Innovation Clubs: Mobilizing Local Creativity for Sustainable Development and Pedagogy

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Abstract

Two months after the 2010 Haiti earthquake devastated Port-au-Prince, a reconnaissance team of structural engineering researchers from the University of Notre Dame travelled to Léogâne to assess the damage. As their research revealed the underlying problems plaguing the residential construction industry in Léogâne, they realized that recommending externally-devised engineering solutions alone would not bring about significant change. In order to discover more holistic and implementable solutions, they turned to the affected community. By hosting open innovation challenges throughout Léogâne, the research team identified local innovators who demonstrated leadership, problem-solving skills, and creativity. These local innovators, forty-two men and women of various professions representing each of the six zones of Léogâne, were then trained and certified in the *Pwosesis pou Innovasyon* (Innovation Process) - a Creole-adapted form of Human-Centered Design. These individuals subsequently engaged their neighbors to form six Innovation Clubs. For seven years, undergraduate and graduate engineering students have worked with these Innovation Clubs to facilitate sustainable development research initiatives. This paper describes the framework used to establish these Innovation Clubs, case studies of cooperative projects, the observed benefits of this collaboration, and recommendations for future implementation.

1 Introduction

Just over ten years ago, a magnitude 7.0 earthquake devastated Port-au-Prince, Haiti, killing 230,000 people and leaving another 1.2 million homeless (Margesson & Taft-Morales, 2010). In Léogâne, a city of 90,000 people near the earthquake's epicenter, 93% of buildings collapsed or were damaged (Eberhard *et al.*, 2010). Two months after the earthquake, a reconnaissance team of structural engineering researchers from the University of Notre Dame travelled to Léogâne to assess the damage (Mix *et al.*, 2011). Upon returning, they established the organization Engineering to Empower (E2E) with the goal of developing new approaches to the Haitian housing crisis. Embracing methods of participatory design, the researchers sought to identify community members to engage in their design process. By hosting open innovation challenges

in each of Léogâne's six zones, the research team identified local innovators who demonstrated leadership, problem-solving skills, and creativity in one of three activities. These local innovators, forty-two men and women of various professions representing each of the six zones, were then trained and certified in the *Pwosesis pou Innovasyon* (Innovation Process) - a Creole-adapted form of Human-Centered Design. These individuals subsequently engaged their neighbors to form six Innovation Clubs, each tied to a zone of the community.

Participatory design can be summarized as stakeholder participation and citizen involvement in the conceptualization and design of engineering projects (Sheller *et al.,* 2013). By involving the end users throughout the design process, one increases the chances that such efforts are aligned with local needs and capacities (Daniell *et al.,* 2010). Although the importance of stakeholder participation in such work is widely recognized (Barreteau *et al.,* 2010; Daniell *et al.,* 2010), available methods of achieving such participation, particularly within the pressures of post-disaster contexts, are limited (Sheller *et al.,* 2013). In this paper, we offer a structured methodology for operationalizing participatory design principles in engineering projects in low-income countries.

Since their formation, these Innovation Clubs ("the Clubs") have worked alongside engineering faculty and students on a variety of sustainable development-related research initiatives. Such engagement in interdisciplinary, project-based roles is critical to preparing engineering students for sustainable development (Lehmann *et al.,* 2008). While some of this work has been previously published or presented academically (Kijewski-Correa *et al.,* 2012; Presuma & Jean, 2014), this paper will focus on recent projects where engineering students were the primary US-based driver of these collaborations. Subsequent sections of the paper overview the selection and training process used to form the Clubs, followed by case study projects led by cross-national teams of US students and Haitian club members. The paper closes with a reflection on the observed benefits for the involved stakeholders, as well as recommendations based on lessons learned throughout the process.

2 Member Selection and Training

To find innovators in the community, the researchers hosted open innovation challenges in each of Léogâne's six zones. Residents of the zones were invited to respond to an open-ended challenge that was publically scored to demonstrate their leadership, problem-solving skills, and creativity in one of three activities described below.

- **Creative Construction:** Participants were asked to design and construct a bench that could support two adults. Each participant was given a specific set of materials (see Figure 1) and a half-day to build their bench. The finished products were judged by community members based on function, cost, and aesthetics.
- **Persuasive Speech:** Participants were asked to give a three-minute persuasive speech showcasing their vision to reduce the amount of garbage in Léogâne's streets and waterways. Speeches were judged by a panel of three local judges based on persuasiveness, feasibility, and popularity.
- **Efficient Production:** Participants received a toy car kit and were asked to develop a production strategy for quickly assembling the car while assuring its quality. They then recruited and trained a production team of three individuals according to this strategy. These production teams were then tasked with building five kits as fast as possible. Participants were scored based on the efficiency of their strategy as well as the quality and consistency of the cars.

These screening challenges were designed to find community members with specific skills that would best align with the needs of the researchers' team at that time, respectively identifying individuals who could fabricate innovative building envelope systems, effectively inspire collective action, and develop quality control processes to regulate construction. The scores of all participants were displayed publically, with those earning the highest scores in each zone invited to receive training in the *Pwosesis pou Innovasyon* (Innovation Process). Those that were not selected were later encouraged to get involved with the Clubs.

Figure 1: The materials available (left) for the bench challenge and the winning design (right).

The *Pwosesis pou Innovasyon* was a Creole-adaptation of the Human-Centered Design (HCD) process outlined in IDEO's Human-Centered Design Toolkit and Field Guide (IDEO, 2009; IDEO, 2015). Using a highly visual workbook and template sheets to organize the outcomes of various stages of the process, the trainees were introduced to techniques to elicit information from end users, sort learnings to generate insights, brainstorm potential solutions, construct "How Might We…?" questions, and rapidly prototype solutions using physical models, role playing and storyboards. The five-day experiential training encouraged the local innovators to form teams that would examine one of three questions: 1) How might we use a savings program to prepare aspiring homeowners for a mortgage? 2) How might we encourage high quality construction practices in the residential sector? and 3) How might we create culturally appropriate finishes for post-quake housing? On the final day, each team presented its prototype to the workshop attendees and received a certificate of completion. Ultimately, forty-two men and women in various professions across the different zones of Léogâne were trained in the *Pwosesis pou Innovasyon*.

Following this training, the forty-two participants returned to their zones and began sharing the outcomes of this experience. Participants reported the continued use of the skillsets developed in the workshop and eventual training of other zone-members in the *Pwosesis pou Innovasyon*. With growing interest and application of this process to address locally-sourced challenges, the researchers worked with the growing cohort of local innovators (100+ people) to form approximately a dozen teams that were eventually consolidated into six Innovation Clubs (see Table 1), each tied to a zone within the community.

Table 1: Demographics of Léogâne-based Innovation Clubs, as of February 2020.

Zone of Léogâne	Number of Women	Number of Men	Mean Age	Age Range
Dufort	11	8	23.6	14-39
Belval	6	12	30.2	22-43
Bino/Bwalam/Ça Ira	22	4	31.8	17-54
Chatuley/Nan Jaden	7	7	30.1	24-39
Corrail/Barriere Rouge	9	7	32.0	16-59
Rue Poudriere	1	10	32.2	19-55

3 Student-Club Collaborations

For seven years, undergraduate and graduate engineering students have worked with these Innovation Clubs to facilitate sustainable development research initiatives in Léogâne, expanding beyond housing to explore community-sourced issues such as financial literacy, sanitation, and drinking water access. The Innovation Clubs significantly bolster the capacity for data gathering in Léogâne throughout the school year, particularly when students cannot travel to Haiti, while ensuring that a wide range of local perspectives are considered. This section provides two case studies of the fieldwork leveraging student-club collaborations.

3.1 Field Work: A Case Study in Financial Literacy

Weak financial institutions, inflation, and frail legal systems have inhibited the maturation of mortgage markets in developing nations (Sanders, 2005). Thus, families must build homes incrementally, buying materials and building as their income allows. The family remains exposed both throughout this decade-plus process and after, as the high variability in materials and workmanship render an incrementally-constructed home highly vulnerable to natural hazards (Mix *et al.,* 2011). For the past five years, students have been involved in an ongoing process to research alternative housing finance solutions to unlock safe construction for those in the middle and lower socioeconomic classes in Léogâne.

In January 2017, two undergraduate students traveled to Haiti for an in-person collaboration on this topic. Each day, a different group of six Innovation Club members came to the Club's office in downtown Léogâne to participate in participatory activities designed to invoke insightful conversation and creative problem-solving. For example, in the Expense Prioritization Activity, participants ranking of 10 common expenditures by importance was used to drive discussion of financial priorities (see Figure 2). In another activity, small teams used live skits to demonstrate how to discourage friends from depleting their savings accounts.

Other activities were more focused on basic accounting skills, such as the Sample Income and Expense Tracking Activity, which provided a fictional narrative that participants then distilled into a record of income and expenses to establish basic concepts in financial literacy. This then enabled participants to complete a Personal Financial Assessment inventorying personal income, expenses, savings, receivables, and debts. As the first full glimpse into their own financial situation, participants requested that these worksheets be modified to form the basis of a finance tracking workbook to help displaced families increase their rate of savings toward a new home.

Figure 2: An undergraduate student and staffer lead the Expense Prioritization Activity.

This week-long engagement and the subsequent remote collaboration that followed has formed the basis for ongoing collaboration between the students and Clubs on alternative housing finance programs in Léogâne. Importantly, the personal networks of the Clubs enable access to different market segments of the community, ensuring that unique perspectives are included in the program design, e.g., isolating the needs of those without land tenure and exploring the potential to connect them to community members interested in developing their larger plots of land into individual parcels.

3.2 Field Work: A Case Study in Drinking Water Access

In 2018, another group of undergraduate students partnered with the Clubs to examine how to expand access to safe drinking water in Léogâne. In addition to facilitating focus groups and brainstorming sessions in the Léogâne office, the Clubs further mobilized a systematic data collection campaign to identify the point in the drinking water supply chain where contamination is likely to occur. The student team discretized the drinking water supply chain into five phases: Source, Transportation, Treatment, Storage, and Use. To facilitate observational research across households in the community, the student researchers designed and encoded a data collection survey in Fulcrum, a mobile surveying application that also collects geocoded photos and videos. Twelve club members used this custom app to each document two community members' interactions with the drinking water supply chain and explore various pain points in the process. The detailed accounts, photos, and videos acquired provided valuable insights into daily life in Léogâne and helped the student team deepen their empathy with the targeted end users. It is important to note that the design of the survey and collection of visual media eliminated the need for translation and allowed student researchers to directly access technical information that is difficult to specify in conversation, such as the type of containers or the process for treating water. Unsurprisingly, this media-based approach further revealed unexpected insights and details the students had not considered, such as the particularities of a cooking setup or the type of covering (or lack thereof) on a well.

Despite the value of the methodology and technology, the success of this activity was made possible by the level of access afforded by the use of the Clubs. As citizens of Léogâne, known and trusted by many in their community, they are able to gather higher-quality data and more candid insights than foreign

researchers. These relationships allow them to negotiate access to private areas such as kitchens (see Figure 3) to observe intimate activities such as food preparation that can reveal the opportunities to reduce contamination.

Figure 3: Imagery collected by Innovation Club members: creative transport of drinking water (left) and use of collected water in food preparation tasks (right).

3.3 Remote Collaboration

Once projects and relationships are established between students and the Innovation Clubs through field work, this work can continue remotely throughout the academic year at times when travel would otherwise be infeasible. This is particularly critical when working in countries like Haiti, where travel restrictions frequently prohibit university-sponsored trips. Students remotely design work packets leveraging focus groups, mobile surveys and other participatory activities, which local staff translate and facilitate, engaging various techniques to capture and transmit the generated data. One example is a housing finance activity in which Innovation Club members were provided with a general framework for a community housing fund and were asked to meet over a series of weeks to detail the framework's implementation within the local context. Another example is the Club-appointed "Water Committee," which assists researchers with brainstorming, concept validation, and market analysis of new interventions to improve access to clean drinking water. While these remote collaborations often move at a slower pace than in-person field work and require care in the design and documentation to ensure clear communication, these modalities facilitate continual engagement of the Innovation Clubs by US-based teams who are required to be on campus throughout the academic year.

4 Observed Benefits

Beyond the data and unique insights generated, collaborating with local Innovation Clubs continuously challenges students and most notably helps develop improved communication and problem definition skills. In order to effectively communicate their ideas across language and cultural barriers, students must distill

their ideas concisely without technical jargon. These constraints often challenge students' creativity and visual communication skills, but are invaluable in preparing students for work in low-income countries or with other non-English speaking or low-literacy populations.

Additionally, these engagements are often among the students' first experiences in open-ended problem solving. While the ambiguity can be unsettling, it forces students to ask the right questions, consider the context, and formulate their own strategy to address the problem at hand. While Club members identify broad areas for potential innovation (e.g., "Dirty water makes people sick") and bring a wealth of local knowledge about such topics, students are central in directing the process toward a viable outcome. This promotes creativity and proactivity as students design and execute their own lines of inquiry.

In addition to benefiting the students and the project outcomes, this collaboration has tangible benefits on the club members themselves. Community members are not only key interlocutors and data collectors, but co-designers of potential solutions to a problem they have collectively identified. The Clubs create a platform and venue for engagement around community issues, while building essential skillsets in collaborative problem solving, teamwork, and Human-Centered Design. Club members note that the product management and research techniques introduced in these collaborations model new modes of work that in turn benefit them in other dimensions of their personal and professional lives. Ultimately, this facilitates the localization of development projects by not only valuing local perspectives and preferences, but also inviting co-design at every step of the process.

5 Conclusion and Recommendations

Overall, the formation of Innovation Clubs in Léogâne has contributed to training student researchers, conceiving innovative research projects, and encouraging co-design with local populations. This paper outlined the Club formation process, case studies of collaborative projects, and observed benefits. These in turn inspire the following recommendations for future implementations of this process:

Logistics: Language skills are often the limiting factor in the research process, especially when working in the field. Thus, encouraging language learning among students, hiring multiple translators, and designing activities to minimize reliance on open-ended verbal communication will improve implementation. Likewise, travel restrictions can disrupt progress, thus establishing the necessary local infrastructure (including personnel, workspaces, technology, etc.) is critical to maintaining the ability to work remotely year-round.

Continuous Involvement: One of the Clubs' obvious strengths is their ability to quickly gather large amounts of data with less bias than external actors. However, it is paramount to not limit Club participation to surveying, data collection and brokering access to subjects. To maximize the potential for impact, the Clubs should be involved in all steps of the research and design process. This will minimize wasting time and resources on well-intentioned, externally-conceived solutions that are not locally feasible.

Support Structure: The proposed methodology requires significant resources and is not recommended for a one-off project. Rather, the creation of such collaboration networks should be part of a well-defined, university-supported initiative. This ensures that the Clubs, local staff, faculty, and students have the resources needed to promote effective partnership on sustainable development projects. Such an establishment would also ensure proper continuity of student researchers engaging multi-year projects.

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