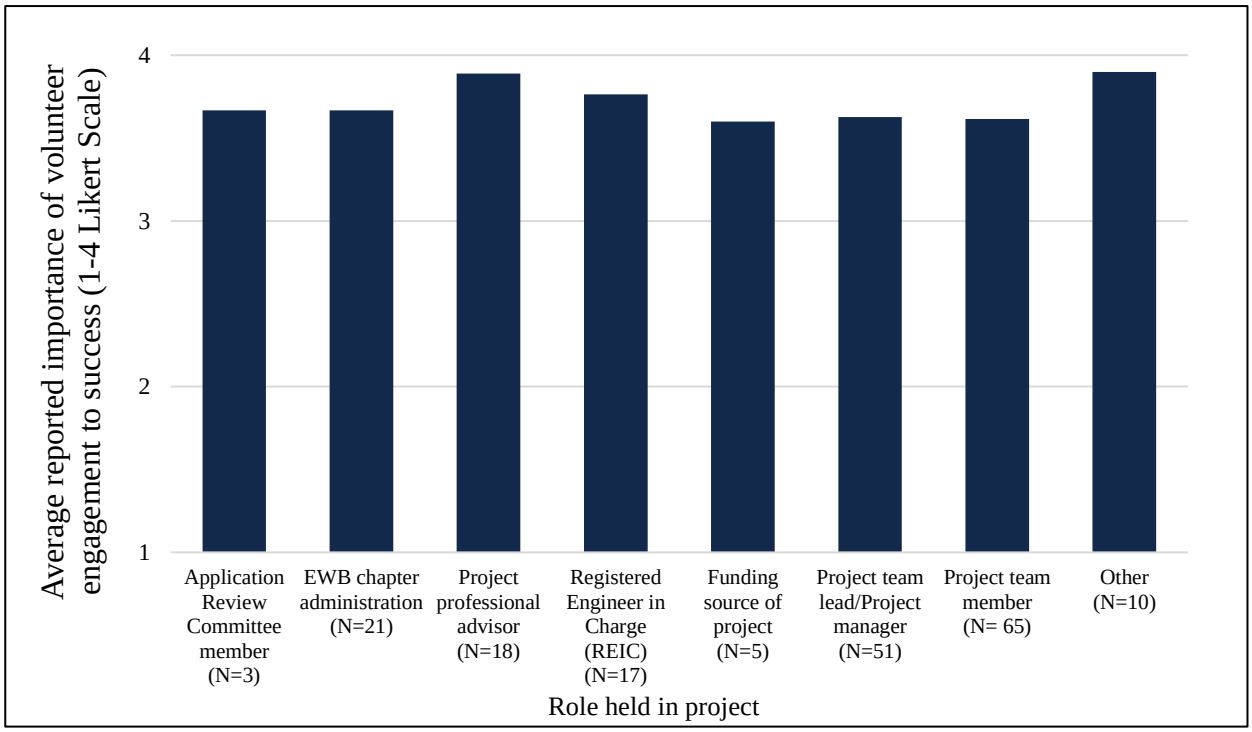


Figure 4.6 Reported importance of volunteer engagement to EWB IEP success on a Likert scale from 1 to 4, sorted by role in EWB.

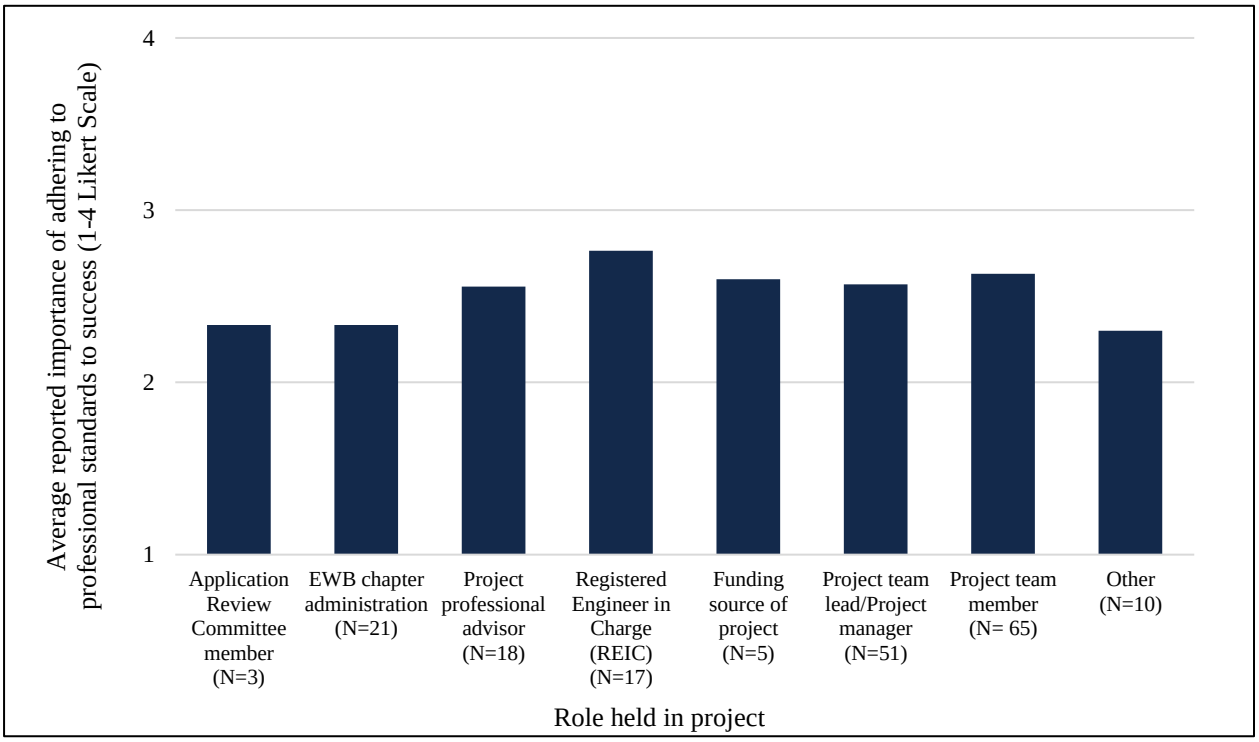


Figure 4.7 Reported importance of adhering to professional (Western) engineering standards to EWB IEP success on a Likert scale from 1 to 4, sorted by role in EWB.

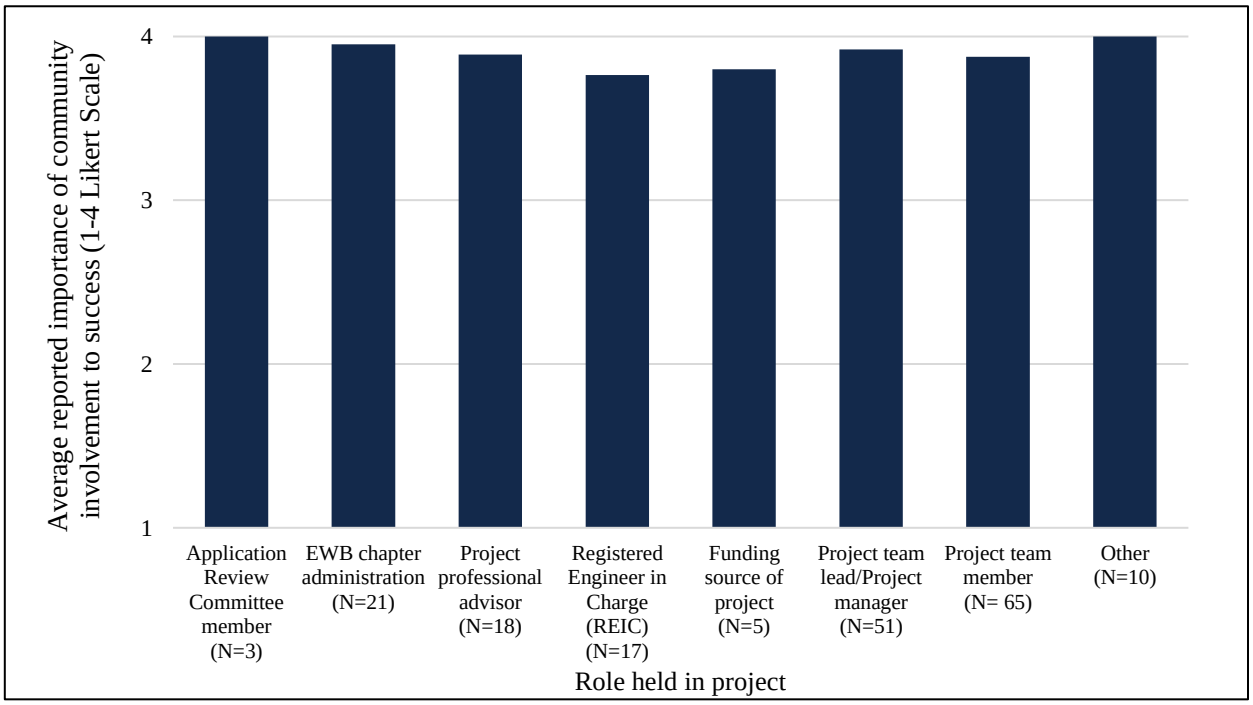


Figure 4.8 Reported importance of community involvement to EWB IEP success on a Likert scale from 1 to 4, sorted by role in EWB.

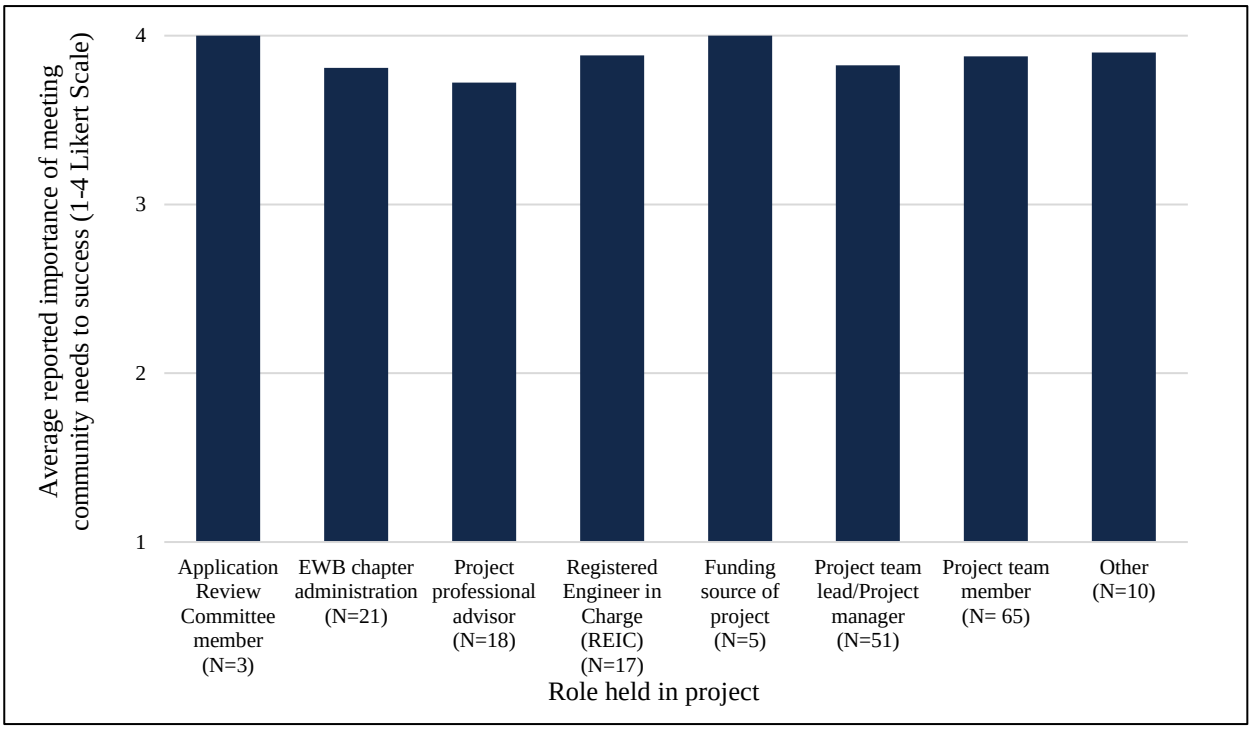


Figure 4.9 Reported importance of meeting community needs to EWB IEP success on a Likert scale from 1 to 4, sorted by role in EWB.

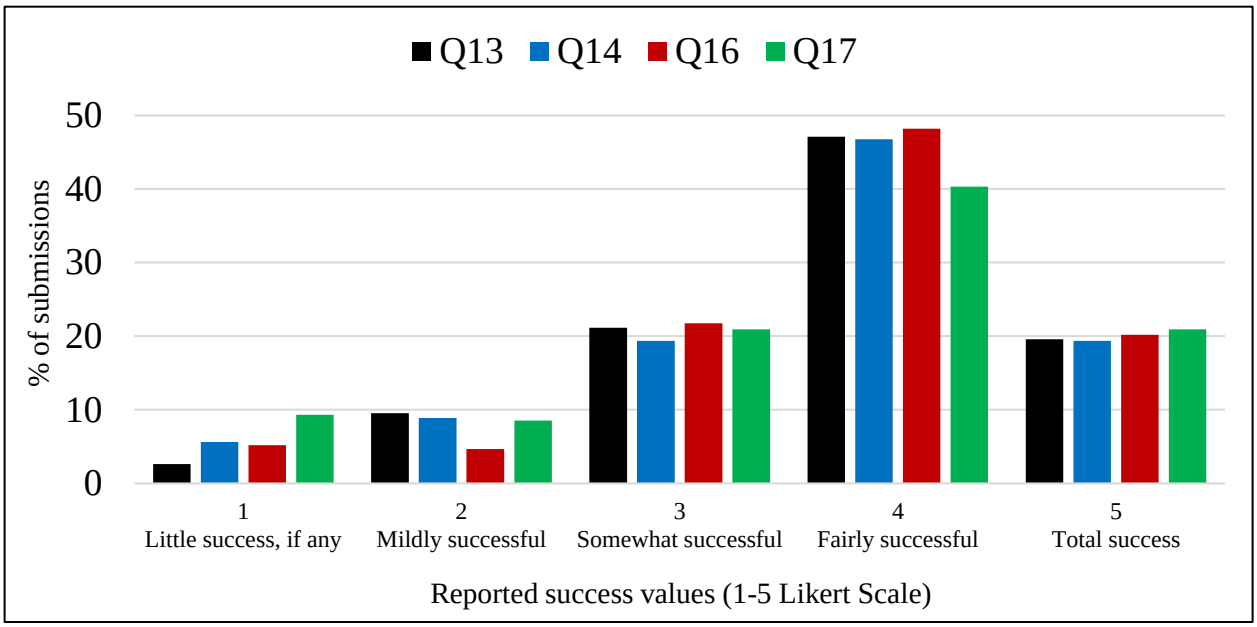


Figure 4.10 Results from questions 13, 14, 16, and 17 in *Survey: Initiation of EWB-USA Projects*. 47 surveyees reported how successful their projects were based on various criteria.

Figure 4.10 shows the distributions of scores on all four reported success questions in tandem. Note that data involving *reported outcome* questions were filtered out based on whether the surveyee had any finished projects to report from Q10. Of the 85 finished surveys, 38 of them had no projects closed out, leaving 47 responses to work with for any reported success data. Figure 4.10 demonstrates that for each of the questions regarding reported outcome (Q13, Q14, Q16, and Q17), the distribution of responses was similar for each question, averaging 3.71 out of 5, 3.65, 3.75, and 3.55, respectively.

4.2 Interview

The survey results and analysis were initially meant to be the primary set of data, supplemented by follow-up interviews in this explanatory sequential design variant of the mixed methods approach. However, the interviews hold considerable weight of their own, equating to that of the surveys, offering context to these findings. Qualitative research is not meant to serve primarily as a *representation* of EWB IEP practices and EWB operations as a whole, but rather to humanize these components. The perspectives of ten interviewees with different roles and levels of experience provided a comprehensive portrayal of the EWB experience.

The transcriptions of the 10 interviewees yielded 63,993 words of insight on EWB IEPs representing 16 EWB chapters and 34 EWB IEPs. Table 4.2 is a breakdown of each interviewee, detailing when they were interviewed, the number of IEPs they discussed, the number of IEPs they have been involved with, and the method used for transcribing the interview. Table 4.3 details the EWB chapters that were covered during these interviews.

Table 4.4 is the full list of themes from the thematic analysis, categorized by research question as well as type of influence on project outcome, whether it be positive, neutral, or negative. Appendix C hosts the complete list of interviewee quotes used in this paper.

Table 4.2 Breakdown of participants in *Engineers Without Borders – USA Project Participants Interview*. REIC stands for registered engineer in charge, and PMEL stands for Planning, Monitoring, Evaluation, and Learning. "Admin" refers to positions within EWB but independent from IEPs, such as chapter president, vice president, treasurer, and student representative of the EWB Board of Directors.

Interviewee	Date (2020)	IEPs discussed	IEPs experienced	Transcription method	Quotes used	Role(s) in IEP as phrased by interviewee
I1	10/26	1	2	Semi-manual	9	Project lead
I2	10/26	2	3	Manual	5	Team member
I3	10/26	2	2	Semi-manual	8	Project lead, team member, admin
I4	10/27	13	19	Semi-manual	10	REIC, on-site travel mentor
I5	10/27	4	11	Semi-manual	9	REIC
I6	10/29	2	2	Semi-manual	6	Team member, PMEL project lead
I7	10/30	2	2	Semi-manual	16	Liaison, travel mentor, admin
I8	10/30	5	7	Semi-manual	10	Team member, admin
I9	11/3	1	3	Semi-manual	11	Project lead, team member
I10	11/9	2	2	Semi-manual	21	Project lead, team member, admin

Table 4.3 16 EWB chapters covered through the 10 participants in *Engineers Without Borders – USA Project Participants Interview*

Arizona State University Chapter	Saint Louis Professional Chapter
Boston Professional Chapter	Saint Louis University Chapter
Carnegie Mellon University Chapter	Southern Methodist University Chapter
Dallas-Fort Worth Professional Chapter	South Florida Professional Chapter
Denver Professional Chapter	University of Illinois Urbana-Champaign Chapter
Harvard College Chapter	University of Southern California Chapter
Milwaukee School of Engineering Chapter	Washington D.C. Professional Chapter
Rice University Chapter	Wisconsin Professional Chapter

Table 4.4 Themes that emerged from the follow-up interviews, categorized by research question as well as whether the theme yielded a positive, neutral, or negative influence on project outcome

	Themes pertaining to research question 1 (how EWB IEPs are initially approached)	Themes pertaining to research question 2 (why stakeholders enter EWB IEPs)	Other themes pertaining to main research objective (initial stages of EWB IEPs)
Themes with positive influence on project outcome	• Establishing relationships with local stakeholders • Readout of local circumstances • Contextual awareness • Projects with existing relationships and partnerships • Flexibility in approach • Coherent communication within EWB chapter • Non-engineers in the EWB project process • EWB in-country staff	• Unified definitions of success • Volunteer introspection • Being upfront about your capabilities as a volunteer • Local initiative in local capacity building	
Themes with neutral or mixed influence on project outcome*	• Variety of methods of first contact between EWB and partnered communities • Disparity of initial approaches from chapters	• Variety of motivations for volunteer involvement • Mixed motivations for community involvement	• Outcome sometimes out of project's control
Themes with negative influence on project outcome	• Efficiency of the dual mission • Approval preceding assessment • Many chapters do not emphasize *go, no-go* option • Issues rooted in community application	• Mixed understandings of short-term vs long-term aid • Ethics of the dual mission	

**Pertains to either initial factors of EWB IEPs or IEP outcomes, but does not link the two as other themes do*

CHAPTER 5

ANALYSIS AND DISCUSSION

This chapter reviews findings from both the quantitative and qualitative assessments in this research, referring back to relevant literature where applicable. The research objective is to evaluate the relationship between the initial stages of international engineering projects (IEPs) conducted by Engineers Without Borders – USA (EWB) and the success of these EWB IEPs. The first research question addressed within this objective is the impact of how EWB approaches IEPs on project outcome. The analysis on this research question can be found in Section 5.1, and its respective discussion can be found in Section 5.2. Section 5.3 contains the analysis pertaining to the second research question, the impact of why stakeholders get involved in EWB IEPs on project outcome. Section 5.4 discusses this second research question. Section 5.5 both addresses and discusses the research objective via observations not categorized under the two main research questions. Section 5.6 reviews the limitations of the methodology implemented in this research. All interviewees will be referred to via they/them pronouns to preserve anonymity.

5.1 Analysis on impact of how EWB initially approaches projects on project success

5.1.1 Survey analysis

Figure 5.1 reports community impact (Q16) in relation to why the chapter chose the project (Q6). Figure 5.2 is the same data, grouping all IEPs with specific selection criteria into one column on the right, accompanied by the respective Mann-Whitney U test results. Figure 5.3 is the same data but grouped together into two categories: one category for options pertaining to *Any project* and one category for *Particular project*. Figure 5.3 also includes a Mann-Whitney U statistical assessment of data that assesses a difference between these two categories.

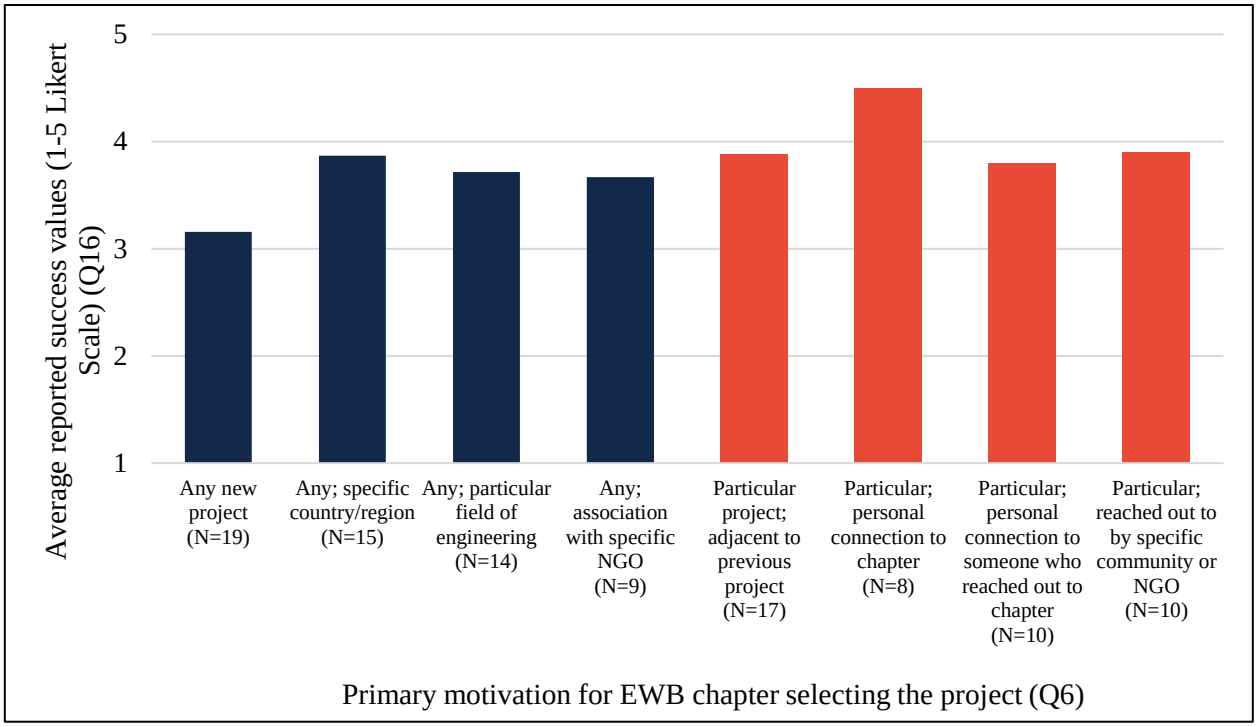
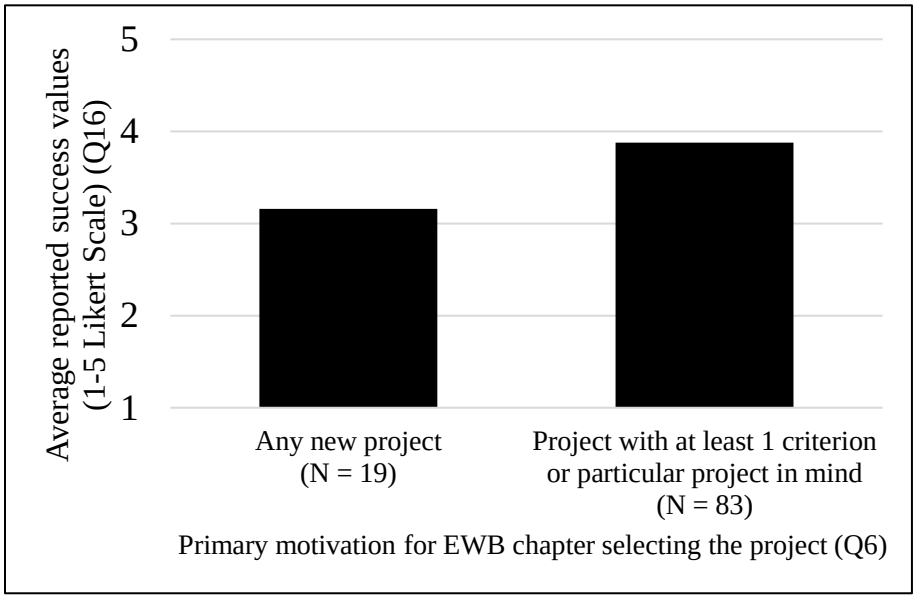
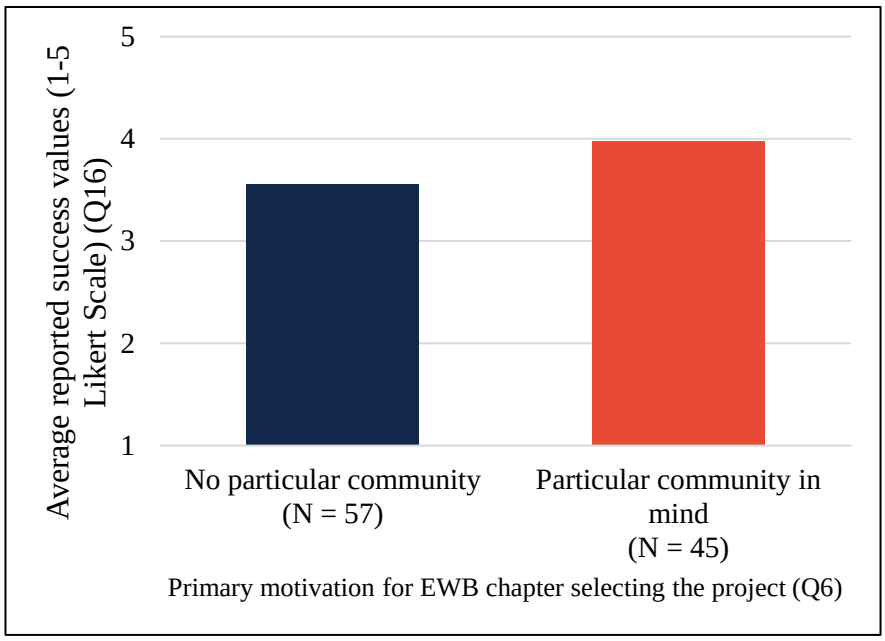


Figure 5.1 Results from question 16 in *Survey: Initiation of EWB-USA Projects* based on their responses from question 6. Blue responses are those that did not specify a project in particular; orange responses did specify. This figure shows how people rated the projects' ability to meet the community's needs, sorted by the EWB chapter's primary reason for choosing the project. There are 102 responses from 47 surveyees. Note the other 38 surveyees' data is not incorporated as none of them reported any closed projects at this time.



	Any new Project	Project with at least 1 criterion or a particular project in mind
N	19	83
Mean rank	36.39	54.96
Sum of Ranks	691.5	4561.5
μ_w	978.5	
σ_w	116.344	
Z	-2.4668	
p-value	0.01363	

Figure 5.2 Results from question 16 in *Survey: Initiation of EWB-USA Projects* based on their responses from question 6. This is the same data in Figure 5.1 but condensed into more general categories. The leftmost bar in Figure 5.1 is the left bar seen here, and the rest of the bars in Figure 5.1 are represented by the right bar seen here. To the right is the table for Mann-Whitney U Test results.



	No particular community	Particular community in mind
N	57	45
Mean rank	46.89	57.33
Sum of Ranks	2673	2580
μ_w	2935.5	
σ_w	148.38	
Z	-1.76912	
p-value	0.076874	

Figure 5.3 Results from question 16 in *Survey: Initiation of EWB-USA Projects* based on their responses from question 6. This is the same data in Figure 5.1 but condensed into more general categories. To the right is the table for Mann-Whitney U Test results.

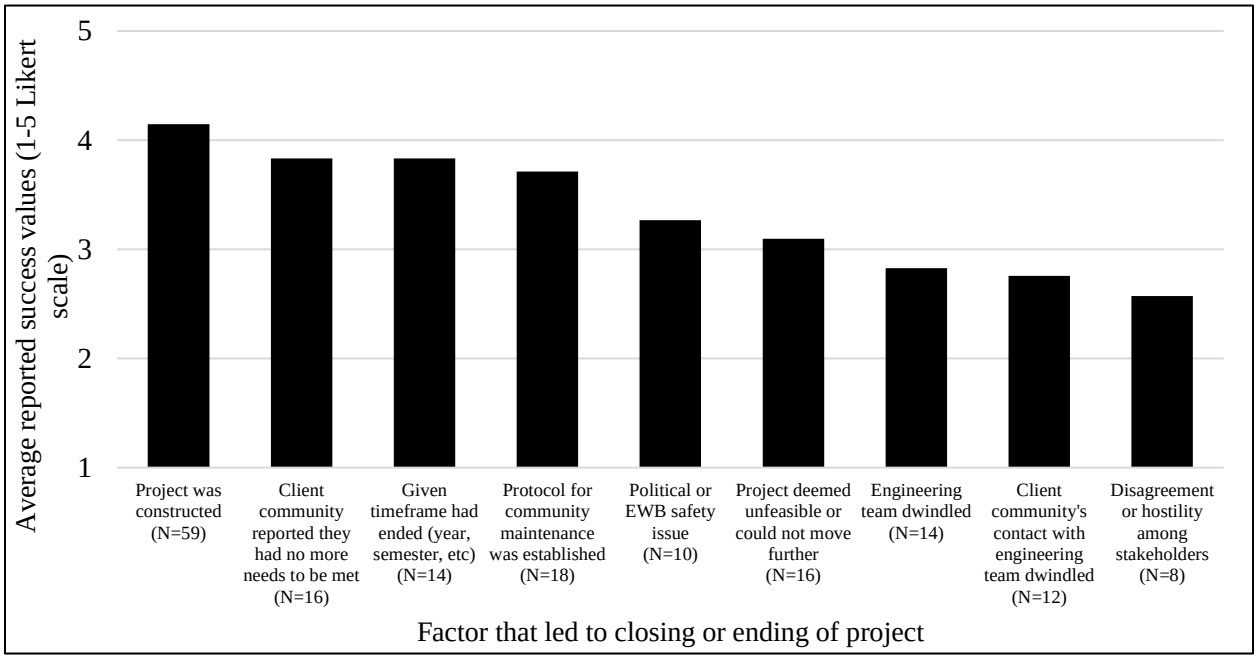


Figure 5.4 Results from question 11 in *Survey: Initiation of EWB-USA Projects* compared to results from questions 16 and 17. This figure shows how people rated the outcomes of their projects relative to how they reported them to end. This figure entails 167 responses by 47 surveyees.

Much of the following survey analysis uses the responses to questions 16 and 17, so it is important to ensure these responses are reliable. A method used to evaluate whether the survey respondents were consistent and reliable in their answers was comparing their responses to these

questions to how they responded to question 11 (Q11). Figure 5.4 correlates responses to how the IEP ended (Q11) to the reported score of meeting community's needs (Q16 and Q17). By noting that more positive closing factors (i.e., *Client community reported they had no more needs to be met*, *Protocol for community maintenance was established*) lined up with higher reported success rates, and that more negative factors (i.e., *Disagreement or hostility among stakeholders*, *Client community's contact with engineering team dwindled*) correlated with lower reported success rates, we can verify the respondents understood the questions and had at least a basic understanding of what it means to meet community needs.

Survey respondents were asked to report the success of EWB IEPs, with the only metric for success being meeting the partnered community's needs. Q16 asked this relative to how the EWB chapter selected the project, comparing IEP data one-to-one with information gathered in Q6. For a full list of options to Q6, see Table 4.1. With the ability to compare responses from each of these questions, relationships can be assessed to test if any methods of selecting a project (answers to Q6) yield a significantly higher or lower rate of reported success than others. Therefore, there were multiple comparisons evaluated from the relationship between Q6 and Q16. When comparing two groups, the Mann-Whitney U test was used. When comparing more than two groups, the Kruskal-Wallis test was used instead. Visual representations of integrating Q6 and Q16 data can be found in Figure 5.1, Figure 5.2, and Figure 5.3. For the following analyses, only responses with a reported confidence level of 4 out of 5 or higher were used (N = 102).

The first comparison was grouping all responses except for *Any new project* together (n = 83) and comparing the respective reported success to those who selected the option *Any new project* (n = 19). This comparison is visualized in Figure 5.2. A p-value of 0.05 was used to test

the following null hypothesis: If an IEP is chosen at random by an EWB chapter (i.e., *Any new project* was selected in Q6), the reported outcome of this project would be the same as those not chosen at random. Average values of reported success for IEPs selected by *Any new project* were 3.16 out of 5, and the grouped responses averaged a score of 3.88 out of 5. With a p-value of 0.01363, we reject this null hypothesis; projects chosen at random yield lower reported rates of success than projects chosen with at least one listed factor in mind.

The second comparison is grouping responses together by whether a particular community or project was in mind prior to the EWB chapter selecting an IEP to work on. The groupings of these projects are labeled via the color schemes in Figure 5.3. A p-value of 0.05 was used to test the following null hypothesis: If an IEP is chosen without a particular project or community in mind (i.e., one of the options selected in Q6 labeled blue in Figure 5.1) (n = 45), the reported outcome of this project would be no different than if a particular project or community were in mind (n = 57). Average values of reported success for IEPs selected without a particular project in mind were 3.56 out of 5, and the IEPs with a particular project in mind averaged a score of 3.98 out of 5. Though notable, with a p-value of 0.0769, the null hypothesis is not formally rejected.

Other questions in the survey pertained to this first research question of how EWB IEPs initiate, though they are not able to compare to IEP outcome data. To see which questions related to how IEPs begin, see Table 3.1. Though these questions were not assessed relative to project outcome directly, it was important to acknowledge their findings in the event that this data supplements interview findings that more directly address the research objective. These questions included who instigated the project on both EWB's end (Q5) and the community's end

(Q8), priorities of adhering to Western engineering practices for success (part of Q12), and priorities of community involvement for success (part of Q12).

5.1.2 Interview analysis

This section addresses the themes analyzed in the inductive thematic analysis that pertain to the research question regarding the impact of how projects begin on project outcome in EWB. There are 14 themes that address this research question. Eight themes demonstrated a positive influence on project outcome, two themes had a neutral influence, and four themes yielded a negative influence on project outcome. These 14 themes will be presented in the order seen in the first column of Table 4.4, categorized by themes with positive influence on project outcome (Section 5.1.2.1), themes with neutral influence (Section 5.1.2.2), and themes with negative influence (Section 5.1.2.3).

5.1.2.1 Themes with positive influence on EWB IEP outcome

Establishing relationships with local stakeholders. Despite no questions being asked about communication in particular, all ten interviewees acknowledged the overwhelming importance of making connections as a vital component to the project's success, whether it be the local NGO, a local contractor, or another local party. Upon their team's first trip, I7 acknowledged that "it's basically vital to the success that you have project partners that are local, so that they kind of understand the context so that during [cut off] up or preparing, they can provide that." I9 stated that for both Global North and Global South projects, "relationships and everything around it can make or break a project." I6, when asked if they could go back and change anything about their IEP experience, wished for "a more effective communication between all the parties that were involved, including the community, the nonprofit we're working with, as well as the actual project lead that we're working with." I8 recounted how "because of a

lack of communication […] there are things which happen that should not." I8 again later cited how communication is "one of the most important things I would focus on more than anything." After experiencing an IEP where communications went sour, I10 recalled their biggest priority heading into their next project: "I think the goal was to come in and, especially with what we learned before, establish a really solid community relationship." It is important to reiterate that none of these interviewees (or any others, who all also emphasized similar points) were prompted to discuss relationships or communications, but all took it upon themselves to make this a point. Conversely, multiple interviewees cited struggling communication as the biggest issue for their projects. I3 recounted wasting a lot of time prior to their team's *Assessment* trip, mentioning how beneficial it would have been to talk more with the community directly ahead of time but never was able to. I3 also recounted unsuccessfully assessing a community's non-technical needs prior to visiting, stating that being physically present on the ground is the most reliable way to assess non-technical components. Multiple interviewees cited NGOs as the key translator in the communication process as well. I5 cited volunteers' lack of communication skills as one of the main problems EWB faces in projects.

Readout of local circumstances. For clarification, the previous theme emphasized relationships with local people; this theme focuses on learning the situations and environments those people are in. When asked the scenario question on how they would set a project up for success, I4, who recounted their experiences with over a dozen EWB IEPs, stated, "Before I would let a project go, I would want to have a good readout on what in-country capacity, on contractors, on engineering firms, and political situation in terms of what can the local government sustain on a long-term basis." To quote I8: "it's essential that the local community along with an in-country program office of EWB-USA (if there is one) are as meticulous about

providing the information as they can be." On setting a project up for success, I10 said, "We were sort of hoping to get some [local] university students involved […] if we have people who have friends who are going to university nearby, we might be able to more easily make connections with local engineers and things like that."

Contextual awareness. To quote I8: "The technical aspect of a project is certainly important, but at no point is the humaneness or the soft aspect any less important." I8's chapter had a nonprofit come in and speak to them about how to deliver a more human-centered design and project. I3 recalled being briefed on the philosophy of contextual engineering, noting the IEP would have failed without it as there was "false information" and "community dynamics" that they only noticed because of what they were taught. I1 claimed that different cultural norms, like handshakes, clothing styles, clothing colors, and other really small things "can make or break a community member's perception of you", and both I1 and I10 warned about presenting yourself as out of touch by bringing high-tech gadgets to a community that may not even have clean drinking water. I10 advised to be aware of gender dynamics in a community, paying special attention to disparities between what the community proclaims and what norms are actually practiced: "From the surface, they have 50% men and women in leadership roles. But there were a lot of specific gender-based problems in the community with division of labor, a division of tasks, sharing money, if one person is the sort of breadwinner and one person is taking care of children. There was a very frank multiple hour-long conversation about birth control, and men withholding their wives from using birth control, even though it was available for free in the village […] I remember our agenda was like half a page. And I have 40 pages of notes." I5 also recounted a time where perspective awareness was critical; upon discussing the nuances between two local tribes, they stated, "the tribal thing is very subtle, but boy you could light off a civil

war with that. If you're somehow coordinating people from different tribes, man you better get all that straightened out." Though each interviewee had a unique background, all were highly conscious of non-technical factors, including those who were more technically fixated. All interviewees were aware of the dangers of irresponsible aid, even those who only had experience with 1 or 2 projects.

Projects with existing relationships and partnerships. I7 recounted an IEP where Engineers in Action (EIA), the NGO for most EWB projects in Bolivia, was assisting with the partnership: "I do think the process is a little confusing or hard if the community doesn't have help from somebody that understands EWB at least a little bit. Like if they were to just find it online, it gets a little complicated […] I think most of them are either EWB reaching out or there's a connection to somebody in EWB or one of their partner organizations that help the communities […] It's definitely helpful if an organization has worked with an EWB team before, because then they know the system." I1 emphasizes they were not working from a blank slate and already had "cultural trainings" and "communication logistics" because of the nonprofit the EWB chapter was working with: "it was definitely a lot more fruitful because of that third party entity that had an ongoing relationship with the community." I1 supported this claim with an example that addressed the issue of volunteer turnover discussed under *need for coherent communication within EWB chapter*: "EWB personnel was not the same between assessment and implementation. But the presence of that nonprofit organization that helped connect us with community was consistent throughout. And I think that was the fundamental basis for a successful relationship, despite the transition in EWB personnel."

Flexibility in approach. I10 recalled their first visit with a community: "We came in with our expectations, and they blew us out of the water. I remember we came to our first meeting,

and we had, you know, an agenda. But they did too, they had an agenda. And we went with their agenda." On the same assessment trip, I10 met with the women of the partnered community and, after thorough and transparent discussion, considered the possibility of assisting with a health clinic in the future, independent of their initial scope pertaining to water access. I7 recalled struggling to mentor a team as many volunteers (students in this case) headed into an IEP with a fixed "cookie cutter" mindset on how to go about the project. With an academic background of social and public health, I7 warned: "You also need to go into your assessment very open-minded. And I think that's kind of a hard thing to explain to student chapters when at least the classes at that point that they've taken are very not that way." Not all interviewees had the same perception on flexibility, however; I5, a supervisor for multiple EWB IEPs, noted how after spending time setting up the project with the community, they "write this obsessive scope of work for the entire year with intermediate achievement points."

Coherent communication within EWB chapter. I10 recalled a project where a student and professional chapter were teaming up, but upon partnership, "it actually became this really tense situation where the professional chapter was trying to control what we [the student chapter] did and what our projects were, but the data we took indicated that we should be making certain decisions over others." They later recalled how the disagreements and "infighting" spilled into the community: "A chapter leader from another project called the village chairman to say not to listen to us, and that we didn't know what we were doing." I10 consequently painted an ideal outcome for the IEP as one with a unified EWB front, with chapters making decisions based on the same information. Regarding turnover within the chapter, everyone cited student graduation as a natural turnover point within university chapters, but two interviewees (I3 and I6) experienced inheriting a project from a project lead who graduated, both of whom struggled to

piece together information. From I6, who experienced this secondhand as an advisor: “They needed to go and find those answers for themselves, which a lot of times it was pretty difficult because that line of communication wasn’t passed down.” It appeared from both anecdotes there was not an emphasis on passing information upon lead turnover, whether or not such protocol existed within EWB. To combat this and other potential situations for lost information, I7 recommended “having a more extensive reference for the project… if there’s questions like thinking through what could happen or things like that, so that they have a way to fall back like, ‘oh, this went wrong, this is the plan that we had to assess and decide how to move forward with the project.’” Emphasis was placed by other interviewees as well on creating a consistent team schedule and sticking with it.

Desire for more non-engineers in the EWB project process. I9 stated that “Engineers Without Borders needs to rebrand because I think the projects need more non-engineers, and I think non-engineers don't think about joining all the time because of the name of the organization.” Throughout the interview, it was clear I9 had encountered the benefit of having non-technically minded individuals in aid work, recalling how much of their chapter was not of an engineering background. I9 continued: “One of our leadership was an international policy person, and she was the one that really pushed making sure we emphasized working with the community and didn't just go and focus on the engineering.” To quote I8: “The technical aspect of a project is certainly important, but at no point is the humaneness or the soft aspect any less important.”

EWB in-country staff. This ties in closely with the previous theme, though there is distinction of EWB’s newer in-country offices. For context, EWB currently has 5 in-country offices with interest in opening more (EWB-USA, 2021d). I2 compared two IEPs they worked

on, noting in-country staff as the key difference between how they turned out: “In Guatemala, we didn't have any of that when I was working on projects. In Nicaragua, I think that was essential. I don't think we would have been able to get things done without those in-country staff. I don't think our community connection would've been enough. I think they really stepped in and helped a lot.” I3 also recounted a “very good partnership” with an in-country EWB office that merged with an existing NGO.

5.1.2.2 Themes with neutral influence on EWB IEP outcome

Variety of methods for first contact between EWB and partnered communities. The order of community acknowledging need and initial contact taking place is unclear in the IEP examples provided by the interviewees. I5 spoke on a project in Ecuador, where someone from the next village over came by and very frankly asked if they would do the same thing for them. It is common for a community to hear about EWB through a neighboring community’s work; EWB even has a separate application process for this variant of initial contact (EWB-USA, 2020d). First contacts with community were split between local initiatives and out-of-country initiatives. For local initiatives, I1, I2, I3, I4, and I5 all cited an NGO as the instigator for the community’s involvement in the IEP. I4 supplements their answer with skepticism: “sometimes [instigating an IEP] is just as much for the NGO. Nothing proves the status of an NGO in-country like success. Success is getting a project implemented and people liking it.” I9 recalled a pastor that “started kind of going around to the rest of the communities and doing applications.” Out-of-country initiatives included churches, Global North NGOs, personal family connections, and a significant number of volunteers who either had a personal connection of their own (I2) or had contact with a friend who was a Peace Corps volunteer (I4, I8, and I9).

Disparity of initial approaches among chapters. As each interviewee discussed their respective chapters' initial project process, it became evident that chapters have a lot of variability in how they first approach projects. EWB's project approach has changed over time, which may contribute to some of the observed disparity, but a number of interviewees found a comfort zone in the industry-based project process. For chapters that do not have an existing connection or particular partnership in mind, there are a variety of ways to choose projects from the list provided by EWB, alongside a variety of motives and decision metrics used to select one. I2 stated the student chapter had the project selected for them by the professional chapter nearby, who happened to have connections in Guatemala. I4 recalled EIA bringing a project proposal to EWB-USA, and chapters "picked it out off a menu a la carte," citing proximity to existing projects. I6 reported the chapter voting on a project "simply based on if we were to participate […] We were asked to select which one we would most likely be interested in." When I5 was asked who the decision-makers were on the projects, they responded with "me." I5 trusted their decades of land development experience to bypass the typical EWB process and assess dozens of potential projects on their own, recalling assessment trips in Kenya and in the Navajo region in the United States. Some chapters had the executive board decide on their own, with or without help from the advisor(s). I10 recounted their chapter's robust process for selecting an IEP, assigning qualities and weights to different metrics. Though it was referred to as "impractical" at one point, I10 stated "when finally it ended up working out, I think the community was a really good match", later citing it as "the best assessment trip I had ever heard of in terms of projects because we were so careful about picking a project that was the right fit for us." As far as motivations to select a project, many factors were weighed by interviewees. These included: novelty, geography, whether the community is within the existing EWB framework of

connections, technical compatibility, linguistic compatibility, capacity compatibility (fundraising, etc.), perceived bias on the community application, and university travel restrictions. When discussing chapter practices, perceived younger interviewees were observed to discuss events in terms of people, whereas older interviewees recalled their experiences primarily through the lens of project process and design.

5.1.2.3 Themes with negative influence on EWB IEP outcome

Efficiency of the dual mission. Note this theme is separate from *Ethics of the dual mission* discussed in Section 5.3.2.1. Related to EWB's project approach as an organization, there was significant feedback on what multiple interviewees referred to verbatim as EWB's "existential crisis", particularly on their dual mission of both meeting the community's needs and providing volunteers with rewarding experiences (EWB-USA, 2021b). Interviewee 4 (I4) found the dual mission to be imperfect: "The project in Bolivia, the two projects that were doing alright, could've been done with local contractors […] Engineering expertise is available in-country to do everything that we're doing […] Can a bunch of U.S. university students out-engineer professional engineers in XYZ country? The general answer is 'No.'" I4 went on to cite three more examples from other IEPs they advised. In addition to local capacity, I4 recalls money to be a critical component as well: "Rarely you can put somebody from the U.S. in a developing country and reduce the cost of that project." Student volunteers typically only attend university for four years, and EWB-community partnerships are intended to be five years. I4 observed an EWB chapter working on an IEP that had "literally gone through a generation of students now that have not been to the country to see the project in any phase of it […] The long [five-year] timeframe works against the success for students." In contrast, I4 praises the scope of work of the Engineering Service Corps, a subset of EWB that only calls on volunteers with expertise

rather than the production of a full-on volunteer experience, since you can save the cost of traveling and just work to hire local contractors and gain trust in the local capacity.

Approval preceding assessment. The two interviewees who had by far the most IEP experience, I4 and I5, both cited the order of steps in the early phases of EWB as a huge pain point to IEPs. I5: “The idea that you would put a project together without going to the ground, talking to all kinds of people… Nobody on the planet would do a project in the sequence that EWB does.” When asked what EWB should know before letting an IEP happen for a community, I9 approached this same idea: “I'm wondering if maybe some sort of visit should happen before the official like… I feel like we normally put everything in place separate, and then people meet in person. So maybe having a team go and meet the community and kind of figure out things on the ground before going into an official agreement.” I9 also posed concern with more assessment prior to approval, however, noting it would be “pushing down the timeline a bit more”, potentially delaying the execution of the IEP at the expense of the community. I7 stated, “I think as far as the project and making sure it's successful, the assessment needs to be at the beginning.” I5 went on to claim that “this isn't some crazy idea of [theirs]; this is an industry”, referring to how the industry-based approach, typically categorized as a more top-down approach, still resonates with talking to people on the ground before further progress is made. However, this can be tough to apply within EWB’s current size and framework, as I10 alluded to: “If [EWB] could monetarily have staff members do assessments, that would be rad, but the money just isn't there.” It can be argued that EWB’s process uses the *Assessment* trip as an alternative method of appraising projects, since there is in fact a *go, no-go* option available for chapters to cancel the IEP before any implementation is done.

Many chapters do not emphasize go, no-go *option*. I10 cited that the *go, no-go* choice to cancel projects after assessment is much more common with professional chapters than with student chapters. The *four-year* timeframe students have in the chapter relative to the *five-year* project process EWB lays out may be related to this. Student chapters have the potential to become much more attached to their respective projects, since students may be inclined (perhaps without realizing) to see for themselves an IEP get implemented in full. I4 on the matter: "I've seen complications in Bolivia where a student took up to 3 trips on the project, and still it didn't get implemented during her college career. That's gotta be frustrating for students." Interviewees discussed the matters of troubled *Assessment* phases and conflicts in stakeholders' needs as if there were no other option than to persist. I7, one of the few interviewees who appeared aware of this *go, no-go* step: "Just because you go on an assessment trip doesn't mean you have to do this project."

Issues rooted in community application. I3 attributed a lot of wasted effort prior to their *Assessment* trip to incorrect information on the community application, citing the wrong Google Earth location provided by the NGO leading them to an entirely different community than the one they spent months of preparation toward. According to I3, this NGO was known to be protective of the community and may not have been clear with the EWB chapter, despite protocol for an initial phone call / meeting with the community. I10 followed up with the listed NGO contact on the community's application that turned out to be a for-profit drilling service unrelated to the project scope, to which their trip experience "lost a couple days" to. Both I3 and I10 cited taking the application as fact as grounds for error in their IEP experiences; I10's chapter was aware of this community application problem and even took it into account when selecting a project, keeping an eye out for applications that "knew exactly what to say" for EWB

approval's sake. The findings from these interviews resonated with the experience of I4: "I don't know a single case where a community found us on the internet and contacted EWB for help." Many attributed both local and out-of-country assistance on the application to "make it more competitive", as phrased by I3. Other examples of helpers for this application (with the interviewee who reported it) include community-based organizations from another community (I8), an Engineers Without Borders organization in a different country (I8), "one person" in the community rather than a community-engaged experience (I9), a local university (I8), a local pastor (I9), an EWB in-country office (I4), an EWB volunteer (I10), a personal connection (I7), and I5 (I5). EWB stipulates that the community should be the primary driver and author of the application; the extent to which this protocol has been followed is low, and the extent of any community involvement in the application process is nebulous. I5 even deliberately excluded the community from the process, justifying that community members cannot interpret for themselves what they need, analogous to how one would not know specifically what is wrong with their car when taking it to get fixed.

5.2 Discussion on impact of how EWB initially approaches projects on project success

The results from the survey and interview indicate that there are multiple aspects of how EWB IEPs begin that significantly impact project success. This discussion section combines the survey and interview analyses to provide an analysis that best connects back to the research question, the impact of how EWB initially approaches their projects on IEP success.

Non-technical components were observed to be the most prominent influencers in project outcome. From the surveys, the priority of *community involvement* averaged a 3.8 out of 4 importance to defining success by the survey respondents, in contrast to the priority of *adherence to professional standards*, which averaged a 2.5 out of 4. From the interviews, e*stablishing*

relationships with local stakeholders (positive influence), *readout of local circumstances* (positive), *contextual awareness* (positive), *coherent communication within EWB chapter* (positive), and *non-engineers in the EWB project process* (positive) were all dominant themes that encompass this non-technical importance.

Regarding both *establishing relationships with local stakeholders* and *readout of local circumstances*, see Table 5.1 for documentation on how an EWB team interacts with the community according to the official project process as well as what is expected from the community (Lundborg, 2020). The required actions for involving the community and other local parties are unclear at multiple points throughout the process; for the implementation trip the EWB team is scheduled to make, for example, there are no documented steps or requirements for the community. To EWB's credit, there are three articles within their website that acknowledge the importance of communication, *Communication Best Practices: after ICP Partnership Adoption* (EWB-USA, 2020a), *Communication Expectations* (EWB-USA, 2020b), and *Communication Plans for ICP Projects* (EWB-USA, 2020c). Additionally, there is a Communication Plan referred to by the project process in which chapters document their contacts. When a chapter applies for a project, part of their internal evaluation is based on the quality of this documentation (Lundborg, 2020). Given these articles and protocol, there is still an observed disparity between how communication and community involvement are emphasized by the interviewees versus how these are reflected in the formal project process. The formal process establishes communication as a bullet point or "key element" (EWB-USA, 2020c), whereas the interviewees acknowledged it as the foundation of the entire project. EWB lists *engineering* and *community-driven* as their first and second of ten core principles of development, respectively (EWB-USA, 2021c). The insights of the interviewees coincide with

literature as well: “It is people that make the difference between success and failure” (Bartlett, 2007).

Table 5.1 EWB-USA Project Process, including required community and NGO actions (Lundborg, 2020)

Phase	Subphase	Required community/NGO action(s)
Form Partnerships (4-10 weeks)	Community Program Application	• Apply for project
	Team Application	
	Create Project	• Be on a welcome call
Assessment (19-22 weeks)	Pre-Trip Plan	*
	Trip Details	
	Assessment Trip	• Discuss expectations of project • Establish lines of communication** • Review required community agreements**
	Post-Trip Report	*
Implementation (47-50 weeks)	Alternatives Analysis	• Discuss and select design alternatives**
	Safety Plan	
	Trip Details	*
	Implementation Trip	
	Post-Trip Report	*
Monitoring and Evaluation (19-22 weeks)	Pre-Trip Plan	
	Trip Details	*
	Monitoring and Evaluation Trip	• Do not conduct monitoring for chapter • Complete maintenance training**
	Post-Trip Report	
Closeout (5 weeks)	Closure Agreement	• Confirm long-term preparation • Discuss future plans with partnership**
	Submit for Project Closure	*

**community/NGO action is short and not design-related (signing a form, going over travel logistics)*
***community/NGO action is grouped in with chapter's actions with no elaboration*

The theme on the strength of *projects with existing relationships and partnerships* can be explained by this core concept of establishing connections. If relationships and lines of communication are already in place via the ongoing partnerships, and these factors are the basis for a successful project, then these projects have a huge advantage in terms of meeting the respective community’s needs. I1 exemplified this well with their example of how swapping EWB personnel during project turnover did not heavily impact the outcome because of the ongoing relationship established with the chapter. This coincides with survey findings as well; as

seen in Figure 5.2 and Figure 5.3, there is an observed increase in reported project success when projects have existing lines of communication in place, especially ones sparking from adjacent communities. This is best explained by the existing lines of communication that EWB has with the local NGO, local contractors, and presumably an EWB team who was already there to responsibly assess the project, time permitting. In practice, looking at the response rates to Q6 on the survey on Table 4.1, there is an even distribution among the criteria used by chapters to select a project. Though IEPs with existing relationships are observed to be correlated with higher reported rates of success, chapters do not always choose work with existing partnerships. This is understandable for newly established chapters who lack these connections, but for chapters with existing relationships these findings may bode useful when selecting an IEP.

The theme of *contextual awareness* resonates strongly with Leydens and Lucena's findings on the need for contextual listening in engineering curricula (2010) as well as Witmer's observations of cultural, economic, political, mechanical, and educational factors having an impact on project outcome (2018). Moreover, the tendency for younger interviewees to discuss projects in terms of people is acknowledged by literature that observed stronger dispositions of social good in EWB student-volunteers than in other engineering students (Litchfield and Javernick-Will, 2016). When Q12 on the survey asked about the priorities of *community involvement* and *adhering to professional standards*, though the averages were 3.8 out of 4 and 2.5 out of 4 respectively, respondents who had the role of Registered Engineer in Charge (REIC) had the lowest average value on *community involvement* and the highest average value on *adhering to professional standards*. This is expected, considering REICs are typically Professional Engineers and consequently may be inclined to place more value on the technical

components of a project. I5, who held a more traditional *blueprint* approach to these projects, held the role of REIC for most of the IEPs they discussed.

Regarding *non-engineers in the EWB project process*, anecdotes from I9 exemplifying the value of non-engineers in EWB IEPs coincide with observations in literature; an EWB IEP closed appropriately due to the presence of an anthropologist advisor rather than an engineering advisor, since the anthropologist knew to advise volunteers on valuing communication and asking questions (Lee et al., 2018).

In addition to non-technical components of EWB IEPs, commentary on EWB procedures were another core concept from the analyses. From the interviews, related themes included *flexibility in approach* (positive influence), *efficiency of the dual mission* (negative), *approval preceding assessment* (negative), *EWB in-country staff* (positive), *many chapters do not emphasize* go, no-go *option* (negative), *disparity of initial approaches from chapters* (neutral), and *issues rooted in community application* (negative).

Regarding the *efficiency of the dual mission*, I10 is optimistic that EWB is approaching a healthy equilibrium, though some literature recommends a length for partnerships to be around 10-20 years (Bond and Hulme, 1999; Great Britain Overseas Development Administration, 1995) rather than the five-year program timeframe EWB suggests. When considering the volunteer half of EWB's dual mission, as mentioned by I4, this five-year model may not bode well for students who want to see tangible change in their time with the organization, let alone the 10-20 years suggested by literature to best suit the local capacity half of the dual mission.

This observation of *flexibility in approach* is conflicting with how little the formal EWB project approach emphasizes flexibility. When describing their *Principles of Development*, EWB states their community-driven project approach as "bottom-up", "specific to the needs, resources

and constraints of the communities they serve" (EWB-USA, 2021c). These concepts are demonstrated well by the interviewees, but not as much by the actual EWB approach. There are only two points in the formalized project life cycle (Post-Trip Report in Assessment and Post-Trip Report in Implementation) where a project can skip, go back steps, or close (EWB-USA and Fite, 2020). Much of this disparity between the importance of flexibility and EWB's rigid approach may be attributed to EWB's volunteer-focused half of the dual mission, which may use this project structure to exemplify how an engineering project would be executed in the Global North, where many volunteers will eventually work or already work. EWB teaches their process as "pretty much the same in the developed world like in the United States or in a developing context" (EWB-USA, 2021a), resonating strongly with the more *blueprint*, top-down approach of international aid work as defined in the literature (Ika and Hodgson, 2014). Paralleling with Global North engineering projects, the EWB IEP process is highly time-sensitive, specifying stages of projects down to the specific week. Interviewee 5 (I5) was very set on this *blueprint* approach by creating "this obsessive scope of work for the entire year with intermediate achievement points." I5 also acknowledged that talking to people on the ground before a project begins is integral to the "industry" approach they endorsed, though it is not reflected as such in the EWB process, and I5 also claimed to write the scopes of work for the community rather than working with them on it.

Many of the issues rooted in the Global North industry-based project process applied in Global South efforts, made clear by both the interviews and the literature, can be attributed to its inflexibility (Analoui, 1989; Bartlett, 2007; Baum, 1978; Bond and Hulme, 1999; Bowen and Acciaioli, 2009; Ika and Hodgson, 2014). These may be contributing factors to why the United Nations Development Programme replaced this *technical cooperation* type of approach more

than a decade ago, citing lack of emphasis on human-centered design and local capacity (Amadei, 2014; United Nations Development Programme, 2009). Reemphasizing the insight from I9: "You also need to go into your assessment very open-minded. And I think that's kind of a hard thing to explain to student chapters when at least the classes at that point that they've taken are very not that way." This open-mindedness in IEPs is supported by an example in the literature. Bowen and Acciaioli found it much easier to successfully implement an EWB IEP when the project team could embrace flexibility in the form of how they interacted with stakeholders, how and when they reported back, and how they treated the recipient community as multiple stakeholders (2009). If EWB's intention is to conduct a bottom-up approach, and EWB participants reported flexibility and relationships as the framework for success, then it may be of EWB's interest to have their IEP process reflect this as well.

Though flexibility is typically a positive trait in context of EWB IEPs, in regard to *disparity of initial approaches from chapters*, this leaves it completely up to each chapter personnel whether or not the chapter's practices prioritize local perspectives and contextual awareness throughout the process. Bartlett, speaking on a similarly functioning nonprofit: "Once the project is approved, a search is made for cogs [people] with the required technical specifications, and it is largely a matter of luck if those people have the commitment, creativity, and communication skills that are needed for the project to succeed" (2007).

On *many chapters do not emphasize go, no-go option*, the stigma around the no-go option for student chapters is understandable provided how detrimental it is for the student experience. However, it would be beneficial to further emphasize this step and reduce the associated stigma, for the sake of reducing unsuccessful IEPs and alleviating any potential harm to other stakeholders, including further investment of everyone's time, money, energy, and care. The

literature makes it clear that it is certainly possible to do more harm than good by continuing an imperfect Global North effort (Easterly, 2006; Fisher, 2001; Scott, 1999). I10 suggested for this option to be available to communities as well, though it could potentially be grounds for both internal EWB dissonance as well as dissonance for communities, who may just be looking for a chapter who would be willing to provide short-term options, relating to the theme of *mixed understandings of short-term vs long-term aid*.

The praise of *EWB in-country staff* is endorsed by literature as a useful alternative to potentially ill-intentioned NGOs (Lee et al., 2018). EWB states that projects must be proposed by the community and must have community input throughout the project process (EWB-USA, 2021c), though observations by interviewees suggest that this is not always the case in practice. In fact, I4, who possessed more IEP experience out of all the interviewees, claimed "I don't know a single case where a community found us on the internet and contacted EWB for help." With in-country offices in place, EWB can more effectively vet projects and mitigate many of the problems described under *issues rooted in community application*.

The theme *variety of methods of first contact between EWB and partnered communities* observed on its own does not address the research question in full, but it provides much relevant insight to the survey findings, which do address the research question in full. We rejected the null hypothesis that chapters who select *any new project* yield the same reported levels of success as projects with at least one criterion or a particular project in mind ($p = 0.0136$, see Figure 5.2). This means how a project is initially selected by a chapter is important to its outcome. Though we do not reject the null hypothesis that projects with a particular community in mind yield the same reported levels of success than selecting projects with no particular community in mind ($p = 0.0769$, see Figure 5.3), there is an observable difference between these

two groups within this survey data. From these two significance tests and from the aforementioned discussion on *establishing relationships with local stakeholders* and the strength of *projects with existing relationships and partnerships*, it is observed that the method of first contact as well as the extent to which the EWB team and community initially make contact influences the outcome of EWB IEPs.

5.3 Analysis on impact of why stakeholders enter EWB projects on project success

5.3.1 Survey analysis

Figure 5.5 reports out response categories on the relationship between community impact and why the community got involved in the project (Q17). Figure 5.6 is the same data but grouped together into *Primarily community need* and *Other primary motivations*.

On reported success in relation to why the community entered the project (Q17), there were 7 options to choose from in the survey. Unlike the survey analysis for the first research question, the questions pertaining to the second research question were more difficult to analyze

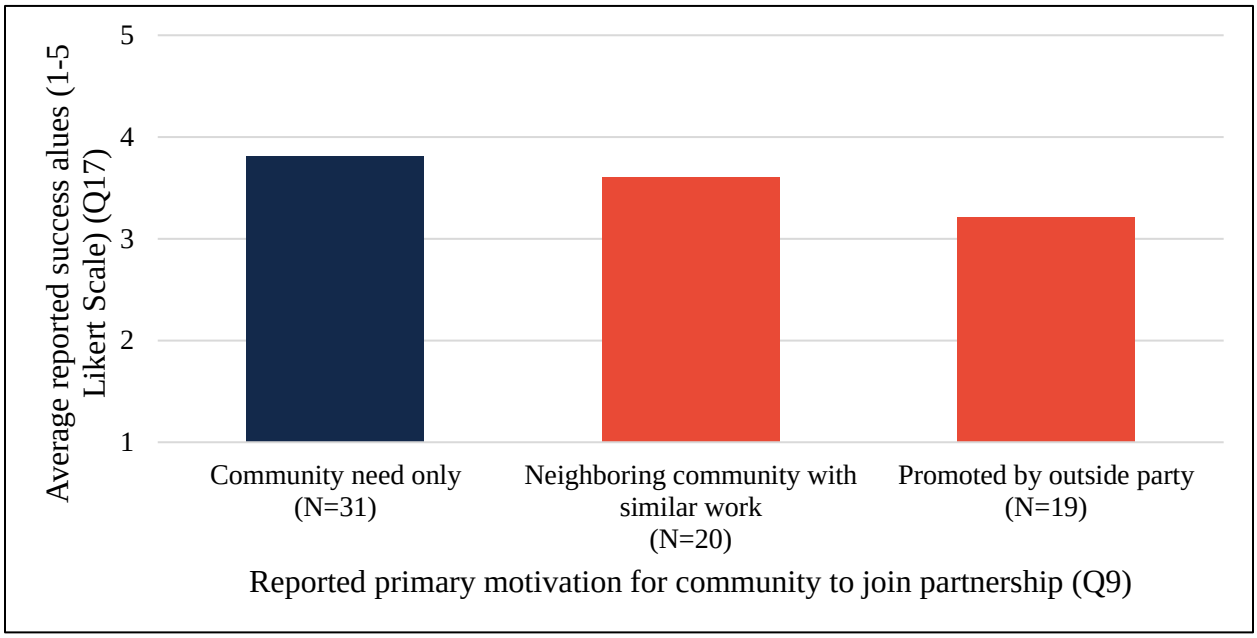
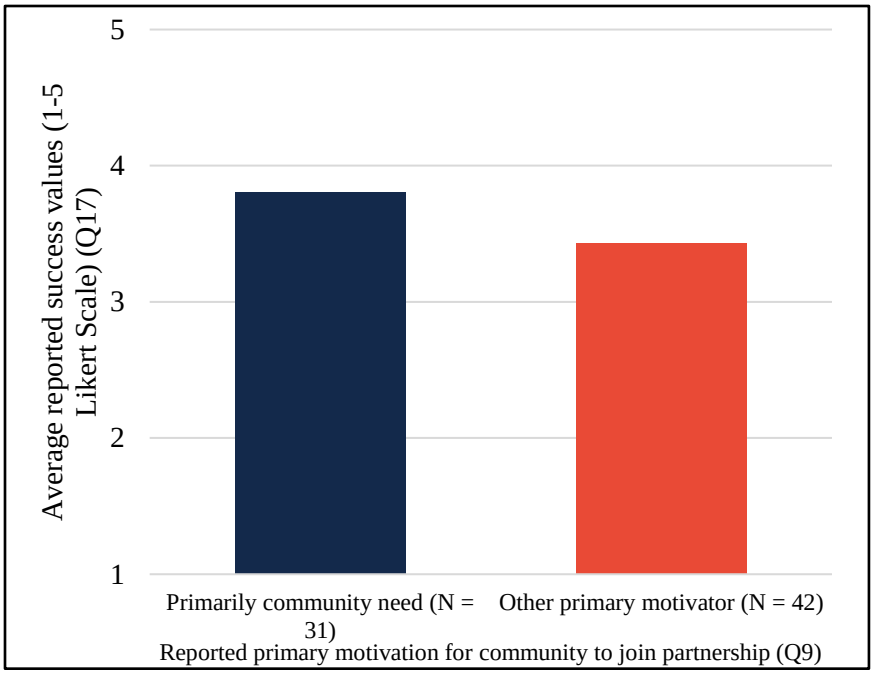


Figure 5.5 Results from question 17 in *Survey: Initiation of EWB-USA Projects* based on their responses from question 9. This figure shows how people rated the projects' ability to meet the community's needs, sorted by the reported motivation for the community to enter the project. There were more than three options selected by the surveyees, but through filtering out responses there were very few surveyees (4 or less); only three options had considerable numbers.



	Only need	Other motivations
N	31	42
Mean rank	46.89	57.33
Sum of Ranks	1258.5	1400.5
μ_w	1147.0	
σ_w	89.60	
Z	1.224	
p-value	0.10668	

Figure 5.6 Results from question 17 in *Survey: Initiation of EWB-USA Projects* based on their responses from question 9. This is the same data in Figure 5.5 but condensed into more general categories. To the right is the table for Mann-Whitney U Test results.

due to the lack of respondents' confidence in their answers to these questions. For the following analysis, only responses with a confidence level of 4 out of 5 or higher were used (N = 70). After filtering out responses by both confidence levels and whether the respondent had reported any closed projects, options with 3 or less responses were not displayed. Figure 5.5 and Figure 5.6 comparing data from Q17 to Q9 present a similar process as Figure 5.1 and Figure 5.2 comparing Q16 to Q6 data described in Section 5.1.1.

Survey respondents were asked to report the success of EWB IEPs, with the only metric for success being meeting the partnered community's needs. Q17 asked this relative to why the community agreed to enter the EWB partnership (Q9). For a full list of options to Q9, see Table 4.1. By comparing IEP outcome data one-to-one with information gathered in Q9, one relationship was assessed to test whether any motivation for the community to get involved (answers to Q9) were correlated with a significantly different reported IEP success than others (Q17). Visual representations of integrating Q9 and Q17 data compared can be found in Figure

5.5 and Figure 5.6. Responses were grouped together by whether a community's motivations were reported to be primarily community need or not. The groupings of these projects are labeled via the color schemes in both Figure 5.5 and Figure 5.6. A p-value of 0.05 was used alongside the Mann-Whitney U test to evaluate the following null hypothesis: If a community agrees to enter an EWB partnership with need being the primary motivation (n = 31), the reported outcome of this project would be no different than if a community agreed to join because of other primary motivators (i.e., *Promoted by outside party*, *Neighboring community with similar work*) (n = 42). Average values of reported success for IEPs where the community joined primarily out of need were 3.81 out of 5, and the IEPs where the community had other primary reasons to enter the partnership scored an average of 3.42 out of 5. We do not formally reject this null hypothesis, however, with a p-value of .107.

The survey questions on participant motivations are limited to the respondents' valuation of *volunteer engagement* and *meeting community needs* to defining success for an IEP. The average reported values for these two components were 3.68 out of 4 and 3.85 out of 4, respectively.

5.3.2 Interview analysis

This sub-section addresses the yielded themes from the inductive thematic analysis related to the second research question: the impact of why stakeholders enter EWB IEPs on project outcome. There are eight themes that address the research question; four themes reflect a positive influence on project outcome, two themes demonstrate a neutral influence on project outcome, and two themes express a negative influence on project outcome. Overall, these eight themes will be presented in the order seen in the first column of Table 4.4, categorized by positive, negative, and neutral influences, similarly to Section 5.1.2.

5.3.2.1 Themes with positive influence on EWB IEP outcome

Unified definitions of success. Speaking from experience on an IEP in Bolivia, I6 recalled a miscommunication of what was needed for the community: “That's one of the things that wasn't looked into. Regardless how much they talk to the community or talk to the nonprofit, obviously, the needs weren't lined up. Regardless of if it started off in a good direction, we ended up creating something, or designed for something to implement that wasn't needed.” I8 had a similar view on the topic: “You could deliver a water treatment system, and if it's not working as what they needed, if it's not being used as it was intended, […] then it is a failure. Even though it is not considered that completely, in terms of the delivery of the human-centered design project, yes.” In addition to I6 and I8, I7 said: “if I went in, and yes, they had running water, but the community didn't engage with it at all, I wouldn't call that a success.” I10 observed a mismatch of definitions of success between different EWB chapters. Regarding the initial mindsets of those in EWB IEPs, I10 said: “There are some big differences between chapters that are very closely aligned with the mission versus chapters that have either been involved with EWB since before the mission got refined, or they just want to do development aid or charity work. And I think a lot of the projects that want to do charity work, struggle a little bit.” On the topic of different stakeholders wanting different things out of the project, I6 emphasized “multiple perspectives when looking at who helps is huge.” I6 advised volunteers: “It would be seriously beneficial for [the EWB team] to understand the actual necessity of it, or what the community is actually needing.” Finding this definition of success is not always straightforward, however; put simply, I7 stated: “You can go interview one person and get one perspective. And then the next person is complete opposite. And they do the same thing. And they live in the same area […] I definitely

need at least a few people to verify this or to come to a consensus because different people are going to lead you in different directions."

Volunteer introspection. Interviewees emphasized the *volunteer introspection* in the early phases of EWB IEPs in addition to simply listening to different perspectives. I10 recounted hours of gathering perspectives of the women in the community but was careful to impose their own subjective cultural norms of measuring gender equality. I10 encouraged a critical self-reflection for both volunteers and chapters on why they joined EWB, stating that "if you found a project on the idea of like, 'We're here to help these poor people', I think that's super morally questionable." I10 cited three different EWB chapters and a Swiss NGO in a single community and acknowledged this outside presence was most certainly doing more harm than good. Upon pondering the thousands of dollars needed to travel relative to what that money could instead do for the community, I1 encouraged "a sense of personal responsibility and understanding how your actions and impact might seem really good and well-intended, but there is another lens in which you could look at everything […] For a volunteer, urge thinking about that perspective." I7 recounted a difficult realization for EWB participants to process. Expanding on a quote from earlier: "Just because you go on an assessment trip doesn't mean you have to do this project […] maybe this community doesn't really need the help that it originally thought […] sometimes the best thing you can do is close out a project […] There are definitely some projects that are like, 'okay, you just need to leave, you're not doing them any good and you're not learning anything either from [them].'" I9 advised a healthy mentality for the required meeting at the beginning of an EWB IEP: "I don't know how to nicely say it, but avoid like the white people coming in and saying, 'This is what you need.'" I1 and I10 also alluded to the notion of "savior" or "white savior" and both warned against it.

Being upfront about your capabilities as a volunteer. I10 made it clear to a newly partnered community about "what we could do and what we couldn't do, and that we were a bunch of students fundraising our own money… we're going to do our best, but we weren't made of money… and I think that really worked." I10 also recalled IEPs where the partnered community knew what to expect from the team: "Projects that are based on communities that have seen other EWB projects are so [redacted] good. If you know what to expect as a community, it seems like you're set up for success." Similarly, I3 directly warns "there should be no false hope, almost like there should be an expectation that we're a student group. We'll help you; it might take a little longer," and later stated that "it's pretty embarrassing if the community is waiting for something and it can't be done because the chapter doesn't know how to fundraise." I10 claimed this transparency must be addressed right at the *Assessment* trip: "As you show up, you're sort of implicitly making a promise, just like how you should never say 'we're gonna do this' on a trip unless you're 100% sure you're gonna do that." I9 recounts a particular example of this on an EWB IEP in Cameroon. Drama ensued over the change in scope of work from one community to many: "We promised to do something for every community. And it seems like we were going back on that because it was harder than we thought. So maybe kind of being clear about that communication at the beginning. And more realistic about what we were capable of doing also."

Local initiative in local capacity building. I7 discussed an IEP they were mentoring where the chapter would only hear back from the community "maybe once every six months", emphasizing "a project can't be successful if the community is not involved." I7 recalled another IEP where "a few members in the community that are very passionate about their community" helped drive an IEP forward to ultimately improve local capacity. I8 contributed a successful IEP

to “great community involvement, the community take[sic] a lot of ownership”. When asked what success means to the community, many responded with fostering community involvement, community ownership, and improving local capacity, among others. I4 placed emphasis on the local capacity and not necessarily the community’s capacity in and of itself since both the community and the NGO “gains confidence in local capacity.” I7 noted that the presence of an IEP success in a community drove them to take more initiative for themselves: “I think just that initial helper, some of the drive for like, ‘Oh, we are getting running water’ helped with that.”

5.3.2.2 Themes with neutral influence on EWB IEP outcome

Variety of motivations for volunteer involvement. I1 embodies this variety of altruistic, personal, and objective motivations well: “I think helping people doing something outside of school while in school for an opportunity to have a real-life application of things you're learning […] and then having the opportunity for service to those less fortunate, having the experience to work on a project that's real and interact with people.” I4 spoke on behalf of volunteers they worked with, inferring “the idea that their skills could be useful for something other than making money for themselves was novel enough.” I5, who oversees a team of roughly a dozen students, says “it’s a ‘save the world’ kind of mentality or perspective”, though the interviewee also acknowledges some were doing it for a resume booster and would show up for weekly meetings and do nothing. I5 personally was motivated to continue their involvement after their first experience: “it was like being in my own National Geographic story, and I just loved the culture and the geography and talking to the people.” I9 stated their chapter, who is more concentrated with non-engineers than other EWB chapters, is generally interested in “international development, supporting communities, and that experience of working internationally while also doing something to help the community.” I9 also referred to a large engineering firm who

donated money to allow their workers to go on these trips via *specialized leave*, and consequently their chapter is highly concentrated with these professionals. I10 claimed having friends in the chapter and social cohesion as the strongest influencer to join for both their chapter and many others. I8, who has experience in both a student and professional chapter, recalled many who wanted to apply the engineering skills they had learned, but professional chapter volunteers had an added layer of determination "based on [their] new experience as an early-career professional, and being able to apply [their] knowledge." Despite the original reason to join, it was agreed by most interviewees that volunteers who stuck around were those who really cared and were invested in the community, including those who may potentially want to do this sort of work beyond college (referring to student chapters).

Mixed motivations for community involvement. I4 bluntly acknowledged that some communities are often offered services by NGOs and do not need much motivation beyond "yeah we'd like that, free stuff is always good." I4 went on to say that "in some of these communities, it's as much of a status symbol for the community as it is a physical benefit for the community," comparing it to how people in the U.S. would buy a Rolex to flex their wealth. I4 continued: "The community looks more important and resourceful and desirable for people to live in," perhaps a stronger incentive to participate "than the physical benefit of the project." I2 recounts an experience where a local NGO had initiated a project: "They [the local NGO] pretty much told us that the community wanted this thing, and when we were there, it was pretty apparent that somebody else felt like they needed it." Most reported motivations for partnerships were not political, however; many had cited evident need as their motivation, whether it be poverty, natural disaster, political displacement, or a very specific fix. Most of these needs would be considered pressing, endangering the long-term capacity of the community, but the latter of

those evident needs was rooted in short-term need, as I2 recounts a project where someone "was just more like, 'hey, we want this fixed', and then didn't realize, when it becomes an Engineers Without Borders project, the full scope of things."

5.3.2.3 Themes with negative influence on EWB IEP outcome

Mixed understandings of short-term vs long-term aid. I10 recalled their chapter's experience: "I think the community partnerships that our chapter has struggled with are the ones that have experienced humanitarian aid, and sort of like relief aid, but had not expressed experience with development aid." I10 drew insight from their IEP experience in Tanzania, a country known for its dependence on aid (Catterson and Lindahl, 1999). I10 continued: "I've heard some really rough stories about communities that were really angry or really frustrated because the EWB team couldn't match their need for aid because they didn't get that it wasn't aid. It was like long-term development aid." I1 said their partnered NGO helped explain to the community "why we were going through this process of asking them to apply for help, rather than just going and helping." This is an example of how this clarification proved useful, but I1 noted that "many communities will fall into the bucket of 'why can't we have this sooner'. If at the end of the project, they're able to see why taking the slow, long route is more advantageous, […] that does lead to a more long-term sustainable solution." When asked if projects are being maintained, I5 responded: "Yeah they're… they're not very good at maintaining it […] The idea of preventative maintenance is really hard to get across."

Ethics of the dual mission. I6 hit at the core of the ethical implications of the dual mission: "I think it's kind of odd, to call success rates simply by the students in the developed world actually gaining something from it." I10 relates EWB's mission to other nonprofits who do similar work but are polarized toward one mission or another. "There are nonprofits that don't

have volunteers and just implement, I think it's [redacted] that does that. Or there are people that are like fully on the volunteer adventure side, I think [redacted] basically just like plops Professional Engineers. And they're like, 'here's the plan, good luck, go get 'em.'" I8 recounted an EWB project in the U.S. that was eventually cancelled: "That was a project where an EWB-USA student chapter doesn't have much to add […] they don't have the capacity to design that, and if something goes wrong, it's engineering students who are on the line […] there's so much bureaucracy to traverse through that it's not fair for the EWB-USA student chapter members to be involved in such a mess."

5.4 Discussion on impact of why stakeholders enter EWB projects on project success

The results from the survey and interview indicate that why stakeholders enter EWB IEPs has a significant impact on project success. This section combines the survey and interview analyses to provide an interpretation that best connects back to the research question, the impact of why stakeholders enter EWB projects on IEP success.

As mentioned in the literature review, community motivations historically have not been well-documented due to their irrelevance to whether projects begin or not; the recent concepts of international aid, international development, and other Global North efforts are an ethically improved update of colonialism, industrialization, and tensions in the Cold War, where Global South communities rarely had say in these partnerships (Lucena, 2010). Assessing the impact of motivations on community involvement upon project outcome is remarkably useful for optimizing IEPs, evidenced by the theme *unified definitions of success* (positive influence). However, these motivations are not well-documented, difficult to assume secondhand, and laborious to document firsthand. The theme of *mixed motivations for community involvement* (neutral) is key because it both acknowledges the communities' presence in the IEP and also

humanizes the diversity of motivations among and within communities. As I4 alluded to, these communities may not have much motivation at all: “Free stuff is always good.” Survey respondents, who were all EWB participants and not members of partnered communities, reported on average a very low confidence level in their knowledge base on community motivations. This made the survey assessment of the relationship difficult, though a slight disparity of reported project success can be observed in Figure 5.5 and Figure 5.6, noting that projects where the community’s motivations were assumed as only need had slightly higher reported rates of success (3.81 out of 5) than those where the community had other primary motivations (3.42 out of 5). Note this analysis is limited by its failure to reject the null hypothesis ($p = 0.107$) as well as the potentially inaccurate assumption of community motivations by respondents.

Literature provides plenty of examples of failure in Global North efforts rooted in a mismatch in motivations between parties involved. NGOs in particular face a lot of skepticism of their motives, who are often pressured to seek projects in order to both raise and spend money (Barry-Shaw and Jay, 2012; Ebrahim, 2005; Gibson et al., 2005; Schuller, 2012). The theme of *unified definitions of success* is considerably influential on EWB IEP outcome, and literature coincides with this observation as well. Witmer (2018) observed that motivations by each IEP stakeholder may not coincide with one other and “may result in rejection of infrastructure.” This observation is made in Global North efforts outside of an engineering context as well; Murdie (2014) noted how local support of aid projects is diminished if other involved organizations hold motives contrary to theirs. Reiterating a quote from I6: “Regardless of if it started off in a good direction, we ended up creating something, or designed for something to implement that wasn't needed.” Similarly to I6’s experience, support of an EWB project disappeared from both the

community and the EWB team after the NGO made it clear the project only existed for the NGO's sake, and only half the community supported the project as a whole (Lee et al., 2018).

On *variety of motivations for volunteer involvement* (neutral), EWB volunteer motivations have been well-documented by engineering education literature such as Ba-Aoum (2016) and thus were not heavily emphasized in either the survey questions or interview questions. The primary emphasis on helping others lines up with Ba-Aoum's survey (2016), but the overall melting pot of reasons to join suggests a complex set of motivations as Jahnke observed (2020), rather than truly altruistic (Ba-Aoum, 2016; Litchfield and Javernick-Will, 2016) or truly self-interested (Butcher, 2003; Guttentag, 2009). It is difficult to correlate EWB participant motivation directly to project outcome, since the extent to which the participant was responsible for the outcome of the project is not made clear with the given data. For the survey questions that did pertain to EWB participant motivations, EWB participants value both *volunteer engagement* and *meeting community needs* highly, with a slight emphasis on the latter. It is worth noting that respondents with the role of *project team member* or *project team lead/project manager*, who could be generalized as the main *volunteers*, prioritized *volunteer engagement* the lowest compared to the other respondents. Volunteers may feel inclined to not see themselves as part of the process and think only in terms of helping the partnered community, an altruistic mindset that is both inspiring and potentially dangerous in practice. It is because of this that *volunteer introspection* (positive) is an important theme to project outcome. The concept of helping others can create a hierarchical *us* versus *them* mindset, what Stephen Riggins refers to as *Othering*, which blurs the judgment of volunteers trying to collaborate with the intended recipient (1997). Intentions of empowerment and participatory development can result in fruitless if not counterproductive efforts to fight inequalities; these types of outcomes

have been a pattern observed in IEPs as well as throughout the field of service learning in general (Blouin and Perry, 2009; Butin, 2003; Cooke and Kothari, 2001; Crabtree, 2013; Tryon et al., 2008). “EWB has created many positive impacts, but the fundamental situation that privileged outsiders are coming into communities in developing countries is a reality that all chapters and participants must grapple with” (Lee et al., 2018). Global North volunteers will continue to be driven by altruism despite its criticisms: “Who says that humanitarianism should be set aside? It is unlikely to be those in distress” (Allen, 2018).

Literature agrees that grassroots pressures like those observed in the theme *local initiative in local capacity building* (positive) are indicative of improving local capacity over time, but emphasis should be placed on how to spark this pressure to begin with rather than simply seeking it out, according to representatives of the World Bank (Mansuri and Rao, 2012).

Regarding the theme of *mixed understandings of short-term vs long-term aid* (negative), it is understandable for a community to receive short-term aid from one party and be confused when another party comes in and does not provide everything right away, especially in communities where a lot of aid groups are present, such as I10’s IEP experience in Tanzania. This is reflected on a larger scale as well to entire nations like Haiti, Tanzania, and Afghanistan; literature provides ample evidence of excessive aid leading to dependency and reducing autonomy and local capacity (Catterson and Lindahl, 1999; Fisher, 2001; Gibson et al., 2005).

5.5 Analysis and discussion of other data

This section reviews the survey and interview data unrelated to how or why projects begin with EWB but still addresses the overall research objective of assessing the impact of the early stages of IEPs on project outcome.

Outcome sometimes out of project's control (neutral). I8 recalled the cancellation of a domestic EWB-USA project, which began prior to the existence of EWB's domestic branch, Community Engineering Corps, over inevitable roadblocks with tribal utility management in the Navajo region. I9 referred to EWB IEP work in Nigeria having to pause due to how dangerous the situation was, referencing how some of their partners were refugees at this point: "It just became unsafe to travel or do any type of work there, even with our local partners." Upon being asked how complete the IEP was, I9 responded: "The water collection system was built, and a storage tank was built […] There was unrest, so we weren't able to complete it, [but] we did, at least at some point get water running. But obviously, we didn't get to the point where, you know, we installed piping and taps in." I3 cited "a civil war going on" to be the reason an EWB IEP was cut early. I4 recounted an IEP that the team was no longer able to go to because it went against their respective university's safety policy, though I4 was remarkably normalized to this environment: "Mortar rounds in their half of the city [were being dropped] the day we were traveling. The university came unglued and said the university couldn't go anywhere near that city. It was the right call, but mortars weren't dropping on the half of the city we were gonna be staying in. If you ever traveled to an international location and heard an explosion, it... you know... it happens. It's no big deal." Multiple interviewees cited COVID-19 as a reason for IEPs to either close or be put on pause. I7, when asked about the outcome of their projects, claimed they were all uncertain, since "you don't know if a project is really successful until a few years out from it."

This theme serves as important counterevidence to other themes, suggesting there are factors out of EWB's control and out of the partnered community's control as well. In addition to the *blueprint* and *contingent* approaches discussed in this research, Ika and Hodgson

acknowledge a third model of project approach around *power*, suggesting that power dynamics and larger forces of authority are the most pertinent drivers of project success, and that stakeholders should be conscious of them (2014). This is evidenced in the interviews by issues such as tribal tensions, ongoing war, and political turmoil, all of which are circumstances well beyond the ability of EWB or the partnered community to address. The presence of COVID-19 is another example of how the fate of projects may be out of the hands of any of the involved stakeholders.

Survey respondents were asked who the primary decision-makers were for instigating projects, both on EWB's end (Q5) and the partnered community's end (Q8). The results to both of these responses can be seen in Table 4.1. The results of Q5 demonstrated that volunteers have an extensive amount of decision-making power in the project selection process, accounting for over half of all responses to who the primary decision-maker was. For student chapters, this tracks with literature that claims that undergraduate students are typically the drivers of EWB efforts as student volunteers, with high motivation accompanied by formidable support and awareness for fundraising to short-term needs (Chisolm et al., 2014). Q8 showed a high influence from NGOs on instigating IEPs, which lines up with the literature (Barry-Shaw and Jay, 2012; Gibson et al., 2005). *The community themselves* and *a third party* were the second and third most common responses to this question.

5.6 Limitations of methodology

5.6.1 Survey limitations

There were several limitations with the implemented survey. Most notably, the findings from this survey only entailed the perspectives of those on the EWB side of IEPs. As made evident by the literature and the findings of the interviews, different stakeholders define success

differently (Schreiber, 2019), each with their own complex motives for getting involved. The research would ideally have gathered insight from people in every involved party, including currently or previously partnered communities, NGOs, donors, university administration, or any other stakeholders in EWB projects, but these perspectives were not directly accounted for. Avoiding this shortcoming entails gathering a comprehensive and diverse set of contacts from all these perspectives, a scope of work difficult to appropriately define and beyond the capacity of this thesis.

For the second challenge faced, neither the respondents nor the researcher could remove their own biases from their experiences and thus the data could not be declared as objective. Aware of this, the survey attempted to minimize the effects of this issue by explicitly detailing *community* impact, placing emphasis on the respondents' personal definitions of success and then deliberately shifting them off of that definition and over to meeting the community's needs. The respondent is asked how successful their IEPs were in terms of their own definition of success, and then they are asked the same question again but only in terms of meeting the community's needs. Moreover, confidence levels were asked for many of these questions with the hopes of filtering out uninformed perspectives. Ultimately, analyzing the data on IEP community impact was in fact an analysis on EWB participants' *perspective* of how the project meets the community's needs rather than the sought *objective* report of community impact, which itself may be interpreted differently for each respondent. Similarly, the failure of a project and how it may not have helped anyone is a sensitive topic for some. It is difficult to acknowledge failure, especially when one's own investment of time, effort, care, and money was involved in the endeavor. There is significant personal reflection expected by this 10-minute survey.

A knowledge gap on how the formal project process in EWB IEPs relative to how projects proceed in practice led to the survey's third limitation. The research initially presumed most if not all EWB chapters follow the same outlined process to apply for IEPs and get approved, so it was surmised that *quantitative* survey questions on procedures would not be very informative. Upon insight gathered from interviews, surveys could have included more specific questions pertaining to chapter procedures and practices as well. As an example, upon learning during the interviews the nuances and diversity of the selection processes chapters go through, these responses could have been phrased better to clarify what was meant by *any* project, intended to signify the chapter choosing from a dropdown of project options and the metrics used to decide which one was best for the chapter.

5.6.2 Interview limitations

The two main limitations of this interview process stem from a lack of additional perspective. The first limitation is the singular perspective of the researcher. A metric for data integrity is its confirmability, which entails ensuring data is able to be corroborated by other sources or researchers (Chowdhury, 2015). Though academic advisors provided ample guidance to this thesis research, having a sole principal investigator for the research limits its ability to evaluate data and therefore reduce subjectivity. Inductive thematic analysis was implemented in an effort to attenuate this potential opening to researcher bias. The second limitation was the unilateral perspective of EWB participants relative to the absence of community perspectives. In a paper whose findings strongly suggest placing more priority on community perspective, it is unfortunate that the data's point of view is limited to the EWB side of the EWB-community partnership present in all EWB IEPs.

CHAPTER 6

CONCLUSIONS

6.1 Summary of findings

The results and analyses from the survey and interview indicate that there are multiple aspects of how EWB IEPs begin that significantly impact project success. Moreover, the interview results also indicate that why stakeholders enter EWB IEPs has a significant impact on project success. The survey results regarding why stakeholders enter EWB IEPs suggest that there may be a correlation, but the survey tool itself did not provide sufficient evidence to establish a relationship.

6.1.1 Overview

The objective of this research was to assess the relationship between the initial stages of Engineers Without Borders – USA (EWB) international engineering projects (IEPs) and their outcomes. Specifically, the two primary questions evaluated in the initial EWB IEP stages were *how* a project begins as well as *why* stakeholders get involved in these projects. A successful IEP outcome was defined only as meeting local needs and improving the partnered community's local capacity, though this is only half of the EWB dual mission.

The explanatory mixed methods approach used to address the objective included a survey administered to all current EWB chapters alongside a follow-up interview. The survey data yielded 85 usable survey responses accounting for 306 EWB IEPs, and the interview data yielded 10 interviews representing 16 EWB chapters and 34 EWB IEPs.

6.1.2 On the impact of how EWB IEPs begin on project outcome

Effective interactions with local stakeholders were observed in both surveys and interviews to be the most positive influencer by far within how to start an IEP on EWB IEP

success. Moreover, the EWB process is both a positive and negative influencer within how EWB IEPs begin on project success. IEPs the EWB chapter selects with at least one criterion in mind or with a particular community in mind yield a significantly higher reported ability to meet the partnered community's needs than projects without ($p = .0136$). Moreover, projects chosen with a particular community in mind before the selection process were observed to yield a higher reported ability to meet the community's needs than those that did not have a particular community in mind, though formal significance is not established ($p = .0769$).

From the interview analysis, fourteen themes were observed pertaining to how EWB IEPs begin. Eight of these themes yielded a positive influence on project outcome, two yielded a neutral influence, and four yielded a negative influence. Overall, the ability to interact with other stakeholders was the most influential factor. Themes that coincide with this concept include *establishing relationships with local stakeholders* (positive influence), *readout of local circumstances* (positive), *contextual awareness* (positive), and *coherent communication within EWB chapter* (positive). In addition to working with other people, the formal EWB process was also emphasized as an influential factor to outcome. Themes pertaining to the EWB process included *projects with existing relationships and partnerships* (positive), *EWB in-country staff* (positive), *efficiency of the dual mission* (negative), *flexibility in approach* (positive), *approval preceding assessment* (negative), *many chapters do not emphasize* go, no-go *option* (negative), *non-engineers in the EWB project process* (positive), and *issues rooted in community application* (negative).

6.1.3 On the impact of why stakeholders enter EWB IEPs on project outcome

Compatibility of stakeholder motivations as well as personal reflections on motivations are both significant influencers within why stakeholders initially get involved in EWB IEPs on

IEP outcome, evidenced by the thematic interview analysis. Survey findings observed a difference in reported project success when comparing different community motivations, though these motivations were assumed secondhand by survey respondents, presumed to be entirely EWB participants.

From the interview findings, interviewees indicated that interactions of different stakeholder motivations played an important role in the reported success of EWB IEPs. Themes pertaining to these motivation interactions include *unified definitions of success* (positive) and *mixed understandings of short-term vs long-term aid* (negative). The data made clear that clashing motivations between parties involved will erode the support for an IEP and diminish its success. In addition to interactions of different stakeholder motivations, self-awareness of motivations for involvement also was a key influencer in project outcome. These themes include *volunteer introspection* (positive), *being upfront about your capabilities as a volunteer* (positive), *variety of motivations for volunteer involvement* (neutral), *mixed motivations for community involvement* (neutral), and *ethics of the dual mission* (negative). Lastly, the theme of *local initiative in local capacity building* (positive) not only reflects the importance of community involvement, but it also acknowledges the responsibility the partnered community has in this EWB IEP process to be motivated to improve and sustain itself.

6.2 Implications for stakeholders

Recategorizing the observed themes by relevant stakeholder(s) rather than by research question provides clearer insight for implications for practitioners. For the complete list of themes sorted by related stakeholder and type of influence (positive, negative, or neutral), see Table 6.1 For the same list of themes sorted instead by research question and type of influence, see Table 4.4.

For EWB chapters, partnered communities, EWB headquarters, and any other stakeholder involved in an EWB IEP, implications of this research can be generalized as encouraging the practice of observed positive influences (labeled green in Table 6.1) and discouraging the practice of observed negative influences (labeled red in Table 6.1). Moreover, it is advised to further explore the intricacies of observed neutral influences. Some themes are listed more than once as they pertain to multiple stakeholders.

For EWB chapters beginning a project, both survey and interview data indicate that the focus should be first and foremost on the relationships between stakeholders in IEPs. To reiterate a quote from I8: "The technical aspect of a project is certainly important -- but at no point is the humaneness or the soft aspect any less important." The observed positive influence of *Flexibility in approach* suggests that having flexibility and being open-minded in initial approach will allow chapters to better establish these relationships and adapt to the highly variable scopes of work of IEPs. When making the decision of whether to work with the same stakeholders or start a new project, recall that IEPs that began with existing relationships were observed to have higher reported rates of success. Regarding motivations, the findings strongly indicate that chapters should encourage honest discussion regarding why they are involved and what they can actually provide via long-term aid as volunteers with their level of expertise. It is also suggested by the findings to be aware of the possibility that the outcome of the project is sometimes out of the control of the chapter, the community, or any involved stakeholder. The observed negative influence of *Many chapters do not emphasize* go, no-go *option* suggests that chapters should be conscious of the *go, no-go* option within an EWB project and have the awareness to acknowledge when a project is better off not existing. This *go, no-go* insight is especially important for student chapters, since student volunteers were observed to grow more attached to

their projects and may resist the decision to end a project, even when it is in the best interest of other stakeholders.

For communities starting their partnership with an EWB chapter in an IEP, findings suggest that focus should be placed on fostering community initiative and educating people on the value of long-term assistance. The negative influence of *Mixed understandings of short-term vs long-term aid* suggests that understanding the differences between these two types of aid efforts will place the community in a much healthier position regarding what to expect from EWB, an organization that specializes in long-term aid efforts. As suggested by the observed negative influence of *Issues rooted in community application*, partnered communities should work to be more involved in writing the community application and should strongly encourage incorporating the diversity of perspectives the community has to offer. The observed positive theme of *Unified definitions of success* suggests that transparent discussion on what a successful IEP means to community members would help the partnered EWB chapter better understand the community's goals and more appropriately assess the scope and feasibility of the IEP.

For EWB headquarters, projects with existing relationships and partnerships should be encouraged as they have been observed to yield higher reported rates of success. As interacting more effectively with local stakeholders was observed to be the most positive influencer within starting an IEP on project success, it is suggested that EWB headquarters help foster the development of partnerships between chapters and local stakeholders, either by providing chapters with more resources regarding how to appropriately form relationships or emphasizing current resources more if they already exist. Themes that were observed to help promote communication include continuing the initiative of EWB in-country staff, as they help substantially with lines of communication between stakeholders, and encouraging the inclusion

of non-engineers in the project process, as their own expertise can provide additional perspectives that are often overlooked by engineering minds. The findings on *Flexibility in Approach* indicate that modifying the formal project structure to resemble a less rigid, *blueprint* approach and a more flexible, *contingent* one would allow chapters to better adapt to new information as well as involve local stakeholders more in the process. Aid efforts with a more *contingent* approach have been observed in both EWB IEPs and in other Global North efforts to better satisfy local needs than *blueprint* approaches. EWB headquarters should work within their capabilities to address the observed issues of *Approval preceding assessment* and *Issues rooted in community application*, perhaps by encouraging students to go on an initial screening trip or by making the *Assessment* trip a more open-ended endeavor rather than one primarily focused on engineering design. Literature suggests 10-20 years as a suitable scope for long-term aid, and the interview analysis reported that a timeframe longer than four years works against the success of the students. The five-year program timeframe is an appropriate compromise for this dilemma, though the observed ethics and efficiency of the dual mission at the root this dilemma may justify introspection. Finally, as there was a strong disparity of practices observed between how different chapters initially approach projects, EWB headquarters may find it in their interest to unify chapter practices, at least in context of valuing the perspectives and motivations of local stakeholders at the start of projects.

6.3 Future work

6.3.1 Replicating this research or conducting similar research

This research took an explanatory mixed methods approach, meaning it was intended that survey data would be the primary form of data acquisition, with interviews serving to provide an explanation to why the survey data came out the way it did. Though interview questions were

Table 6.1 Themes that emerged from the inductive thematic analysis of interview transcripts, categorized by stakeholder the theme pertains to as well as whether the theme yields a positive, negative, or neutral outcome (note that some themes are listed twice if they apply to more than one stakeholder)

	Themes pertaining to EWB chapters	**Themes pertaining to partnered communities**	**Themes pertaining to EWB headquarters**
Themes with positive influence on project outcome	• Establishing relationships with local stakeholders • Readout of local circumstances • Projects with existing relationships and partnerships • Unified definitions of success • Contextual awareness • Flexibility in approach • Volunteer introspection • Being upfront about your capabilities as a volunteer • Coherent communication within EWB chapter • Non-engineers in the EWB project process	• Local initiative in local capacity building • Unified definitions of success	• Projects with existing relationships and partnerships • Flexibility in approach • EWB in-country staff • Non-engineers in the EWB project process
Themes with neutral or mixed influence on project outcome	• Outcome sometimes out of project's control • Variety of motivations for volunteer involvement • Variety of methods of first contact between EWB and partnered communities • Disparity of initial approaches from chapters	• Mixed motivations for community involvement • Outcome sometimes out of project's control	• Disparity of initial approaches from chapters
Themes with negative influence on project outcome	• Mixed understandings of short-term vs long-term aid • Many chapters do not emphasize *go, no-go* option	• Issues rooted in community application • Mixed understandings of short-term vs long-term aid	• Efficiency of the dual mission • Many chapters do not emphasize *go, no-go* option • Approval preceding assessment • Issues rooted in community application • Ethics of the dual mission

tailored based off the survey results, interviews provided ample insight on the EWB IEP process and experience. Upon replicating this research, it is recommended to instead take an exploratory mixed methods approach, beginning with the qualitative assessment to explore the depth of the topic to better inform a subsequent quantitative assessment (Creswell and Plano Clark, 2006).

The research question pertaining to how projects begin relative to project impact was not addressed to its fullest extent in the survey; with the now-observed disparity in chapter practices, additional insight to gather from EWB chapters could include general EWB chapter operations, the presence of advisors, the prominence of advisors, and the extent to which non-technical components are taught. Gathered survey data that fell outside the scope of this research objective may be useful in future work on EWB participant motivations, provided the potential to cross-reference responses to the *personal* survey questions to data from other questions.

Perspectives of local stakeholders are a remarkable research gap relative to how quintessential they are to the success of IEPs. These findings strongly endorse future research on better gathering local perspectives before, during, and after EWB IEPs, whether that be in the form of replicating this research or pursuing future research topics.

For any future research interested in using either the survey data set or the interview codes, the full survey data as well as the sorted NVivo project file for interview themes are available upon request.

6.3.2 Directions for future research topics

There were many compelling points made by the interviewees that did not make it into the 23 themes as they were out of the scope of this research objective. However, these concepts are worth exploring in future research.

From the EWB perspective, many concepts were introduced by interviewees that would be of interest to explore further. Some of these topics included, but were not limited to: volunteers' communication skills, the importance and influence of the EWB team's advisor, the impact of COVID-19 on the design process, the feasibility of conducting projects remotely, the nuances of how projects come to exist from existing partnerships, the influence of local government on a project's community impact, the variation of project approach by continent or by country, comparing project approaches by EWB student chapters versus professional chapter project approaches, comparing approaches by older EWB chapters versus newer ones, assessing how non-engineers perceive being a part of EWB, how different EWB volunteers would approach capacity building, the comparisons and contrasts between EWB and other similar non-profits, change in EWB's strategy over time, the extent of knowledge on the historical context of Global North efforts by EWB volunteers, the perspective of donors on EWB IEPs, and the relationship between short-term aid and long-term assistance. These were all points of curiosity that were sparked during the research process and can perhaps be of assistance to help inspire ideas of future researchers.

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APPENDIX A

SURVEY: INITIATION OF EWB-USA PROJECTS

[Note: Questions 13, 14, 16, and 17 will only show rows that correspond with their responses to either question 6 or question 9. If they selected two options for question 6, for example, there will be two rows for question 13.]

1 Thank you for participating in this survey. This survey should take no more than 10 minutes to complete, and it will provide us with a stronger understanding of how infrastructure projects are approached and implemented to serve societies unfamiliar to the practitioner.

Please enter your name and email address upon completion of this survey if you would like to take place in a follow-up interview. Please note if you opt out of the follow-up interview your submission will remain anonymous.

If you should have any questions or comments regarding this online survey, feel free to contact Principal Investigator Ann-Perry Witmer at awitmer@illinois.edu. We look forward to receiving your insight.

-The International Center for Contextual Engineering Research Group

Please read the attached Behavioral research consent form.

- ○ I have read and understand the attached consent form, I certify that I am 18 years old or older and, by choosing this option, I indicate my willingness to voluntarily take part in the study.
- ○ I have not read or do not understand the attached consent form, or I am 17 years old or younger and, by choosing this option, I do not consent to voluntarily take part in the study.

2 How many EWB projects or other humanitarian engineering projects have you been a part of?

- ○ 1
- ○ 2
- ○ 3-4
- ○ 5-10
- ○ More than 10

3 For any projects of this nature, please indicate any roles you took on during the course of the project: (if more than one role applies, select multiple)

- [ ] Full-time EWB-USA employee
- [ ] EWB-USA Application Review Committee member
- [ ] EWB chapter administration
- [ ] Project professional advisor
- [ ] Registered Engineer in Charge (REIC)
- [ ] Funding source of project
- [ ] Project team lead/Project manager
- [ ] Project team member
- [ ] Other _____

4 How familiar are you with the process by which an EWB-USA chapter adopts a project? (Eligibility, Application, "Create a new project", etc.)

- ○ No idea
- ○ Vaguely familiar
- ○ Somewhat familiar
- ○ Familiar
- ○ Very familiar

5 Of the projects you've been involved with, who was the primary decision-maker for instigating the projects, from the perspective of the EWB chapter? If possible, please choose one per project. (If different projects had different main decision-makers, select multiple)

- [ ] Head sponsors of the EWB chapter (professors, P.E.s, etc.)
- [ ] Responsible Engineer in Charge (REIC) associated with EWB chapter
- [ ] Higher organization that the EWB chapter resides under (company, university, church, etc.)
- [ ] Funding source (rotary, etc.)
- [ ] Volunteers in the EWB chapter (students, church members, etc.)
- [ ] Other _____
- [ ] I'm unsure who the primary decision makers for instigating the project(s) were

6 Of the projects you've been involved with, what do you believe was the initial motivation for beginning the projects, **from the perspective of the EWB chapter**? If possible, please choose one per project.

- ☐ General interest in working on any new project
- ☐ General interest in working on any project in a specific country or region
- ☐ General interest in working on any project in a particular field of engineering
- ☐ General interest in working on any project in association with a particular NGO
- ☐ Interest in working on a particular project, new or existing, similar to or adjacent to a previous project of the EWB chapter
- ☐ Interest in working on a particular project, new or existing, with a personal connection to someone in the EWB chapter
- ☐ Interest in working on a particular project, new or existing, with a personal connection to someone that reached out to the EWB chapter
- ☐ Interest in working on a particular project, new or existing, as the chapter was reached out to personally by the community or an NGO
- ☐ Other initial motivations?
_____
- ☐ ⊗ I do not know what the EWB chapter's initial motivations for beginning the project(s) were

7 How familiar are you with the process a recipient community must follow to have their project listed with EWB-USA for adoption? (Community Application, Statement of Intent, Review Committee, etc.)

- ○ No idea
- ○ Vaguely familiar
- ○ Somewhat familiar
- ○ Familiar
- ○ Very familiar

8 Of the projects you've been involved with, who was the primary decision-maker for instigating the projects, from the perspective of the recipient community? If possible, please choose one per project.

- ☐ A local NGO, who assisted the community in applying to EWB
- ☐ An outside NGO (not EWB), who reached out to the community or a local NGO
- ☐ A government entity, who reached out to the community or a local NGO
- ☐ A third party (an individual, church, company, etc.), who reached out to the community or a local NGO
- ☐ The community themselves
- ☐ Someone else _____
- ☐ I'm unsure who the primary decision makers for instigating the project(s) were

9 Of the projects you've been involved with, what do you believe was the initial motivation for beginning the projects, **from the perspective of the recipient community**? If possible, please choose one per project.

- [ ] Interest in service, technology and/or funding, promoted by an NGO, government entity, or other third party
- [ ] Interest in obtaining a similar service, technology, and/or funding that a neighboring community received
- [ ] Interest in service, technology and/or funding, promoted primarily by a community's curiosity in new technology
- [ ] Interest in service, technology and/or funding, promoted ONLY by community need
- [ ] Other initial motivations? _____
- [ ] N/A (Community not involved in its application process)
- [ ] ⊗ I do not know what the community's initial motivations for beginning the project(s) were

10 What is the current state of the projects you've been involved with? (Please fill in the number of projects associated with each option, based on your answer to how many projects you've been involved with. If you don't have an exact number, "some" or "many" is also fine)

- ○ In progress - Assessment phase _____
- ○ In progress - Implementation phase _____
- ○ In progress - Monitoring phase _____
- ○ Closed, with occasional contact with community _____
- ○ Closed, with infrequent or no contact with community _____
- ○ Not sure of project outcome _____

11 For projects that are closed out, please indicate any of the factors that led to the project closing out: (if more than one applies, select multiple)

- ☐ Given timeframe had ended (year, semester, etc.)
- ☐ Project deemed unfeasible or could not move further
- ☐ Client community's contact with engineering team dwindled
- ☐ Disagreement or hostility among stakeholders
- ☐ Protocol for community maintenance was established
- ☐ Engineering team dwindled
- ☐ Project was constructed
- ☐ Client community reported they had no more needs to be met
- ☐ ⊗ No projects are closed out yet
- ☐ Other _____

12 Question 12 of 18: From your perspective, how important are each of the following conditions in determining a positive outcome for the project (i.e. calling it a "success")?

	Nonessential	Somewhat important	Fairly important	Imperative
Volunteer/Student engagement	○	○	○	○
Adherence to professional (Western) engineering practices and standards	○	○	○	○
Community involvement in decision-making throughout project	○	○	○	○
Community needs (defined by community) met	○	○	○	○

[Note: Questions 13, 14, 16, and 17 will only show rows that correspond with their responses to either question 6 or question 9. If they selected two options for question 6, for example, there will only be two rows to address for question 13.]

13
For the parameters of success you selected in the last question, how would you rate the outcomes of the projects you've participated in, given the EWB Chapter's initial motivations? The choices you selected earlier in the survey are below. A reminder this survey is anonymous. (If you've had different outcomes

	Little success, if any	Mildly successful	Somewhat successful	Fairly successful	Total success
General interest in working on any new project	☐	☐	☐	☐	☐
General interest in working on any project in a specific country or region	☐	☐	☐	☐	☐
General interest in working on any project in	☐	☐	☐	☐	☐

a particular field of engineering					
General interest in working on any project in association with a particular NGO	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, similar to or adjacent to a previous project of the EWB chapter	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, with a personal connection to someone in the EWB chapter	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, with a personal connection to someone that reached out to the EWB chapter	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, as the chapter was reached out to personally by the community or an NGO	☐	☐	☐	☐	☐
"Other initial motivations" option you filled out in question 6	☐	☐	☐	☐	☐

with the same motivation, you can select more than one option

14 Same question, but now given the recipient community's initial motivations.

For the parameters of success you selected, how would you rate the outcomes of the projects

you've participated in, given the recipient community's initial motivations? The choices you selected earlier in the survey are below.

	Little success, if any	Mildly successful	Somewhat successful	Fairly successful	Total success
Interest in service, technology and/or funding, promoted primarily by community need	☐	☐	☐	☐	☐
Interest in service, technology and/or funding, promoted by an outside stakeholder (local NGO, outside NGO, government entity, or other third party)	☐	☐	☐	☐	☐
Interest in obtaining a similar service, technology, and/or funding that a neighboring community received	☐	☐	☐	☐	☐
Interest in service, technology and/or funding, promoted primarily by a community's curiosity in new technology	☐	☐	☐	☐	☐
"Other initial motivations" option you filled out in question 9	☐	☐	☐	☐	☐
N/A (Community not involved in its application process)	☐	☐	☐	☐	☐

15 Please indicate your overall confidence level in your answers to the previous 2 questions (13 and 14):

- ○ 0: No idea
- ○ 1: Not sure
- ○ 2: Somewhat confident
- ○ 3: Confident
- ○ 4: Absolutely Sure

16
Question 16 of 18: (Almost there, thank you so much!)

Now let's modify the parameters above and **treat the question as if the only measure of "success" is having the recipient community's needs met** (needs defined by the community).

Given this new parameter, how would you rate the outcomes of the projects you've participated in, given the EWB Chapter's initial motivations? The choices you selected earlier in the survey are below. One last reminder this survey is anonymous. (If you've had different outcomes with the same motivation, you can select more than one option)

	Little success, if any	Mildly successful	Somewhat successful	Fairly successful	Total success
General interest in working on any new project	☐	☐	☐	☐	☐
General interest in working on any project in a specific country or region	☐	☐	☐	☐	☐
General interest in working on any project in a particular field of engineering	☐	☐	☐	☐	☐
General interest in working on any project in association with a particular NGO	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, similar to or adjacent to a previous project of the EWB chapter	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, with a personal connection to someone in the EWB chapter	☐	☐	☐	☐	☐
Interest in working on a particular project, new or existing, with a personal connection to someone that	☐	☐	☐	☐	☐

reached out to the EWB chapter					
Interest in working on a particular project, new or existing, as the chapter was reached out to personally by the community or an NGO	☐	☐	☐	☐	☐
"Other" option you filled out in question 6	☐	☐	☐	☐	☐

17 Same question, but now given the recipient community's initial motivations you selected. Treat the question as if the only measure of "success" is having the recipient community's needs met.

How would you rate the outcomes of the projects you've participated in?

	Little success, if any	**Mildly successful**	**Somewhat successful**	**Fairly successful**	**Total success**
Interest in service, technology and/or funding, promoted primarily by community need	☐	☐	☐	☐	☐
Interest in service, technology and/or funding, promoted by an outside stakeholder (local NGO, outside NGO, government entity, or other third party)	☐	☐	☐	☐	☐
Interest in obtaining a similar service, technology, and/or funding that a neighboring community received	☐	☐	☐	☐	☐
Interest in service, technology and/or funding, promoted primarily by a community's curiosity in new technology	☐	☐	☐	☐	☐
"Other initial motivations" option you filled out in question 9	☐	☐	☐	☐	☐
N/A (Community not involved in its application process)	☐	☐	☐	☐	☐

18 Please indicate your overall confidence level in your answers to the previous 2 questions (Questions 16 and 17):

- ○ 0: No idea
- ○ 1: Not confident
- ○ 2: Somewhat confident
- ○ 3: Confident
- ○ 4: Absolutely Sure

19 Thank you for your time. This survey has been 100% anonymous, but we will be conducting follow-up interviews with a random selection of those who took this survey. You have the option to opt out of this process if you would like, as providing contact information for a follow-up interview may compromise anonymity (we will certainly not include any names in our findings without additional permission).

Thank you once again for your time.

- ○ Opt in for potential follow-up interview (will fill out separate form)
- ○ Opt out of potential follow-up interview (remain anonymous)

[Survey would end here if participant opted out]

20 Thank you for opting in for a potential follow-up interview. Please use the following link to fill out your contact information:

[URL removed from thesis]

- ○ Got it, I will copy this link and fill the form out with my basic contact information

APPENDIX B

ENGINEERS WITHOUT BORDERS – USA PROJECT PARTICIPANTS INTERVIEW

Interview Date: xx/x/20
Interview Location (Check one): ☐ **Zoom** ☐ **Phone Call**
Interviewer: x
Interview Code: 001

The primary goal of this research is to look into different factors that go into how an EWB-USA project begins and whether any of them are indicative of the respective project's outcome. In short, we're trying to find if how a project begins impacts how it turns out in the end.

Information not to be used in any published reports (only helpful for internal organizational purposes)	
Name	
Date of interview	

Demographics	
Field of work / Major	
How long they've worked in field / What year in school	
Brief description of how many projects they've worked on in EWB and a general overview of the type of projects	
Brief description of humanitarian engineering projects they've worked on anywhere else	

Thank you. Now we'll being going into project-specific questions, if that's alright. Let's start with one project (or one chunk of projects, if they've worked on many).

Project-Specific Questions [1 of x]	
Describe the project you worked on. They can include location, type of engineering work, and what chapter/organization it was through. Make sure to follow up on highlighted questions if not addressed.	
What roles did you have in the project? Head of chapter, project lead, registered engineer in charge, etc.	
How long did the project take, from initial approval to closing?	
How long were you specifically on the project for?	
The chapter decided to do this project in particular. Were you a part of this decision-making process?	
If so, what led you to choose this community's project, or if not, do you know what led the chapter to choose this project?	

Do you know who led the chapter to choose this project?	
Did you get a sense of why people in the chapter were involved? Feel free to speak for yourself as well. (e.g., just want to help people, resume booster, job obligation, personal connection with the project, etc.)	
In order for an EWB project to exist, the community also has to go through an application process. For this project, would you be able to speak to whether anyone helped the community apply for assistance? (an NGO, a non-profit, extended family member, etc.)	
Would you be able to speak to why and how the community ended up applying to EWB? (if more than just a call for assistance)	
"Success" for projects of this nature is very interpretable, so I'm just going to ask a couple of general questions about the outcome. Is the project complete?	
From the EWB chapter's end, how successful did the project seem? (Did team members get what they wanted out of the experience, did they feel like they helped people, etc.)	
From the community's end, do you know how successful the project ended up being? How do you know? (Did the project end up in a way that was desirable and useful for the community? Was it constructed? Is it currently being maintained? Did the project really help them, etc.)	
Were the EWB personnel who were working on the project at the beginning the same as those at the end? If not, what changed?	
Does anything else stick out to you about the beginning of this project's existence or the outcome of this project?	
Describe your ideal outcome for this project. Did that happen? If not, what needed to happen for this ideal outcome to become reality?	
If you could go back and change something about the approach leading up to your project, would you? If yes, what would it be and why?	

At this point, we have an option of what we would like to discuss. If you feel there are other specific projects you worked on that would be particularly helpful to this research, we can go through those questions again for those projects no problem. Otherwise, I can ask questions pertaining to all the projects you've worked on.

If the surveyee has more project to talk about, copy and paste the table above and repopulate it.

General International Engineering Questions	
In general, how would you define a successful project for EWB?	
How would you define a successful project for the communities these projects serve?	

For the projects you've worked on, do you feel the way in which the projects and partnerships were chosen was appropriate? Was it responsible?	
What do you think engineers/any EWB leadership should know before letting an EWB project happen for an international, rural community?	
If you had complete control of setting up the beginning of a project, from the organizations to the engineering team to the community interactions, but once the team started working on the project you had no more control over the project, how would you best set the project up for success?	
Last question: The primary goal of this research is to look into different factors that go into how an EWB-USA project begins and whether any of them are indicative of the respective project's outcome. In short, we're trying to find if how a project begins impacts how it turns out in the end. Given your past experience on projects and your intuition, do you have any additional insight to offer on the topic?	

APPENDIX C

SELECTED QUOTES FROM INTERVIEWS

Interviewee	Quote
1	It was definitely a lot more fruitful because of that third party entity that had an ongoing relationship with the community.
1	Cultural trainings, communication logistics, to in from the community, were a lot easier because of the prior relationship that one of our students had with an organization that had worked with this community in the past.
1	I think helping people doing something outside of school while in school for opportunity to have like a real-life application of things you're learning, whether it's engineering, public health, you know, any sort of thing like that, and then having the opportunity for service to those less fortunate having the experience to work on a project that's real and interact with people.
1	Knowing, like different handshakes that they do, and how like different, like clothing styles or colors might mean different things. So being aware of all those really small things, like I think, can make or break a community members perception of you.
1	Presence of bringing technology and high-tech gadgets to a community that doesn't even have clean drinking water.
1	Why we were going through this process of asking them to apply for help, rather than just going and helping.
1	So EWB personnel was not the same between assessment and implementation. But the consistent presence of that nonprofit organization that helped connect us with community was consistent throughout. And I think that was the fundamental basis for a successful relationship, despite the transition in EWB personnel.
1	I think many communities will fall into the bucket of why can't we have this sooner. And so if at the end of the project, they're able to see why taking the like, slow, long route is more advantageous than to then, you know, why can't we just like, get this done right now. And you know, pay someone to like install a light, that doesn't take five years. But understanding like, the longer path that does lead to a more long-term sustainable solution would be a measure of success.
1	A sense of personal responsibility and understanding like, how, you know, your actions and impact might seem really good and well-intended, but there is another lens in which you could look at everything […] for a volunteer, urge thinking about that perspective.
2	In Guatemala, we didn't have any of that when I was working on projects. In Nicaragua, I think that was essential. I don't think we would have been able to get things done without those in-country staff. I don't think our community connection would've been enough. I think they really stepped in and helped a lot.
2	I think it was really based upon connections. Our [university] connected to people in the [chapter], who had like connections in Guatemala.

2	They pretty much told us that the community wanted this thing, and when we were there, it was pretty apparent that somebody else felt like they needed it.
2	They [local NGO] pretty much told us that the community wanted this thing, and when we were there, it was pretty apparent that somebody else felt like they needed it.
2	I think their initial thing was just more like, "Hey, we want this fixed." and then didn't really realize, when it becomes an Engineers Without Borders project, the full scope of things.
3	there should be no false hope, almost like, there should be an expectation that we're a student group. We'll help you; it might take a little longer.
3	I feel like we wasted a lot of time in preparing for the assessment trip. There were a lot of factors that really had nothing to do with like a typical project, but I feel like it would've been really, really beneficial to talk to the community directly before.
3	No records of anything from the previous group.
3	So there's the civil war going on there. So the project had to be cut early. Because we've been traveling back like a few years ago, there was no... there's really nothing for EWB in place about remote implementation.
3	It's pretty embarrassing if the community is waiting for something and it can't be done because the chapter doesn't know how to fundraise.
3	I would say it wouldn't have gone as well because we really did have a lot of false information (unintentional, but still like information that wasn't true), and there were a lot of community dynamics that we noticed that would've been really difficult for other people to have noticed.
3	Like, in the, our NGO sent us a Google map, like location link, like for Google Earth to like, walk around in Street View and stuff. And that was not it wasn't the right location or something. Because we didn't see any of those places the whole time. Um, so that gave us like, a false impression of the community. And then when we got there, just completely different.
3	While they were skeptical at first, I think they they're a good partnership for us.
4	Before I would let a project go, I would want to have a good readout on what in-country capacity, on contractors, on engineering firms, and political situation in terms of what can the local government sustain on a long-term basis.
4	They liked the idea that their skills could be useful for something other than making money for themselves was novel enough.
4	[Local NGO] brought project proposal to EWB-USA and local chapters, in both cases picked it out off a menu a la carte.
4	Does the NGO recognize the motives of the community? Sometimes they do, sometimes it's just as much for the NGO. Nothing proves the status of an NGO in-country like success. Success is getting a project implemented and people liking it.
4	Yeah, we'd like that too, free stuff is always good'. You have to realize that in some of these communities (?) that it's done, it's as much of a status symbol for the community as it is a physical benefit for the community. In other words,

	we're a poor community, we see a slightly richer community that gets a benefit from the municipality or the national government with wherever contacts, and we want the same thing as much so that our community looks more important and resourceful and desirable for people to live in than the physical benefit of the project.
4	I was involved just because the country was on a high-risk travel, the team starting on project was no longer able to go to country because of the university's safety policy
4	in the eastern part of city [they] were dropping mortar rounds in their half of the city the day we were traveling; the university came unglued and said the university couldn't go anywhere near that city. it was the right call, but mortars weren't dropping the half of the city we were gonna be staying in. If you ever traveled to an international location and heard an explosion, it... you know... it happens. It's no big deal. Same with the (?) gunfire. (?) No problem.
4	The project in Bolivia, the 2 projects that we're doing alright, could've been done with local contractors. Engineering expertise is available in-country to do everything that we're doing.
4	Can a bunch of U.S. university students out-engineer professional engineers in XYZ country? The general answer is "no". It's rare that they can provide something that can't be done in-country if it was financed. There are limited cases where outside technical consultants could improve the quality, make it more sustainable, with possible exceptions of like really rough places like Haiti and Malawi, local capacity exists. It may not be fast, but neither is EWB-USA quite often. There are certain places where technical expertise could improve the quality or durability or sustainability, rarely you can put somebody in the U.S. in a developing country and reduce the cost of that project.
4	I've seen complications in Bolivia where a student took up to 3 trips on the project, and still it didn't get implemented during her college career. That's gotta be frustrating for students. It's great for the students if they happen to be the one that their junior year or their senior year the project gets implemented and works, "Yay, it works, we got to see it completed" even if they didn't necessarily see it start. The long timeframe works against true success for students.
5	Some were doing it for resume booster, some would show up for weekly meetings and do nothing. [Lazy student commentary] But by and large for the people who, you know, actively participate, it's a "save the world" kind of mentality or perspective? I've got about 13 engineers working with me now. Big group. Um, yeah, I guess it's more to save the world, humanitarian thing.
5	It was like being in my own National Geographic story, and I just loved the culture and the geography and talking to the people.
5	The tribal thing is very subtle, but boy you could light off a civil war with that. If you're somehow coordinating people from different tribes, man you better get all that straightened out.
5	[in reference to who led the chapter to choose the project] Me.

5	[when asked whether anyone helped the community apply for assistance] Probably not supposed to tell you this, but we did. We filled out all the applications. [Did they ask you to do it?] No.
5	To speak to that Ecuador project, the next village over came over and asked, "hey would you do the same thing for us?"
5	The idea that you would put a project together without going to the ground, talking to all kinds of people... Nobody on the planet would do a project in the sequence that EWB does.
5	I spend quite a bit more time than most with community setting it up, and then the group here, as I said, I write this obsessive scope of work for the entire year with intermediate achievement points, and so I don't think physically I can do any more.
5	But then this idea that they have a project sequence that's different from the civil engineering and construction industry? Hello? Hello? Sorry. This isn't some crazy idea of mine on a Saturday night, this is an industry.
6	A more effective communication between all the parties that were involved, including the community, the nonprofit we're working with, as well as the actual project lead that we're working on.
6	They needed to go and find those answers for themselves, which a lot of times it was pretty difficult because that line of communication wasn't passed down.
6	Multiple perspectives when looking at who helps is huge.
6	Regardless how much they talk or community or talk to the nonprofit, obviously, the needs weren't lined up. Regardless if it started off in a good direction, we ended up creating something, or designed for something to implement that wasn't really needed. So regardless if it started right or not, it developed into something that wasn't needed.
6	Simply based on if we were to participate… we were asked to select which one we would most likely be interested in.
6	I think it's kind of odd, to call success rates simply by the students in the developed world actually gaining something from it.
7	I do think the process is a little confusing or hard if the community doesn't have help from somebody that understands EWB at least a little bit. Like if they were to just find it online and, it gets a little complicated, and so from my perspective, I think most of them are like, either EWB reaching out or there's a connection to somebody in EWB or one of their partner organizations that kind of help the communities.
7	It's basically vital to the success that you have project partners that (1) are local, so that they kind of understand the context so that during [cut off] up or preparing, they can provide that.
7	Maybe once every six months… a project can't be successful if (1) the community is not involved and (2) you can't get the information that you need to design anything.
7	It's definitely helpful if an organization has worked with an EWB team before, kind of, because then they know the system.

	I think almost every, I would say, like 90% of the projects happening in Bolivia partner with [local NGO]. And it's definitely helpful if an organization has worked with an EWB team before, kind of, because then they know the system.
7	Having a more extensive reference for the project so the project is underway. If there's questions like thinking through, like, what could happen or things like that, so that they have a way to fall back like, "Oh, this went wrong, this is the plan that we had to assess and decide how to move forward with the project."
7	Black & Veatch is like a big, they donate a decent amount of money or allow their workers to go on these trips. Like, give them specialized leave, I think, for it. And so we have a bunch of people from there.
7	You can go interview one person and get one perspective. And then like, the next person is complete opposite. And they do the same thing. And they live in the same area… I definitely need at least a few people to verify this or to come to a consensus because different people are going to lead you in different directions.
7	And since they go into these communities with a certain mindset, and I think that EWB as a whole kind of needs to come up with some way to kind of explain that more in-depth to new members.
7	You also need to go into your assessment very open-minded. And I think that's kind of a hard thing to explain to student chapters when at least the classes at that point that they've taken are very not that way.
7	A few members in the community that are, are very, like passionate about their community.
7	So, if I went in, and yes, they had running water, but the community didn't engage with it at all, I wouldn't call that a success.
7	I think as far as the project and making sure it's successful, the assessment needs to be at the beginning.
7	There are definitely some projects that are like, okay, you just need to leave, you're not doing them any good. And you're not learning anything either from [them].
7	I went like a little over a year ago back to the community for one of the implementation trips, and seeing it from where it was when I first went is just like night and day. We first went in and it was like super hard. They've like worked with their government to fix the road going to the community. They've also applied for like another grant from Intel, so they got like some computers and a satellite for their schoolhouse. And so they've like, been putting a lot of other stuff into it as well. And I think just that initial helper, some of the like, drive for like, "Oh, we are getting running water" helped with that.
7	Just because you go on an assessment trip doesn't mean you have to do this project because sometimes you just have the information that was put in on that application. And again, if you go in, and that was just one person, like, maybe this community doesn't really need the help that it originally thought. And I think that's kind of where that came, where it's like, sometimes the best thing you can do is close out a project.

8	So the project I've worked on, it was, (1) like I mentioned, the EWB international chapter, or (2) the community-based organization where we had previously interacted with. So those were the, like points of contact that helped the community apply for the form. There has also been an example where a local university helped the community apply.
8	Because of a lack of communication… there are things which happen that should not, and it's always better to communicate more than to communicate less.
8	I don't think we should have taken part in that because that was a project where an EWB-USA student chapter doesn't have much to add in terms of (1), they don't have the capacity to design that, and (2) if something goes wrong, it's student engineers, or even engineering students, who are on the line. And then (3), there's so much bureaucracy to traverse through that it's not fair for the EWB-USA student chapter members to be involved in such a mess. So yeah, hindsight is great at telling me that, okay, we should not have, you know, considered that project at all.
8	it seemed to me that this project was, for lack of a better phrase, destined for failure, because of the fact that there were a lot of roadblocks with the community, with the tribal utilities, with the way that EWB-USA hadn't really charted out the way that the domestic projects work, and this was really in the beginning when the CE Corps was about to be launched properly with the structures and everything.
8	[regarding communication] One of the most important things I would focus on more than anything.
8	I think it's essential that the local community (or whichever has the CBO) along with an in-country program office of EWB-USA (if there is one) are as meticulous about providing the information as they can be.
8	When I was in [university], so the students who were working wanted, among other reasons, a place where they could learn the skills, be able to apply those engineering and engineering trading(training?) skills, learn from project engineers or seasoned experienced professionals and be able to serve community.
8	The technical aspect of a project is certainly important -- but at no point is the humaneness or the soft aspect any less important.
8	Based on your new experience as an early-career professional, and being able to apply your knowledge -- because a lot of people, even in the professional chapter, are the early-career professionals, and most of them are also seasoned professionals.
8	Great community involvement, the community take[sic] a lot of ownership.
9	a lot of times, yeah, it's maybe one person filling out the application. And, you know, maybe not even a key person in the community.
9	Relationships and everything around it can make or break a project", which lines up with the literature.
9	International development, supporting communities. And kind of that experience of kind of working internationally. Well also doing something to help the community.

9	The pastor started kind of going around to the rest of the communities and doing applications. He was kind of the key person.
9	I'm wondering if maybe some sort of visit should happen before the official like, I think I feel like we normally like put everything in place separate, and then people meet in person. So maybe like kind of having a team go and meet the community and kind of figure out things on the ground before going into an official agreement.
9	We were actually communicating everything and being clear, and including, which I don't know, I think our product, our team had an advantage in that we had a lot more non engineers than EWB projects normally have. So one of our leadership was like an international policy person, and she was the one that really pushed making sure we emphasized working with the community and didn't just go and like focus on the engineering.
9	Engineers Without Borders needs to rebrand because I think the projects need more non engineers and I think non engineers don't think about joining all the time because of the name of the organization.
9	I remember once I started going, there was kind of some drama around like, where the first system was built. And you know, the other communities were feeling, you know, neglected, and "Why aren't we getting a water system?" It was mainly picked because they found a source. And then, you know, it made the most sense construction-wise. So it was picked more out of, you know, what was the most actual feasibly construction-wise, maybe not politics? I don't know if there really is a better way, but maybe, I think maybe at the beginning, we promised to do something for every community. And that it seems like we were going back on that because it was harder than we thought. So maybe kind of being clear about that communication at the beginning. And more realistic about what we were capable of doing also.
9	I don't know how to like nicely say it, but avoid like the white people coming in and saying, "This is what you need."
9	The water collection system was built, and a storage tank was built. So our last step, which we haven't been able to do was just to build taps. However, when we left water was flowing out of the system. So feasibly people could collect water. I guess there was unrest, so we weren't able to complete it, [but] we did, at least at some point get water running. But obviously, we didn't get to the point where, you know, we installed piping and taps in.
9	For a while we were trying to just act through partners, but honestly, some of our partners are refugees in Nigeria now. Or, you know, it just became unsafe to travel or do any type of work there, even with our local partners.
10	one of the EWB volunteers from those teams helped them write an application
10	I think the goal was to come in and, especially with what we learned before, establish a really solid community relationship.
10	We were also hoping, it was kind of a pipe dream, but we were sort of hoping to get some university students involved… if we have people who have friends who are going to university nearby, we might be able to more easily make connections with like local engineers and things like that.

10	It actually became this really tense situation where the professional chapter was trying to control what we did and what our projects were, but the data we took indicated that we should be making certain decisions over others.
10	A chapter leader from another project called the village chairman to say not to listen to us, and that we didn't know what we were doing.
10	A unified EWB kind of front of all chapters, working through the same people and all chapters making decisions based on the same information.
10	That was like very clear from the get-go of like what EWB did and didn't do, what we could do and what we couldn't do, and that we were a bunch of students fundraising, our own money, and that we're going to do our best, but we weren't made of money, and that we didn't have the option of doing side projects, just cause. And I think that really worked.
10	Having friends in the chapter... I could list like 10 chapters that also have that same sort of vibe.
10	We did have a couple of team members who weren't but you know, on the surface, it was like great things are awesome. Like the wives are super involved. And I was Like, Oh, wait, but only the women are cooking for us. And they collect water and they do children and also all of these things that were raised in the meeting.
10	even though there was a village Chairwoman for this water committee, we still had to be aware, basically, we couldn't be off our guard, because we thought now there's a good gender dynamic, like, we don't have to worry about that. Um, it might inform our future projects, too, though, because it might lead to a health clinic project once the water is done the water project.
10	It was way too long of a process. I think they spent two months deciding. And while it was thorough, it was the most impractical thing in the world. So that was where a faculty advisor stepped in and was like, "Guys, I respect your processes. But like, really, can we make this faster?" When finally it ended up working out, I think the community was a really good match. And they knew about EWB, which was a big one.
10	And it actually turned out to be the best assessment trip I had ever heard of in terms of projects, because we were so careful about picking a project that was the right fit for us.
10	It just turned out to be a company with like, with a, you know, just like a scholarship program, but because on the application, it said they were the NGO contact. We lost a couple days to that, but it wasn't like fatal it was just confusing.
10	I remember we came to our first meeting, and we had, you know, an agenda. But they did too, they had an agenda. And we went with their agenda.
10	Oh, they have 50% men and women, they've got, you know, like women in leadership roles. But like there were a lot of specific gender-based problems in the community with division of labor, a division of tasks, sharing money, if one person is the sort of breadwinner and one person is taking care of children. There were there was like a very frank multiple hour-long conversation about birth control, and men withholding their wives from using birth control, even though it was available for free in the village. It was like, way beyond I

	remember our agenda was like half a page. And I have like 40 pages of notes because it was just it was crazy.
10	I think normalizing, there is actually sort of a hidden step in there, it's a Go or No-Go decision that comes after the assessment, sometimes chapters make go-no-go decisions after an implementation trip, but there's sort of this implied trip after the assessment trip that's like "Go, no-go on establishing an implementation partnership", like a "we're gonna build something partnership", and I wish that were normalized as a bigger step, not only for chapters but for communities. The other challenge is that as soon as you show up, you're sort of implicitly making a promise. Just like how you should never say "we're gonna do this" on a trip unless you're 100% sure you're gonna do that, but yeah, I totally agree. If we could monetarily have staff members do assessments, that would be rad, but the money just isn't there... Go no-go's I see way more with professional chapters.
10	Just in my experience, I think the community partnerships that our chapter has struggled with are the ones that have experienced humanitarian aid, and sort of like relief aid, but had not expressed experience the development aid, just because I think I found like, everybody's mission is fairly narrow. It's like engineering infrastructure. That's what we do. There's like no donations, there's no monetary stuff. We can't buy like computers for computer labs and stuff. And so the community partnerships that seemed to work best for chapters do tend to be the ones where their community is not hurt if they can't donate money, or the community understands that, like, we do water, or we do a bridge, or we do a building. Yeah, I've heard some really rough stories about communities that were really angry or really frustrated because the EWB team couldn't match their need for aid because they didn't get that it wasn't. It wasn't aid. It was like long term development aid.
10	There are nonprofits that don't have volunteers and just implement like, I think it's [redacted] that does that. Or there's people that are like fully on the volunteer adventure side, like I think [redacted] basically just like plops Professional Engineers. And they're like, here's the plan, good luck, go get them.
10	If you found a project on the idea of like, we're here to help these poor people. I think that's super morally questionable. If it's sort of someone searching for an opportunity to be a savior.
10	I think normalizing, there is actually sort of a hidden step in there, it's a Go or No-Go decision that comes after the assessment.
10	There are some big differences between chapters that are very closely aligned with the mission versus chapters that are, either they've been involved with EWB since before the mission got refined, or they just want to do development aid or charity work. And I think a lot of the projects that want to do charity work, struggle a little bit.