Contesting Design: Ancestral Technology as Portal to Post-Design(s)

by

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Submitted to the Program in Media Arts and Sciences, School of Architecture and Planning, in partial fulfillment of the requirements for the degree of

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Contesting Design: Ancestral Technology as Portal to Post-Design(s)

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Abstract
Nowadays, designers and technologists are constantly exposed to increasingly technocentric views of the future, primarily fueled by dominant ideologies—scalability, universal applicability, and profit, among others. Many of these future makers are preparing in the present, often at institutions reproducing these ideologies. However, this established understanding of what technology is and what is worthy of design is currently being challenged. Literature and practice connecting with ways of knowing and doing outside this dominant lens are rising in both technology and design studies. Alternative design programs at higher education institutions, preparing students for a world where technology is de-centered, and grassroots initiatives building futures through Indigenous technology are some of the ways in which these techno-narratives can be contested. This dissertation joins these efforts by foregrounding —and moving into practice— alternative ways to teach design and think about technology.

I start by exploring the value distribution from participatory design initiatives across participants and introduce a model for longitudinal assessment of these programs. Using the findings and insights from this study, I propose and implement two largely immersive university courses on technology design in close collaboration with rural collectives in Colombia. In contributing to methodological shifts within participatory design, I foreground connections at its intersection of Indigenous research methods. In giving a language to these proposals, I advance the notion of 'Ancestral Technology' as an alternate framework to approach technology design. It is a form of world-making (design) that primarily supports cultural cohesion, is rooted in bounded geography, and has a history living through collective memory. As designers and technologists interested in helping build a future outside the techno-centric imaginary, we must connect to the ancestral.

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Acknowledgments

Dedicated to Amandita

I have been fortunate to have experienced a Ph.D. journey filled with community, love, and discovery. There were, of course, difficult times along the way. [1] On both sides of that coin, I was blessed with a network of friends, family, collaborators, scholars, and institutions that helped me pull through. If at the time you are reading this, you are not experiencing your doctoral track this way, reach out to me or anyone around you. While rough and demanding, the memories of your time as a Ph.D student should primarily be of gratitude and joy. There are likely people out there who can help you make the most out of this chapter of your life, the way I was helped throughout all these years.

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None of this would have been possible without the Diversa team. This community played a role in virtually every chapter of this dissertation. I am grateful to everyone gravitating around Diversa who helped assemble the International Development Design Summits (IDDS) we did in Colombia. I thank Daniela Delgado for her partnership in writing about the results of these summits. I owe a lot to Alejandra Villamil, Alexander Freese, Ángela Camargo, Aura Fernanda Flechas, Liliana Murcia, and Silvia Buitrago for their leadership and support in putting together the "Technologies for Coffee Production". We are indebted to the communities at DeFinca and APRENAT for constantly challenging and supporting us in making it all possible. In 2022, we grew bigger for the "Technologies for Rural Sustainability" course. I thank Diana Duarte, Alex Freese, Nicolás Gaitán, Aura Mora, Diana Gamba, Natalia Barrera, Joako Puentes, and Orlando Díaz for their tireless work as design facilitators and field leaders at different community sites. Naturally, this was only possible thanks to our partnering communities, RuralCoop S.A.S, El Carmen rural school, De Finca, Corporación Red Mujer, the Zaragoza artisanal gold miners group, Asoreciubaté, and the Sembradoras de Vida collective.

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1: I am grateful to Luzángela Brito for her cover art for this dissertation. Her piece brings together the places, people, and cultures I had the privilege to encounter during the making of this dissertation. You can see more of Luzángela's art on her Instagram

2: I also want to thank Pablo Jojoa and Victoria Durán in La Cocha, for their art covering each of the chapters of my dissertation. you can learn more about his work in this video

and take off research projects shortly after joining their team. I am also thankful to Amy Smith for mentoring me while I began my involvement with the International Development Design Summits (IDDS). These two moments were seminal for what I did during my Ph.D. years.

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My family has been angular for any achievement that might have come from my Ph.D. years. Thanks to everyone in Cambridge, Allston, Bogotá, Cali, Greenwood, Nashville, and beyond. Special thanks to my children Gigi and Simón for sharing their worlds filled with creativity and imagination with me. The unfolding of their life has given great purpose to mine. I have been immensely supported by my putative siblings, Andrés Salazar and Samantha Gutiérrez-Arango, whom I encountered along the way and have become an essential part of my life. None of this would have been possible without my wife Julia, the engine and meaning of my existence and the real heroine behind everything and anything I do.

Above all, thanks to Mother Nature, *Pachamama*, for making this story possible.

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The 'mochilero' or 'toche'(Icterus Chrysater). Belongs to the great family of orioles. Their elongated nests call our attention, not only for their complex fabrication in palm fiber, hanging from tall heights, but also for being sociable birds that weave their nests in community

Pablo Jojoa

Contesting Design The World of Ancestral Technology

1

"There is no human being in the world who is not born into a happening life—who is not born with the will to endlessly design." [112]
— bell hooks, Design: A Happening Life. 1998

Being human is being a designer. In his 2015 book "Design, When Everybody Designs," Italian scholar Ezio Manzini concedes that much: *"Let's start with the following statement: every human talent may evolve into a skill and sometimes into a discipline (meaning a culture, tools, and professional practice): everybody can run, but not everybody takes part in the marathon and few become professional athletes; everybody can tap out the beat with a tambourine, but not everybody plays in a group and few make a living playing it professionally. Similarly everybody is endowed with the ability to design, but not everybody is a competent designer and few become professional designers."* [155]. This statement begs the question: Who gets to claim themselves as competent designers in a world where everybody designs? To solve this, Manzini proposes the categories of diffuse and expert to denote the types of design done by people with no formal training in their everyday lives and the Design done by people who receive professional training as designers, respectively. While this separation can help study these different modes and their relationships, it ignores that only until recently, the vast majority of the focus has been on the "expert" side of the spectrum, almost rendering its "diffuse" counterpart invisible. This privileging dynamic is also present in the field of technology studies, where accounts of technological development have favored the 'modern' and novel over the 'old' and ancestral. In his 1996 book "Changes in the Technological Landscape," Swedish historian Svante Lindqvist raised this criticism within the field of history of technology. He went on to argue that in having ignored the coexistence of various technological paradigms (e.g., the 'modern' and the 'old'): *"[...]historians of technology have so far only written half or even less of the history of technology"* [150].

[112]: hooks bell (1998), *Design: A Happening Life*

[155]: Manzini (2015), *Design, When Everybody Designs: An Introduction to Design for Social Innovation*

[150]: Lindqvist (2011), *Changes in the technological landscape: essays in the history of science and technology*

This dissertation is about reclaiming the ancestral within both design and technology studies.

I offer three main pathways to get us there. First, I will build on some of the changes taking place within design education, particularly those focused on community-based collaborations. This can take the form of novel assessments of these partnerships (Chapter 2) or further expansions of current design education offerings, with an eye on increasing accountability and involvement from collaborators (Chapter 5). Second, by expanding current notions of technology with the purpose of helping designers and technologists recognize different forms of technological making, especially those "from below" (Chapter 3). Lastly, by turning to Indigenous research methods (Chapter 4), and considering what tools we can build to support these methodological changes (Chapter 6) to broaden the methodological landscape designers and technologists can draw upon.

In what follows, I (1) introduce three areas of motivation for this work —all of which I touch upon across the dissertation; (2) outline the dissertation; (3) establish my positionality as a researcher; and (4) state the contributions I make. These goals provide context and framework for the rest of the dissertation.

1.1 Towards the Ancestral in Technology: Extending the Notion

For many people who, like me, had the chance to grow connected to rural life, witnessing technological inventiveness was part of their daily activities.

Many farms in the region where my family grew up and where I spent a good chunk of my childhood have spaces filled with contraptions, artifacts, materials, and tools used to make do within places far from urban centers. During my time doing fieldwork in Colombia, I had the chance to meet Don Floro and his son Fabio, two self-made Colombian technologists. Together, they design and build technology for thousands of farming families in the central Andean region of Colombia. They are among those who have made their life about the specific knowledge of place and have mastered the machines and materials to act technologically upon that knowledge. People like them are common in rural places across Colombia.

During my time in college, I worked building tools to document and characterize the sounds of Indigenous, endangered languages in Colombia for research and educational purposes. While there, I encountered a different type of attitude towards technology. Experts worked in their labs, designing and building what they thought were the right tools to be used by people like my family to make do in places far from urban centers. Right out of college, and before I came to MIT, I worked for several years for the One Laptop per Child Foundation,[1] or OLPC, which coincidentally came out of the Media Lab. The project had designed a low-cost computer, and when I came across the organization, it was working on bringing it to every child in what was referred to as "developing countries." During this time, I was exposed to a version on-steroids of the attitude towards technology I had experienced in college. Not only were we in the business of telling people what "modern" and "good" technology was and how they needed it to "make progress," but we were also now in the business of influencing how they were taught and what they should learn. Only when I came to join the MIT D-Lab[2] at the Massachusetts Institute of Technology (MIT)[3] did I realize that throughout college, OLPC, and in many places at MIT but outside D-Lab, the inventiveness I had been exposed to during my childhood did not really count. Don Floro and Fabio were not part of the idea of what a creator of technology is. Paradoxically, people like them and my family, living in remote places, were a motif for learning and meaning under the narrative of innovation. I lost count of how many courses I have seen asking people to design and build technology for the next billion people, the "last mile." These environments were framed as highly educational: under-resourced and remote; they made for challenging places to work

1: One Laptop per Child https://laptop.org/

2: D-Lab is a program at the Massachusetts Institute of Technology that "works with people around the world to develop and advance collaborative approaches and practical solutions to global poverty challenges." You can learn more about it at their website

3: Massachusetts Institute of Technology. https://mit.edu/

for. And, of course, they made for an excellent business case with billions of people living in geographies like this. However, any technological knowledge present in these places was often seen as a craft or mere hacks.

From a technological point of view, there needs to be more acknowledgment or engagement with the place-based knowledge present within these geographies. ***Therefore, we must closely consider the ancestral in technology.***

At first sight, the notion of technology seems well-established. Especially in places like MIT, what technology entails seems so ingrained that it will go about uncontested regardless of how the notion is deployed. Despite this unspoken and apparent collective agreement, in 2024, the universe of things we consider technology continues to expand.

Except for the pandemic-induced lockdown, my entire time at MIT has oscillated yearly between being on campus and going through months-long fieldwork in Colombia. Especially towards the beginning of my time in the field, it was common for me to meet people and collectives in rural areas who had built inventive artifacts to go about their work or daily lives, people like Don Floro and Fabio. They did not see themselves as technologists, makers, or designers. To many, devising solutions by modifying or building new artifacts is part of daily life. While often discounted under mainstream conceptions of technology, these were all, undeniably, technologies. In the context of scarce resources, limited purchasing power, constrained access to technical education, and little to nonexistent manufacturing infrastructure, among other challenges, these technologies looked more complex and sophisticated than many MIT projects I have seen.

During fieldwork, I began having conversations with various collaborators who were themselves creating technology about what they consider technology to be. Unsurprisingly, computing devices, large transportation machines, medical devices, and last year's sweetheart, ChatGPT,[4] were at the top of the list. More intriguingly, some answers pointed to fancy versions of devices that accomplished the same functions as artifacts they owned and had built (e.g., small mills or biofencing). In their view, theirs were simple 'cacharros,' improvised or modified devices built out of empirical experience. The flashy versions were tecnología moderna (modern technology). As "modern" technologies become more complex, these systems look magical for many. The notion of the 'modern' in this context is problematic as it denotes an inevitable dominance over a narrative of value surrounding technology, a narrative that continues to fan racial, gender, class, and environmental challenges [19]. While not 'modern' under their perspective, these frugal versions of technology seem better suited for the environments in which they were built: affordable, made with local materials and techniques, more accessible to maintain, often collectively owned and accessed, and commonly connected to the local culture. The inherent characteristics of these simple 'cacharros' might hold clues as to how we face the material, energy, and climate health scarcities we as humanity currently face. As the race towards magical tech continues, there are questions about how these two ways of conceiving technology can co-exist, perhaps co-evolve.

Notwithstanding an increasing recognition of the multiplicity of ways in which design and technology can take place [77, 249], "modern"

4: ChatGPT https://chat.openai.com/

[19]: Benjamin (2019), *Race after technology: abolitionist tools for the new Jim code*

[77]: Escobar (2016), *Autonomía y diseño: la realización de lo comunal*
[249]: Velasco-Herrejón et al. (2022), *Challenging dominant sustainability worldviews on the energy transition: Lessons from Indigenous communities in Mexico and a plea for pluriversal technologies*

technologies continue to be pushed globally carrying with them a host of idiosyncrasies and ideologies often gone unquestioned [8, 53, 255, 257]. With limited participation in the making of the "modern" and the "magical," these rural technologists will continue to be excluded from these dominant narratives about technology.

[8]: M. G. Ames (2019), *The charisma machine: the life, death, and legacy of One Laptop Per Child*
[53]: Costanza-Chock (2020), *Design justice: community-led practices to build the worlds we need*
[255]: Walz and Deterding (2014), *The gameful world: approaches, issues, applications*
[257]: Warschauer and M. Ames (2010), *Can One Laptop Per Child Save the World's Poor?*

To rectify this, I propose extending current notions of technology and the methodologies we use to encounter technology. Building on an understanding of technology as a means to an end, as constructed through their constant interaction with culture and society, and as an expression of different forms of approaching the world, I put forward the concept of *Ancestral Technology*. I define it as *a form of world-making (design) that primarily supports cultural cohesion, ancestral technology is rooted in bounded geography and has a history that lives through collective memory.* This notion offers us a pathway into local, culturally informed, and collective forms of technology that we might have overlooked. I further discuss and illustrate this proposal in Chapter 3. In building from the technological knowledge and expertise from rural geographies in Colombia, I hope to contribute to the body of work connecting these two 'techno-worlds.' To bridge the 'ancestral' to the 'modern.'

1.2 Expanding Recent Shifts Within Design Education

Shortly after joining the MIT D-Lab, and taking one of their class courses, I quickly understood that they were breaking with this view of "modern tech" by displaying artifacts in their hallways similar to the ones I had seen growing up and teaching students about them. Significantly, they were also disrupting established practices of knowledge production by giving students the chance to co-design with communities in historically marginalized geographies, or what we call these days the Global South. Since then, this community-oriented aspect of design has expanded to influence many fields and disciplines, from management to engineering, in and out of academia [127]. Design became entangled with narratives of development first, with fields like Information, Communications, and Technology for Development (ICT4D) or Human-Computer Interaction for Development (HCI4D) taking off, to mention a couple [141]. Later, it came closer to narratives of innovation and social innovation via design firms, later rebranded as innovation firms, many of whom gained legitimacy through partnerships with prestigious academic institutions [127]. These changes made designing in the Global South less foreign for many of these fields and institutions. In a blasting essay, author Courtney Martin called this tendency "The Reductive Seduction Of Other People's Problems," where she articulates this attraction towards problems far from home as a quest for individual meaning animated by well-intentioned NGOs, universities, and government agencies, but that often ends in failed infrastructure, and naive solutions to complex problems [157]. Within academia specifically, and in the context of HCI and design studies, Professor Lilly Irani, now at the University of California, San Diego, USCD, revealed some potential issues with engagements in the Global South when they take place without attention to ethics. Reproduction of globalization ideologies colliding with highly

[127]: Johansson-Sköldberg et al. (2013), *Design Thinking: Past, Present and Possible Futures*

[141]: Kuutti (2009), *HCI And Design – Uncomfortable Bedfellows?*

[157]: C. Martin (2019), *The Reductive Seduction Of Other People's Problems*

localized modes of life, the economics of the individual contrasting with communal forms of exchange, and culturally unaware engagements that led to naive, unsustainable solutions [121].

[121]: Irani et al. (2010), *Postcolonial computing: a lens on design and development*

So, from a design point of view, there was also little to no connection to the particulars of local economics, politics, or social structures. We must move towards shifts within design education.

For most of its history as a formal discipline, the knowledge, methodologies, tools, and access to Design within higher education were reserved for a few elites. The inauguration of the first Design school in the United States near the end of the nineteenth century was an answer to the moment's needs: to prepare professionals for an age of industrialization [173]. From there, Design continued its trajectory within higher education confined mainly to traditional Design domains, both following the influence from the European tradition —broadly influenced by the Bauhaus movement— and the more commercial, corporate influences in Design embodied by key figures such as Henry Dreyfuss and Raymond Loewy among others [141]. During the 1990s, Design began to appear as part of the engineering curriculum, mainly as a response to engineers being unable to adapt to industry design requirements. This shift began taking place across other fields, steering design education into a different moment. Through the first-year design courses that later evolved into cornerstone (design) courses, the notion of engineering design became widespread [73]. This opened a new frontier for Design education, which currently features capstone design courses for engineering students and Design academies at prestigious technology and engineering institutions.

[173]: Muratovski (2020), *The Making of an American Design School: Lessons Learned*

[73]: Dym et al. (2005), *Engineering Design Thinking, Teaching, and Learning*

Around the same time, ideas from the Participatory Design (PD) movement and Computer Supported Collaborative Work (CSCW) began making their way into the field of computing not long after the Human-Computer Interaction (HCI) field was born as a discipline. These interactions created a connective tissue between computing disciplines and design, a conversation that started in the 1980s context of the computing and cognition era [141]. In integrating Design into their curricula, both Design and Engineering turned to a model broadly construed as problem, challenge, project-based courses with instructors developing abstract challenges for students to work through [73]. As these course offerings began to move from abstract to "real-world" problems, the idea of community-based partnerships came into view. While this model provides opportunities to approach various important societal issues intersecting with technology, it also raises questions about the continuation and reproduction of corporate ideas present in the United States design education models from its inception. As of 2024, much of the power wielded over technology is in the hands of private Big Tech companies, most of which are laser-focused on relentless global growth —even at the expense of human and natural harm. Virtually none of them is concerned with the possibilities of any paradigm getting in the way of their worldwide expansion. With this direct line between academia and Big Tech, it is too easy for new generations of designers, engineers, and the like to fall prey to the same dominant narrative. This issue is further exacerbated by the intersectional challenges posed by the lack of diversity in teams designing technologies at these sites. Perhaps more worryingly, this design education model has taken a sharp turn towards designing globally with an increased interest in direct action within

historically marginalized geographies or what is currently referred to as the Global South. This turn in Design education, partly originating from the discourse on development around the 1960s and later continued through narratives of globalization, will be further discussed in Chapter 5. For now, it suffices to say that the results of these trends in Design education have been mixed at best; many of them met with criticisms around the lack of accountability, tokenization, and transactional nature of these models [121, 187]. I identify that the position of privilege within Design has come into question. From workers taking active roles in designing at the workplace to grassroots histories of material culture told from the Design perspective, there is an increasingly strong movement of contestation to this historical, arbitrary privilege [77].

[121]: Irani et al. (2010), *Postcolonial computing: a lens on design and development*
[187]: Papanek (1985), *Design for the real world: human ecology and social change*

[77]: Escobar (2016), *Autonomía y diseño: la realización de lo comunal*

In this dissertation, I propose we meet this moment by expanding the project-based model into a more culturally aware, accountable, and respectful practice using insights from the practice of Participatory Design/Co-Design. I address this opportunity by departing from the experiences of a handful of higher education programs that have already incorporated these insights. By building on frameworks such as equityXdesign and recognizing ancestral forms of social organizing and Indigenous research methods, this dissertation provides examples of how university students and design practitioners alike can approach building technology in a more respectful, culturally appropriate, diverse, and sustainable manner. These opportunities can take us beyond abstracted ethics and demonstrate how design can occur from different values and goals.

1.3 Design Research Methodologies Expanding

In offering a postcolonial critique of design engagements, Professor Irani and collaborators also wrote something that particularly caught my attention: "While HCI research has recognized the cultural specificity of design products, the processes and methods of design have largely been imagined as universal." [121]

Others have preceded or followed similar critiques, primarily pointing out how the packaging of design education and its methods, to be quickly applied in virtually any domain, has led to shallow ways of engaging. For example, instrumentalizing empathy or flattening social and cultural nuance to paint a picture fitting to approachable solutions [2, 218]. Others have focused on tracing how methods in design run at risk of carrying dominant ideas or ignoring colonial histories in the places where they are applied. On the one hand, ideas such as exponential growth, global markets, or nature as a mere resources [17]. Design practice without acknowledgment of the history and politics of land, as an extension of western industrialization, or without recognition of local ancestral knowledge and wisdom, on the other hand [224].

[2]: Ackermann (2023), *Design thinking was supposed to fix the world. Where did it go wrong?*
[218]: Serpa and Batista (2021), *Solidarity as a principle for antisystemic design processes: two cases of alliance with social struggles in Brazil*

[17]: Bardzell (2018), *Utopias of Participation: Feminism, Design, and the Futures*

[224]: Sletto (2012), *Indigenous Rights, Insurgent Cartographies, and the Promise of Participatory Mapping*

From a methodological point of view, we are also disconnected from the specifics of place. ***We must expand the methodological universes within technology and design studies.***

Along with Design becoming mainstream, the methods by which people practice it have also increased in popularity. Traveling with these tools are

the worldviews embedded in them. As a case in point, Serpa and Batista (2021) argue that empathy, as a way to relate and access understanding in Design, "can be associated with the objectification and dehumanization of subjects." In other words, empathy's focus on the individual and its lack of commitment in exchange for ephemeral emotional resonance can be detrimental to those being "empathized with." Instead, and building on Freirean philosophy, they propose a design that relates through solidarity: a relationship where designers acknowledge the power dynamics they are implicated in, position themselves accordingly, and act in support and alliance with the groups they collaborate with [218]. This kind of engagement, however, requires time, commitment, and accountability on the side of designers. These criteria can often be at odds with the arbitrary fast pace of research, the seasonality of projects within higher education environments, and the sometimes misled desire for designers to operate at a global scale.

[218]: Serpa and Batista (2021), *Solidarity as a principle for antisystemic design processes: two cases of alliance with social struggles in Brazil*

Particularly in the past decade, discussions and ideas have touched upon this issue, advancing methodological proposals that recognize these shortcomings and prioritizing the rightful agency of the communities designers engage with. One strand of these discussions builds on decolonial and postcolonial theory to move designers towards different practices. This growing body of literature departs from the formulation that remnants of the colonial project in culture, institutions, and economic models can be reproduced from within Design. Therefore, Design ought to be reoriented to neutralize these legacies [1, 3, 215]. Another strand stems from the work done by Indigenous scholars, mainly in the context of cultural studies and anthropology. The main concern here is with claiming an Indigenous research paradigm that recognizes the agency and right to self-determination of Indigenous Peoples, acknowledges them as the rightful owners of the land —along with subsequent land back movements— and represents the different ways of knowing, being, and doing of each different group. While the connections with Design are less common, in large part due to the narratives behind Design that I discussed earlier, we are seeing an increase in practice and knowledge production at this intersection [16, 21, 142, 197, 221, 240].

[1]: Abdulla (2018), *Design Otherwise: Towards a locally-centric design education curricula in Jordan*
[3]: Albarrán Gonzáles (2020), *Towards a Buen Vivir Centric Design. Decolonising artisanal design with Mayan weavers from the highlands of Chiapas, Mexico*
[215]: Schultz (2019), *Decolonising Design: Mapping Futures*

[16]: Barcham (2023), *Towards a radically inclusive design – indigenous story-telling as codesign methodology*
[21]: N. Bidwell and Winschiers-Theophilus (2015), *At the intersection of indigenous and traditional knowledge and technology design*
[142]: Laiti (2021), *Old Ways of Knowing, New Ways of Playing — The Potential of Collaborative Game Design to Empower Indigenous Sámi*
[197]: Red Wing (2016), *Learning the traditional Lakota visual language through shape play*
[221]: Sheehan (2011), *Indigenous Knowledge and Respectful Design: An Evidence-Based Approach*
[240]: Tunstall and Agi (2023), *Decolonizing Design: A Cultural Justice Guidebook*

With this dissertation, I direct attention to these new ways of thinking about and practicing Design, with a particular focus on connections with the body of work on Indigenous research methods. As inherently relational, these methods naturally overlap with approaches and practices from participatory design. Therefore, it is essential to position this conversation as taking place between these traditions. In facilitating this dialogue, I abandon the differentiation between co-design and participatory design, which is sometimes present in the literature. As a scholar and design practitioner, I have experienced this distinction as virtually nonexistent in practice and not very generative for moving our practice forward. Therefore, in this dissertation, I treat them interchangeably.

I mobilize two ways to gain inspiration from Indigenous research methods. First, I report on a review of the rising literature on the convergence of design and Indigenous research methods. In doing so, I intend to offer new and seasoned designers novel departure points and inspiration for their practice (Chapter 4). Second, I present brief ethnographies around designs and technology based entirely on Indigenous and farmers' worldviews and methods (Chapter 3).

In summary, we have three significant areas of motivation: Recent shifts in design education taking place that expand notions around who designs and how to engage with design in the Global South Dominant notions about what technology is expanding via histories of ancestral technology being centered and a broader recognition that technology can take place outside privileged circles And an acknowledgment that we might be constrained by the methods we use in studies of design and technology

These are the three threads along the dissertation and the space in which my work sits. All of the work you will read about in the following chapters is an effort to build on this momentum and continue to take us in a direction closer to the ancestral within design and technology studies and practice.

1.4 Outline of the Dissertation

I chose the framing of contesting because, since the beginning of my doctoral journey, I have perceived —and continue to do— many uncontested assumptions in Design. So, instead of being a witness, I reply. As you read through, you will find how I contend with many established ideas and explore ways we can transform our practice as designers, practitioners, and scholars. This exercise consists of six chapters. *Chapter 1*(where you currently are) introduces vital themes running throughout the dissertation and conveys the contributions made. *Chapter 2* presents a mixed-methods proposal for evaluating community-based participatory design programs, contesting the notion that quantifying these kinds of design experiences can distort its ultimate goals.

In light of the need to further connect with the ancestral in design and technology studies, *Chapter 3* shows what is possible outside of dominant narratives in technology through ethnographic work done in rural Colombia. I explore expanded notions of technology, leading to the proposal of ancestral technology as a concept. In light of the findings and limitations of the study presented in Chapter 2 and the possibilities opened by the notion of Ancestral Technology, *Chapter 4* offers a literature review of Indigenous research methods at the intersection with design practice, pushing back on mainstream methods in design practice. *Chapter 5* reports on two community-based technology design courses that integrate methodological and evaluation insights from my prior work. These university courses present design as a political, relationship-based practice in opposition to common practices of seasonal, transactional approaches that are common in higher education. Finally, *Chapter 6* introduces a digital tool for facilitating, documenting, and disseminating grassroots, community-driven technology.

The dissertation does not follow a traditional continuous flow in the sense that it was not made by findings following each other. It may be a metaphor for how knowledge is also not linear. Instead, chapters explore various aspects along the three motivation themes I described above. What the thesis follows closely is a heuristic of love, as Professor Sara Hendren puts it. I love the practice of design, I love community work, and I love hearing and telling stories. It is also a heuristic of service. My main driver as a researcher was not building a research agenda but rather

a process of becoming a better researcher by serving the communities I worked with.

1.5 Positionality

To Cree scholar Shawn Wilson, reality stems from relationships [263]. In the case of research, this means that the knowledge we produce carries elements of the relationships connected to it. Feminist philosopher Donna Haraway refers to this in terms of *situated knowledge* [104]. In this dissertation, I discuss work from multiple sites, often widely different culturally and geographically. Two of the most salient communities I build knowledge with are rural farmers and Indigenous peoples. *I do not speak (or intend to) on behalf of any of them*. Moreover, because of the relational, situated nature of the work I engaged in this dissertation, it is important to share how I relate to it.

[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

[104]: Haraway (1997), *'Situated Knowledges: the Science Question in Feminism and the Privilege of Partial Perspective'*

I am Colombian, born in a family of farmers. While I spent periods growing up within that culture, I have spent the most significant part of my life living in cities. Despite speaking openly about this with the farmer groups I work with, I am still perceived under this identity and benefit from it as a field researcher. As a *mestizo*, a mix of white and Indigenous heritage, most of my work with Indigenous collaborators is mediated through the rightful perception of me as a white settler in Indigenous land. I receive no benefit from this as a field researcher. That is not to say I do not benefit from working in the field. What it means is that my position as a white settler (and in my experience as a doctoral student), it does not grant me rapport and trust as it does when I collaborate with farmers, more directly connected to my identity. Across both groups, I benefit from the fact that I am a white man working in a country (Colombia) still grappling with cultures of machismo and racism. I certainly benefit from this as a field researcher.

For almost fifteen years, including my years as a graduate student, I have done work in rural sites and places of what is called these days the "Global South." Starting in 2015, I began focusing my work on rural geographies in Colombia and collaborating with historically marginalized communities. As a result, along with a group of collaborators, I co-founded a non-profit organization, Diversa,[5] dedicated to serving these collectives by providing accessible technology design education, collaborating and facilitating partnerships supporting local innovation projects, and offering technical support to new and existing rural infrastructure projects. I greatly benefit from these experiences and affiliations as a field researcher. More importantly, Diversa's human resource and institutional umbrella were angular for most of my doctoral work. Across the dissertation, I use 'we' to describe the work at hand; more often than not, 'we' refers to this team and myself.

5: Diversa https://diversa.co/

Finally, following the provocation from trawlwulwuy scholar Lauren Tynan, I position my approach to research as kinship, meaning I use the process of research and writing as an opportunity to build, center, and care for relationships [241]. I keep it real when it comes to the writing part. While I often author academic works with my collaborators, academic authorship is often meaningless to their goals. So, in lieu of the privilege and status I draw from academic publishing, I preamp all

[241]: Tynan (2020), *Thesis as kin: living relationality with research*

my research projects with a clear commitment to meaningfully support the advancement of my collaborators' goals, even if far from the themes of my research. Only there have I found these relationships to become genuine.

1.6 Contributions

In this dissertation, I use Design as a focal point to drive attention to the dominant narratives behind its practice and contribute new ways to evaluate, think about, teach, document, disseminate, and encounter it. We designed and deployed multiple experiments in collaboration with various collectives in rural Colombia and a network of scholars and practitioners. Courses, digital platforms, and various technologies to aid rural life are among them. I developed evaluation methods to critically and reflectively look at these experiments.

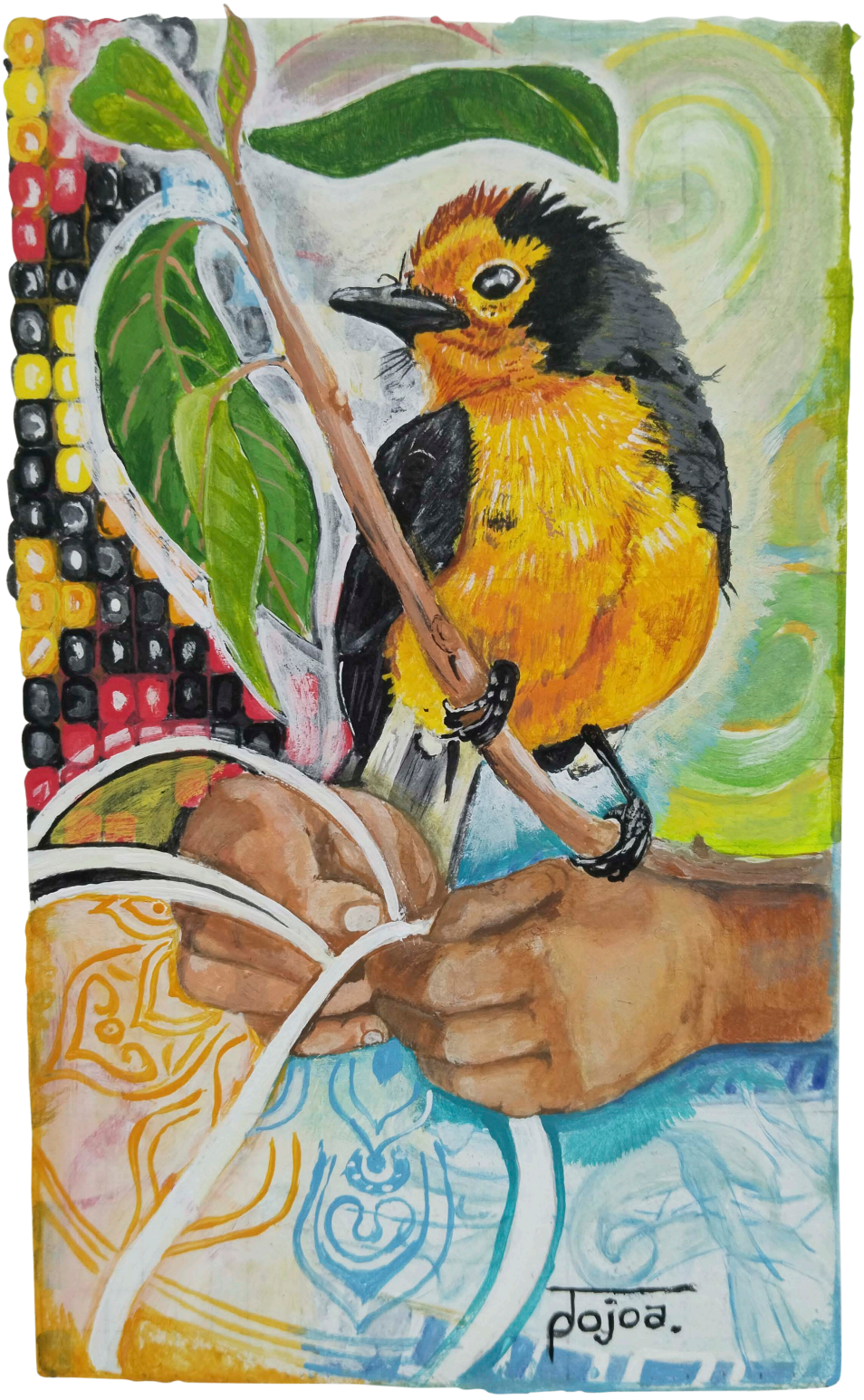
Throughout, I center my work on partnering with rural collectives because of the personal commitments that accompany my identity and because, when it comes to technology, I consider these geographies to be the last site of resistance to the 'modern.' I deliberately prioritize collaborations with these marginalized populations with the commitment to contribute to changing their perception within technology narratives and working to support their visions of technological self-determination.

I highlight contributions to three key fields this dissertation engages with:

Participatory Design
Contributions include a model for longitudinal evaluation of community-based technology design programs (Chapter 2) and a literature review of Indigenous research methods at the intersection of design and technology research (Chapter 4). Additionally, my colleague Diana Duarte and I present the design and deployment of a digital platform for documenting and disseminating rural technologies: Retos (Chapter 6).

Philosophy of Technology
Contributions include advancing the notion of Ancestral Technology (Chapter 3) as a coming together of different strands within the field. This conceptualization is accompanied by ethnographic work on local technology in rural Colombia, also contained in Chapter 3.

Design Education
Contributions include the design and implementation of two immersive, community-driven courses on technology design developed and taught in collaboration with rural collectives in Colombia (Chapter 5). These courses feature long-term commitments and heavily involve rural collaborators in their implementation. Reports and documentation for both courses are freely available under Creative Commons licensing.



En en suroccidente colombiano se presenta un fenómeno excepcional: el híbrido entre las aves Myioborus Melanocephalus y Myioborus Ornatus. El ave se posa sobre las manos que tejen comunidad y territorio

In southwestern Colombia an exceptional phenomenon occurs: the hybrid between the Myioborus Melanocephalus and Myioborus Ornatus birds. The bird perches on the hands that weave community and territory

Pablo Jojoa

2 Investigating the Value of the "Co-"

Sections of this chapter include edited excerpts and images of a conference paper that underwent a double-blind peer-review process and was published in 2020. Copyright has been obtained from the publishers to include this paper in this thesis. Publication details:

Reynolds-Cuéllar, P., & Delgado Ramos, D. (2020). Community-Based Technology Co-Design: Insights on Participation, and the Value of the "Co." Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1, 75–84. https://doi.org/10.1145/3385010.3385030

In the previous chapter, I argued that we could expand on the transformations already taking place within Design education by building on the work advanced by Participatory Design (PD) initiatives and, mainly, investigating how the benefits of these programs end up distributed in reference to its curriculum. In this chapter, I delve into this idea by reflecting on how I arrived at it and proposing a novel method for evaluating PD projects.

One of the fantastic things about MIT in the time I have known it as an institution is how much it strives to make knowledge available to the public. Upon my arrival at the university —and before I enrolled in graduate school— I spent time as a listener in various courses. While it seemed hard to believe at first, many of the professors I approached asking to allow me to attend their courses graciously made space for me. That spring, I audited three classes, yet one of them stood out above the rest: D-Lab Education.[1] I had just finished a nearly four-year tenure with the One Laptop per Child Foundation (OLPC) and had many questions about the role of technology in development. The more I read, the more I was brought to grapple with the glooming reality of how things have gone wrong.[2] OLPC was not unique in its class; projects like the PlayPump and the Gates Foundation toilet challenge joined its ranks, providing a clear picture of the palpable pitfalls of top-down technocentric projects at home and abroad.[3] In many ways, the monumental flops of some of these projects and the spotlight they shone over the ideologies that animated them paved the way for questions such as *who gets to design?* Or *who gets a say in crafting their technological futures?* Participatory Design, at least in my trajectory, comes into the picture in this context. In this chapter, I discuss why I consider the question of participation in Design as still open, present some of the criticisms of the practice of Participatory Design (PD), introduce a PD program aimed at contributing to the struggle against global poverty through the co-design of low-cost, appropriate technologies, and discuss the design and results of a quantitative, multi-year study exploring the outcomes of this program.

1: Taught at the MIT D-Lab

2: If you are interested, many post-mortem analyses of OLPC have come and gone through the years including how it fell short in its promises to educational transformation, how it reinforced technocentric views of development, and how its origins are rooted in gender and class privilege M. G. Ames [8], Kraemer et al. [139], and Warschauer and M. Ames [257]

3: Courtney Martin's brilliant essay offers an autopsy of the tropes behind this category of initiatives through what she calls the "Reductive Seduction Of Other People's Problems." C. Martin [157]

2.1 Journey Into Participation

As I mentioned in the introductory chapter, one of how Design has exerted dominance over other ways of knowing, making, and being has been through the centering of designers in practicing Design. In the United States, for example, this originates from how Design positioned itself professionally and from the influences the field built upon during that seminal time, notably and, as mentioned before, a close relationship to the corporate world.[4] This privileged dynamic is then extended within higher education, influencing how new generations of designers are prepared, making it a space for contestation, as I will demonstrate in Chapter 5. In essence, Design, through its entangling with the capitalist project in the United States, "glorified" the designer's position and, by extension, its influences. It then bestowed capital value upon what was created by these professionals. In exchange, everything created outside this box, regardless of how equivalent it could be to what designers produced, was almost automatically tagged as a craft. This limited the universe of practices considered exemplary expressions of Design for almost a century. More consequentially, this dynamic established that in order to design, one needed to be a designer.

4: If you are interested in a richer discussion of this historical aspect of Design, take a quick jump to the intro of Chapter 5

To disrupt this false classification and to engage in the politics concealed behind the act of designing, the field of Participatory Design (PD) has offered a space for much-needed criticism. Starting in the 1960s, and with roots in Scandinavian unionism, Latin American Marxist, social theory,[5] and perhaps the 'ladder of citizen participation' framework,[6] one of its most poignant arguments is the right for non-designers to participate in the making of the artifacts and systems built around them [11, 96]. Over the years, PD has amassed much praise across multiple disciplines beyond Design. For example, in their survey of community-based approaches to public health, Israel et al. demonstrated that, despite the need for more fine-grained data, programs using participatory approaches seem to increase the efficacy of their efforts and the level of inclusion across historically marginalized populations [124]. Similar success can be found in the fields of ICT4D, digital education, accessibility, online communities, and urban planning, to mention a few [6, 23, 89, 265].

5: Thinkers such as Paulo Freire and Orlando Fals Borda were discussing similar themes around the same timeline. Fals Borda, in particular, turn to participation following work on Marxist theory. An in-depth discussion of this turn can be found in Díaz-Arévalo [63]

6: Interestingly, histories of Participatory Design (PD) do not feature Sherry Arnstein's 'Ladder of Citizen Participation' framework. However, given that the latter was published in 1969, around the time PD was articulating itself as a discipline, it seems plausible the two schools of thought influenced each other.

[11]: Arnstein (1969), *A Ladder Of Citizen Participation*

[96]: Gregory (2003), *Scandinavian Approaches to Participatory Design*

[124]: Israel et al. (1998), *Review of Community-Based Research: Assessing Partnership Approaches to Improve Public Health*

[6]: Al-Kodmany (2001), *Bridging the Gap Between Technical and Local Knowledge: Tools for Promoting Community-Based Planning and Design*

[23]: Blake et al. (2011), *Deaf Telephony: Community-Based Co-Design*

[89]: Fuller et al. (2004), *Community based innovation: a method to utilize the innovative potential of online communities*

[265]: Winschiers-Theophilus et al. (2013), *Moving away from Erindi-roukambe: Transferability of a rural community-based co-design*

[208]: Rivera Cusicanqui (2006), *El potencial epistemológico y teórico de la historia oral: de la lógica instrumental a la descolonización de la historia*

2.2 Criticisms of Participatory Design. Moving Forward

Participatory Design is not without criticism. During my doctoral proposal presentation, one of my committee members, Professor Azra Akšamija, told me, *"Participation has not realized the promise of emancipation."* Particularly in the field's early years, the methods employed by practitioners suffered from some of Design's historical paternalistic tendencies, partly due to the centering of designers, and more broadly of researchers, when working with underserved populations. In her defense of oral histories as a liberation mechanism, Bolivian historian Silvia Rivera Cusicanqui draws attention to how researchers using participatory approaches were still "deciding and orienting the actions and modalities of participation" [208].[7] This is a systemic challenge that PD has grappled with, especially as it unfolds in diverse contexts. These contexts can also

7: Translation is mine

be represented by the discipline as "the other," constantly cast as "in simple opposition" to mainstream concepts and practices in the field, therefore unable to inform them [102, 164, 204]. Scholars have questioned the efficacy of democratizing the design process in the face of the often hierarchical relationships between researchers and community members, sometimes leading to compounding inequities [189]. This is particularly evident in analyzing how numerous participatory methods have been co-opted by development agencies and banks, many operating under top-down mandates [231]. A fascinating discussion on the theoretical amnesia of Participatory Action Research, specifically, can be found in Díaz-Arévalo [63]. In exploring the notion of pseudo-participation in the context of digital services and how it gives the illusion of participation while intentionally negating agency to citizens, my colleagues Victoria Palacin, Matti Nelimarkka, Christoph Becker and I extend these criticisms [186]. These and other challenging questions to PD have led some scholars to refer to 'participation' as a form of oppression or 'tyranny' [51]. Needless to say, no field is without blind spots, and despite these valid concerns, the reality is that PD as a collective presents itself as constantly in flow and open to challenge. At a personal level, I have constantly been frustrated at the limited work coming from research and practice, looking at quantitatively anchoring the effectiveness of participatory programs. Recent calls for more studies in this area demonstrate that this area remains understudied [177]. This chapter partially attends to this call.

[102]: Hakken and Maté (2014), *The culture question in participatory design*
[164]: Merritt and Stolterman (2012), *Cultural hybridity in participatory design*
[204]: Reynolds-Cuéllar et al. (2022), *Reviews Gone South: A Subversive Experiment on Participatory Design Canons: Dedicated to the Memory of Oscar A. Lemus*
[189]: Pedell et al. (2014), *Tools for Participation: Intergenerational Technology Design for the Home*
[231]: Swantz (2016), *In Search of Living Knowledge*
[63]: Díaz-Arévalo (2022), *In search of the ontology of participation in Participatory Action Research: Orlando Fals-Borda's Participatory Turn, 1977–1980*
[186]: Palacin et al. (2020), *The Design of Pseudo-Participation*
[51]: Cooke and Kothari (2001), *Participation: the new tyranny?*
[177]: Nguyen (2022), *Evaluation in Participatory Design – The Whys and the Nots*

Cognizant of several of the limitations of PD I discussed and the fact that many of its criticisms were theoretical, I grew interested in criticisms expressed in practice. Shortly after arriving in the United States in 2013, I joined the MIT D-Lab program, which focused on exploring when and how participatory approaches to design are appropriate, specifically in the context of global poverty. After a couple of years of taking part in their initiatives and teaching education and solid waste management classes, I decided to try my hand at leading a participatory program in Colombia. Between 2015 and 2018, I led four design summits in four different regions in the country. These summits followed the International Development Design Summit (IDDS) methodology developed at the MIT D-Lab. As I learned about what the program had already achieved when I joined, it became clear that working through this type of participation could be an effective way to begin contesting Design. Thus, I contested it.

In what follows, I introduce the International Development Design Summit program, offer a brief overview of the summits I led, describe a longitudinal study that asks questions about the benefits of these programs to participants, discuss its results, and offer hope and lingering questions moving forward.

2.3 The IDDS Model

The International Development Design Summit (IDDS), a collaborative community-based PD program, was established by MIT's D-Lab, Olin College of Engineering, and Caltech in 2007 under Amy Smith's guidance. The program is an "intense, hands-on, community-based design training that brings together a diverse group of people to teach them the co-creative design process and how to prototype low-cost technological

solutions to improve the livelihoods of people."[8] The summit follows the methodological precepts of the "Creative Capacity Building" framework,[9] also developed by Dr. Kofi Taha and Amy Smith at MIT D-Lab. Its philosophical underpinnings range from Gandhi's early critiques of industrialization to the concept of "Buddhist economics" from the 1970s, challenging the notion of prioritizing goods over people and consumption over creative endeavors [232].

To date, summits have been conducted 24 times across more than 12 countries and with hundreds of participants worldwide. The program varies in duration with short (two-week) and longer (up to five and a half weeks) formats. Each summit typically involves intensive 10-hour workdays, interspersed with one or two rest days per working week. Hosted within partner communities, these summits accommodate 40-60 participants, usually divided into teams of 4-8, each assisted by one or two design facilitators. Community selection is either self-initiated or based on connections with the organizing team. Partner communities have varied, including local governments, informal groups like coffee farmers and former guerrilla combatants, and local and international not-for-profit organizations. The themes for each IDDS are chosen based on preliminary field research in partnership with local collaborators. Upon arrival, participants from diverse backgrounds begin collaborating, focusing on challenges and opportunities identified through earlier research.

A typical day at the summit involves a mix of practical PD design, action research, reflection, and intercultural collaboration tailored to each project. The structure of each summit is adapted to its specific goals, resources, and timeline, often segmented into stages with significant milestones like community visits, sometimes involving homestays, for example. The first stage, crucial for establishing strong interpersonal and team relationships, includes activities geared towards creating a common language around designing and building rapport between participants and local communities. It also includes practical sessions to contextualize each challenge or opportunity and to build core technical and methodological skills that are practical for advancing projects. The second stage, starting with a first community visit, emphasizes fieldwork activities and a deeper contextualizing of the environments where projects will occur. Local community members play a dual role here: as team members and as liaisons with the broader community. This stage involves activities such as rapid prototyping, production, and evaluation of various sketch models. The final stage is dedicated to co-designing and co-producing full-scale, functional prototypes assisted by design facilitators and supported by allocated budgets to procure materials. These prototypes or "co-productions" are the culmination of the learning arc of the summit. The program concludes with a public fair showcasing the projects and local community products. Recent summits have incorporated budgets and planning towards project continuity to support teams' long-term plans.

The program's methodology is guided by a Design Workbook developed by MIT D-Lab and Olin College instructors and incorporates collaborators' feedback worldwide.[10] The workbook outlines the design process, includes case studies, and facilitates participants' documentation. Participants engage in group work from the program's start, with the

8: You can learn more about the IDDS summits at the International Development Innovation Network (IDIN) website

9: While the methodological basis of IDDS summits is the Creative Capacity Building framework, I will refer to IDDS as the umbrella concept for both

[232]: Taha (2011), *Creative capacity building in post-conflict Uganda*

10: Versions of the IDDS Design Workbook in English, Spanish and Swahili are available for download at the IDIN webpage

first stage being the most instruction-intensive. Subsequent stages focus on teamwork and practical content guided by design facilitators who also manage team dynamics and foster collaboration across teams. The core curriculum is annually updated to align with each event's theme and incorporate participant and facilitator feedback from prior summits. Outcomes traditionally focus on co-designing and co-producing technologies, though some teams have pursued non-technological interventions. Completed projects are documented in reports covering cultural context, the process by which each team arrived at a prototype, and continuity plans if considered. Efforts to integrate project continuity into the curriculum have included worksheets and specific curricular elements geared toward sustained engagement. Project examples include recycled plastic extruders, Arduino-based soil testers, and portable solar lanterns. Notably, IDDS is volunteer-driven, with former participants often joining organizing teams.

2.4 Learning About the Value of the "Co"

You may wonder about the human, capital, and material resources these summits require. In my experience, and in the telling from past participants and organizers, the program had reaped benefits in learning and outcomes for all participants and communities. However, for at least the first six years of its implementation, the program went without any evaluation, which meant there needed to be a detailed understanding of its effectiveness beyond anecdotal information. When I began working with the format of summits, the program was housed under a United States Agency for International Development (USAID) grant, which meant there was a continued monitoring and evaluation (M&E) component. Moreover, while the grant faded away a few years later, the culture of M&E remained.[11] That said, a critical look at this M&E effort will reveal that its primary purpose was reporting back to the granter. Evaluations looked at progress in learning during the summit as opposed to sustained impact over time. Although efforts were made, there needed to be a reliable structure to develop more fine-grained evaluations. Similarly, the implementation of prototypes was taken as the sole proxy for the success of the projects, with little attention paid to continuity following summits. At first, this point did not represent a concern, but as projects rolled out, many of them only functional for short periods, questions began to creep in about this way of measuring success. This was one of the main points of departure for this research project. To investigate these questions, and using the M&E data collected during four summits, I helped lead in Colombia; my colleague, Daniela Delgado Ramos, at the University of Illinois, and I started looking closely at the distribution of learning benefits across participants and the longevity of projects longitudinally.

11: A dataset compiling survey responses from summits between 2014 and 2017 can be found in the IDIN repository

In the following sections, I present the results from a quantitative study Daniela and I designed. With this study, we asked the following research questions:

- What is the perceived value from participants of each summit across groups from local community members, members from the host country, and international members?[12]

12: We placed emphasis in quantifying this question, especially given that one of the main goals of IDDS' programs is to provide as much value as possible to local communities

- How can collaboration (the "co") be operationalized and quantified for technology design experiences?

Table 2.1: General information for the five summits included in the sample for this study

Summit	Year	Location	Topic	Number of Participants	Community Partners	Other Stakeholders
Zero Waste (ZW)	2015	Cali, Colombia	Solid waste management	49 | 40	▸ Waste pickers associations ▸ Recycling civil groups	▸ Local government units ▸ Local/national universities ▸ International research labs
Education (ED)	2016	Bogotá, Colombia	Education	48 | 47	▸ Local schools ▸ Community schools	▸ Local universities ▸ Local NGOs ▸ International research labs
Climate Change Adaptation (CCA)	2017	Fusagasugá, Colombia	Climate change	58 | 58	▸ Local farmers collectives ▸ Local artisans ▸ Fishermen collectives ▸ Agroecology collectives	▸ Local universities ▸ Local government units ▸ International research labs
Building Peace (BP)	2018	Las Colinas, El Capricho, Colombia	Peacebuilding	61 | 54	▸ Territorial Spaces for Training and Reincorporation (ETCRs)	▸ National universities ▸ Multilateral institutions ▸ International research labs
New Coastal Territories (NCT)	2018	Santa Marta, Colombia	Environmental justice	37 | 37	▸ Fishermen collectives ▸ Local Indigenous groups	▸ Local government ▸ Local Indigenous government ▸ Local universities

2.5 Data Collection

We used data from five IDDS programs conducted in Colombia between 2015 and 2018. Table 2.1 describes the summits included in the sample and provides overview details to help understand each program better. Data was collected using a self-perception survey developed by the MIT D-Lab monitoring and evaluation team and administered at three points during each summit: the start (Day 1, 25 questions), midpoint (Day 9, 14 questions), and at the closing of the summit (Day 17, 16 questions). The survey distribution was 79% digital, 16% paper-based, and 5% through structured interviews to accommodate varying literacy levels. The survey covered three main areas: *"Objectives and Aspirations,"* capturing participants' expectations and subsequent impressions; *"Learning,"* for self-evaluation of technical and methodological skill development; and *"Feedback,"* gathering insights on the curriculum, logistics, and infrastructure. Our analysis focused on survey questions on the Learning category, which directly reflect participants' value perceptions related to the educational content of the summits. We include limited textual analysis of answers to open-ended questions in the Objectives and Aspirations category. All questions in the Feedback category were dropped as part of our analyses. Appendix A contains a complete set of questions in the survey administered to participants. Our dataset included a total of 236 participants across all five summits. We enriched this data with information about participants' continued engagement

13: Data related to gender was collected through a binary choice of male/female. Therefore, we have no way to report results on non-binary participants

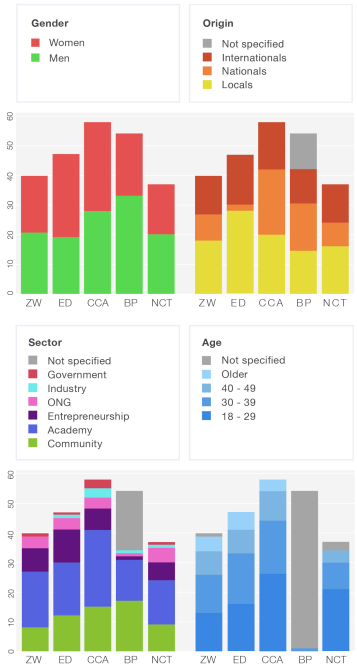


Figure 2.1: Demographic distribution across all summits on gender, participants' origin, participants' sector affiliation, and age. IDDS program key: Zero Waste (ZW), Education (ED), Climate Change Adaptation(CCA), Building Peace (BP), New Coastal Territories (NCT). n=224

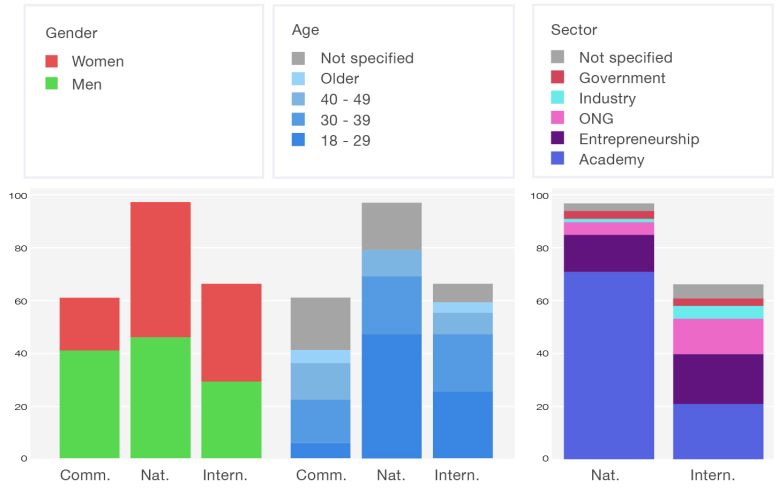


Figure 2.2: Demographic distributions of across local, national, and international groups on gender, age and sector of affiliation

with the program over the years based on calls, text messages, and social media posts related to projects.

2.6 Data Analysis

The demographic distribution of participants shows an average age of around 40 years old, with a balanced gender distribution across all summits.[13] While local and national participants attended most summits, people based internationally also constitute a sizable portion of each summit's demographic. Community members and academics were the two predominant affiliations among participants. Figure 2.1 shows these distributions in detail. Figure 2.2 shows demographic distributions for community (participants from local communities), *"National"* (from in-country but not from local communities), and *"International"* participants to further illuminate how this data is distributed across different groups.

In attempting to quantify the value of participation (the "co"), we analyzed the data through individual, collective, and artifactual perspectives. We began by parsing these components: *"Participants"* (learning data reported by the total sample of participants) *"Communities"* (learning data reported only by participants from local communities) *"Co-productions"* (participants' perceptions of the prototypes produced and sustained use of prototypes over time)

Given the program's emphasis on prototyping, we intentionally included the latter category. Our findings, following this categorization, including reflections on unintended outcomes, are detailed in the following sections. We include participants' vignettes to nuance some of our results.

2.7 Empirical Findings

2.7.1 Value of the program to participants

What can be said about the value of the program for its participants? To address this question, we primarily focus on skill development, utilizing two data

points: (1) participants' perceptions of their skills before and (2) after the program. This approach aligns with the structure of our evaluation instrument, as detailed in the data collection section. Here, we also follow the data segmentation over local, national, and international participants to explore the value to local communities.

Regarding skills, we focused on six specific skills as categorized by the survey: (1) Tooling and Machining, (2) Creative Use of Materials, (3) Intercultural Collaborations, (4) Information Gathering, (5) Teaching, and (6) Adaptability. The question for each category in the survey was formulated as follows: *"How confident do you feel about..."*. Participants responded using a Likert scale. We observed a consistent increase in skills across all programs and for all assessed skills when looking at responses at mid and post (at the end of the summit) points; Figure 2.3 illustrates these distributions and specifies changes unique to each program. Notably, the skills showing the most variability at the midpoint of all summits were 'Tooling & Machining' and 'Creative Use of Materials.' This variability indicates that some participants initially reported a lack of these skills, but others considered themselves experts. However, by the end of the IDDS program, participants commonly reported medium to high expertise in both areas, showcasing significant progress with increases of 18.17% and 13.98% between the mid and post-conditions for each set of skills, respectively.

'Information Gathering,' 'Teaching Others,' and 'Adaptability' were the skills with the highest scores towards the end of the program. Table 2.2 presents all skills-related results, clustered by participants' age and gender. This segmentation revealed differences in skill development from a gender perspective. Women reported a 3.12% higher skill increase across all summits than men. Female participants noted significant enhancements in technical skills, with a 31.40% increase in their ability to use tools and a 15.66% increase in their creative use of materials. Interestingly, skills reliant on oral communication, such as intercultural collaboration and information gathering, did not significantly improve, potentially indicating gender or power dynamics within groups. Conversely, men reported the highest increases in skills related to adaptability, information gathering, and creative use of materials. From an age perspective, participants in the 18-32 age bracket reported the highest increases in technical skills (tooling, machining, and creative use of materials), with a 17.24% increase, compared to a 7.38% increase from their counterparts aged 49 and older.

This data suggests a generational knowledge gap, with the 18-32 age group showing the least progress in intercultural collaboration skills and the 49-and-older group reporting the least progress in tooling and machining skills. These results can be indicative of generational-based knowledge gaps.

How were international, national, and community participants groups differentiated? When analyzing changes for each participant group across all six skills and programs, we found that international participants accounted for the majority of skill progress, with a 12.60% overall increase for all five skills, compared to 10.00% and 6.64% increases from their national and community counterparts, respectively. One explanation for these results could be the survey design itself. Educational levels, experience, and cultural background also play a role. However, given that the survey data

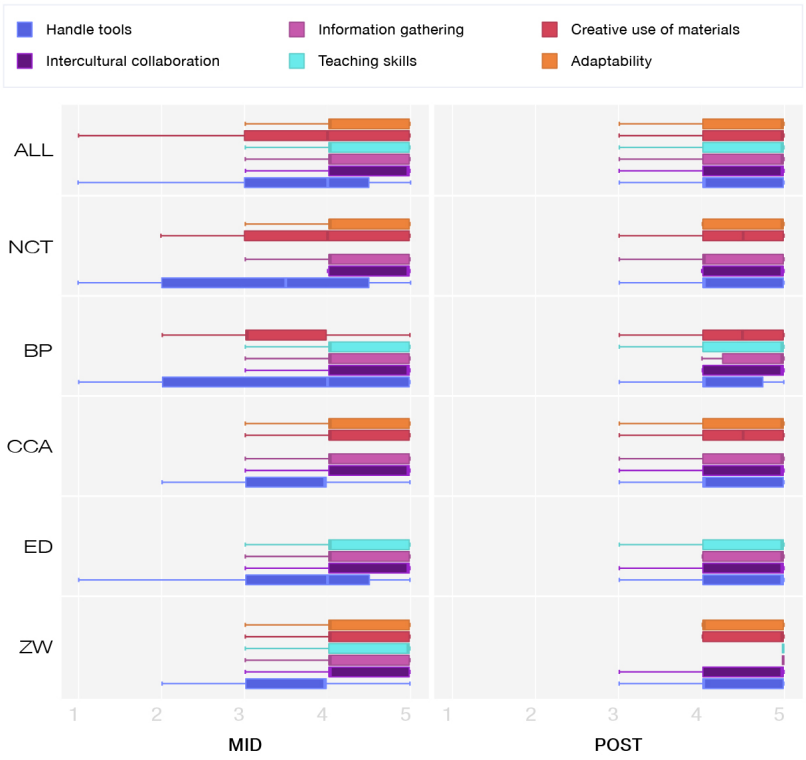


Figure 2.3: Box plot of participants' skills distribution for each summit. Measures are made between pre-summit survey and mid-survey, and between mid-survey and post-survey

came from multiple-choice, numerical questions and was administered with consideration for participants' educational backgrounds, it seems reasonable to rule out these arguments. That said, differences in self-esteem or self-awareness, where community members may undervalue their learning compared to international participants, could contribute to these findings. International participants also reported the smallest increase in intercultural collaboration skills, with only a 1.32% increase across all summits. However, they showed the highest increases in technical skills, with a 23.84% increase in tooling and machining and a 16.67% increase in the creative use of materials. Conversely, community members reported the lowest rates of increase in skills, with notable exceptions for tooling and machining, and information gathering, each with a 10.57% and 10.77% increase, respectively.

2.7.2 Value of the program to communities

In addition to metrics over learning and the value of prototypes (co-productions), community members provided insights into their perceived value of the program through the open-ended questions in the "Objectives and Aspirations" section of the survey. The question we looked at was prompted: *"Please share your thoughts about the value of IDDS. What has been most valuable for you?"* Their responses highlighted themes related to the program's goals and collective mechanisms. For instance, participant 0968 noted, *"the interest in making a change in communities, such as the recyclers community, involving all knowledge to boost access to technologies according to needs. We were one, thinking as one single family."*[14] Similarly, participant 0878 reflected on *"first, the co-creation, and second, the sharing of empirical and theoretical knowledge. It values the knowledge one has as a*

14: All translations are ours

fisherman, while scientists or professionals share their theoretical knowledge, and we mutually provide feedback to each other."

Table 2.2: Averaged progress across skills reported by participants. Pre at the beginning of IDDS, and Post at the end

Skills	Total			By Gender					
				Female			Male		
	Pre	Post	N	Pre	Post	N	Pre	Post	N
Tooling & machining	3.61	4.27	160	3.14	4.13	77	4.05	4.40	83
Creative use of materials	3.92	4.47	133	3.83	4.43	65	4.01	4.51	68
Intelectual collaboration	4.47	4.58	160	4.47	4.58	78	4.46	4.57	82
Information gathering	4.25	4.61	159	4.38	4.57	77	4.13	4.65	82
Teach others	4.27	4.67	81	3.19	4.59	37	4.34	4.73	44
Adaptability	4.22	4.57	112	4.24	4.47	58	4.20	4.68	54

	By Age								
	18 - 32			33 - 48			49 - Older		
	Pre	Post	N	Pre	Post	N	Pre	Post	N
Tooling & machining	3.55	4.33	78	3.57	4.23	47	4.11	4.28	18
Creative use of materials	4.02	4.52	64	3.91	4.41	34	4.31	4.77	13
Intelectual collaboration	4.60	4.62	77	4.40	4.48	48	4.39	4.72	18
Information gathering	4.25	4.57	77	4.34	4.68	47	4.00	4.61	18
Teach others	4.39	4.77	31	4.35	4.65	23	4.33	4.75	12
Adaptability	4.30	4.66	64	4.21	4.52	33	4.08	4.25	12

	By Origin								
	National			International			Communities		
	Pre	Post	N	Pre	Post	N	Pre	Post	N
Tooling & machining	3.58	4.24	76	3.44	4.26	50	3.97	4.39	31
Creative use of materials	3.97	4.52	62	3.75	4.38	40	4.22	4.52	23
Intelectual collaboration	3.46	4.59	76	4.54	4.60	50	4.35	4.52	31
Information gathering	4.33	4.68	76	4.14	4.49	49	4.19	4.65	31
Teach others	4.33	4.69	36	4.04	4.58	24	4.47	4.84	19
Adaptability	4.29	4.64	56	4.05	4.54	37	4.44	4.42	18

Furthermore, as part of our data exploration, we employed textual analysis techniques to probe sentiment dimensions related to community members across projects. Utilizing the Natural Language Understanding service from the IBM Watson platform, we analyzed sentiments in responses to the prompt: *"Based on your experience, what worked well with the projects, and what can be improved?"* Sentiment was evaluated based on its polarity on a scale from -1 to 1, with -1 indicating negative sentiment, 0 neutral, and 1 positive. Figure 2.4 reveals that the NCT and ZW programs had the most positive average sentiment scores among community members' comments. However, the sentiment scores showed less variation in the NCT program, suggesting that experiences within the ZW program were more diverse. It is also noteworthy that the ED program exhibited the slightest variation. However, most comments from

the ED summit displayed neutral or positive sentiments, contrasting the scores from the CCA or ZW programs. Further analysis of participants' self-reports on specific curriculum components may provide additional insights into these observations.

2.7.3 Value of co-productions to community partners

In our analysis of the program's value, we focus on one of its most significant outcomes: co-productions. We operationalize the value of these co-productions as a function of how long the project remained active post-program. Activity, in this context, means the continuity of a project, either in its original form or as a new project, provided it retains its original members and communities. *What can be said about the value of co-productions for community partners?* Notably, during five summits, 40 prototypes were developed, 6 of which were non-technological (e.g., eco-tourism services design, pedagogical materials). These prototypes were classified into nine categories based on the problem or opportunity they addressed: waste (9), water (2), sanitation (1), agriculture (8), energy (4), education (7), tourism (3), infrastructure (4), and business (2). This variety in technological co-designs demonstrates tangible value through collaborative gains. To further substantiate this, we analyzed self-reported responses to the open-ended question: *"In general, how do you feel about your project?"* collected at the midpoint and end of the program. Results shown in Figure 2.5 indicate an overall positive sentiment towards the projects. Analysis by participant type revealed that national participants' sentiments remained unchanged throughout the program, while international participants reported increased positive sentiments. Conversely, community members felt less favorably by the program's end. Additionally, a linguistic shift in referencing co-productions and multiple mentions of collaboration gains (e.g., team, community, communication) were observed between the midpoint and endpoint, aligning with the increased value reported by international participants across skill dimensions.

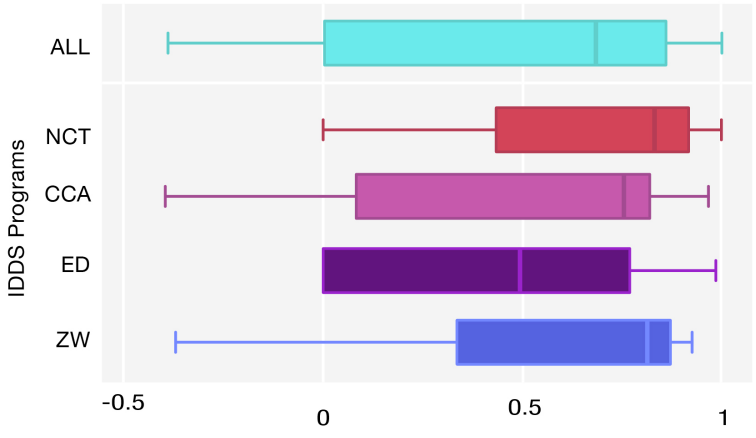


Figure 2.4: Perception of the value of summits as self-reported by community participants throughout the summit, measured by a sentiment analysis of responses to open-ended questions. The BP summit was not included due to insufficient data

We also examined the duration of participant involvement in these or derivative projects, summarized in Figure 2.6. Our analysis of this data shows no direct correlation between skill development or community-perceived value and project longevity. Although we claim no correlation, summits with consistently positive ratings (ZW and ED) did exhibit longer project sustainability. Trends in themes that informed co-production

showed waste, agriculture, and education as the areas of most interest, encompassing 24 projects in total. Critical areas such as water, sanitation, and energy saw only seven projects, highlighting a potential gap. Not present were health-focused projects, possibly due to specific technical requirements for manufacturing prototypes.

2.8 Discussion, Reflection, and Future Work

2.8.1 Evaluating participatory experiences

We introduced an approach to understanding participation in community-based PD programs as a function of outcomes observed from participants, partner communities, and coproductions during and after the program. However, what do these results tell us about the value of the "co"? What insights can be driven from that analysis?

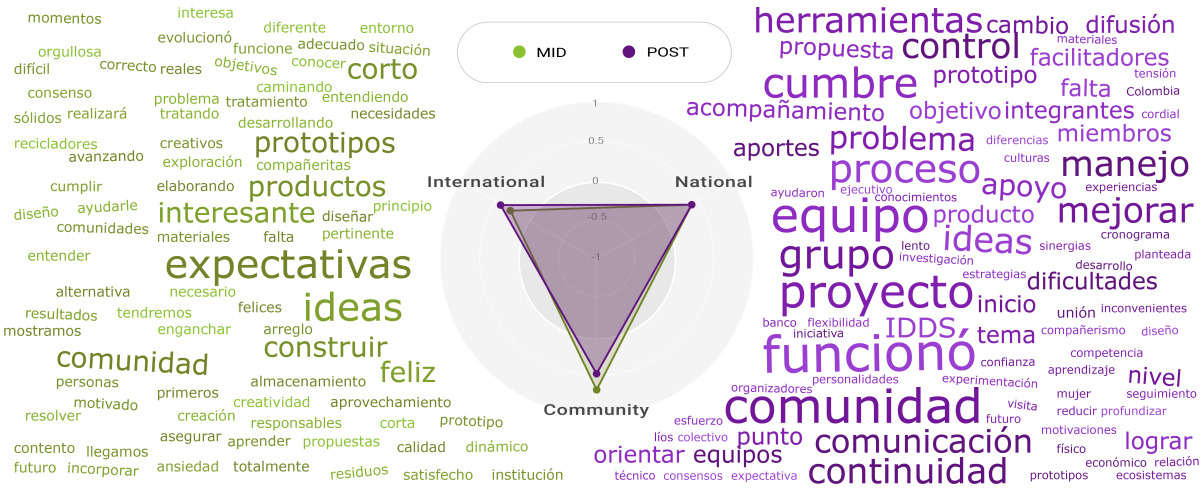


Figure 2.5: Participants' sentiment and word analysis on answers to self-perception open-ended questions regarding co-productions at MID and POST stages of the program. Data is displayed in two word clouds, green showing terms reported at the middle point, and purple showing terms reported at the end of the program

First, data indicates that these kinds of PD programs indeed generate significant value for the actors directly engaged. Educational achievements are evidenced by consistent self-reported skill improvements, aligning with the program's learning objectives. Notably, this value seems predominantly realized by international participants, a finding that diverges from the program's initial design intentions. This discrepancy should spark a crucial dialogue on how future designs integrate value into local communities more effectively.

Additionally, we observed that female participants reported substantial gains in technical skills yet lesser improvements in oral communication skills. The former observation is consistent with what has been reported in the literature about technology design gender bias [94]. The latter observation appears to relate to gender dynamics expressed in the context of design teams. This finding aligns with prior work depicting potential gender biases within collaboration [93]. Further exploration is necessary, yet the finding itself begs the question of how these biases can be addressed directly from within the design of these programs.

[94]: Gaughan and Bozeman (2016), *Using the prisms of gender and rank to interpret research collaboration power dynamics*

[93]: Gartner and I. Wagner (1996), *Mapping Actors and Agendas: Political Frameworks of Systems Design and Participation*

Age-related differences in skill development, particularly between the 18-32 and 49-older age brackets, hint at age-related learning differences and inter-generational gaps. These insights could inform future program designs to accommodate diverse learning needs better.

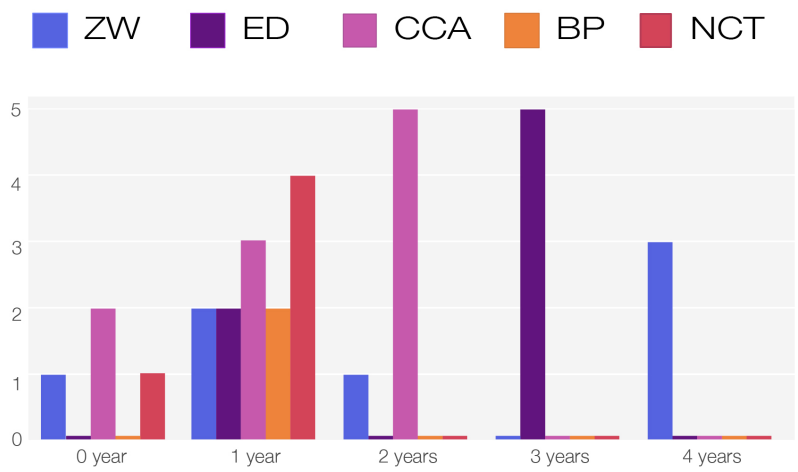


Figure 2.6: Plot of how projects sustained over time across four years for all five summits

Second, despite metrics not showing community members as the primary beneficiaries, the technological output, individual value reported, and the emergence of continuity channels all signify substantial value. One important insight we drive from this surprising result is that our proposed model for evaluation needs to surface these gains directly. We recognize that our decision to pursue quantifiable gains creates this gap. Is it enough? Further studies are necessary to determine the relationship between cost vs. benefit in the context of these programs, not only through the lens of local community stakeholders but from all stakeholders involved. Furthermore, this finding opens the opportunity for future program designs to address this paradox by modifying the existing curriculum to drive more value to community participants under the current model.

2.8.2 (Sometimes) Unseen value from the "co": moving forward

One of the main arguments we are trying to make with the evaluation proposal we presented in this chapter is how fundamental it is to look at participatory programs over time. Long-term qualitative research might succeed where longitudinal, quantitative evaluations like this one might fail. In this brief discussion, I want to highlight two aspects of the IDDS summits in Colombia that were not captured by the model we proposed and that qualitative research at each summit might have missed unless the complete set of summits was considered.

The first dimension is the emergence of *institutions*. One often overlooked aspect of implementing programs repeatedly is the tendency of this rhythm to resolve in institutionalization. Take the IDDS model, for example. It began in 2007 as an experiment on the participatory design of low-cost technology in Ghana. As the program featured every year, it began to evolve into a formal organization. By 2012, the program was institutionalized as part of a larger umbrella model supported by a

USAID grant. This funding made forming the International Development Innovation Network (IDIN) possible.[15] To this day, this is the institution in charge of overseeing the IDDS program. In the case of Colombia, the 2015 Zero Waste Summit was the stage for the emergence of two organizations: C-Innova[16] and Distancia Cero (Zero Distance). Summit participants and organizers started both of them, the former dedicated to increasing technology design education in rural areas of Colombia, the latter with the mission of connecting university students with rural innovation projects. Shortly after, these two organizations merged into a nonprofit: Diversa, which I mentioned in Chapter 1. This organization ended up being the umbrella host for the following IDDS summits and has grown to become a thriving institution in the field of rural and local innovation and technology development.

15: IDIN Network https://idin.org/

16: Centro de Innovación de Tecnologías Apropiadas y Educación C-Innova

The second dimension is the forming of a long-lasting *community*. Partly due to the institutionalization of efforts following the first IDDS summit in Colombia, a community of practice formed, making it possible for Diversa to access qualified, value-aligned human resources. These nascent institutions became springboards for the practice and careers of several summit participants who passed through and moved to work in government, academia, and industry positions while carrying the shared values that forged the community. Conversely, the specialization of communities and individuals enabled these institutions to stay relevant and updated and extend their scope of influence through collaborations.

2.9 Conclusion

While studies focusing on evaluation remain uncommon, they are, as I mentioned before, a necessary component. This study, for example, reveals a paradox between the stated goals of the IDDS program —namely, primarily benefiting local communities— and the outcomes reported regarding learning and impact reported by participants from these groups. At the same time, it highlights the potential of these kinds of international programs to affect learning and mindsets locally, nationally, and abroad. We offer an option for operationalizing quantification, which might not be appropriate for all programs and all contexts but certainly offers a path forward. Our framework can be expanded by, for example, adding participants' assessments across the curriculum to control the quality of learning. It is not the first time this approach has been taken into account. The work from [27, 93, 212] long predates ours and greatly informed our study design.

[27]: Bossen et al. (2010), *User gains and PD aims: assessment from a participatory design project*
[93]: Gartner and I. Wagner (1996), *Mapping Actors and Agendas: Political Frameworks of Systems Design and Participation*
[212]: Sabiescu et al. (2014), *Emerging Spaces in Community-based Participatory Design: Reflections from Two Case Studies*

Understanding where the efforts invested in producing outcomes and impact through participatory programs is crucial. In the face of co-opting and appropriation of "the co" by actors seeking to maintain business as usual, all evidence of benefits and best practices for using participation as a strategy is our most robust line of defense. In centering a quantitative, longitudinal analysis of a participatory program, I hope to continue shaking the conversation around the role of evaluations in PD programs. I recognize this goal is in tension with other goals the community is pursuing, such as epistemic justice —as quantification can be seen as flattening voices— we must continue finding ways to weave all these goals together.

From my perspective, the study I report in this chapter highlights the need for a couple of shifts. First, we should expand on these PD programs and towards alternatives that plan for increased community benefits, from curriculum design to program evaluation. To explore how we can move towards these shifts, Chapter 4 explores alternative methodological landscapes from the perspective of Indigenous research methods. Later on, in Chapter 5, I report on the design of two courses taught at MIT geared towards increased community agency and benefits.

Secondly, there is a need for methods in design practice that depart from different imaginaries and, more critically, have community benefits as their point of origin. Conversely, this will allow us to improve our practice, making space for the ancestral in technology and design. In the next chapter, and given the importance of the notion of the ancestral takes as a point of connection for Design and technology studies moving forward, I introduce the concept of Ancestral Technology and exemplify it through fieldwork in rural Colombia.

La Tonta Hermosa (Trogón Personatus) guarda un gran misterio para las comunidades: cuando se la busca en la montaña, ella canta muy suave, haciendo que quien la busca se interne cada vez más adentro del bosque. Así, la investigación con tecnologías ancestrales invita a adentrarse cada vez más en los saberes, historias y territorios de las comunidades

The Beautiful Fool (Trogon Personatus) keeps a great mystery for the communities: when searched for in the mountains, she sings very softly, making those looking for her go deeper and deeper into the forest. Thus, research with ancestral technologies invites us to delve deeper and deeper into the knowledge, stories and territories of the communities

Pablo Jojoa

3 Encountering Ancestral Technology

This section of the chapter includes edited excerpts of a book chapter that underwent peer-review process and was published in 2024. Copyright has been obtained from the publishers to include this chapter in this thesis. Publication details:

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3.1 Part I: Ancestral Technology

3.1.1 Introduction

In previous chapters, I have demonstrated the opportunity to open up in design and technology studies to attend to place-based, culturally-aware, ancestral knowledge. Through reflexive analysis of how we engage collaboratively with communities in historically marginalized geographies (Chapter 2), I argued for a missed opportunity to further engage people and their knowledge in participatory design experiences. In giving a language to this space, I adopt the notion of Ancestral Technology as one of the main results of my fieldwork in rural Colombia for the past five years. This notion, which I explain and exemplify in detail in the following sections, will inform the rest of the work included in this dissertation. In Chapter 4, I argue that, when connecting to the ancestral in Design and technology studies, we will be well served by turning methodologically towards new horizons, and suggested Indigenous research methods as a knowledge tradition to learn from. In Chapter 5, I present two university courses to elevate and make ancestral knowledge an integral part of the curriculum of participatory design educational offerings. These courses needed to continue a reflexive tradition of assessment and put forth a way to do this using the equityXdesign framework. Lastly, and inspired by how Indigenous research methods approach making in the world (designing) —namely, the importance of reciprocity, accountability, respect, and relationality— my colleague Diana Duarte and I propose a model for a digital system to support these values in the context of participatory design engagements (Chapter 6). In setting the stage for the chapters to come, I offer the notion of *Ancestral Technology* as a provocation: a call to establish new ways to engage design and technology studies in places traditionally considered "at the margins" yet not marginal.[1]

In this chapter, I introduce the notion of *Ancestral Technology* as a pathway into extending technology studies and as a theme for the rest of the dissertation. Conversely, this expansion signals design scholars and

1: This play of words in inspired by Indian scholar Anil Gupta's book Grassroots innovation: minds on the margin are not marginal minds [99]

practitioners with the responsibility to acknowledge and learn about these alternative ways of making and transforming the world (design). In making this case, I present a brief overview of how technology has been approached from within technology studies with connections to other disciplines, such as history and archaeology, in Latin America. From there, I briefly touch upon a few moves to extend notions of technology from within the philosophy of technology and advance a formal definition of ancestral technology, offering a couple of examples from fieldwork done in Colombia. I close the chapter by zooming in on the use of social organizing as a manifestation of ancestral technology in the form of the 'Investigative Minga' as practiced by the Asoyarcocha collective in the Nariño region of southern Colombia.

3.1.2 The Ancestral Gap Within Technology Studies: A Brief Overview of the Latin American Case

In her study of the *chuño*, an ancestral technique for the long-term conservation and storage of potatoes, still practiced in the Peruvian and Bolivian highlands and dating back to the Inca Empire, Peruvian historian Alejandra Osorio highlights a notable omission in the study of technology in Latin America. She points out that regional technological history's predominant focus has been industrialization and modern technology (e.g., hydroelectric systems, telephony, and, more recently, the internet and social media). In her view, this focus has left out pre-existent technological practices in the region, particularly those that have withstood the influence of the "modern" [185]. There are, of course, exceptions to this trend including the work of scholar Sebastián Carenzo looking at the technological developments of waste pickers in Buenos Aires, Argentina, and Mapuche scholar Luis Cárcamo-Huechante's work focused on the role of community radio in the transit towards self-determination projects of rural Mapuche communities in Chile, among others [37, 38]. However, for the most part, the accounts within history of technology in the region seem to have disregarded these technological productions.

[185]: Osorio (2022), *Why Chuño Matters: Rethinking the History of Technology in Latin America*

[37]: Cárcamo-Huechante (2013), *Indigenous Interference: Mapuche Use of Radio in Times of Acoustic Colonialism*
[38]: Carenzo (2020), *Contesting informality through innovation "from below": epistemic and political challenges in a waste pickers cooperative from Buenos Aires (Argentina)*

This gap is also echoed in the field of archaeology. Through his research across the Andean region, Peruvian archaeologist Alexander Herrera uncovers a rich technological heritage manifested in agriculture, grazing, and agroforestry practices by various communities throughout the Andean mountains. These practices showcase a diverse array of artifacts and processes and illustrate nuanced relationships with materials, ecosystems, and non-human agents, reflecting a sophisticated approach to ecological balance in the face of technological progress. He argues that the lack of scholarly focus on these Indigenous technological frameworks represents a "debt" to Indigenous knowledge and further contends that some of the persistent poverty issues in Latin America could be attributed to this neglect of existing technological landscapes in favor of continuously importing foreign technologies [110]. In his work on Afro-Brazilian archaeology, explicitly studying the material culture of colonial beef jerky plantations in Uruguay, Argentina, and Brazil, scholar Lucio Menezes Ferreira also points to this window of possibility. He points out that the absence of interest in the intersection of archaeology and technology studies has left out important insights about

[110]: Herrera (2008), *La Recuperación de Tecnologías Indígenas: una deuda con nuestros pueblos*

the entanglements between technical artifacts and spiritual relationships relevant to current environmental studies [85].

[85]: L. M. Ferreira (2022), *Ancestral technologies: Afro-Brazilian archaeology and its contributions to the material history of Latin America*

Perhaps more consequential for my argument in this dissertation, this gap in technology studies has largely left the study of Indigenous knowledge and technology out of the picture. This disregard has also left out the histories of technologists within these groups and kept us from building an expanded field of technology studies in Latin America. Osorio's positioning of the chuño as an Indigenous, ancestral technology sharpens the persistent overlooking of this category of technologies, even though its continued existence is relevant today. An upcoming review of the literature around the history of technology in Latin America highlights that studies of Indigenous technologies remain an understudied field and brings to attention recent literature contributing to this topic [202]. This recent interest in Indigenous knowledge and technology has also been picked up from within the field of Design. For example, Australian design scholar Julia Watson conducted technical studies of Indigenous technologies, placing ancestral knowledge from various Indigenous groups in conversation with contemporary architectural design. This work represents a significant step towards bridging the historical gap by revaluing ancestral, Indigenous technical systems and practices that are still relevant today [258].

[202]: Reynolds-Cuéllar et al. (2024), *Seeds, Dams, and Khipus: Latin America's Eclectic Recent History of Technology*

[258]: Watson (2019), *Lo-TEK: design by radical indigenism*

Within this context, this dissertation contributes the notion of ancestral technology as a step towards increased attention to the ancestral in technology studies. Given how diverse definitions of technology can be, it is crucial also to situate how ancestral technology positions itself in reference to this landscape.

3.1.3 Notions of Technology Expanding

Having established the space of opportunity for the ancestral within technology studies, I now build upon various conceptualizations of technology in order to propose an expanded understanding in the context of ancestral technology. Because of its prominence in design studies and social studies of technology, I turn to philosophy of technology building over two well-known approaches to the concept of technology and a more recent proposal.

In one of his Bremen lectures, German Philosopher Martin Heidegger called for a broader understanding of technology as more than just a means to an end, driven mainly by human activity. As a prominent phenomenologist, he questioned what the essence of technology is or what technology's reason to exist is beyond its functional purposes. It invited a study of technology as it unfolds. In approaching the question of technology this way, he argued that Nature and, to a certain extent, humans are made into standing reserves: resources waiting to be tapped into for technical purposes [108]. For the most part, this instrumental view of technology —a means to an end— within this particular school of thought remained largely dystopian. Herbert Marcuse, for example, built on Heidegger to advance the idea that the instrumentalization of technical progress led to a "pacification of nature and society" [156]. The Critical Theory of Technology tradition later picked up this wave of analysis into technology.

[108]: Heidegger (1977), *The question concerning technology, and other essays*

[156]: Marcuse (1991), *One-dimensional man: studies in the ideology of advanced industrial society*

Studies within Critical Theory of Technology maintained that analyses of technology were to take place as technology and society continuously and dynamically molded each other, assuming that technologies are socially constructed. U.S. philosopher Andrew Feenberg formalized this position as part of his instrumentalization theory [83]. This view of technology studies is the cornerstone of several criticisms of modern technology, expanded by scholars within this tradition [26], [83]. This period positioned technology as being in flux between being a force of good and wrong [30]. It is within this position of neutrality that the critical work of scholars such as Langdown Winner appears —in his case, demonstrating that technology is value-laden through his analysis of Robert Moses' New York low bridges [264]. These criticisms also highlighted the abstract conceptualization of technology used until then and the need for concrete studies of particular technologies. This opportunity has developed into a growing body of scholarly work at the intersection of fields such as Science, Technology, and Society (STS) and communication studies, among others. Regardless of these transformations, the key takeaway is the idea of technology as a function of social interactions in which they continuously transform each other.

[83]: Feenberg (2012), *Questioning Technology*

[26]: Borgmann (2006), *Technology and the character of contemporary life: a philosophical inquiry*

[30]: Brey (2010), *Philosophy of Technology after the Empirical Turn*

[264]: Winner (1980), *Do Artifacts Have Politics?*

Finally, I foreground the notion of *cosmotechnics* as advanced by Hong Kong philosopher Yuk Hui. Drawing from Eastern and Western traditions of philosophy, including Daoism and Heidegger's phenomenology, Hui proposes that the Nature and function of a given technology (technics) are determined by how cultures relate differently to the world (ontology). One of the critical goals of this understanding of technology is the rejection of a universal categorization of technology in exchange for a culture-specific categorization. Therefore, technology studies must take this techno-diversity into account. He uses this argument to position what he calls *technodiversity*: the possibility of the coexistence of different forms of technology, each informed by different forms of knowledge. In his view, this move towards pluralism in technological paradigms offers an effective response to the homogenization around technology that has led to increasingly harmful impacts of humans over Nature [115, 116]. As a result, this opens the door to radically different, culturally informed narratives of technology. This is precisely the space in which ancestral technology takes shape.

[115]: Hui (2018), *The question concerning technology in China: an essay in cosmotechnics*

[116]: Hui and Lemmens (2021), *Cosmotechnics: for a renewed concept of technology in the Anthropocene*

In summary, I approach technology as a technical means to achieving goals, as a continuous expression and way to reproduce culture, and as an expression of different ways to relate to the world, a representation of technodiversity.

3.1.4 Ancestral Technology: A Proposal in the Making

Within the confines of this broadened interpretation of technology, I formulate a working definition of Ancestral Technology as *an approach that characterizes elements of material culture that primarily support cultural cohesion, are rooted in bounded geography, and hold a history that lives through collective memory*. In what follows, I explore this definition, using the lens of artifacts of material culture I encountered during my doctoral fieldwork in rural Colombia. This process was heavily inspired by the Indigenous research methods of yarning circles, the Shod Yotra, and the *caseo*, all of which I cover in Chapter 4 [46, 98, 256].

[46]: Chindoy Chasoy (2019), *Los kamentsá y el legado visual de la diócesis de Mocoa-Sibundoy*

[98]: Gupta (2006), *From Sink to Source: The Honey Bee Network Documents Indigenous Knowledge and Innovations in India*

[256]: Wanjunagalin and Thompson (2023), *Yubbi Yarning Circle Model: Collective Narratives and Cultural Expression in the Journey of Trauma*

Ancestral technologies accomplish utility functions, such as those connected to the production of goods. However, their primary purpose can be observed in their role in supporting the reproduction of culture. This can take the form of continuing a practice specific to a human group and is essential for maintaining their identity. The *guanga*,[2] a weaving loom used by various Indigenous groups, including the Pastos, Ingas, Quillasingas, and Kamëntšá in the Nariño and Putumayo regions of Colombia, exemplifies this property.

2: Wangësha in Kamëntšá language

Historically, the guanga has represented socio-cultural aspects carried forward by these groups from the beginning of their culture to the present. In its form, the guanga represents the universe; it is an artifact that gives place to loops and patterns in weaving, similar to how the happenings of daily life unfold. The guanga embodies the family space, with two poles representing mother and father, and the space in between acts as a canvas where all essential aspects of culture and family can be represented. Grounded on earth by its base and with a mirroring upper part looking to the sky, the guanga allows for a seamless transition between the two, symbolizing the equilibrium of two opposing representations. Within the social structure of the Pastos Indigenous community, for example, the guanga represents female independence and self-reliance by opening the possibility for women to provide economic support to their families through the crafting of clothing and decorative objects (Chamorro Ramírez, 2022). Batás, or traditional female weavers, are also respected in their communities for their craft and the knowledge imparted through it. Across all these cultural groups' traditions, the guanga also makes possible the fabrication of the *tšombiach* (or *chumbe* in the Inga Indigenous language), a traditional sash commonly worn by pregnant women, carrying an important cultural story related to the life to come. Worn around the stomach, the tšombiach functions as a way to protect life [148]. The symbols embodied in the sash allude to the land, the gods, or family stories, tying all families' heritage together [171]. Some of them, along with the weaving technique in which they are fabricated, can reveal the lineage behind them, effectively building a bridge across generations and tightening the fabric of the community.

[148]: Leyva Mosquera (2015), *El Tsombiach: tejiendo la vida entre memoria y tradición*

[171]: Muchavisoy Chindoy (2003), *Fortaleciendo la educación indígena Kamëntsä a través del Tsombrach*

In the northern part of the country, across the region known as the Bajo Cauca Antioqueño, the *batea*, a wooden pan used for artisanal gold mining, and the ancestral practice of the *barequeo*,[3] achieve similar functions. While part of a set of tools used in artisanal gold mining, the batea is arguably the most important for the *barequeras*.[4] The artifact, accompanied by the practice of barequeo, provides a collective experience where the culture is reproduced. During the barequeo, women recount community stories, often touching upon the role of women who lifted the community thanks to artisanal mining. These stories also relate to myths and cosmological aspects that define the collective identity. The batea is a connecting thread across community members. Discussions about the trees the bateas are made of, their life span, and the plants used with the bateas for the separation of particulate matter from gold are common during the barequeo. This use of plants, lost in the collision between artisanal and small-scale mining —the latter which commonly uses mercury to separate gold from other materials— is making a comeback thanks to the knowledge transmitted through collective memory and across generations. Bateas are commonly passed from generation to generation

3: Roughly translated as artisanal gold panning

4: Female gold panners

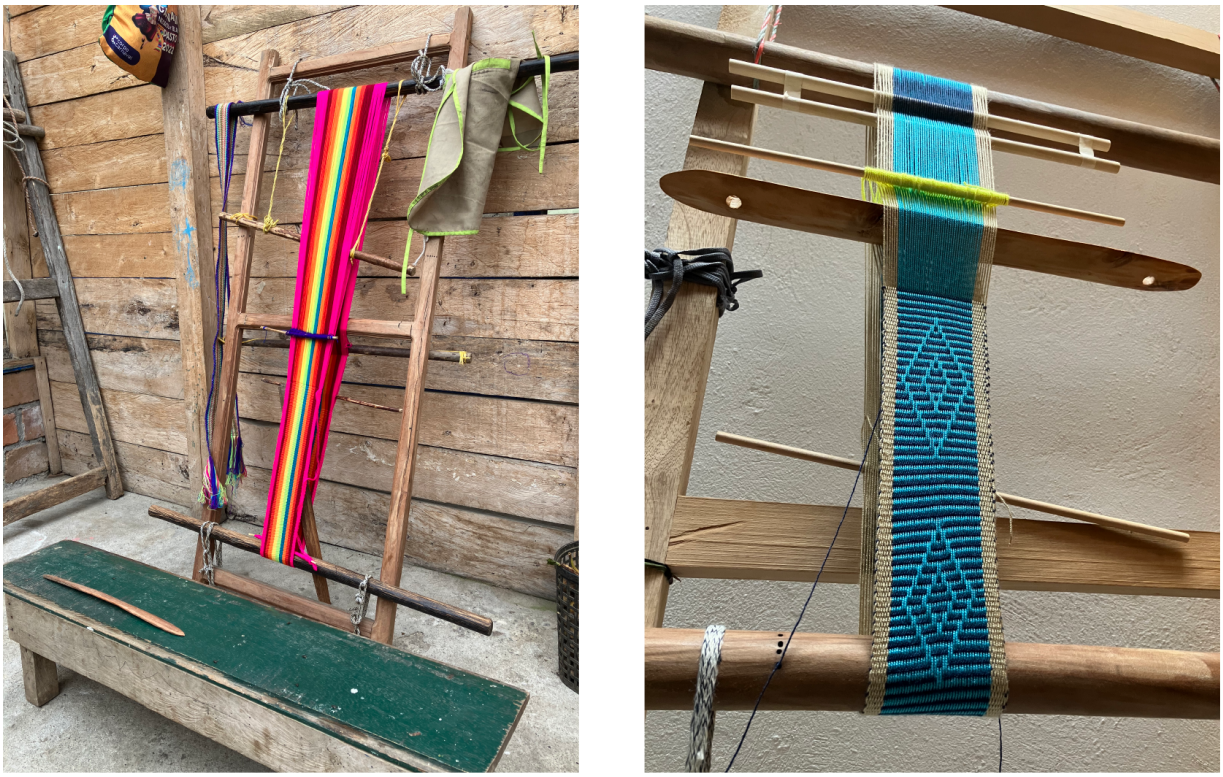


Figure 3.1: Left: guanga weaving loom in the Indigenous Quillasinga style. Right: fabrication of a traditional tšombiach in the Inga Indigenous tradition

and treated with great care. Like the guanga, the batea provides women social status within the community. Barequeras are informally known as 'golden women'. While men also practice the barequeo, it is primarily women who organize it and also the ones who fill with social and cultural meaning the practice of barequeo.

While these two technologies can be found in other geographies, both claim a specific cultural and communal identity defined by the geography from which they stem.[5] Along with the different cosmology and materiality surrounding different bateas, the use of plants and the types of plants used in gold processing as a response to the toxic harms brought by the use of mercury also vary. Moreover, within Colombia only, for example, the Pacific and Atlantic coasts bareque traditions vary in technique. Within the Bajo Cauca region, the *bamburreo* (recovering of debris following machine-drive mining), the *guerreo* (communal agreement with large-scale machinery operators for post-processing of gold), and the *tambeo* (gold panning at the last point of a river stream), as specific to the socio-technical arrangements of place. The symbology behind the guanga, and sometimes even the attaching of meaning to the device, varies across territories.

The cultural significance of these artifacts and practices endures, like the chuño in the Andean highlands. This endurance is possible thanks to a collective memory built and carried almost systematically across oral traditions. In a way, these artifacts and practices act as a node that focuses on meaningful relationships for cultural unity, identity, heritage, and knowledge flow. To expand the understanding of the space of possibility opened by the notion of ancestral technology, the second part of this

5: Similar versions of the guanga can be found across other Indigenous groups in the Andean region. In Colombia, for example, the Arhuaco weaving looms from the Arhuaco Indigenous community while looking similar in form, it accomplishes different cultural functions. Similarly, gold panners and gold panning can be seen across the world within artisanal gold mining communities. However, the meaning attached to the practice varies culturally and geographically

Figure 3.2: Left: monument to the barequera women in the Zaragoza municipality. Right: batea during the barequeo along with the *jaboncillo* plant for segregating gold from sediments

chapter provides an in-depth exploration of the *Minga Investigativa*, as practiced in the Nariño southern region of Colombia, and locally understood as a technology. This form of knowledge production and social organization further emphasizes the cultural, collective memory, and territory characteristics of ancestral technology.

3.2 Part II: The Minga Investigativa

"La raíz [de un árbol], nadie la ve, pero es la que más trabaja, como los Indígenas y los campesinos (The roots [of a tree], nobody sees them, but they are the ones doing most work, just like Indigenous peoples and farmers)."[6]
— León Octavio Osorno. La Paz se Cuenta, 2022

6: Taken from Pérez Mejía, 2021. Banco de La República de Colombia, Ángela Pérez Mejía and León Octavio Osorno (2021) in "La Paz se Cuenta", episode 27: "Antes de reforestar las lomas, hay que reforestar el corazón". MP3 audio, 33 minutes, 34 seconds. Online archive [190]

As mentioned in the first part of this chapter, ancestral technologies are defined by the possibilities they provide for cultural cohesion, their capacity to find meaning and use within particular territorial bounds, and their existence and reproduction through collective memory. They exist within the confines of an expanded understanding of technology in which artifacts are tools for achieving goals, an expression of culture in motion, and an expression of the diverse ways human groups relate to the world. To further illustrate the expanded frame of ancestral technology, I present an in-depth analysis of the 'Minga Investigativa': a social organizing and knowledge production mechanism practiced by farmers and Indigenous Quillasinga groups in Colombia's La Cocha southern region. The account —prepared in collaboration with members from these groups— reveals how the 'Minga Investigativa' made its way back into the culture of the

region following a wave of neoliberal policy and how these groups make meaning of it as a technology, leveraged for systemic change in the field of ecological conservation.

3.2.1 Introduction

In his 2010 book 'Design as Politics', design theorist Tony Fry calls designers to act upon imagining and building a new outlook of the world in which the unsustainable is overcome: sustainment. To move us in that direction, he argues, designers can create the systems and governing mechanisms to get us there. Yet, most of the work needs to be focused on redirecting: disrupting the present, transforming "[...] what [these systems] mean and to [...] effectively redirecting [their] status, value and use" [88]. Along with Fry, other design theorists and social scientists have conveyed that the magnitude of a change at this scale will be difficult to attain without concertedly moving into a massive collective transformation [35, 78]. Instead, what can effectively move us in the right direction is a tapestry of efforts toward sustainment. In recent years, and specifically within the field of Design, this vision for a decentralized world has been conveyed through the concept of the '*pluriverse*.' The notion, brought to conversations in Design primarily by Colombian sociologist Arturo Escobar, is a formulation of how the discipline's present concerns are to be mediated by the challenges and opportunities of a world where divergent cultural, environmental, and epistemological worldviews are to co-exist together equitably: a politics of difference [78]. Moreover, while this approach to the role of Design and designers moving forward has garnered much attention, there are still only a handful of examples in the literature of how the pluriverse can be brought upon or what it looks like.

[88]: Fry (2011), *Design as politics*

[35]: Cadena and Blaser (2018), *A world of many worlds*
[78]: Escobar (2018), *Designs for the pluriverse: radical interdependence, autonomy, and the making of worlds*

In his account of the local epistemologies emerging from the relationships between Afro-descendant communities in the Pacific coast of Colombia and river basin geographies, Ulrich Oslender makes this case clearly: *"I find that debates on pluriversality [...] often lack concrete ethnographic evidence to back up conceptual claims that some readers may find shrouded in unnecessarily convoluted language"* [184]. This chapter and the story it tells are an effort to contribute to bridging that gap. There is no more pressing matter in the present and the near future than the current environmental crisis, a challenge that compels us all. One of the most essential strategies in addressing climate change and its adverse effects is the practice of conservation, ecological guardianship, and restoration of vital natural ecosystems, among other strategies [61, 109]. Furthermore, while conservation presently faces several challenges in making its practices more effective [152], it remains one of the most holistic and tangible ways to contribute to the reduction of greenhouse gasses through carbon sequestering and restoration of biodiversity, both key positive indicators in the struggle against a changing environment [61], [149].

[184]: Oslender (2018), *Local aquatic epistemologies among black communities on Colombia's Pacific Coast and the pluriverse*

[61]: Delgado et al. (2013), *Conservation Practices for Climate Change Adaptation*
[109]: Heller and Zavaleta (2009), *Biodiversity management in the face of climate change: A review of 22 years of recommendations*
[152]: Mackey et al. (2008), *Climate change, biodiversity conservation, and the role of protected areas: An Australian perspective*
[149]: Lindenmayer et al. (2010), *Conservation strategies in response to rapid climate change: Australia as a case study*

Here, I report on work done along with my colleagues Lorena Matabonchoy, Yazmin Yenny de la Cruz, Camilo Hidalgo, and Omaira Bonilla from the Minga Asoyarcocha collective, retracing an account of the work on conservation, sustainability, and sustainment, advanced over the past 42 years by their grassroots organization.[7] Specifically, we focus on a traditional form of social organizing in the region: the '*minga*.' In light

7: Asoyarcocha is a farmers and Indigenous Quillasinga peoples-led rural association located in the Southern region of Nariño, Colombia. https://asoyarcocha.com/

of the ethnography I presented in the first part of this chapter, I argue that the minga serves Asoyarcocha —and the many other collectives that practice it— as a powerful form of ancestral technology.

Mingas are an ancestral form of collective work dating back to the Inca Empire and are widely practiced across the Andean region of South America. Since the practice varies according to local aspects such as culture and governance, it makes it suitable for a wide range of collectives historically connected to this tradition. This variance in how Mingas are practiced while maintaining a core framework makes it relevant when considering the necessary coexistence of difference the pluriverse invites us to attend to. To further situate the minga, we zoom in on the work of Asoyarcocha. We begin with a brief historical account of the organization, specifically in relation to its work on sustainability. We discuss key ideas driving their work and how they map to their initiatives. Following Escobar's concern on the mechanics of difference, and in steering away from romanticizing the idea of the pluriverse in the context of Design, we explore some of the tensions emerging from communal work between two groups with sometimes divergent views and discuss how these are approached to achieve collective goals in the realm of sustainability. We then highlight the organization's collective vision and the vision for the ecosystems they are bound to preserve. We close with a reflection on the nuances of doing community-based work at the intersection of design and sustainability and how designers and readers, in general, can use this experience as a blueprint and inspiration moving forward.[8] In offering this account, we have three main goals: first, to attend to Fry's call to designers and practitioners to *create* and *redirect* Design by showcasing how both actions can take place in the context of conservation. Second, to contribute to the literature exemplifying how pluriversal design can be instantiated by offering an example of a decentralized initiative yet connected to broader, mainstream systems. Lastly, to provide designers and design practitioners with hope and real-world examples for a just, diverse, equitable, and sustainable/sustained world.

8: I want to note that, in my work with Asoyarcocha, I do not speak the language of Design. This is largely a foreign notion for them that members of the collective usually interpret as a privileged activity. Creation on the other hand, is a more familiar term that usually encompasses what academics interpret as design. However, while I do not speak about Design during fieldwork, I am interpreting my experiences through that lens, at least for the purpose of writing this piece

3.2.2 Brief Notes on Methodology

In this section, I offer thoughts on how we collectively approached this collaboration from a process and methodological perspective. These notes are not meant to glorify the research ethics practiced by the authors. Instead, they are meant to surface the places and knowledge traditions that informed how the work occurred. They make concrete abstract, often romanticized claims, percolating practice and academic spaces concerning community-based design work, particularly in the context of discussions around the pluriverse.

While this account aims to highlight the role of the minga as a model for sustainable design, developing this piece reflects how design research methods can be moved in different directions inspired by Indigenous worldviews. Concretely, two of the core methodological and ethical principles in collaborative work in Indigenous worlds, whether research or otherwise, are the presence of meaningful relationships and forms of reciprocity [45, 242, 263]. The idea of this writing came more than a year after I visited the Asoyarcocha community for the first time. It was the natural step after collaborating on other initiatives supporting

[45]: Chilisa and Tsheko (2014), *Mixed Methods in Indigenous Research: Building Relationships for Sustainable Intervention Outcomes*
[242]: Tynan (2021), *What is relationality? Indigenous knowledges, practices and responsibilities with kin*
[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

the Association's mission, including maintaining and developing local technology infrastructure.[9] After living within the community with no agenda, we could speak freely about the goals, dreams, and challenges of myself and the community. This does not ignore differences in values and culture between both. On the contrary, it offered the time and space to form a relationship and find common ground to work through those differences. As I mentioned, embracing difference is essential for instantiating the pluriverse. In moving beyond compensation or transactional actions and into giving back, sharing knowledge, embodying relational accountability, and practicing continuous reciprocity, the work was framed within a series of long-term commitments from both parties [162]. These included ongoing financial, educational, and technical support towards various organizational components of the Association on my end and support with logistics and field research on Asoyarcocha's end. In recognition of the power dynamics inherent in this relationship, we all discussed the purpose of this chapter and contributed to how it is laid out. The chapter proposal and the reciprocity mechanisms mentioned before were submitted for discussion in March 2023 and presented at Asoyarcocha's general assembly later that year, where they received public commentary and approval. I led the research process, leaving the framing of the primary account reported here to be decided by my collaborators in consultation with a small group of community and organization members. My collaborators reviewed, approved, and extended all the secondary data collected for this work. I led the qualitative data analysis and received feedback at multiple points. Several drafts were produced in preparation, all of which were read by all authors and formally submitted for Asoyarcocha's approval.

9: I lived at various times between 2021 and 2023 in the Asoyarcocha community, understanding their structure, becoming familiar with their work, supporting the development and maintenance of food post-processing technological infrastructure, and learning from local cultures

[162]: McGregor and Marker (2018), *Reciprocity in Indigenous Educational Research: Beyond Compensation, Towards Decolonizing: Reciprocity in Indigenous Educational Research*

Methodologically, we followed guidelines from Participatory Action Research (PAR) methods [40, 80, 82], a method known and used in the past by the Asoyarcocha collective and familiar to all authors. The methodology's specific actions included:

- Letting the theme of the work emerge from the community by focusing on the development of a relationship of solidarity instead of an academic relationship
- Legitimizing lived experience by centering local knowledge and by prioritizing qualitative analysis of materials produced by or in partnership with the community;
- Ensure active participation from community members at all stages of the process;
- Submitting the work to the local governance and decision-making mechanisms;
- Discussing the project's goals, process, and outcomes collectively
- Developing work geared towards concrete activities beneficial to the mission and vision of the Asoyarcocha association.

[40]: Caxaj (2015), *Indigenous Storytelling and Participatory Action Research: Allies Toward Decolonization? Reflections From the Peoples' International Health Tribunal*
[80]: Evans et al. (2009), *Common Insights, Differing Methodologies: Toward a Fusion of Indigenous Methodologies, Participatory Action Research, and White Studies in an Urban Aboriginal Research Agenda*
[82]: Fals-Borda (1987), *The Application of Participatory Action-Research in Latin America*

3.2.3 From a Mal Vivir to a Buen Vivir: The Beginnings of Asoyarcocha

The La Cocha Lagoon (also called Guamez Lagoon, sacred territory of the Mocoas and Quillacingas Indigenous peoples) is a glacial reservoir located in the southwestern region of Colombia in the Nariño department, across what is known as the Sibundoy Valley.[10] It is the second-largest

10: The name La Cocha comes from the Indigenous Quechua word "qucha" meaning 'lagoon'

water reservoir in the country. Its location at the intersection between the Andean, Amazonian, and Pacific mountain regions makes it a key biodiversity and natural hotspot. Today, the La Cocha lagoon is the most well-conserved high Andean lagoon, which led to its declaration as a critical wetland under the Ramsar convention in 2000 [166, 250]. Before the period of colonization during the 1500s, this region was inhabited, and the land was owned by a variety of Indigenous groups, including the Quillacingas, Awá, Iscuandés, Telembíes, Tumas, Tabiles, Abadaes, Chinches, Chapanchicas y Pichilimbíes (Ramírez, 2007). Following the colonial process, several groups in this region used the artisanal production of charcoal, combined with subsistence agriculture, small-scale livestock, and collective work as the main mechanisms of economic prosperity. During the first half of the twentieth century, farmers arrived in this region and began to settle. They, too, turned to the same economic activities. However, working conditions were precarious, sometimes involving the labor of entire families, including children. Therefore, communities began to realize a need for alternatives to dignify their work [92, 233]. During this historical juncture that took place over the second half of the century, the boom of what was known as the green revolution pushed the narrative that poverty could only be overcome through agriculture at a mass scale, which implied the expansion of monoculture, the use of agrochemicals, and the technification of production processes into several geographies around the world including rural Colombia [39]. This narrative was brought upon communities by enacting multiple liberal and neoliberal policies submitting to consumption and capital growth measures as well-being indicators. As a result, several existing social, cultural, environmental, and economic dynamics were negatively affected [199]. These adverse effects included accelerated deforestation, soil quality reduction, market dependencies, debt, loss of land ownership, internal conflict, youth migration, and family disintegration, among others. As put by one Asoyarcocha member, "Our history was a history of bad experiences, a history of mal vivir" (Taken from [39, 92].[11] Faced with these negative effects along with rising economic and environmental constraints, the 1980s to the end of the 2000s saw a dramatic shift in how local communities approached established relationships with Nature.

Led by a group of women and under the precepts of the communal, collective framework of the "minga," both farmers and Indigenous Quillacinga groups began to search for alternatives to transition to a more sustainable, nature-based model [92]. In 1980, with support from the Canadian government, a group of 25 members established the Asociación para el Desarrollo Campesino (ADC, Association for Farmers Development) and the Cooperativa Multiactiva Yarcocha Ltda (Coyarcocha, Yarcocha Multiactive Cooperative).[12] In 1996, the cooperative was restructured as a 'minga asociativa' (associative minga) and changed its name to Asoyarcocha to increase participation and to reconnect with the ancestral organizational model of the 'minga' [128]. Some of the early goals for the organization included regaining land back through the collective purchase of property, establishing rotary funds for members and their families, searching for sustainable agricultural and conservation practices, increasing a sense of belonging to place, promoting a dignified approach to rural life, and exerting a fundamental reliance on communal models of social organizing and governance [169]. To date, the Asoyarcocha Minga convenes 154 families across more than 3,000 hectares of land surrounding

[166]: (n.d.), *Minga Asoyarcocha*
[250]: Vélez L. et al. (2015), *Evaluación comparativa de las reservas Refugio Cristalino y Cuatro Esquinas, la Cocha, Nariño*

[92]: Galeano Martínez (2015), *La Asociación de Reservas Campesinas de la laguna de La Cocha: una experiencia alternativa al desarrollo con implicaciones socioambientales y de género.*
[233]: Tarazona Pedraza (2015), *Movimiento en defensa del Lago de la Cocha, Pasto, Nariño, Colombia (1993-2001)*
[39]: Carvajal (2014), *Experiencias significativas de conservación ambiental a nivel de campesinado en Colombia*

[199]: Revelo Salazar (2007), *Disoñar en colectivo una opción para la seguridad y soberanía alimentaria de los pueblos*

11: Translation is ours

12: Since the official establishment of diplomatic relationships between Colombia and Canada in 1953, Colombia has received assistance from Canada across a variety of issues including poverty, inequity, and the establishment of peace. This relationship persists to this day and has expanded to assistance during the signing of the peace agreement and the COVID-19 pandemic

[128]: Jojoa Cerón (2020), *Informe de Gestión, Año 2020*
[169]: Morán Burgos (2014), *Gestión de información espacial como insumo para la planificación de reservas naturales de la sociedad civil, estudio de caso, Minga Asoyarcocha en el Corregimiento de El Encano, Pasto - Nariño - Sistema Institucional de Recursos Digitales - Universidad de Nariño*

Figure 3.3: View of the Laguna de La Cocha from the El Encano municipality

the La Cocha Lagoon. Together, the collective exercises political influence by playing critical roles in the development of environmental policy around wetlands in Colombia, an effort that has significantly increased the genetic biodiversity and quality of the soil, the reforestation and regeneration of native forests, the recovery of natural water sources, along with the return and revitalization of native animal species in their local territory [50, 92, 250].

[50]: Colombia (2006), *WWF Colombia en Acción*
[92]: Galeano Martínez (2015), *La Asociación de Reservas Campesinas de la laguna de La Cocha: una experiencia alternativa al desarrollo con implicaciones socioambientales y de género.*
[250]: Vélez L. et al. (2015), *Evaluación comparativa de las reservas Refugio Cristalino y Cuatro Esquinas, la Cocha, Nariño*

"Since we stopped logging, little by little, we have lowered the consumption of fertilizers and herbicides. We began to see how life was greening. The hummingbirds returned, the water reappeared, and the houses were filled with flowers. It was the body of water surrounded by forest, by life." (Taken from [92], our translation)

At the center of the success of Asoyarcocha's nearly forty-year efforts are the gears, the nuts, and bolts of a common tool for sustainable design and design in general: social organizing.

3.2.4 La Minga Investigativa: Disoñando a Human-Scale Development for La Cocha

The current techno-solutionist approach to change, prevalent in wealthy, privileged portions of society, tends to steer governments, academia, the private sector, and, to some extent, citizens toward a technocratic vision of the future. In finding ways to respond to the influence these narratives wield within Design, scholars and practitioners are increasingly turning to tools from social organizing and adapting them for this purpose. Social organizing core methods, such as the recognition of lived experience, the active engagement of citizens, collective action, and the establishment of critical places in a system where influence can be exerted, resemble strategies widely used in design practice (co-creation activities, community brainstorming, and stakeholder analysis methods). The experience of employing social organizing as a tool to

enact material change (designing) is well exemplified by Asoyarcocha's transition to a sustainable present and sustainable futures. Their process also illustrates a touchpoint between design and social organizing. In our closing remarks, we will discuss what this teaches us about the space between social organizing and design. For now, we offer how this is beautifully conveyed by the notion of 'disoñar,' which is what "those who design their life according to their dreams do."[13] It is "committing to the preparation and execution of a life project tailored to one's illusions; it is to collect those illusions and join them with our dreams to make our way in our own safe direction" (From [69], our translation). *Ultimately, social organizing is design in action.*

13: Disoñar is a concept composed of two words: diseñar (to design) and soñar (to dream). In his book 'Autonomía y Diseño: La Realización de lo Comunal', Arturo Escobar explains how the purpose is "to bring together these two activities, usually separated, and use them to formulate new utopias and propose creative solutions to life issues" ([77], translation is ours). The term is coined by poet and environmental activist León Octavio Osorno

[69]: Duque López (1996), *Disoñadores del Futuro para Cambiar el Rumbo*

3.2.5 The Minga Model in the La Cocha Region

The Minga is an ancestral form of collective work dating back to the Incas and is widely used across the Andean region of South America.[14] Mingas have evolved from being a form of collective work to becoming a widespread model for social organizing [50]. The minga invokes the collective's efforts for communal benefits in terms of labor and intellectual support, a novel aspect of the practice of the minga we will expand on later. This form of collective solidarity opens the possibility to specifically define local needs, largely ignoring external political or economic impositions. In the La Cocha region, following the rise of the neoliberal, technocratic policy mentioned before, the minga practice was substantially discontinued and replaced by participation in consumer markets and exchange networks primarily mediated by external intermediaries. Much of the work involved in counteracting these dynamics and eventually constituting the Asoyarcocha association has been reimagining the minga institution. Led by women, this process has focused on infusing the minga with local cultural elements, maintaining a fluent connection between its constituency and surrounding institutions [92, 233].[15] Therefore, one of the roles of the minga, as practiced by Asoyarcocha, is to expand the realm of the local by building bridges to institutionalized participation spaces (e.g., local cooperatives, regional governments instances) and everyday spaces and networks [199]. This is what the organization calls Associative Minga (Minga Asociativa).

14: The word 'minga' comes from the Indigenous Quechua word 'minka' or 'minccacuni' which means 'to ask for help'. The minga was the traditional voluntary collective work mechanism employed by the Inca Empire or 'Tawantinsuyo'. Following the fall of the Empire, the practice prevailed and is now widely practiced across the Andean region by farmers and Indigenous Peoples alike

[50]: Colombia (2006), *WWF Colombia en Acción*

[92]: Galeano Martínez (2015), *La Asociación de Reservas Campesinas de la laguna de La Cocha: una experiencia alternativa al desarrollo con implicaciones socioambientales y de género.*

[233]: Tarazona Pedraza (2015), *Movimiento en defensa del Lago de la Cocha, Pasto, Nariño, Colombia (1993-2001)*

3.2.6 The Investigative Minga

One of the unique dimensions defining Asoyarcocha's practice of the minga is the central role given to intellectual support and knowledge production both locally and from outside collaborators and institutions. They refer to this as the *Minga Investigativa* (Investigative Minga). To Asoyarcocha, the Investigative Minga is "an applied form of research and participatory action" [69]. This approach to the Minga began in the late 1980s in the context of research collaborations with a group of Canadian researchers led by anthropologist Marie France Labrecque, who developed and deployed a research project with members of Asoyarcocha as research assistants. As an outcome of this experience, Asoyarcocha members developed a sense of empowerment over the means of knowledge production. They began to see a possibility of reducing the reliance on external technicians and development specialists.

[194]: Quevedo C. (1996), *La minga investigativa: conocimiento y saberes compartidos*

15: Across this piece, we highlight the role of female leadership in building, implementing, fostering, and maintaining the mission and vision of Asoyarcocha. We think this is an important aspect since the review of historical documents, gray literature, and conversations with current members, all elevate the angular role of women in the history of the collective. Also, the Investigative Minga model itself is characterized by critically and explicitly approaching hierarchical relations, especially gender and intergenerational relationships, frequently overlooked by other types of research [194]. An in-depth analysis of the role of women in the nature-based development of the La Cocha region of Colombia, see Galeano Martínez [92]

[199]: Revelo Salazar (2007), *Disoñar en colectivo una opción para la seguridad y soberanía alimentaria de los pueblos*

This began the formal practice of the Investigative Minga [69]. Its practice is similar in form and function to Participatory Action Research (PAR).[16] In what follows, we illustrate a rough outline of how the process takes place based on previous experiences in areas such as agroforestry, preservation of traditional foods, or economic exploration of environmental services, as described by [194]. It begins with consultations at the Associative Minga, in which a member (minguero) publicly presents a community research proposal and discusses its objectives. A local research group is assembled and breaks down objectives into problem framings and specific activities, considering the input of members of the Minga participating in the research. The team then decides what instruments and sampling are required to carry on with the project, ensuring intergenerational participation across children, adults, and elders. Once this information is collated, it is submitted for consensus to the local research team, and each researcher is provided with goals and activities and offered the necessary training to bring them to completion. Data is collected and cataloged according to the project's plan, ensuring easy communication with the Associative Minga. The process is built on three core premises: (1) ongoing training to local researchers, (2) continuous assessment of activities, and (3) constant exchange between researchers and research groups along the process. It is important to note that at its origin, the Investigative Minga was devised as a mechanism for local community members to advance community research. Therefore, the community provided the teams, training, instruments, assessments, and other assets needed to advance the research. As the minga stabilized its model, it began to collaborate more intentionally with external researchers, using this as an opportunity to bring new knowledge into the organization on its own terms. It is now common for external researchers to train local researchers in data collection or analysis methods, provide metrics for assessment of existing processes, or support communication of progress and results. The methodology has been employed in service of Asoyarcocha's conservation efforts through research in topics such as water management, the conflict between conservation goals and forest-based energy, and agroecological approaches to corn sowing, among others. As a result, the Association has seen positive results in this area, including the recovery of ancestral knowledge around native biodiversity, the possibility to systematically characterize the landscape, the development of Geographic Information Systems (GIS) pipelines to track natural resources, and the production of local technology according to collective cultural precepts (e.g., living fencing, artisanal trout nurseries). This cultural, investigative dimension to the Minga is also enacted through the local dissemination of knowledge by exchanging traditional food recipes and ancestral preparations of products such as ointments and cleaning supplies [92, 227]. These products also act as additional sources of income, boosting the local economy. Combining local and ancestral knowledge with the skills provided by interfacing with Western, scientific-oriented academics while having the legal standing and representation to be able to secure funds from public and private organizations provides the Asoyarcocha Minga with the necessary tools to strengthen their community base and be the protagonists of their future. In Asoyarcocha's eyes, interactions with academics and intellectuals in the context of research projects connecting to the organization's structure should result in increased local capacity of members as researchers. This can occur through

[69]: Duque López (1996), *Disoñadores del Futuro para Cambiar el Rumbo*

[69]: Duque López (1996), *Disoñadores del Futuro para Cambiar el Rumbo*

16: It is worth mentioning that, methodologically, this chapter follows the Investigative Minga process, therefore, the explanation of its underpinnings partially explains the methodology followed in the elaboration of this chapter

[194]: Quevedo C. (1996), *La minga investigativa: conocimiento y saberes compartidos*

training and resources provided by external collaborators and the knowledge resulting from their lived experience and knowledge of their community [92, 233]. Asoyarcocha has been particularly generative about this intellectual dimension of the minga. For example, their sister organization, ADC, started in the 1990s an international gathering to further expand the dialogue between "professionals," local farmers, and Indigenous community members with empirical, lived experience: the 'Encuentro internacional de disoñadores para el buen vivir' (International disoñadores meeting for the Buen Vivir).[17] These yearly encounters brought together youth, environmentalists, doctors, and some of the most influential thinkers of the time in Latin America, including Uruguayan writer Eduardo Galeano and renowned Chilean economist Manfred Max-Neef. For example, the relationship with Professor Max-Neef made it possible for the minga to become familiar with and eventually adopt Max-Neef's alternative model of Development at Human Scale [233]. In his book "Economics Unmasked: From Power and Greed to Compassion and the Common Good," Prof. Max-Neef highlights the success of combining his model of development with the elements of the Associative and Investigative Mingas:

"All families of the community leave 66 percent of their holdings for conservation, compared with not more than 20 percent conserved by non-members [...] The success of this structure is due to the fact that all productive projects, as well as other initiatives, are designed in coherence with the ecological, geographical, and cultural characteristics of the different areas." [161]

These transitions, made possible by the model of the Investigative Minga, have also been recognized by local farmers who directly enjoy the benefits of this renewed way of interacting with their territory:

"We did not foresee that here, at our house, hummingbirds would arrive, toucans. Why would I believe that this process of planting a little and in variety would give me more than livestock and look now? We enjoy the water (we have fourteen sources), the flowers, the birds, the lagoon." (Taken from [92], our translation).

As we mentioned, the return to ancestral knowledge has made it possible for the minga to find value in investigating itself. Following a generation of La Cocha communities who were oppressed by a period of neoliberal policy, the founding leaders of Asoyarcocha took a chance on a model that leverages ancestral, local practices and recognizes the lagoon as a living, ever-changing environment [92]. This vision also leverages female wisdom, artistic expression, intergenerational forms of knowledge building and dissemination, and traditional agricultural practices and preparation of foods and medicine, to mention a few. It promotes establishing a relationship that allows humans and Nature to transform each other beneficially. Nature, by offering the goods and services required for human sustainment, and humans as agents of care and guardianship of Nature's cycles who act without a sense of accumulation [7].

This approach to the minga that continuously investigates itself allows its members to build on their cultural heritage, further intergenerational

[92]: Galeano Martínez (2015), *La Asociación de Reservas Campesinas de la laguna de La Cocha: una experiencia alternativa al desarrollo con implicaciones socioambientales y de género.*
[227]: Sostenible (2004), *Mesa de incentivos para la conservación y uso sostenible de bienes y servicios de páramos y humedales*

17: From the Quechua expression 'sumak kawsay' (Buen Vivir, or Good Living in English), is a philosophy and political project that emphasizes peoples' agency and responsibility over the protection of the environment and the practice of solidarity towards a dignified, balanced and harmonious life [13]

[161]: Max-Neef and P. B. Smith (2014), *La economía desenmascarada: del poder y la codicia a la compasión y el bien común*

unity, and provide a space for the practice of their farmer and Indigenous identities. This reconnection with ancestral knowledge does not necessarily exclude Western scientific ways of knowing. In fact, the Investigative Minga is an embodied example of how both epistemic traditions can co-exist. As one of Asoyarcocha's members, Patricia Jojoa reflects:

> *"We should not fall into the error of giving greater or unique importance to science's knowledge, academia, or other models. From the communities and collectives, life revolves around many knowledges that allow us to unfold through life respecting wisdom and recognizing our knowledge keepers."* [195].

This re-encounter with heritage-based practices has allowed Asoyarcocha to boost a sense of belonging to place and each other while simultaneously redirecting their future towards sustainable trajectories.

[7]: Altieri and Toledo (2011), *The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants*

3.2.7 Designing Sustainable Futures

As we have recounted, the Asoyarcocha collective and the network of organizations and communities surrounding it have enjoyed several economic, environmental, social, and cultural benefits due to their transformation and return to the minga model. Nevertheless, the question remains: How can this model help design and effect transitions toward sustainable futures? To illustrate the possibilities, we present two significant systemic changes made possible by the Investigative Minga. As mentioned before, protecting and conserving the La Cocha geographical area of influence is one of the main drivers for Asoyarcocha and the connecting thread to other collectives across the region. However, as with many biodiverse and water-rich geographies, it is vulnerable to external interests, from extracting industries to large infrastructure projects and everything in between. This was the case of the Multipurpose Guamés Project (PMG for its Spanish name Proyecto Multipropósito Guamés), which proposed the building of a hydroelectric plant, a system to deal with the increasing need for potable water in the region, and a guaranteed supply of water for the surrounding area. The project received substantial pushback from the community and national and international environmental groups who recognized the potential adverse ecological effects it could lead to. Using the Minga's network connections and relations with external actors, Asoyarcocha and ADC were able to mobilize research and activist collaborations with members of academia and social and environmental NGOs. At the same time, they leveraged influence through the recruiting of 'renowned' experts, politicians, and international institutions such as the WWF (World Wildlife Fund) to the cause, sometimes through the initiative of the Encuentros de disoñadores mentioned in the previous section [233].

[195]: Ramos (2021), *Sociedad civil presenta los desafíos de las diversidades más invisibilizadas de la EPJA*

These connections allowed for multiple research projects to be deployed in the La Cocha region, all using the Investigative Minga model, and led to the backbone of scientific evidence used to request formal international legal protection for the lagoon. The results of these academic and social organizing efforts came on January 8, 2001, when the La Cocha lagoon was declared a key wetland site under the Ramsar Convention. This categorization gave the La Cocha ecosystem legal standing and privileges, which led to the denial of the required licenses for the PMG project to

move forward [39]. More consequentially, the effort set a precedent for other conservation groups working near similar natural ecosystems in other geographies across the country. Another systemic accomplishment came as the Minga sought to provide a legal framework for farmers to continue conserving biodiversity and food sovereignty initiatives. Shortly after the constitutional reform of 1991, which made significant progress regarding environmental protections, Asoyarcocha members sought and achieved consensus around declaring their farms as civil society natural reserves, making them pioneers of this model in the country. As a result, more than 4,000 hectares of their territory, including wetlands, temperate rainforests, water reservoirs, and the biodiversity inherent to the land, were legally declared as natural reserves [161]. Under decree 1996 of 1999, legally recognized natural reserves are to be economically incentivized for their ecosystemic services, receive compensation for biodiversity loss as a result of public projects (e.g., infrastructure), be eligible for tax discounts, and gain access to resources provided by regional environmental organizations among other benefits. Asoyarcocha's partner organization, ADC, later served in leadership of the establishment of the Fundación de las Reservas Naturales de la Sociedad Civil (Foundation of Civil Society Natural Reserves), the first conglomerate serving these kinds of reserves nationally [233]. This move will minimize future threats and negative impacts over the La Cocha territory, offering extra legal protection they saw as needed based on their experience with the PMG project. More importantly, the policy created a framework for collectives in other places around Colombia to use this legal figure for projects related to the protection and guardianship of biodiverse-rich land areas [41]. To date, there are 1,205 protected areas across the country under the figure of civil society natural reserves, protecting a total of 278,100.49 hectares of terrestrial and maritime land [175].

[233]: Tarazona Pedraza (2015), *Movimiento en defensa del Lago de la Cocha, Pasto, Nariño, Colombia (1993-2001)*

[39]: Carvajal (2014), *Experiencias significativas de conservación ambiental a nivel de campesinado en Colombia*

[161]: Max-Neef and P. B. Smith (2014), *La economía desenmascarada: del poder y la codicia a la compasión y el bien común*

[233]: Tarazona Pedraza (2015), *Movimiento en defensa del Lago de la Cocha, Pasto, Nariño, Colombia (1993-2001)*

[41]: Charry et al. (2015), *Áreas Protegidas: Territorios para la Vida y la Paz Tomo I*

3.2.8 Pluriversal Differences in Sustainable Design Practice

The Investigative Minga represents a foundational dimension of the transitions made possible for the community and the surrounding environment. The work leading to these changes has required, at multiple steps, joint action across actors within wide-ranging diversity. In turn, this kind of collective effort calls for strategies to work through these differences. In other words, strategies to make it possible to instantiate the pluriverse. In the case of the Minga Asoyarcocha, these differences have taken place in the context of historically rooted differences and views on land ownership. It has also taken place in the realm of epistemology, where contact with Western science remains a sensitive topic. Here, we offer a short account of these differences and how both groups have overcome them to achieve radical, collective change while maintaining divergent positions. The arrival of farmers to La Cocha territory, a land historically inhabited by Indigenous groups, and the subsequent turn to economic production models gave place to a division in how both groups approached the land.[18] While it is true that this period saw almost all populations turning to neoliberal practices to ensure survival, the historical tethering of Indigenous groups to the territory made their claims

[175]: Naturales de Colombia (n.d.), *Registro Único Nacional de Áreas Protegidas RUNAP*

upon the land more emphatic. Alongside this cultural and historical disjunctive, a history of mistrust in the region, largely a consequence of ill-intentioned political action and remnants of internal conflict, made trust-building across both groups a surmounting task [233]. Moreover, while cultural practices and narratives surrounding the land between members of Indigenous and farmer descent vary, the collective has been able to effect systemic, transformational change over the years. The first test of this collectivity came from the PMG project we described earlier. The fight to declare the La Cocha lagoon a Ramsar wetland and the active participation in establishing the policy for civil natural reserves were pivotal moments in furthering progress and ameliorating some of the issues connected to difference. The collective nature of these transformations gave rise to what has become a collective farmer identity across cultural borders (that complements, rather than takes away from, Indigenous and farmers' identities). And even though positions around the land did not change, the challenge of trust became less prominent, leading to the historic, peaceful, collective accomplishments we hope our account brings to the fore. In our minds, this is clear evidence that the cooperative coexistence of difference, the pluriverse, is a factual possibility.

Some critical aspects that have made these achievements possible are structural, while others build on spaces for cultural exchange. For starters, Asoyarcocha enacts a horizontal, nonhierarchical governance model, following the precepts of the ancestral minga, allowing for highly democratic vision-building and decision-making. Governance leadership is intentional about having representatives from both groups across all organization instances, for example, by tailoring balanced representation during election times. Fluid and ongoing communication channels, including decentralized meetings, large assemblies, and the Association's radio stations, among others, ensure cohesion across all instances, from Asoyarcocha's base to local representatives, all the way to leadership. Some of these spaces are also used to reaffirm and share key aspects of culture across both groups, furthering an understanding of each other's worldviews, values, cultures, and histories. Lastly, working with younger generations, for example, through Asoyarcocha's Herederos del Planeta initiative, ensures early learning on how to work together across cultural boundaries.[19]

18: According to elders' stories, the first inhabitants of this territory arrived at the 'El Encano' village around 150 years ago from neighboring territories in the Nariño and Putumayo departments without recognizing themselves as coming from different Indigenous groups. In 1998, the community experienced the 'Indigenous Quillacinga awakening' where the local history is revised to recognize that some of these early groups were in fact Quillacinga. Since not everyone self-identifies as Indigenous during the 1998 awakening, the community recognizes the territory as inhabited by Indigenous peoples and rural farmers

3.2.9 Conclusion

Social Organizing as Design and as Ancestral Technology There are many strategies and ways to enact change these days. Somewhat unexpectedly for the realm of design, the Asoyarcocha experience portrays how an ancestral, somewhat familiar tool like social organizing can be as, if not more effective for effecting change than many of the staple methods in Design theory and practice. This is not to diminish the potential that Design holds as a discipline and as a narrative. On the contrary, it casts an exciting possibility for designers to recognize the existing influences of social organizing over Design. It also highlights the pressing importance of social organizing methods as part of every designer's toolchain. Is there a designer in social organizing? This is a question open for the reader to consider. What seems clear is that social organizing

Figure 3.4: Illustration of the network of natural reserves in the Laguna de La Cocha. Prepared by ADC, picture taken at the "Búho Natural Reserve"

ought to be part of a designer's practice. The Asoyarcocha experience makes it clear that you can design without engaging Design. Perhaps most thrillingly, it underscores the obligation for designers to engage in respectful curiosity and deep appreciation of the work that grassroots collectives worldwide have been and continue to do. Ultimately, we have a debt in learning about and considering the work of organizations like Asoyarcocha as models for sustainable design, particularly in response to the planetary crisis we collectively face. Hopefully, the portrayal of Asoyarcocha's organizational model, historical achievements, and continued commitment to (re)imagine better futures for all can inspire designers and practitioners alike.

In the same way I encountered the guanga and the batea, walking across Colombia, I came across the Investigative Minga. Similar to previous encounters, the minga appeared to serve the specific purposes of a particular group within a particular territory. Although Asoyarcocha's achievements came from leveraging the minga as a tool for change, they were not interested in making this a model for everyone else to follow. At a moment when both Indigenous and farmers communities were facing the pressure of neoliberal change, the minga served as a mechanism to rally together over shared cultural values. This return to historical identities allowed Asoyarcocha to continue a legacy of collectivism, built and maintained through collective imaginaries.

On January 28, 2023, I had the chance to meet Conchita Matabanchoy, one of the founders of the Minga Investigativa and a fearless leader who has played an integral role in the transformations leading to Asoyarcocha's achievements. After I left her natural reserve, I wrote in my journal:

"Her reserve is a testament to what decades of conservation look like. Her place has many native and endemic trees, plants, and animals. Wild parrots fly and hang out around huge trees in front of her house. The place is covered in green. She has a large collection of succulent plants, likely the biggest one I have ever seen. She has received several awards for her work with women and her leadership within the organization. Upon arrival, I was introduced to her. She thanked me for the work we did with the machines at the Association; we talked more about dreams for the future. When I asked about her thoughts about the

19: The initiative is an effort bringing together youth groups from five different regions to collectively advance research, conservation and communication efforts. See online at https://adc.org.co/en/herederos-del-planeta

minga, she said, "My work is about making our dreams come true; the minga is the technology we use for that."[20]

Figure 3.5: Sign posted at the entrance of the "Encanto Andino Natural Reserve". It reads: "This corner in the Andes, scenery of natural beauty, school of ancestral knowledge and wisdom. Here, where life finds refuge, empire of the waters and the wind that turns into a song. . . disoñamos (design-dream) the 'buen vivir' in harmony with nature."

Walking across Colombia taught me that there is a world of technology outside of what I see day in and day out at a place like MIT. The minga, a simple idea, a strategy, a tool, or, as Conchita names it, a technology, is yet another example of why the question of what technology is remains open. In learning the story of Asoyarcocha and the Investigative Minga, I found something that moved across generations through collective memory. Something that, despite existing across a larger region in various forms, is infused with local culture and feels and is experienced as local. Something that exists because of the territory where it is expressed and is present in a territory that is possible thanks to its existence. The minga is an exemplary representation of what ancestral technology is and can be.

3.2.10 Ancestral Technology Moving Forward

In this chapter, I outlined my understanding of what Ancestral Technology is and what type of changes it makes possible, and offered examples of how I have encountered it during fieldwork in rural Colombia. By highlighting the territory-specific roles played by technologies such as the guanga, the batea, and the minga, I argued that we could read and imagine technology outside narratives of globalization, scale, and modernity —often in tension with place-based values— and into narratives around the local, right-sized, and ancestral. In leaning into the culturally aware dimensions of these artifacts, I propose that designers and technologists can be exposed to a host of worldviews and connections, leading us to different technological imaginaries. Finally, the dynamic, highly relational Nature in which these technologies endure through collective memory offers an understanding of technology beyond mere instruments, inactive elements of material culture, and into socially constructed, localized, and ever-changing mechanisms.

Throughout the dissertation, and with the formal definition of Ancestral Technology I offer here as a central point of inflection, I made a case for a renewed outlook on the ancestral in reference to Design and technology studies. By seeking inspiration from Indigenous research methods or encounters with technology in historically marginalized geographies, we open technology studies to the ancestral. In making local expertise and place-based knowledge prominent in engaging design education, we open design studies to the ancestral. In expanding the methodological and ethical universes from which design and technology studies depart and using tools that respond to those values, we provide structures of support to future engagement with the ancestral. I hope technologists and designers alike use these insights to explore new horizons in their practice. This dissertation is in service to that hope.

El Barranquero Andino (Momo-tus Aequatorialis) cava huecos de 1 mt de profundidad en los barrancos para poner sus huevos, para después exhibir su gran belleza. Así mismo es el trabajo del investigador, que se interna en la profundidad de las comunidades para mostrar sus saberes en torno al trabajo de la miel y el café

The Andean Barranquero (Momotus Aequatorialis) digs 1 meter deep holes in the ravines to lay its eggs, and then display its great beauty. This is also the work of the researcher, who goes deep into communities to show his knowledge about the work of honey and coffee

Pablo Jojoa

4 Design Research at the Interface

In Chapter 1, I stated my intention to work throughout this dissertation towards reclaiming the ancestral within design and technology studies. This begs the question of how one does such a thing. In this chapter, I argue that one powerful way is by questioning the methods and methodologies we use when doing design research, as well as the worldviews from which these methods —and subsequent designs— are departing. In bringing this insight to practice, I present a narrative review of Indigenous research methods utilized in the context of various design projects. First, I set the context in which the review takes place, flesh out its importance for the practice of design, and then detail its methods, findings, and the insights I drew from it.

4.1 Methodological Imaginaries in Design

As I mentioned in Chapter 2 and later in Chapter 5, the history of Design in the United States and the commercial "flavor" in which it developed led to an explosion within Design education. This was further galvanized by the intersection of these narratives with global innovation ideas. Through the expansion of Design within academia, corporate circles, and the proliferation of Design agencies, the discipline has become a much more approachable field. One of the key moves in this apparently "democratic" move in Design was the productization of design research methods as one of the ways to engage with 'designerly thinking.' As a result, a rapid increase in packaged methods took place, which left us with a series of toolkits, card decks, and best practices, all promising to bring us closer to becoming designers. There is no shortage of stories portraying how these tools can produce results that satisfy users, creators, and investors' expectations. Partly, this is a product of the fast turnaround in results these methods provide and the sense of progress animating the ideas behind these tools [2]. Hackathons, for example, have become a staple in the corporate world and academia, as they are misleadingly effective ways to deploy rapid design methods that will lead to impactful results [120].

While this "democratization" of the Design narrative has provided various groups opportunities to participate in the conversation, it has also made it difficult to agree on the values we should aspire to when engaging in design practice. Therefore, the default values turned out to be the ones of the privileged groups who can operate under the narrative of Design, at times, over the global stage. As a result, many of these engagements have taken place while replicating these dominant groups' power, wealth, and political and social dynamics. Also, it has flattened important ideas behind research and social interaction more generally. For example, lessons learned, user personas, design requirements, or knowledge gained express an extractive attitude towards design research instead of a mutually beneficial encounter [121]. Important social mechanics

[2]: Ackermann (2023), *Design thinking was supposed to fix the world. Where did it go wrong?*

[120]: Irani (2015), *Hackathons and the Making of Entrepreneurial Citizenship*

[121]: Irani et al. (2010), *Postcolonial computing: a lens on design and development*

such as empathy are then trivialized into mere transactions, largely ignoring situated knowledge and avoiding commitments or solidarity [53, 218]. Therefore, despite the perceived popularity of Design, we need to rethink how we engage with it, especially when working within community-based programs in historically marginalized geographies. We must extend the ways in which Design engages. Here, I embrace the postcolonial computing project as a way where "all design research and practice is culturally located and power-laden, even if considered fairly general." [121].

[53]: Costanza-Chock (2020), *Design justice: community-led practices to build the worlds we need*
[218]: Serpa and Batista (2021), *Solidarity as a principle for antisystemic design processes: two cases of alliance with social struggles in Brazil*

There are multiple ways in which Design can be put into action, including planning, design research, deployment of technology, and monitoring and evaluation, among others. In this chapter, I focus on design research and use it as a point of departure toward extending our methodological imaginations. While there are several established methods for design research within Participatory Design [103], some of which are explicitly to work in the Global South [144], here, I draw inspiration from Indigenous research methods.[1] As a long-standing struggle, Indigenous research methods are characterized by their focus on enabling knowledge production that reacts and pushes back to dominance, animated by visions of autonomy and self-determination [44, 138, 263, 266]. These methods also differentiate from classic design research methods in that they are the result of generations of knowledge transmission through experiential mechanisms, storytelling, and connection to the land and the spiritual world, among others [147, 160, 226]. Noonuccal scholar Karen Martin-Booran called Indigenist Research the type of research that sits over three primary constructs: "first, establishing through law what is known about the Entities [constituting the world around]; second, establishing relations amongst Entities; and third, enacting ways for maintaining these relations." She denotes these as "Ways of Knowing, Ways of Being, and Ways of Doing." [158]. Relationality, as this review will demonstrate, is a crucial force within Indigenous research methods. So, respect, reciprocity, and responsibility are all values that counteract the ones pervasive in current design research methods, as mentioned before. These connections have the potential to offer a new outlook into how design research is engaged. Examples of how design can be approached methodologically, from Indigenous perspectives, are already appearing in the literature [111, 216]. This review provides an additional connection to this body of work.

[103]: Hansen et al. (2019), *How Participatory Design Works: Mechanisms and Effects*
[144]: Laura Ramírez Galleguillos and Coşkun (2020), *How Do I matter? A Review of the Participatory Design Practice with Less Privileged Participants*
1: Kanaka ʻŌiwi scholar Renee Pualani Louis outlines Indigenous research methods this way: *"Indigenous methodologies are alternative ways of thinking about research processes [...]. They are fluid and dynamic approaches that emphasise circular and cyclical perspectives. Their main aim is to ensure that research on Indigenous issues is accomplished in a more sympathetic, respectful, and ethically correct fashion from an Indigenous perspective. There are overwhelming commonalities in the literature on Indigenous methodologies and Indigenous research agendas. These include four unwavering principles: relational accountability; respectful representation; reciprocal appropriation; and rights and regulation."* [151]
[44]: Chilisa et al. (2017), *Community engagement with a postcolonial, African-based relational paradigm*
[138]: Kovach (2010), *Indigenous methodologies: characteristics, conversations and contexts*
[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*
[266]: Xiiem (Archibald) et al. (2019), *Decolonizing research: indigenous storywork as methodology*
[147]: Lekoko (2007), *Story-Telling as a Potent Research Paradigm for Indigenous Communities*
[160]: Mavhunga (2017), *What Do Science and Technology mean for Africa*
[226]: L. T. Smith (2012), *Decolonizing methodologies: research and indigenous peoples*
[158]: K. Martin and Mirraboopa (2003), *Ways of knowing, being and doing: A theoretical framework and methods for indigenous and indigenist re-search*
[111]: Hokowhitu et al. (2021), *Routledge handbook of critical indigenous studies*
[216]: Schultz (2018), *Mapping Indigenous Futures: Decolonising Techno-Colonising Designs*

4.2 Suspending Damage in Design Research

Those of us who have used Design research methods unreflectively and are now engaged in reflexive design practice will eventually be confronted with our complicity in business as usual into how some of the dominant ideologies and values I mentioned before are reproduced within Design. In 2019, after having numerous transformational experiences thanks to collaborators from the Arhuaco Indigenous community in Colombia, I read a text that entirely shifted my thinking. "Suspending Damage: A Letter to Communities." In it, Unangaŝ scholar Eve Tuck offers a sharp call to research communities to move away from research that tokenizes, focuses on experiences of marginalization, gives voice to others to learn

from their challenges, and ultimately appropriates these voices and the culture surrounding them, rendering them as mere academic assets. In reading and applying Indigenous research methods without deeply engaging with the worldviews, norms, and politics of this knowledge, we run the risk of perpetuating these dynamics.

In her call to stop damage-centered research, Prof. Tuck invites researchers to shift to what she calls desire-based research. A practice that "[...] accounts for the loss and despair, but also the hope, the visions, the wisdom of lived lives and communities." [237] She invokes examples that look beyond the histories or current challenges facing minority groups —such as African Americans and Native Americans— and into their hopes for the present and visions for the future. Across the text, she lays out how, historically and in the present, research can serve as an instrument of oppression. She is not alone in this criticism, as Māori scholar Linda Tuhiwai Smith makes clear when she calls research "one of the dirtiest words in Indigenous worlds." [226]. However you approach this call, these are hard questions to confront.

[237]: Tuck (2009), *Suspending Damage: A Letter to Communities*

[226]: L. T. Smith (2012), *Decolonizing methodologies: research and indigenous peoples*

As I hinted at the beginning of this section, reflexivity is essential in moving us away from something we know "works" to something we know works and avoids damage. In my view, and throughout this dissertation, I propose this search to begin with yourself. Let me explain. Two years ago, my colleague Claudia Grisales and I wrote about the "Saber y Vida" methodology, a program led by our colleagues Gloria Muñoz and Andrés Sicard at the Universidad Nacional de Colombia. In essence, the methodology proposes —at least in the way I interpret it— that to design externally, you start by tracing and "designing" your own self, your identity. The methodology proposes that collective and individual memory and our links to the territory[2] will eventually emerge as principles guiding your way of designing [97]. Introspection is never easy, especially when it comes to our identities and our "professional" practices. This is particularly true in a world where our territories and our memories can be situated across multiple cultures and geographies. I firmly believe that a path in which we begin with ourselves will inevitably lead us to a place where we can approach Design and designing more critically and constructively. As someone raised in a family of rural farmers in a territory historically inhabited by Indigenous Peoples —yet not raised under that culture— I was drawn to these memories and these territories in the search for an identity as a designer.

2: Saber y Vida considers the body the first and foremost territory from which one can depart. This view is aligned with decolonial views that see the body as the beacon to all relationships in one's life [100]

Despite the challenges in switching the usual ways in which Design research has unfolded, I contend that we have a responsibility and opportunity to do so and that Indigenous research methods provide great inspiration for that purpose. For example, the Honey Bee Network in India focuses on positioning Indigenous and grassroots technology in a level plain field with dominant narratives and structures for technology development. Through a combination of Indigenous research methods, systematic documentation of technology, and policy change, the network managed to construct a repository of more than 50.000 technologies [98]. To my knowledge, this initiative represents one of the first systemic efforts to formulate a technological paradigm from the bottom up and with an entirely different economic model than the Khunian and Neo-Schumpeterian scientific and technological paradigms dominating neoliberal economies [65, 176, 251]. All are departing from

[98]: Gupta (2006), *From Sink to Source: The Honey Bee Network Documents Indigenous Knowledge and Innovations in India*

[65]: Dosi (1982), *Technological paradigms and technological trajectories*

[176]: Nelson (2008), *Factors affecting the power of technological paradigms*

[251]: von Tunzelmann et al. (2008), *Technological paradigms: past, present and future*

Indigenous and grassroots perspectives. Many more examples of different ways to leverage design research to highlight what is possible through Indigenous research methods can be found in Prof. Julia Watson's Lo-TEK compilation, a visual collection of Indigenous research methods into action [258].

[258]: Watson (2019), *Lo-TEK: design by radical indigenism*

In what follows, I present a narrative review of Indigenous research methods utilized in the context of various projects. I start with a series of recommendations on how to read this review in light of the need to suspend damage. I outline the methodologies and methods I used in developing the review and discuss a series of findings and insights and the limitations of this work. My goals are (1) to consolidate an array of work using Indigenous research methods in connection to designerly work and (2) to describe their commonalities and how they can contribute to designers thinking differently about their practice. I hope to facilitate a bridge for design students, practitioners, and theorists who, like me, do not have a grounding in Indigenous culture but feel compelled to explore new Ways of Knowing.

4.3 The Spirit of this Review

I followed a few guiding principles while working on this review. The first one, offered by Opaskwayak Cree scholar Shawn Wilson, is an invitation to redirect the established academic meaning of literature reviews as a way to fill a gap. Instead, a review can be approached as an exercise in threading across and embracing different ways of knowing [263]. Relationality is a fundamental idea in the context of a literature review of research methods because it helps drive the point that a vital component of a research method is not the method itself but its relationship to a given set of worldviews. As Pasqua scholar Margaret Kovach pointedly explains in the context of Indigenous research: "Indigenous methodologies are a paradigmatic approach based upon an Indigenous philosophical positioning or epistemology. Thus, it is not the method, per se, that is the determining characteristic of Indigenous methodologies, but rather the interplay (the relationship) between the method and paradigm and the extent to which the method itself is congruent with an Indigenous worldview." [137]. Ultimately, as tools themselves, literature reviews, as any other tool, can —and should— be transformed and expanded [243].

[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

[137]: Kovach (2020), *Conversation Method in Indigenous Research*

[243]: Tynan and Bishop (2023), *Decolonizing the Literature Review: A Relational Approach*

In building this bridge across knowledges, I follow the guidance from Māori academic Sir Mason Durie, who names the space where different knowledges touch points as an interface,[3] an interface where "[...] knowledge systems entwine in equal partnerships, where one system is not superior over the other" [70, 72, 211]. Ultimately, I agree with scholar Meg Parsons and colleagues in that there is room for improvement when collaborating with Indigenous communities in the context of design [188]. One way of doing it is by turning our eyes to other ways of doing research while recognizing those enabling these transformations. Citations, for example, help signal these knowledges, as remarked by scholar Eve Tuck and other Indigenous and non-Indigenous scholars under the banner of citational justice [33, 49, 170, 239]. It might also involve rethinking the way in which these knowledges are approached within academia

3: The notion of interface has been explored by other Indigenous scholars in other domains. See the work from Nakata [174] on cultural interfaces.

[70]: M. Durie and Zealand (2004), *Exploring the Interface Between Science and Indigenous Knowledge*

[72]: M. Durie (2005), *Indigenous Knowledge Within a Global Knowledge System*

[211]: Ryder et al. (2019), *Indigenous research methodology – weaving a research interface*

[188]: Parsons et al. (2016), *Alternative approaches to co-design: insights from indigenous/academic research collaborations*

[33]: Burgess et al. (2021), *Calling forth our pasts, citing our futures: an envisioning of a Kaupapa Māori citational practice*

[49]: Collective et al. (2022), *Citational justice and the politics of knowledge production*

[170]: Mott and Cockayne (2017), *Citation matters: mobilizing the politics of citation toward a practice of 'conscientious engagement'*

[239]: Tuck and Yang (2016), *What Justice Wants*

by turning critically to established systems like review boards [107, 114, 192].

[107]: Hayward et al. (2021), *A New Era of Indigenous Research: Community-based Indigenous Research Ethics Protocols in Canada*
[114]: Hudson et al. (2010), *Te Ara Tika Guidelines for Māori research ethics: A framework for researchers and ethics committee members*
[192]: Pollock et al. (2017), *Ngapartji Ngapartji: Finding Ethical Approaches to Research Involving Indigenous Peoples, Australian Perspectives*

4.4 Recommendations for the Reader

I will be remiss if I do not highlight a few aspects I consider important when reading this review. These are considerations that I have taken as I produced the review and, more broadly, in my journey of engaging with Indigenous scholars and practitioners and their work.

- Use this review as an opportunity to build a relationship with this work instead of just taking the work and running with it. When researchers deploy ideas that have been built and cared for by Indigenous colleagues without fully engaging with them, we run the risk of depleting them of their power, co-opt and de-contextualize them, ultimately domesticating them into mainstream narratives.[4] Koori scholar Dennis Foley refers to using Indigenous research methods without the required commitments as a "McDonaldisation" effect [86]. We must remain respectful of the meaning and importance of Indigenous knowledge in lieu of the painful history of appropriation and colonization that has descended upon these communities.
- Not all Indigenous knowledge is meant to be known. Embrace that as a feature. While the review highlights many examples of how design practice can intersect with Indigenous research methods, there is undoubtedly more that is place- or culture-specific, which is implicit, unspoken, and therefore unclear to us.
- The knowledge contained in this review does not belong to the world of Design. In most cases, the authors did not even use that language. Perhaps more importantly, if we are to contest the dominance of Design's narratives, we must develop a sense of connection with ways beyond its scope. In speaking outside that scope, we sustain power in the sites where the knowledge included in this review comes from.
- Seek inspiration, not romanticization. My intention with this review is not to romanticize, exoticize, or make value judgments about any form of knowledge. Instead, I invoke notions advanced by Indigenous scholars in an effort to encourage readers to engage with them as they go about their design practice.

4: The rise in use of the language of Decolonization is a palpable example of this [238]

4.5 Methods

In this review, I combine a systematic approach to finding literature and reflexive thematic analysis to explore it. These methods were informed by the relational framing of literature reviews advanced by trawlwulwuy and Gamilaroi scholars Lauren Tynan and Michelle Bishop. They identify that literature reviews, methodologically speaking, could begin with knowledge raised through relationships with colleagues or culture. They also bring into question what constitutes literature within Indigenous scholarship by pointing out that a vast amount of knowledge is kept orally within these communities. They highlight literature reviews as a

method to relate to people producing knowledge instead of relating to architectures that store knowledge, such as databases [243]. I integrated all these principles and further explained how I did so below. I used the Scale for the quality Assessment of Narrative Review Articles (SANRA) to guide the process of reporting the importance, goals, methods, and results I offer [14].

[243]: Tynan and Bishop (2023), *Decolonizing the Literature Review: A Relational Approach*

[14]: Baethge et al. (2019), *SANRA—a scale for the quality assessment of narrative review articles*

4.5.1 Data Collection

Using [243] as guidelines for data collection, I structured the process through five steps: (1) Eliciting literature from Indigenous colleagues and colleagues working with Indigenous methods; (2) Searching on databases, screening abstracts, screening; and (3) reading full-texts Annotating data from texts.

Relational and Database Search

I began the search for sources through personal communications. I reached out to sixteen collaborators, most of them of Indigenous descent, all working at an intersection with Design. In my request, I disclosed I was building on the critical work of Tynan and Bishop —mentioned at the beginning of the methods section—and used the following prompt to ask them if they could recommend works to include in this review: "Would you be open to sharing texts, art, songs, etc, that, in your view, speak to the ways in which Indigenous methods/methodologies intersect (or could) with design research —as traditionally taught in western design institutions?" Furthermore, I met with nine collaborators to clarify their shared work or to receive suggestions for oral stories and songs that added context. I received a total of twenty-three documents through this search strategy. Nine of these went into the final sample. While not speaking directly to the intersection of Indigenous research methods and design research and practice, the remaining texts were used for contextual discussions, and many were referred to during the introduction of this chapter.

I then searched using a mix of databases and repositories of specific publications. I used several databases in Drawson, Toombs, and Mushquash systematic review of Indigenous Research Methods [67]. The final database list included ACM Digital Library, EBSCO, ERIC, ScienceDirect, Native Health Database, Taylor & Francis, and Wiley. I also targeted specific publications related to design, including Design Research Society, Journal of Textile Design Research and Practice, American Indian Culture and Research Journal, Native American and Indigenous Studies, International Journal of Critical Indigenous Studies, Decolonization: Indigeneity, Education & Society, and AlterNative. I intended to include works from the Native Studies Review publication, but the repository does not have a search function.

[67]: Drawson et al. (2017), *Indigenous Research Methods: A Systematic Review*

I developed a boolean search iteratively to identify work done using Indigenous research methods that were intentionally framed as or intersected with Design. I included multiple common denominations related to Indigenous work to solve the challenge of searching for works related to specific Indigenous groups. These included searches with

the terms "aboriginal", "native american", and "first nations". Also, in trying to expand beyond the language of Design, I included the terms "participatory design," "Co-design," "codesign," and "co-creation" in the search. Table 4.1 shows the search terms I used. I included one piece of gray literature, the 'Collaborative Indigenous Research Digital Garden' created and managed by the Tkaronto CIRCLE Lab [64]. I used the "Indigenous Research Methods" filter option to select relevant works. While I think this is a step in the right direction, many repositories of knowledge outside of the academic space are not accounted for in this review. The search included peer-reviewed articles primarily in written English and published between January 2003 and 2024. I included a few works in Spanish, most of which were suggested by colleagues. Therefore, this is a limited sample of non-English literature. The total hits received by this search strategy was 769 texts.

[64]: Digital Garden (2023), *Welcome to the Collaborative Indigenous Research Digital Garden! | Collaborative Indigenous Research*

Abstract and Full-Text Screening

I started the screening process by removing any duplicates in the dataset. At this point, I included works focused on all stages of a given research project. I retained works solely theoretical instead of case studies of projects where artifacts were designed.

Table 4.1: Search terms on databases and specialized publications

Database	Data type	Search terms
ACM, EBSCO, ERIC	Full text and metadata	("indigenous" OR "aboriginal" OR "native american" OR "first nations") AND ("research" OR "methods" OR "methodologies" OR "methodology") AND ("design" OR "co-design" OR "codesign" OR "participatory design" OR "co-creation")
ScienceDirect, Taylor & Francis, Wiley	Title, abstract and keywords	("indigenous" OR "aboriginal" OR "native american" OR "first nations") AND ("research" OR "methods" OR "methodologies" OR "methodology") AND ("design" OR "co-design" OR "codesign" OR "participatory design" OR "co-creation")
Design Research Society, Journal of Textile Design Research and Practice, American Indian Culture and Research Journal, Native American and Indigenous Studies, International Journal of Critical Indigenous Studies, Decolonization: Indigeneity, Education & Society, and AlterNative	Title and abstract	(indigenous OR aboriginal OR native american OR first nations) AND (research OR methods OR methodologies OR methodology) AND (design OR co-design OR codesign OR participatory design OR co-creation)

As the delineation of what constitutes design became blurry for some articles, I excluded works that (1) did not directly use Indigenous research methods (e.g. research that drew inspiration from a method but did not use it in the research described); (2) used work done through Indigenous research methods to implement a project, but did not employ Indigenous research methods in the process (e.g. health interventions only informed by data collected through Indigenous research methods); or (3) did not use Indigenous research methods but engaged with members of Indigenous communities.

I reviewed all the results' titles and abstracts, putting aside 12 edge cases. After finishing applying the eligibility criteria, I read in full the 12 articles marked as edge cases and made decisions on those based on the criteria

mentioned before. After revision of the 769 texts, forty-two were left for analysis. This process is shown in Figure 4.1.

Full-Text Annotation

I then went on to read the forty-two texts identified. First, I collected information from each paper regarding (1) the type of publication venue, distribution of articles per year and geography; (2) the Indigenous groups referred in articles; (3) key methods and notions advanced by the articles; (4) domains where the research was done; (5) research methods used; (6) the stage of research at which the methods were used; (7) ethical frameworks used to guide the research; and (8) the type of work described in the article (case study or theoretical).

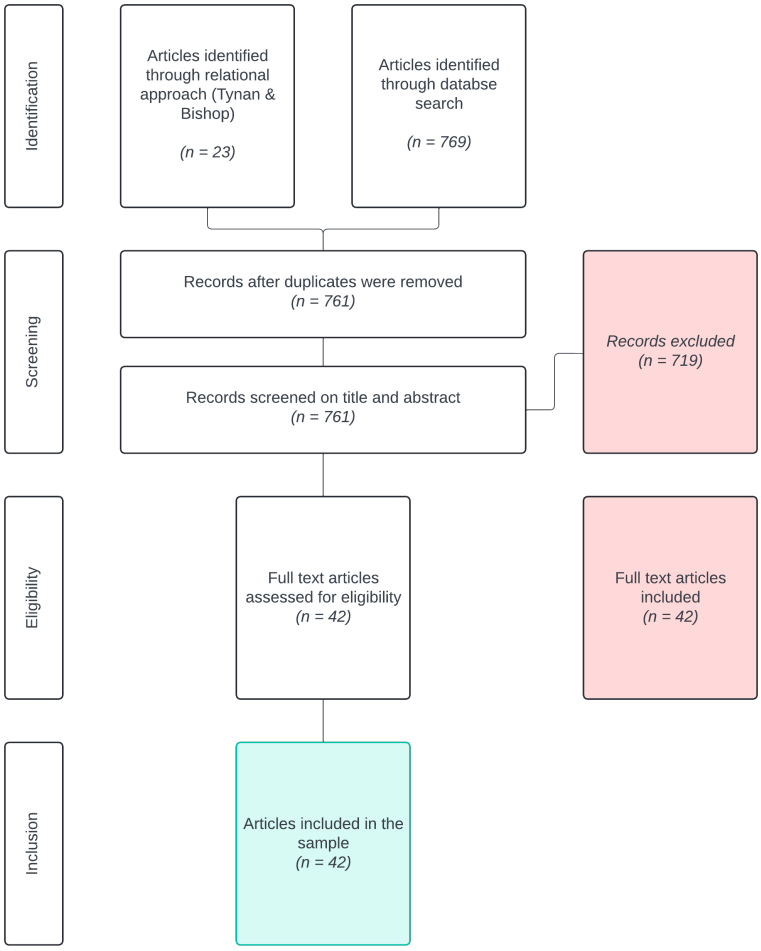


Figure 4.1: Flowchart outlining the inclusion selection process for building the review corpus

4.5.2 Data Analysis

In analyzing the texts, I used an inductive thematic analysis approach, following six main stages: (1) familiarization with the data; (2) code generation; (3) generation of initial themes; (4) themes revision; (5) definition and naming of themes; and (6) production of findings [28, 29]. I note that I cannot take full advantage of this methodological approach, given that I am the sole author of this review. In the first

[28]: Braun and Clarke (2022), *Thematic analysis: a practical guide*
[29]: Braun and Clarke (2006), *Using thematic analysis in psychology*

stage, I collected general information from the texts as a first step in familiarizing myself with the data. I then read all articles in full, using ATLAS.ti[5] to code text and cluster annotations into teams as I developed them. During the initial theme generation, I circled back to some of my collaborators for their input on what I found in the theme revision stage. I took the set of themes I developed and reviewed it against a small set of seminal books on Indigenous research methods, namely "Research as resistance: Critical, indigenous and anti-oppressive approaches"; "Research is Ceremony: Indigenous Research Methods"; "Indigenous methodologies: Characteristics, conversations and contexts"; "Decolonizing methodologies: Research and indigenous peoples"; and Indigenous research methodologies" [31, 43, 138, 226, 263]. The resulting themes and findings are presented in the Findings section below.

5: ATLAS.ti https://atlasti.com

[31]: Brown and Strega (2005), *Research as resistance: critical, indigenous and anti-oppressive approaches*
[43]: Chilisa (2020), *Indigenous research methodologies*
[138]: Kovach (2010), *Indigenous methodologies: characteristics, conversations and contexts*
[226]: L. T. Smith (2012), *Decolonizing methodologies: research and indigenous peoples*
[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*
[243]: Tynan and Bishop (2023), *Decolonizing the Literature Review: A Relational Approach*

4.5.3 Limitations

This review highlights notions and knowledge in an inorganic way. Tynan and Bishop also identify this tension when they discuss the abstracting characteristics of literature reviews in the face of what essentially is relational knowledge. Knowledge is presented as detached from the places and cultures animating it [243]. A narrative review focusing on a small set of studies might be more appropriate to mediate this tension. This should serve as a reminder of my recommendation to readers that the knowledge offered by this review is not to be taken lightly, rather than engaged with depth and commitment.

While the descriptive statistics I present in the findings section can help understand certain aspects reported by the texts, it runs the risk of excluding information that might be important to Indigenous scholars, for example. As I stated in Chapter 1, my positionality is one of a non-Indigenous researcher and design practitioner attempting to engage in conversation with a broad audience of peers. I recognize that my non-Indigeneity cuts my analysis short or takes it in a different direction, at best. One clear example of this is the focus of this review on articles discussing Indigenous methods that intersect with design. This decision leaves behind articles that discuss Indigenous methodologies without signaling this connection, but that could speak to it.

Perhaps the most significant limitation of this review is the fact that the analysis was done only by me. While I received feedback from a handful of Indigenous researchers, I considered this study incomplete at best until analyses can be done in collaboration, ideally led by Indigenous scholars. I recognize I am at risk of underrepresenting Indigenous views for the sake of summarizing findings.

4.6 Findings

The literature at the intersection of Indigenous knowledge and Design, at least in the context of the articles collected here, can be divided into two main strands. On the one hand, a series of papers conceptualizing various research methods from an Indigenous standpoint often in the context of design projects. On the other hand, a series of studies using established

Indigenous research methods as part of design processes. In engaging both strands, I present my findings by offering a descriptive analysis of the article sample. Then, I report the network of methods I encountered in reviewing these articles —structured into three sub-themes and two overarching themes encompassing the literature sampled.

4.6.1 Descriptive Statistics

The articles included in the review were published between 2003 and 2024. The data suggests an increase in interest at this intersection with rising publications between 2019 and 2023, which can also be attributed to a rise in publications overall (n=32, 72%). While this does not seem to be an effect of contributions to a particular publication, it is worth noting that AlterNative: An International Journal of Indigenous Peoples represented the largest publication in the sample (n=8, 18%). Figure 4.2 shows this distribution across years and countries where the studies included in the publications took place. Australia, New Zealand (Aotearoa), and Canada (Turtle Island) are the countries in which a large number of these studies took place or were written (n=13, n=8, n=6, respectively. 62% aggregated). Many articles were produced in countries within the Global South, including Latin America, Australia, the Pacific Islands, and Africa (n=29/39, 74%). Three articles did not include geographical location.

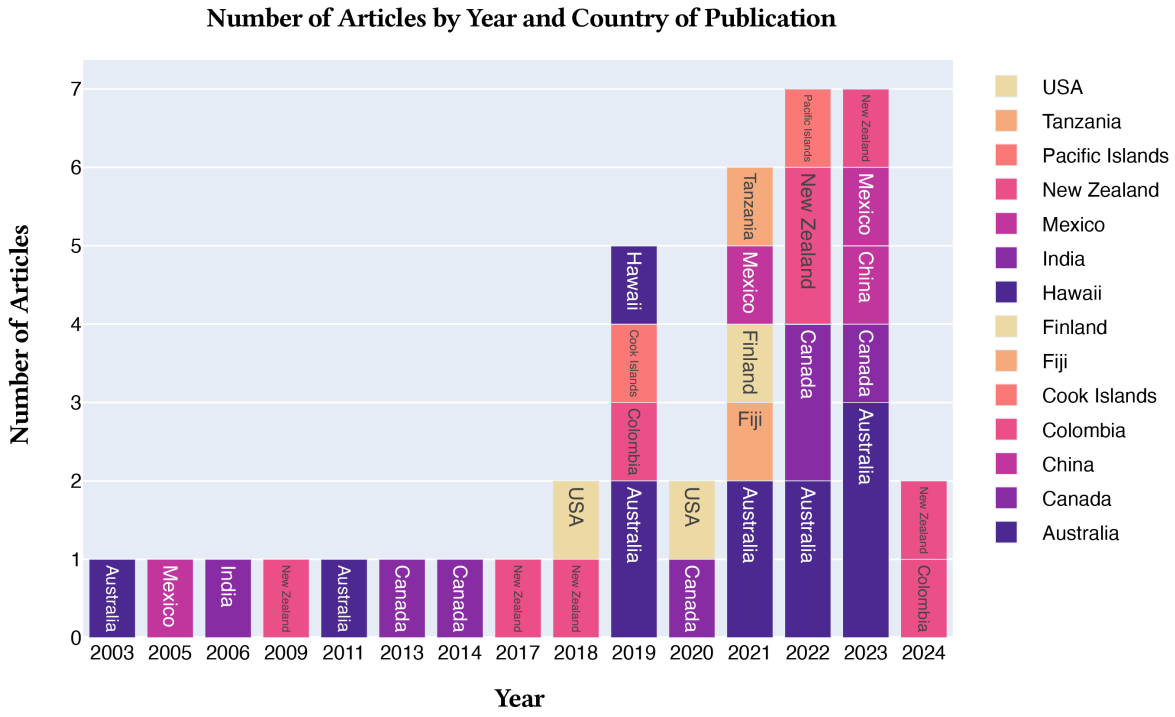


Figure 4.2: Plot of number of articles included in the literature review published per year and per geography. n=39

In total, the articles present thirty-eight different research methods or Indigenous notions. Studies have applied these methods in designing programs (e.g., health and education), running design workshops, and theorizing research methods for the purpose of designing things or products. These methods were used in the context of fifteen academic and practice domains, most of them within academia. Seventeen Indigenous

groups and communities advanced key methodological concepts and methods in the sample. Articles discuss research across various stages, mainly research design (n=35), data collection (n=36), and data analysis (n=10). These groups are spread across fourteen different countries. Table 4.2 showcases this data.

While some of these methods might not look unfamiliar to researchers, they all emphasize the importance of culturally sensitive research, research that embraces and builds from the worldviews, protocols, and relationships present in the sites where research takes place.

4.6.2 Indigenous Research Methods

Western frameworks and tools have primarily dominated the methods taught and used in the context of design practice. Indigenous scholars and practitioners highlight some of the problematic effects of this dominance. Examples include the design of faulty health interventions as a result of design research that fails to acknowledge vital cultural connections between members of Indigenous groups and connections to territory [15] or the failure to apply culturally and historically informed analysis when developing land governance guidelines [211]. To mediate these challenges, the works included in this review advance a series of methodological alternatives. I present these alternatives into three categories: worldview methods, Indigenous research tools, and Indigenous research metaphors. Figure 4.3 showcases a set of visual representations of methods and methodologies used in Indigenous research.

[15]: Barcham (2022), *Decolonizing Public Healthcare Systems: Designing with Indigenous Peoples*

[211]: Ryder et al. (2019), *Indigenous research methodology – weaving a research interface*

Worldview Methods

For many scholars and practitioners, research must depart from a place informed by culture, often represented in particular Ways of Knowing, Ways of Being, and Ways of Doing. Kaupapa Māori research, for example, involves being guided by Tikanga Māori foundations (values, philosophies, and principles) in recognition of the validity and legitimacy of Māori knowledge (Mātauranga Māori) within the Māori world (Te Ao Māori).[6] Doing so places importance on the role of this knowledge and principles for achieving self-determination [101, 165, 234]. Relationships of ancestry (whakapapa) are also important in establishing a designer within the practice [4]. These views within Māori can help emphasize more specific issues. For example, Mikahere-Hall [165] reports on the use of the Mana Wāhine methodology, embedded within Kaupapa Māori, to center on gender issues. The method is focused on the "interacting dynamics Māori women have concerning Tikanga and as nurturers of whānau."[7] To other authors, leveraging relational aspects of Indigenous research allows increased "understanding of the interconnection between knowledge, gender, and land and [. . .] the tools to draw from their cultural background to pursue knowledge." [52].

6: For an extended discussion on the differences between Kaupapa and Mātauranga Māori, see Royal [209]

[101]: Haitana et al. (2020), *The Transformative Potential of Kaupapa Māori Research and Indigenous Methodologies: Positioning Māori Patient Experiences of Mental Health Services*

[165]: Mikahere-Hall (2017), *Constructing research from an indigenous Kaupapa Māori perspective: An example of decolonising research*

[234]: Te Morenga et al. (2018), *Co-designing an mHealth tool in the New Zealand Māori community with a "Kaupapa Māori" approach*

[4]: Albarran Gonzalez and Taller Experimental Textil (2021), *Sjalel Lekil Kuxlejal: Mayan Weaving and Zapatismo in Design Research*

7: "Extended family, family group, a familiar term of address to a number of people - the primary economic unit of traditional Māori society". From online Māori dictionary https://maoridictionary.co.nz

[52]: Copenace et al. (2020), *Auntie's bundle: Conversation and research methodologies with Knowledge Gifter Sherry Copenace*

Table 4.2: Compiled information of publication year and primary domain of articles in the review. Also included are the geography discussed in the articles, as well as Indigenous groups, key notions and ethical frameworks mentioned

Year	Publication Type	Geography	Indigenous group	Primary domain	Key notion	Ethical frameworks
2020	Book chapter	Canada (Turtle Island)	Anishinaabek	Research Methods	Auntie's bundle	
2014	Journal article	Canada (Turtle Island), USA (Turtle Island)	Anishinaabek	Engineering	Biocultural engineering	Anishinaabek Indigenous Knowledge
2022	Journal article	Australia, Canada (Turtle Island), New Zealand (Aotearoa), USA (Turtle Island)		Health	Indigenist Ecological Systems Model	
2023	Journal article	Mexico (Abya Yala)	Masewal	Agroforestry	Chikomexochitl	
2018	Journal article	New Zealand (Aotearoa)	Māori	Health	Kaupapa Māori Tikanga	Kaupapa Māori
2017	Journal article	New Zealand (Aotearoa)	Māori	Gender studies	Mana Wāhine	Mana Wāhine, Kaupapa Māori
2022	Journal article	Australia	Ngan'gikurunggkurr	Research Methods	Dadirri	Australian On Country
2009	Journal article	New Zealand (Aotearoa)	Māori	Research Methods	Pūrākau	Kaupapa Māori
2022	Journal article	Australia, New Zealand (Aotearoa)	Māori	Health	Yarning	
2023	Journal article	Australia		Design Research	Design Conditions Coexistence	More-than-human
2022	Journal article	Pacific Islands Region	Pasifika	Research Methods	e-talanoa	Pacific worldview
2023	Conference paper	China	Fujian	Product Design	Five Elements Strategic Diagram	Chinese Daoism
2006	Journal article	India		Innovation studies	Shod Yatra	
2020	Journal article	USA (Turtle Island)	Nkwejong	Education	Generative Generations	Traditional Ecological Knowledge
2021	Journal article	Tanzania	Maasai	Education	Globalized Design	Enkigúɛná
2021	Journal article	Australia	Aboriginal and Torres Strait Islander	Health	Good Spirit, Good Life	Participatory Action Research
2023	Report	New Zealand (Aotearoa)		Design	Decolonised Research Framework	
2019	Journal article	Australia	Ngunnawal	Environmental planning	Aboriginal Waterways Assessment	Traditional Ecological Knowledge
2022	Journal article	Canada (Turtle Island)		Design	The Seven Grandfathers	
2011	Journal article	Australia		Design Research	Respectful Design	
2019	Journal article	Australia	Aboriginal and Torres Strait Islander	Research Methods	Research at the interface	
2013	Journal article	Canada (Turtle Island)	Métis	Research Methods	Storytelling	

Table 4.2: Continued. Compiled information of publication year and primary domain of articles in the review. Also included are the geography discussed in the articles, as well as Indigenous groups, key notions and ethical frameworks mentioned

Year	Publication Type	Geography	Indigenous group	Primary domain	Key notion	Ethical frameworks
2018	Report			Design	International Indigenous Design Charter	
2024	Book chapter	Colombia	Quillasinga	Environmental planning	Investigative mingas	Buen Vivir
2019	Book	Colombia	Kamëntsá	Ethnoeducation	Casear	
2019	Book chapter	Hawaii	Hawaiian	Research Methods	Mā'awe Pono	Traditional Hawaiian worldview
2022	Conference paper	New Zealand (Aotearoa)	Māori	Design Research	Blend approach	
2021	Thesis	Finland	Sámi	Education	Indigenous ethnographic research	Indigenous Ways of Knowing
2021	Journal article	Australia		Health	Dadirri	Participatory Action Research
2018	Journal article	USA (Turtle Island)		Education	Star Quilt Framework	
2023	Conference paper			Technical professional communications	Focused life-story interview	African Afrikology, Third space
2021	Conference paper	Mexico	Maya	Design Research	Lekil Kuxlejal	Mexican Zapatista Principles, Corazonar
2019	Journal article	Cook Islands		Education	Tivaevae Model	Pito'enua
2021	Journal article	Fiji		Health	Talanoa	Pacific worldview, Fijian worldview
2020	Journal article	New Zealand (Aotearoa)	Māori	Health	Kaupapa Māori Research	Quandamooka ontology
2005	Journal article	Mexico (Abya Yala)	Maya	Education	Ceiba model	
2024	Journal article	New Zealand (Aotearoa)	Māori	Research Methods	Te Ara Tika	Kaupapa Māori Tikanga
2023	Journal article	Canada (Turtle Island)	Cree	Design Research	Storytelling	
2003	Journal article	Australia	Aboriginal and Torres Strait Islander	Research Methods	Indigents Research Theory	
2023	Webpage					
2022	Conference paper	Australia		Participatory Design	ilkwatharra	Australian On Country
2023	Journal article	Australia	Wiradjuri	Health	Yarning	
2023	Journal article	Australia	Mariku	History	Yubbi Yarning Circle Model	

In the same line of thinking, the accounts of Barcham [15], N. J. Bidwell et al. [22], and St John [228] remark on the importance of 'Country' as a framework to reveal relationships between people and places often

left unnoticed. Other studies done in collaboration with Aboriginal and Indigenous Peoples in Australia and China also showcase the importance of working within worldviews and central cultural notions such as 'Country' or the precepts of 'Daoism,' respectively [55, 126]. Elders Charles Moran and Greg Harrington from the Bundjalung Nation in Australia, along with scholar Norm Sheehan, assert that when design departs from 'Country,' it claims belonging to place and culture, where "design is simply action in relation and that everything on earth and in the universe is thus a designer." [168]. Essentially, 'Country' encompasses the tangible and intangible relationships between humans and 'more-than-human' entities in a specific time and place [55]. Similarly, in exploring Daoism and Daoist culture intersections to design projects, Jiang et al. [126] reported on using the Five Elements framework —inspired by principles of Daoist doctrine— supplemented by in-depth consultations with priests at Taoist temples. In presenting the program's outcomes, authors remark on the advantages of design research and prototyping done in tandem with worldviews across material, social, cultural, spiritual, and ecological dimensions.

[55]: Country et al. (2016), *Co-becoming Bawaka: Towards a relational understanding of place/space*

[126]: Jiang et al. (2023), *Exploring and facilitating Daoism's contributions to design prototype, a case study from a "More-than-Human" social innovation project: Hokkhi*

[168]: Moran et al. (2018), *On Country Learning*

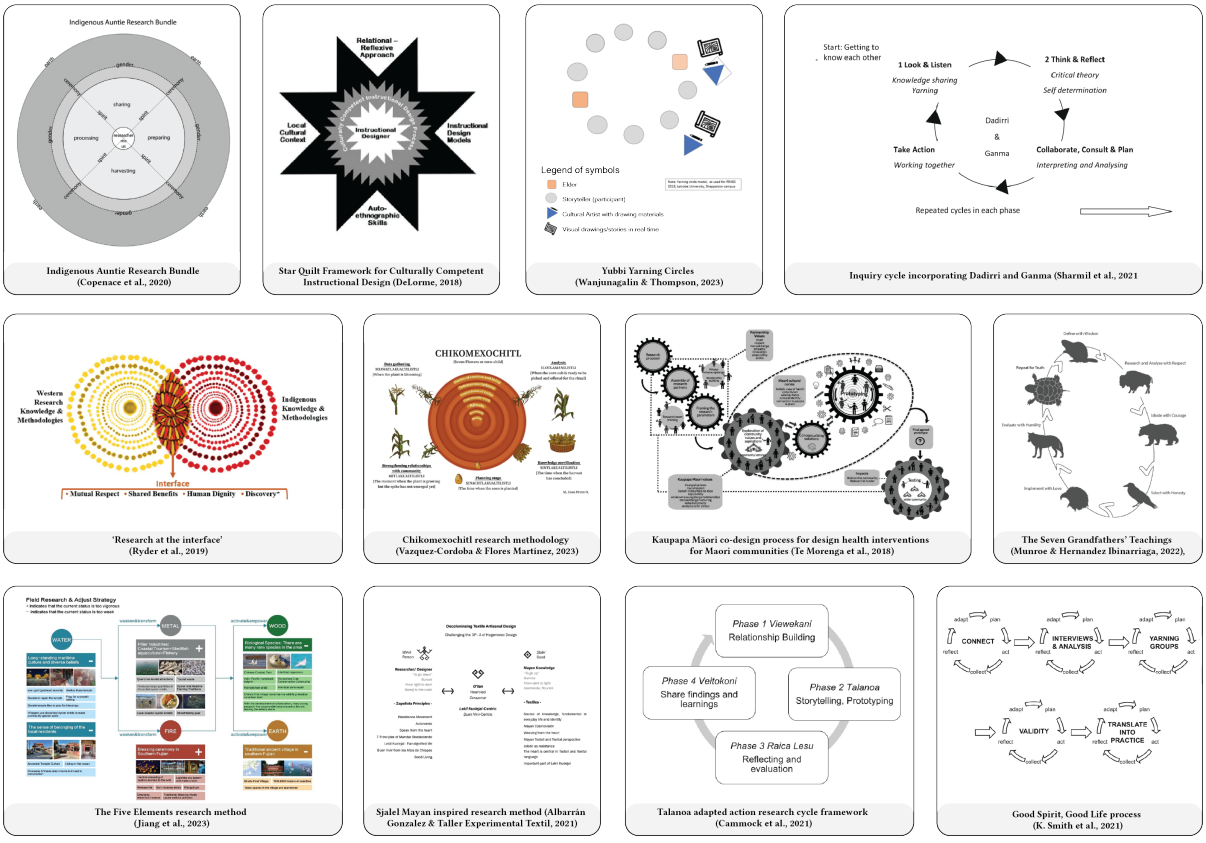


Figure 4.3: Indigenous research methods diagrams presented in articles included in the review. From first row, upper left to right: Indigenous Auntie Research Bundle Copenace et al. [52], Star Quilt Framework for Culturally Competent Instructional Design DeLorme [62], Yubbi Yarning Circles Wanjunagalin and Thompson [256], Inquiry cycle incorporating Dadirri and Ganma Sharmil et al. [219], 'Research at the interface' Ryder et al. [211], Chikomexochitl research methodology Vazquez-Cordoba (Totonac) and Flores Martínez (Masewal) [248]), Kaupapa Māori co-design process for design health interventions for Maori communities Te Morenga et al. [234], The Seven Grandfathers' Teachings methodology Munroe and Hernandez Ibinarriaga [172], The Five Elements research method Jiang et al. [126], Sjalel Mayan inspired research method Albarran Gonzalez and Taller Experimental Textil [4], Talanoa adapted action research cycle framework Cammock et al. [36], Good Spirit, Good Life process K. Smith et al. [225]

Authors also produced their methods in collaboration with communities. Writing from the Huasteca region of Mexico, Vazquez-Cordoba (Totonac)

and Flores Martínez (Masewal) proposed the Chikomexochitl research methodology —co-developed in collaboration with members of the Masewal Indigenous group— as a way to center their "aspirations and their ways of knowing and being." The method draws inspiration from the ritual practice that accompanies corn growing and considers all research stages, from planning stages (Xinachtlakualtilistli) to knowledge mobilization (Sintlakualtilistli). Its goal is to offer researchers and designers a way to work with the Masewal people in a way that is relational, reciprocal, and accountable [248]. Pesambili's use of the enkigúєna worldview of the Maasai peoples in Monduli, Tanzania, highlights the dialogical aspects of building a methodology and its importance in centering a view that prioritizes relationality with human and non-human [191]. The instantiation of the methodology takes place in a combination of structured methods such as traditional feasts and rituals (olpûl), inkiguєnát (meetings), and traditional design research methods such as interviewing or participant observation.

[248]: Vazquez-Cordoba (Totonac) and Flores Martínez (Masewal) (2023), *Chikomexochitl: an Indigenous research methodology rooted in the Masewal people's worldview*

[191]: Pesambili (2021), *Glocalised research design: exploring the encounter between Indigenous and Western methodologies among the Maasai Pastoralists in Monduli, Tanzania.*

The authors also used Indigenous worldviews to operationalize design research processes. Boardsworth et al., for example, reports on the usage of the four components of the Māori' Hui' traditional gathering to support relationship-building with research participants [24]. Worldviews can also serve as guiding principles for new ways of engaging in Design. The Great Law of the Iroquois Confederacy states that decisions taking place in the present must offer sustainment for seven generations into the future [48]. The Seven Grandfathers' teaching adds to this mandate by calling for an Indigenous way of being that looks seven generations back [172]. Both 'Transition Design,' a recent proposal for "design practice, study, and research that advocates design-led societal transition toward more sustainable futures," and the methodological approach provided to students at Design courses at the OCAD University in Toronto, Canada, instantiate this perspective [122], [172].

[24]: Boardsworth et al. (2024), *Toward Culturally Responsive Qualitative Research Methods in the Design of Health Technologies: Learnings in Applying an Indigenous Māori-Centred Approach.*

[48]: Clarkson et al. (2001), *Our Responsibility to The Seventh Generation*

[172]: Munroe and Hernandez Ibinarriaga (2022), *Indigenising design: The Seven Grandfathers' Teachings as a design methodology*

[122]: Irwin (2015), *Transition Design: A Proposal for a New Area of Design Practice, Study, and Research*

Indigenous research tools

While departing from Indigenous worldviews, some methods focus on guiding researchers in interacting and building relationships with the communities they work with. For example, the Honey Bee Network initiative in India developed a model for community research called 'Shodh Yatras.' This ethnographic method, consisting of community walks directed by members of local communities, is utilized to uncover and document artifacts locally built and their connection to larger technology ecosystems in deep rural places. The walks are complemented by educational and celebratory spaces built around the findings collected during Shodh Yatras [98]. Other methods help determine how communication takes place during research. 'Talanoa' and 'e-talanoa,' for example, define the ways of "communicating, connecting and learning about Pacific people and their realities" [36, 81]. This greatly benefits establishing connections and understanding between researchers and collaborators. The authors also report on simple mechanisms that intersect established cultural practices as useful for design research. Cuarán Jamioy et al. for example, used the Inga and Kamëntsá peoples' practice of visiting each other at home or 'casear,' as a method to increase understanding of the

[98]: Gupta (2006), *From Sink to Source: The Honey Bee Network Documents Indigenous Knowledge and Innovations in India*

[36]: Cammock et al. (2021), *Strengthening Pacific voices through Talanoa participatory action research*

[81]: Fa'avae et al. (2022), *e–talanoa as an online research method: extending vā–relations across spaces*

meanings embedded in the making of the traditional tšombiach sash [46, 58].

These relationships are sometimes mediated by the methods used to gather information. Traditional approaches, such as interviews, can be reimagined from Indigenous perspectives. First advanced by Edwards et al., 2005 in the context of research design for health interventions, the 'life-story interview' delves into personal stories, intentionally embedding them into culture and in accordance with Kaupapa Mäori principles [74]. This method closely resembles how oral histories are approached methodologically, differing in that 'life-story interviews' intentionally seek to connect knowledge to ethical and cultural principles to support local knowledge. Oral histories, while deeply contextual and tied to palace-based knowledge, are not by design meant to serve as an instrument for cultural preservation, though their practice suggests they can serve this purpose [125, 207]. Design researchers are already calling attention to these interview alternatives in the face of increasingly disengaged interviewing practices, constantly preparing for further responses rather than connecting to the feelings and commitments required by deep dialogue [5, 219]. These methods can sometimes combine with other forms of dialogue. The Māori narrative form of Pūrākau, expressed "in moteatea (traditional chants), reciting whakapapa (genealogies), whaikōrero (speechmaking) and whakatauki (proverbs)," can be intentionally used for engaging intergenerational dialogue [145, 165].

Dialogical methods play an important role in Indigenous research. This importance translates in the context of design research, as reported by the authors. "Yarning Circles,"[8] a model for organized dialogue, allows for visibility of often overlooked yet foundational cultural notions such as the roles played by extended family within a community, the historical meaning attached to places, or the relationships between people and non-human entities[9] [15, 256]. Dadirri, a research method from the Ngan'gikurunggkurr people from the Daly River region in Australia, also offers a space for cyclic "re-listening at increasingly deeper levels that promote a richer understanding and knowledge building." Authors remarked that both methods are potentially therapeutic. Because of its flexible character, researchers have also used these methods in various contexts, including health, education, and environmental planning, to mention a few [15, 221, 262]. This flexibility is not without issues. Authors remark that the practice of Yarning Circles can be challenging outside of Indigenous contexts as it contrasts with Western "normative pedagogic and research modes that codify information, centralize its interpretation, and regulate through its dissemination" [221].

In the group of dialogical methods, storytelling repeatedly appears to be an essential mechanism used by Indigenous cultures worldwide to protect, care for, and help flourish their knowledge and relationships [67]. Because of how central storytelling is, scholars have conceptualized it as an effective method of research [123]. In the context of design, authors remark its importance in grounding designers in "long-standing traditions of design that already exist around the world." [16]. In practice, authors reported using storytelling (in tandem with Kaupapa Māori principles) as a tool in co-designing health-oriented apps by leveraging Māori creation stories to elicit users' input along the process [234]. Others used storytelling to bridge the values of a First Nations group

[46]: Chindoy Chasoy (2019), *Los kamentsá y el legado visual de la diócesis de Mocoa-Sibundoy*
[58]: Cuarán Jamioy et al. (2023), *Los Tejemanejes de la Creación-Investigación en el Tšombiach (Fajas tejidas del pueblo Kamëntsa Biya)*

[74]: Edwards et al. (2005), *Collaborative Research with Māori on Sensitive Issues: The Application of Tikanga and Kaupapa in Research on Māori Sudden Infant Death Syndrome - Ministry of Social Development*

[125]: Janesick (2014), *Oral History Interviewing: Issues and Possibilities*
[207]: Ritchie (2015), *Doing oral history*

[5]: Al-hassan (2023), *Revolutionizing methods and methodologies: Advancing indigenous-centered research methodologies in user experience research (UXR), technical and professional communication practice*
[219]: Sharmil et al. (2021), *Participatory Action Research-Dadirri-Ganma, using Yarning: methodology co-design with Aboriginal community members*

8: "Yarning Circles" are an ethically and culturally accepted research modality with Indigenous Peoples in Canada and Australia. Yarning is a "sequencing structure" where "each person speaks in turn, holds authority for the time they speak, and reciprocates by speaking responsibly from self and not about others." [221]

9: In the context of design, the consideration of non-humans (sometimes also more-than-humans), has its origins in the grappling tension between our current climate crisis (sometimes referred to as Anthropocene or Capitalocene in Design texts), and the use of Design's methods and narratives to serve and center human goals, and serving capitalistic purposes. See Anderson [9] and Vazquez [247]

[15]: Barcham (2022), *Decolonizing Public Healthcare Systems: Designing with Indigenous Peoples*
[221]: Sheehan (2011), *Indigenous Knowledge and Respectful Design: An Evidence-Based Approach*
[262]: Williams et al. (2023), *Yarning about river safety: A qualitative study exploring water safety beliefs and practices for First Nations People*

[67]: Drawson et al. (2017), *Indigenous Research Methods: A Systematic Review*

[123]: Iseke (2013), *Indigenous Storytelling as Research*

[16]: Barcham (2023), *Towards a radically inclusive design – indigenous story-telling as codesign methodology*

[234]: Te Morenga et al. (2018), *Co-designing an mHealth tool in the New Zealand Māori community with a "Kaupapa Māori" approach*

in Prairies, Canada, and the design of new governance models for local schools [16]. The Kū-A-Kanaka developed the Mā'awe Pono participatory methodology —inspired by hundreds of Hawaiian proverbs ('ōlelo no'eau)— allowing researchers to align with Hawaiian protocol [129].

[16]: Barcham (2023), *Towards a radically inclusive design – indigenous story-telling as codesign methodology*

[129]: Kahakalau (2019), *MĀ'AWE PONO: Treading on the Trail of Honor and Responsibility*

Along with methods, Indigenous scholars and practitioners also report developing tools to serve specific needs, departing from Indigenous precepts. For example, Mooney and Cullen used the Aboriginal Waterways Assessment (AWA) —a tool developed by the Australian government in partnership with Aboriginal leaders and Traditional Owners— to aid water resource planning across seven projects in the State of Victoria, Canada. The instrument, consisting of a matrix of questions and scoring options, allows for encoding cultural values and traditional knowledge into data-feeding policy design. In turn, this allows Indigenous groups to participate directly in the governance planning surrounding water management [167].

[167]: Mooney and Cullen (2019), *Implementing the Aboriginal Waterways Assessment tool: collaborations to engage and empower First Nations in waterway management*

Lastly, some methods look at forms of organizing that depart from Indigenous principles and provide specific forms of social governance conducive to design practice. For example, the 'minga,' a form of collective organizing practiced by various farmers and Indigenous communities across the Andean region, has been studied as the basis and mechanism in design processes. Testori and d'Auria, 2018 critically study the principles and governance system of the 'minga' as a pathway to "re-orient mainstream client-based and for-profit urban design practices in Ecuador." They do so by applying it to an urban design project and analyzing the advantages and challenges of the minga in this context [235]. My work in collaboration with the Asoyarcocha Minga in the La Cocha region, southern Colombia, highlights the use of the 'investigative mingas' as a model of social organizing employed in the design and ultimate establishment of environmental policy for civic society natural reserves across the country [201]).

[235]: Testori and d'Auria (2018), *Autonomía and Cultural Co-Design. Exploring the Andean minga practice as a basis for enabling design processes*

[201]: Reynolds-Cuéllar et al. (2024), *Investigative Mingas*

Indigenous research metaphors

In several cases, authors used existing cultural references in the form of objects or concepts to map them onto methods and use them as a methodological framework. The Tivaevae research method —first designed by Indigenous educator Teremoana Maua-Hodges— utilizes the steps of fabricating the Kuki Airani Tivaevae quilt as a research metaphor. The conceptualization ('akapapa), data collection ('akaruru), data analysis (pakoti), and research reporting (o'ora te tivaevae) stages are "stitched" along with the values of collaboration (taokotai), respect (tu akangateitei), reciprocity (uriuri kite), relationships (tu inangaro), and shared vision (akaari kite). These resulting weaved elements are then mapped onto the four stages of preparation, making, and display of the quilt. Authors report using the method to design learning and education programs [12, 90]. As mentioned before, the work from Vazquez-Cordoba (Totonac) and Flores Martínez (Masewal) with the Masewal people uses the stages of growing corn as a way to help local communities relate to each research stage [248].

[12]: Ava and Page (2020), *How the Tivaevae Model can be Used as an Indigenous Methodology in Cook Islands Education Settings*

[90]: Futter-Puati and Maua-Hodges (2019), *Stitching tivaevae: a Cook Islands research method*

[248]: Vazquez-Cordoba (Totonac) and Flores Martínez (Masewal) (2023), *Chikomexochitl: an Indigenous research methodology rooted in the Masewal people's worldview*

These metaphors do not emerge only as a collective effort to guide research; some respond to personal, specific motivations driving designers'

and researchers' practice. Mayan scholar Vivian Jimenez Estrada uses the sacred 'Ceiba' tree as a metaphor for her research methodology. Departing from Mayan wisdom in the sacred book, the Popol Vuh, she approaches research through three dimensions. First, defining the bark (theories guiding the research). Second, establishing the trunk (stories and narratives accompanying the research), and third, developing the branches (ways in which the research connects to other knowledges) [79]. Also building from Mayan knowledge and traditions, scholar Diana Albarrán turns to the practice of Jolobil, a traditional backstrap loom (telar de cintura) weaving technique, as a metaphor for assembling a decolonial methodological framework. Her proposal maps the different parts of the Jolobil loom and the process of weaving in the Jolobil style to research stages from leveraging values of respect and connection to culture all the way to the embodied knowledge contained in the act of weaving [3]. Similarly, using the metaphor of the Khipu —an ancient Inca knowledge-keeping system— scholar Mariaelena Huambachano develops a research model that uses knots to intertwine the ancestral Indigenous worldviews, Indigenous ethics and precepts, and participatory research methods in accordance with Indigenous protocol [113].

[79]: Estrada (2005), *The Tree of Life as a Research Methodology*

[3]: Albarrán Gonzáles (2020), *Towards a Buen Vivir Centric Design. Decolonising artisanal design with Mayan weavers from the highlands of Chiapas, Mexico*

[113]: Huambachano (2016), *Through an Indigenous Lens Food Security is Food Sovereignity: Case Studies of Māori of Aotearoa New Zealand and Andeans of Peru*

4.6.3 The Three R's of Indigenous Research

In his discussion of Indigenous values and methodologies as part of an Indigenous research paradigm, Shawn Wilson invokes the work from Métis educator Cora Weber-Pillwax to establish that, given the relational nature of Indigenous research, "respect, reciprocity and responsibility" are key features of any healthy relationship and must be included in an Indigenous methodology." They call this the "3 R's of Indigenous research and learning." [261, 263] This triad is widely discussed across the works included in this review, setting an important precedent and signaling core driving values accompanying Indigenous research.

[261]: Weber-Pillwax (2001), *What is Indigenous Research?*
[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

Fijian scholar Radilaite Cammock and collaborators articulate how Fijian research blends the worldview of vanua (Fijian lands, beliefs, and values systems), along with the values of respect (vakarokoroko), reciprocity (veitokoni), and relationship (veiwekani) in the context of the relationships between researchers, participants, and their culture. The values behind this worldview are then integrated into the design of public health projects [36]. These three dimensions in research are also reported by authors in the use of the Dadirri, Chikomexochitl, Mā'awe Pono, and ilkwatharra [129, 228, 244, 248]. Chikomexochitl, for example, emphasizes its goal to align with principles of reciprocity and respect as a pathway to increase accountability in research and to put research at service of specific needs of specific Indigenous peoples [248]. These sets of values are, in many ways, a response to what some Indigenous scholars see as a historical irrelevance of Western approaches to research in Indigenous worlds. Where Indigenous ways of promoting "collective responsibility, individual integrity, respect, reciprocity, harmony with nature, and genuine relationships that lie in the heart of community life and community development" "Western ways encourage an individualistic and competitive environment [172, 226].

[36]: Cammock et al. (2021), *Strengthening Pacific voices through Talanoa participatory action research*
[129]: Kahakalau (2019), *MĀ'AWE PONO: Treading on the Trail of Honor and Responsibility*
[228]: St John (2022), *Working together with 'ilkwatharra' good feelings*
[244]: Ungunmerr-Baumann et al. (2022), *Dadirri: an Indigenous place-based research methodology*
[248]: Vazquez-Cordoba (Totonac) and Flores Martínez (Masewal) (2023), *Chikomexochitl: an Indigenous research methodology rooted in the Masewal people's worldview*
[172]: Munroe and Hernandez Ibinarriaga (2022), *Indigenising design: The Seven Grandfathers' Teachings as a design methodology*
[226]: L. T. Smith (2012), *Decolonizing methodologies: research and indigenous peoples*

Indigenous scholars also use these values to establish their positionalities as design researchers. Sami scholar Outi Laiti explains how the use of these concepts helps her position herself as "the researcher conducting this study, for, in addition to the knowledge obtained through my Indigenous worldview, the Indigenous methodology stresses that understanding these core concepts is essential." [142, 193] Authors also report on how design researchers can approach interviews through the lens of the 3 R's. The use of the Tikanga Māori to frame and run interviews "based on respect, reciprocity, and trust" were used in the context of a health study on stroke rehabilitation [24]. Futter-Puati and Maua-Hodges also report using the 3 R's to align their design practice with action towards honoring and benefiting the Kuki Airani (Cook Islands) peoples [90].

[142]: Laiti (2021), *Old Ways of Knowing, New Ways of Playing — The Potential of Collaborative Game Design to Empower Indigenous Sámi*
[193]: Porsanger (2004), *An Essay about Indigenous Methodology*
[24]: Boardsworth et al. (2024), *Toward Culturally Responsive Qualitative Research Methods in the Design of Health Technologies: Learnings in Applying an Indigenous Māori-Centred Approach.*
[90]: Futter-Puati and Maua-Hodges (2019), *Stitching tivaevae: a Cook Islands research method*

4.6.4 Relationality

Perhaps one of the most salient aspects of Indigenous research, both as a field and at its intersection with design practice, is its relational nature. In articulating what an Indigenous research paradigm is, Shawn Wilson signals the concept's centrality: "Relationships are the essential feature of the paradigm." [263]. The authors included in this review report a similar understanding.

[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

In the account of her experience with design education programs in Western Arrarnta Country, Australia, scholar Nicola St John remarks how respect for local protocols, worldviews, and ways of knowing, especially for non-Indigenous scholars, requires a deep sense of relationality, which often begins with acknowledgment of local protocol [228]. Her experience using the local notion of 'ilkwatharra' (good feeling) to mediate the sometimes arbitrary nature of consent, moving it towards a more relational experience, highlights the commitment designers require in doing meaningful and respectful research with Indigenous groups, Aboriginal peoples in her case. The use of 'yarning circles,' 'mingas,' and other methods mentioned in the previous section are also a step into this relational dimension in design research by way of stressing relations as a point of departure in preparing design projects, as a method for data collection, or as a way to determine successful outcomes [235, 256, 262]. In my fieldwork and collaborations designing and teaching courses (see Chapter 3 and Chapter 5), I have experienced relationships as an effective way to design and implement research.

[228]: St John (2022), *Working together with 'ilkwatharra' good feelings*
[235]: Testori and d'Auria (2018), *Autonomía and Cultural Co-Design. Exploring the Andean minga practice as a basis for enabling design processes*
[256]: Wanjunagalin and Thompson (2023), *Yubbi Yarning Circle Model: Collective Narratives and Cultural Expression in the Journey of Trauma*
[262]: Williams et al. (2023), *Yarning about river safety: A qualitative study exploring water safety beliefs and practices for First Nations People*

The Seventh-Generation teachings, which I presented earlier, extend the scope relationships can encompass by measuring accountability as a function of how we relate to generations past and future. This is a critical aspect in building sustainable futures: "The foundation of sustainable design is how our initiatives or designs realized in our lifetime impact future generations and wellbeing. An Indigenous worldview treats everything as interconnected through relationality." [172]. For several authors, relationality extends beyond considerations of time and into the entities with which we relate. Connections with 'non-human' or 'more-than-human' entities are an example of this [15, 52, 54, 68, 167, 221]. Using the lens of Daoism, human views of 'non-human' entities as mere resources at service of human wellbeing can be shifted towards designs

[172]: Munroe and Hernandez Ibinarriaga (2022), *Indigenising design: The Seven Grandfathers' Teachings as a design methodology*
[15]: Barcham (2022), *Decolonizing Public Healthcare Systems: Designing with Indigenous Peoples*
[52]: Copenace et al. (2020), *Auntie's bundle: Conversation and research methodologies with Knowledge Gifter Sherry Copenace*
[54]: Cotsaftis et al. (2023), *Designing conditions for coexistence*
[68]: Droz (2014), *Biocultural Engineering Design: An Anishinaabe Analysis for Building Sustainable Nations*
[167]: Mooney and Cullen (2019), *Implementing the Aboriginal Waterways Assessment tool: collaborations to engage and empower First Nations in waterway management*
[221]: Sheehan (2011), *Indigenous Knowledge and Respectful Design: An Evidence-Based Approach*

that "shape the life that humans and non-humans intertwine with each other." [126]

Munro and Hernandez Ibinarriaga also urge designers to move from acting as mere observers and learners to building meaningful connections and shared values with people. To them, this will provide designers with opportunities to be exposed to other ways of thinking and coming together [172]). This reflects DeLorme's insight that when designers immerse themselves into the relationships framing the culture of the groups they work with, they are provided with helpful evidence, rapport, and technical knowledge [62], all essential dimensions for designers to serve better the communities they collaborate with. To other authors, commitments to relationality are commitments to accountability. In their view, basing design practice on honoring relationships keeps them accountable to, for example, escaping the common tropes of issues, challenges, and sickness that have permeated research of Indigenous peoples in the past [90, 234]. Grounding design practice and research work into relationality "of all with all, create a respectful basis when interfacing with other ways of being, opening the door for generative engagements in the face of tensions arising from worldview differences." [16]

[126]: Jiang et al. (2023), *Exploring and facilitating Daoism's contributions to design prototype, a case study from a "More-than-Human" social innovation project: Hokkhi*

[172]: Munroe and Hernandez Ibinarriaga (2022), *Indigenising design: The Seven Grandfathers' Teachings as a design methodology*

[62]: DeLorme (2018), *Quilting a journey: decolonizing instructional design*

[90]: Futter-Puati and Maua-Hodges (2019), *Stitching tivaevae: a Cook Islands research method*

[234]: Te Morenga et al. (2018), *Co-designing an mHealth tool in the New Zealand Māori community with a "Kaupapa Māori" approach*

[16]: Barcham (2023), *Towards a radically inclusive design – indigenous story-telling as codesign methodology*

4.7 Discussion

The conversation around the use, acknowledgment, respect, and interfacing with Indigenous research methods in the context of design theory and practice is both recent and exciting. These critiques and proposals take many shapes and come from scholars and practitioners from multiple geographies and cultural backgrounds. The works from [43, 67, 138, 226, 240, 263] are a great starting point and, in many ways, an articulation for how the type of knowledge and experiences included in this review should have a greater prominence within Design. I recommend you read this section —and the review overall— in tandem with those. In what follows, I reflect upon some key aspects we should further consider and offer my perspective on how design research and practice can move forward using the insights and actionable tools that Indigenous scholars, educators, and practitioners in this review have shared with us.

[43]: Chilisa (2020), *Indigenous research methodologies*

[67]: Drawson et al. (2017), *Indigenous Research Methods: A Systematic Review*

[138]: Kovach (2010), *Indigenous methodologies: characteristics, conversations and contexts*

[226]: L. T. Smith (2012), *Decolonizing methodologies: research and indigenous peoples*

[240]: Tunstall and Agi (2023), *Decolonizing Design: A Cultural Justice Guidebook*

[263]: Wilson (2008), *Research is Ceremony: Indigenous Research Methods*

4.7.1 Methodology over Methods

In an upcoming Science for the People magazine article, my colleague Alvin Harvey (Diné Bikéyah) draws a distinction between methodology and methods: *"In my experience, methodology is the philosophical rationale and basis for selecting methods. My methodology is rooted in the knowledge of my people and its connection to shared principles. This methodology, rooted in relationality, guides the way in which any "data" are "analyzed" and in what methods are selected for research."* [200] This conceptualization can be seen in action in many of the studies discussed in the "worldview methods" section above. Often, methods are wrapped around a knowledge base (e.g., Kaupapa Māori, Mayan cosmovision), which is essential to put methods into action: "Naming a research method without articulating its whakapapa (genealogy or lineage) can have ethical implications on the

[200]: Reynolds Cuéllar et al. (2024), *On Kinship: Indigenous Knowledge(s) & Western Knowledge*

people and knowledge involved" [213]. This is particularly problematic when these studies attempt to speak on behalf of local knowledge [47].

This approach to methodology/methods contrasts with how, for example, western scientific paradigms generalize methods (e.g., the scientific method) to any and all contexts. This can be problematic since designers might apply the same logic to design methods with results that do more harm than good. That does not mean designers' only option is to use culture-specific methods (although this might be ideal). Along with the methods discussed, the review also reveals the importance of participatory methodologies for Indigenous research, primarily those concerned with community participation and action in research (Participatory Action Research, PAR) as well as those concerned with the politics of participation (Participatory Design, PD) [36, 167, 201, 219, 225, 256]. It is worth noting that technical discussions on these non-Indigenous methods seem much more developed, leaving a challenge for design practitioners, Indigenous and non-Indigenous alike, to provide technical specificity around when and how to use Indigenous methods in the context of design research.

4.7.2 Indigenous Research at the Design Interface

First articulated by Māori academic Sir Mason Durie, 'research at the interface' is the intersection, the weaving of Indigenous Knowledges, methods, and methodologies with Western research methodologies [72]. This interaction of knowledges is one of the most critical aspects authors seem to be advancing. The findings reveal a wide variety of approaches that are inclusive of established methods in Design, which are presented with the caveat that they all require careful consideration of worldviews and methodological aspects pertinent to each Indigenous group. Along with these tools, authors argue that specific methods can be followed in order to aid the process of interacting with different knowledges, as illustrated by the Ganma methods developed by the Yolŋo people in Arnhem Land, Australia [211, 219]. There is not a single way this can be done. Other proposals include 'glocalised design,' 'Mā'awe Pono,' 'respectful design,' 'biocultural design,' and 'Design conditions for coexistence', to mention a few, all of which can support these interactions [54, 68, 129, 191].

This interface does not need to make value judgments over knowledge. Instead, it must provide a practical way to identify the strengths of different methodological approaches and 'blend' them together. The notion of "Two-eyed seeing" ('Etuaptmumk'), first coined by Mi'kmaw First Nations Elder Albert Marshall, describes the unfolding of this process: "To see from one eye with the strengths of Indigenous ways of knowing, and to see from the other eye with the strengths of Western ways of knowing, and to use both of these eyes together." [105, 211]. Needless to say, this interfacing implies a tension between different knowledges. For example, Indigenous Knowledges are "situated within an intelligent and intelligible world of natural systems, replete with relational patterns for being in the world." [221]. Design, on the other end, seems concerned primarily with the aesthetics of the material world, taking for granted its "inside" function of social and cultural utility. Fortunately, designers are already at work figuring out how to mediate these differences [97].

[213]: Sanga (2017), *To know more of what it is and what it is not : Pacific research on the move / by Kabini Sanga and Martyn Reynolds*

[47]: Chuenrudeemol et al. (2012), *Design Process in Retrieving the Local Wisdom and Communal Identity: A case study of Bangchaocha's bamboo basketry crafts*

[36]: Cammock et al. (2021), *Strengthening Pacific voices through Talanoa participatory action research*

[167]: Mooney and Cullen (2019), *Implementing the Aboriginal Waterways Assessment tool: collaborations to engage and empower First Nations in waterway management*

[201]: Reynolds-Cuéllar et al. (2024), *Investigative Mingas*

[219]: Sharmil et al. (2021), *Participatory Action Research-Dadirri-Ganma, using Yarning: methodology co-design with Aboriginal community members*

[225]: K. Smith et al. (2021), *Good Spirit, Good Life: A Quality of Life Tool and Framework for Older Aboriginal Peoples*

[256]: Wanjunagalin and Thompson (2023), *Yubbi Yarning Circle Model: Collective Narratives and Cultural Expression in the Journey of Trauma*

[72]: M. Durie (2005), *Indigenous Knowledge Within a Global Knowledge System*

[211]: Ryder et al. (2019), *Indigenous research methodology – weaving a research interface*

[219]: Sharmil et al. (2021), *Participatory Action Research-Dadirri-Ganma, using Yarning: methodology co-design with Aboriginal community members*

[54]: Cotsaftis et al. (2023), *Designing conditions for coexistence*

[68]: Droz (2014), *Biocultural Engineering Design: An Anishinaabe Analysis for Building Sustainable Nations*

[129]: Kahakalau (2019), *MĀ'AWE PONO: Treading on the Trail of Honor and Responsibility*

[191]: Pesambili (2021), *Glocalised research design: exploring the encounter between Indigenous and Western methodologies among the Maasai Pastoralists in Monduli, Tanzania.*

[105]: Harbord et al. (2021), *"Nothing about us, without us": An investigation into the justification for indigenous peoples to be involved in every step of indigenous digital product design*

[211]: Ryder et al. (2019), *Indigenous research methodology – weaving a research interface*

[221]: Sheehan (2011), *Indigenous Knowledge and Respectful Design: An Evidence-Based Approach*

[97]: Grisales-Bohórquez et al. (2022), *Participation reimagined: co-design of the self through territory, memory, and dignity*

Building this interfacing with Design also requires advancing best practices for collaborating and working with Indigenous communities. While these 'best practices' are not necessarily methodological, they do provide an overall framework for non-Indigenous designers to learn how to engage appropriately. The 'Decolonised Research Framework' and the International Indigenous Design Charter guide: "Protocols for sharing Indigenous knowledge in professional design practice" are steps in this direction [119, 130].

[119]: Innovation Aotearoa (2023), *IDIA Decolonised Research Framework.pdf*
[130]: Kennedy et al. (2018), *International indigenous design charter: protocols for sharing Indigenous knowledge in professional design practice*

4.7.3 Spirituality in Design

An area that several authors and works in this review approach but that appears overlooked in design practice is the question of the role of spirituality. This dissonance can partially be an effect of the segmentation between methodologies and methods I mentioned before in the context of the scientific method —since the scientific method seeks to abstract and categorize in order to advance understanding. For example, authors argue that spiritual considerations are often necessary when defining a theory of change for health and wellbeing that is culturally informed. Māori Meihana model exemplifies this [71]. Without a methodology and a set of methods to surface the spiritual, designs will likely be ill-informed at best.

While fields like architecture or learning design have dealt with themes of spirituality through the lens of religion, much less literature seems engaged with this connection in the context of the practice of design research. This is not what this review reveals. Case in point, many of the authors referred to their methodology or their methods as the "spirit" of their research [52, 62, 79, 81, 126, 142, 172, 182, 191, 256]. For some authors, however, this relationship between research and spirituality might be impossible to resolve from within Western scientific precepts [165]. Yet, Indigenous designers and researchers included in this review are navigating these possibilities in the face of the importance of facilitating the encounter of these two ways of knowing. This is a space of opportunity for non-Indigenous designers as well.

Spirituality also seems to offer a pathway into another untapped area in Indigenous research: data analysis. In this review, for example, most qualitative data analysis authors did was through Western-oriented methods such as grounded theory or thematic analysis. Bama researcher Tyson Yunkaporta and Kamilaroi scholar Donna Moodie identify an absence of work in the Indigenous methodologies literature concerning data analysis methods. Their work hints at the possibility of using Indigenous Knowledge and rituals to investigate datasets by placing them in the context of core values such as relationality, diversity, or adaptation [267]. All in all, spiritual connections offer an opportunity to expand the scope of design research, its cultural appropriateness, and its sources of information.

[71]: M. H. Durie (1985), *A Maori perspective of health*
[52]: Copenace et al. (2020), *Auntie's bundle: Conversation and research methodologies with Knowledge Gifter Sherry Copenace*
[62]: DeLorme (2018), *Quilting a journey: decolonizing instructional design*
[79]: Estrada (2005), *The Tree of Life as a Research Methodology*
[81]: Fa'avae et al. (2022), *e–talanoa as an online research method: extending vā–relations across spaces*
[126]: Jiang et al. (2023), *Exploring and facilitating Daoism's contributions to design prototype, a case study from a "More-than-Human" social innovation project: Hokkhi*
[142]: Laiti (2021), *Old Ways of Knowing, New Ways of Playing — The Potential of Collaborative Game Design to Empower Indigenous Sámi*
[172]: Munroe and Hernandez Ibinarriaga (2022), *Indigenising design: The Seven Grandfathers' Teachings as a design methodology*
[182]: O'Keefe et al. (2022), *Centering Indigenous Knowledges and Worldviews: Applying the Indigenist Ecological Systems Model to Youth Mental Health and Wellness Research and Programs*
[191]: Pesambili (2021), *Glocalised research design: exploring the encounter between Indigenous and Western methodologies among the Maasai Pastoralists in Monduli, Tanzania.*
[256]: Wanjunagalin and Thompson (2023), *Yubbi Yarning Circle Model: Collective Narratives and Cultural Expression in the Journey of Trauma*
[165]: Mikahere-Hall (2017), *Constructing research from an indigenous Kaupapa Māori perspective: An example of decolonising research*
[267]: Yunkaporta and Moodie (2021), *Thought Ritual: An Indigenous Data Analysis Method for Research*

4.8 Conclusion

I conducted a narrative literature review and reflexive thematic analysis of Indigenous research methods at the intersection with design research. Drawing on the articles reviewed, I highlight a typology of methods and a series of considerations about putting them into action. The goal is to encourage non-Indigenous designers to build on these insights into their practice. This encounter presents areas of opportunity and tension moving forward. My intention is not to resolve them but rather to point practitioners to ways in which they can think about navigating them in their work, at times guided by the work of Indigenous scholars, such as the ones included in this review.

While these methods open new possibilities for designers, there is still ground to cover when it comes to reconciling the relationships between said methods and their corresponding methodologies. My hope is that this review helps drive non-Indigenous designers towards a space of reflection upon the methodologies they enact in their current practice. I look forward to future research agendas in Design that integrate some of the worldviews, tools, and methods in this review, making it a focal point of attention in the coming years. In the context of this dissertation, I lean into some of what I have learned throughout this review and work it into the realm of design education and ethnography of technology, as you will read in Chapter 3 and Chapter 5, respectively.

El Corbatejo Azulado (Oxy-pogon Guerinii) se creía extinto. Los científicos no lo habían visto en la Sierra Nevada de Santa Marta por más de 49 años hasta que en el 2015 el ave pudo ser fotográfiada nuevamente. Sin embargo, las comunidades conocen y aprenden de su territorio a través de la conexión espiritual que tienen todos los seres que habitan en él

The Blue-corbatejo (Oxypogon Guerinii) was believed to be extinct. Scientists had not seen it in the Sierra Nevada de Santa Marta for more than 49 years until 2015 when the bird could be photographed again. However, communities know and learn about their territory through the spiritual connection that all the beings that inhabit it have

Pablo Jojoa

5 Teaching Co-Design Within Higher-Education

[173]: Muratovski (2020), *The Making of an American Design School: Lessons Learned*

[95]: Giroux (2009), *Neoliberalism, Corporate Culture, and the Promise of Higher Education: The University as a Democratic Public Sphere*

Beginning in Chapter 1, I signaled that one of my main goals with this dissertation is to reclaim the ancestral within design and technology studies. In Chapter 2, I explored how community-based participatory programs are a way to connect design practice with place-based knowledge. However, I concluded that we still have work to do to ensure that learning goals match outcomes across all participants. In Chapter 4, I proposed that connecting with Indigenous research methods can help us expand the methodological imaginaries from which design research departs. In this chapter, I build from these learnings to explore ways to improve our engagements with communities in the context of co-design experiences.

I present the results of two hands-on, field-based courses designed and taught in collaboration between myself, the Diversa team, and local community members. I report how we put together these courses and what the experience entailed, and I share some of our results. Admittedly, none of these courses are entirely comprised of Indigenous research methods. However, they both explain how we can find inspiration in them and move Design in different directions. While some of the activities and content provided throughout these courses leveraged established methods in Design, we experimented with different narratives and ways of knowing as we were in the field with students. Along with the results of these courses, I present a post-mortem analysis of the 2019 course on coffee production technology building from decolonial and critical theory in Design. This is a continuation of my explorations on bringing evaluation into Participatory Design (PD), which I began in Chapter 2. I close with a discussion on how these courses can be improved, the limitations of academic institutions like MIT in their pursuit of connecting their work with surrounding communities, and how we can continue transforming Design education.

5.1 (Do We Need) New Paths in Design Education?

The foundation of the McMicken School of Design in Cincinnati in 1869 launched a wave of Design schools in the United States, the majority created with the purpose of "advancing industry by using Design as a tool for creating a competitive advantage" [173]. This connection to the private sector continued a tradition where universities and industry fed on each others' narratives. A tradition that remains with a much more prominent influence of the corporate over higher education than vice-versa [95]. As I mentioned in Chapter 1, this grip has tightened in the context of Design education via the engineering and computing disciplines. I consider two moments in this trajectory of how Design has been approached within higher education essential to foreground. The first is the increased —and somewhat recent— attention to global issues

within these disciplines. Initially responding to ideas around international development in the late 1990s, universities, and research labs at higher education institutions began to partner with multilateral organizations or develop relationships in historically marginalized geographies [136, 236]. Many of these communities fall under what we refer to as the Global South at the moment, but at the time, they were seen as places that required help from industrialized, developed nations to catch up. Organizations such as Engineers Without Borders (EWB), along with the rise of disciplines such as Information and Communications Technologies for Development (ICT4D) and Human-Computer Interaction for Development (HCI4D), are a testament to this intention. Consequently, universities diligently prepare students to meet the moment's demands [180], [236].

[136]: Kothari (2019), *A radical history of development studies: individuals, institutions and ideologies*
[236]: Toyama (2017), *Design, Needs, and Aspirations in International Development*

[180]: Nieusma and Riley (2010), *Designs on development: engineering, globalization, and social justice*

The second moment is the appearance of design thinking as a practice and product, greatly influenced by management studies. Mainly, with the inauguration of design management as an academic field in the 1970s, design thinking discourse began to gain popularity, mainly thanks to its possibility to focus management around narratives of innovation [127]. This allowed the design firm IDEO to position itself as an innovation agency that, through its partnership with Stanford, established legitimacy within higher education and was at the foundation of the launching of several programs in design thinking across the United States [127]. Innovation programs naturally began integrating design education and actively teaching it to students. Through the narrative of globalization, these educational offerings began to look at the world as their concern. Rapidly and aided by the global expansion of IDEO and the rise of many similar design agencies, issues in the Global South became issues of innovation and, by extension, issues of design thinking.

[127]: Johansson-Sköldberg et al. (2013), *Design Thinking: Past, Present and Possible Futures*

Both of these moments have been met with great resistance. The postcolonial computing criticism made visible the negative socioeconomic impacts of the role played by governments, international development agencies, the nonprofit sector, and most importantly for this argument, academia in the places where they operated. It did so while demonstrating how many of these interventions were, intentionally or otherwise, infused with dominant, universalizing ideas of progress and technology: a form of continuation of colonial legacies [121]. These ideas, together with the rise of Design education within higher education and its close connection with the corporate world, put the higher education model of Design under scrutiny. As early as 1985, and in reference to how designers were being taught how to develop a philosophy, Austrian-American designer and educator Victor Papanek argued that said philosophy was "[...] an equal mixture of self-indulgent and self-expressive bohemian individualism and a materialism both profit-oriented and brutal." [187] More broadly, Austrian philosopher and theologian Ivan Iliich's critique of schooling, also looked at Design as commoditization of learning, described as a made belief "[...] that learning and the growth of cognitive capacity, require a process of consumption of services presented in an industrial, a planned, a professional form;... that learning is a thing rather than an activity. A thing that can be amassed and measured, the possession of which is a measure of the productivity of the individual within the society. That is, of his social value" [91]. As I articulated in Chapter 1 and Chapter 4, the productization of design education and design research leaves us with a need for alternatives to turn these criticisms into

[121]: Irani et al. (2010), *Postcolonial computing: a lens on design and development*

[187]: Papanek (1985), *Design for the real world: human ecology and social change*

[91]: Gajardo (1997), *Ivan Illich*

constructive action. Early articulations of how this can take place include the proposal to detach Design schools from universities to distance them from "rigid academic systems [that] may become detrimental to design's creative and technical ethos." and keep them more closely connected cross-disciplinarily, in turn offering greater space for conversations with scientific and political discourses and practices. While these proposals have not taken off into the mainstream, they signal the possibility of imagining different design education ways [25].

[25]: Bonsiepe (2022), *The disobedience of design*

Universities worldwide have started to break, or at least diversify, the way they go about design education and relate to communities in the Global South. Particularly during the past few decades, Design-related disciplines within higher education institutions have seen traction in this direction. One example is the growing number of programs connecting students with pressing societal, cultural, and ecological issues, sometimes in partnership with communities directly affected. This can often occur in the context of engineering departments and in academic and practice coalitions like Engineers Without Borders, Engineers for a Sustainable World, Engineering for Change, or Design for America. At the same time, university offerings like D-Lab at MIT, Stanford's 'Design for Extreme Affordability,' and Olin College's 'Affordable Design and Entrepreneurship' (ADE), to mention a few, opened the possibility of sustained courses and field-based community engagement through Design education. These programs are now a staple of higher education institutions in Engineering and Design schools, helping to create a sense of responsibility and purpose within these fields while pointing attention to pressing issues, sometimes invisible or invisibilized.

While beneficial for higher education programs, these spaces are prone to some of the 'modern' technological gaze mentioned in the previous section. For better or worse, the advent of these alternatives has made it possible for trainee designers to work on problems on the global stage. This unique opportunity for students to be attuned to inequities worldwide simultaneously creates the conditions for anyone to build their narrative onto someone else's problems. Moreover, since these programs operate under the dynamics of larger institutions from which they receive funding and social capital, they often end up enmeshed in larger narratives and incentive models. Some of these include the idea that innovation's natural place is within a market and that if such a market does not exist, it needs to be created. Or that formal, higher education training provides the authority to operate in technological landscapes that are not fully understood without the need to factor in local dynamics. Also, to be successful, all innovation has to be part of a globalized stage, with little to no value for local economies or decentralized systems and infrastructure.

Approaches seeking more foundational change have begun to appear with entire design programs devoted to preparing students to act upon complex, 'wicked problems' such as Carnegie Mellon's Transition Design offering.[1] Other programs focus on decolonization issues in the context of Indigenous rights while seeking to change the structure of higher education institutions, as is the case of the Faculty of Design at the Ontario College of Art & Design (OCAD).[2] This growing move towards engineering and design programs tightly connected to current societal/ecological needs creates an opportunity to imagine learning

1: Transition Design https://design.cmu.edu/content/phd

2: OCAD Faculty of Design https://www.ocadu.ca/academics/faculty-of-design

offerings that bridge some of the gaps created by institutional barriers. It also makes it possible to subvert established assumptions around knowledge production, for example, that knowledge and innovation belong primarily in elite learning institutions or that scientific knowledge holds authority over other knowledge-making traditions.

The design of the two courses I present in this chapter is situated within this space, representing another approach to connecting Design with the ancestral.

5.2 A New Kind of Co-Design Experience

As mentioned in Chapter 2, the IDDS program had, by many measures, yielded various successes. Along with the emergence of institutions that continue supporting and extending participatory work in technology design and rural innovation, the program drove additional outcomes across various spaces. These included showcasing the potential for universities to become more involved in community collaborations with the National University and launching their 'Laboratory of Social Innovation for Peace,' founded with assistance from IDDS former participants.[3] The extensive media coverage across all summits demystified the idea that rural collectives were not worthy of Design. Summit alums founded companies[4] and extended their local influence through government programs among other achievements.[5] At the same time, questions surrounding the longevity of projects, how communities were engaged, the metrics for understanding impact, and the planning for continuity when designing curriculum were coming into view.

3: Laboratory of Social Innovation for Peace Website

4: MAECOL is a construction material recycling company based in Colombia, spun out of the IDDS Zero Waste summit through a project exploring methods for turning rubble into construction materials https://construyendo.co/articulos/maecol.php

5: Cria Pez is one of the community partners of the 2018 IDDS New Coastal Territories. The organization went to be awarded a grant from the Colombian Ministry of Science to expand their ecological work based on the prototype produced at the summit. The grant was prepared with support from IDDS alums

Following the wrap-up of IDDS in 2018, our group in Diversa decided to take a break to gain time and space to reflect and learn ways to improve the experience we were offering. We returned to the qualitative feedback provided by participants of IDDS in Colombia and accompanied the analysis of this data with the results from the longitudinal study presented in Chapter 2.

From this reflection exercise, four themes/areas of improvement emerged. These became our design guidelines moving forward:

Some of the key differentiating factors we wanted to include were:

- Increase community involvement in the making of the curriculum of the programs. While IDDS summits provide space for participants to offer feedback through surveys, there is no systematic way to turn that feedback into changes in the curriculum.[6] Most curricular innovation in the program comes via members of the summit's leadership team relentlessly iterating over activities to make them more effective. We wanted to allow communities to imagine how their local knowledge could better serve students coming from abroad.
- Involve local community members as facilitators. While the idea of having community members inside each IDDS design team was for outside participants to learn from them, this method was not systematic, and no formal structure was in place for this teaching/learning process. Our goal with the course was to

6: In other words, it is a pseudo-participatory process

intentionally feature community members as knowers and experts in their craft and, therefore, worthy for MIT students to learn from.
- Change the purpose of design research. In many respects, research leading to IDDS programs aims to inform participants about the contexts and 'creative spaces' they could act upon during the summit. However, research rarely produces outcomes that directly impact local communities. Less so, it focuses on how engagements can commit beyond the timeline of courses/design summits.
- Emphasize long-term relationships. One of the most common questions and suggestions offered as feedback by IDDS participants revolved around continuity. While they recognize the value of the experience, they worry about the program becoming an ephemeral effort. Also, due to the communication challenges often faced in rural areas in Colombia, participants wondered how they could remain in touch with communities as they moved forward.

Along with these themes, I became interested in bringing these re-designed experiences into academia. I began thinking of future designers as the target audience for the changes I was seeing in the field. While I had the chance to experience the format of D-Lab's courses, along with its field components, I recognized that (1) the temporal frame of a semester was detrimental to long-term engagements and (2) because facilitation for trips was primarily voluntary, there was plenty of room for improvement in designing a more comprehensive field experience for students. By 2019, my colleagues Alexander Freese, Alejandra Villamil, Aura Flechas, Ángela Camargo, and I, along with our community partners (mentioned in the next section), began to devise a course that departed from these themes and integrated with my renewed interest in working from within higher education. By 2022, we were designing a second course along with our colleagues Diana Duarte, Aura Mora, Nicolas Gaitán, Orlando Díaz, and Diana Gamba, and with newly added community partners in partnership.

In the next section, I provide a brief overview of each program, describe their designs, and zoom in on how we realized the themes we identified. I offer an experimental post-course evaluation model designed along with my colleague Rubez Chong for the course's first iteration. Then, I go on to close with a set of reflections emerging from the collective practice of the courses, conversations with our community partners, and feedback from organizers and participants.

5.3 Co-Design Experiences: Technologies for Coffee Production and Technologies for Rural Sustainability

Colombia is one of the leading coffee producers in the world. Unlike other large producers, the sector is composed in its majority of a vast network of more than 600.000 small-scale producers across the country. The decentralized nature of production allows regional clusters to develop cooperation and resource-sharing. During the 2017 IDDS Climate Change Adaptation program, we partnered with two coffee producers in the Cundinamarca, central region of the country: DeFinca[7] and APRENAT.[8]

7: DeFinca Association website
8: APRENAT Association website

Both organizations produced organic coffee via agroecological practices, combining this with other economic activities. These collaborations became the basis of the first 2019 course, "A Co-Design Experience: Technologies for Coffee Production."[9]

While agriculture is only a portion of Colombia's national economy, it remains a major activity. From avocado and palm oil to banana, sugarcane, or beef, Colombia remains high in several lists of global producers of agricultural goods. Culturally, agriculture remains a large part of the country's identity. As cities grow larger, they begin to encounter historically rural landscapes. This connection opens new peri-urban dynamics around agriculture, such as direct markets between farmers and small businesses (e.g., restaurants or neighborhood markets). An increasing need for infrastructure to maintain product quality and a movement towards conserving the culture animating these agricultural collectives in the face of the pressure of urban culture became the space of opportunity for the 2022 course "A Co-Design Experience: Technologies for Rural Sustainability." In 2021, following requests for collaboration from other partners in the Diversa network, we expanded our pull of collaborators to include the collectives Sembradoras de Vida (Sowers of Life),[10] Asoreciubaté,[11] Corporación Red Mujer (Women Network Corporation), DeFinca, Colectivo de Mujeres Punto R (R Point Women Collective), the El Carmen School in Guasca, and RuralCoop,[12] all of them also located in the Cundinamarca region. Table 5.1 showcases key information about each course, including territories we worked at, the communities and partners involved, and other general details.[13] You can find the reports produced for both courses in Appendix B.

9: Both courses were funded by the MIT J-WEL initiative. The 2019 course received support from the Jorge Tadeo Lozano University in Colombia. I received funding from the Priscilla King Gray Public Service Center at MIT, and the Harold Horowitz Foundation to travel at various times to Colombia for research and follow-up purposes

10: Sowers of Life https://www.facebook.com/people/Colectivo-Sembradoras-De-Vida/100062967264707/

11: Asoreciubaté https://www.facebook.com/Asoreciubate/

12: RuralCoop https://www.facebook.com/RURALIDADCIUDADBOLIVAR

13: You can read a more in-depth analysis of the 2019 coffee course in my colleague Rubez Chong and I's paper 'Coffee Farms as Design Labs' [203]. Further details about the curriculum can be found in colleagues Alexander Freese, Alejandra Villamil and I's paper 'Coffee and Engineering Education' [205]

Table 5.1: Information about MIT 2019 and 2022 courses. (U= Undergraduate, G= Graduate).
* All locations in the Cundinamarca department

Course	Year	Theme	Community partners	Number of students	Projects	Territory *	Duration
Technologies for Coffee Production	2019	Coffee post-production infrastructure	▸ De Finca association ▸ APRENAT rural association	16 (12 G, 4 U)	▸ Extraction system for coffee roaster ▸ Sensor system for beehives ▸ Point-of-sale mobile shelving ▸ Digital marketplaces ▸ Associative organizational guides	Guavio Alto	4 weeks
Technologies for Rural Sustainability	2022	▸ Artisanal fishing ▸ Small-scale agriculture ▸ Beekeeping ▸ Invasive plant species management	▸ RuralCoop S.A.S ▸ El Carmen rural school ▸ De Finca association ▸ Corporación Red Mujer ▸ Asoreciubaté Association ▸ Sembradoras de vida collective	24 (18G, 6 U)	▸ Modular, artisanal fish pond ▸ Crop transportation air cable ▸ Sensorized beehive for cold climate beekeeping ▸ Automatized lettuce cleaner ▸ Greenhouse sensing system	Guasca	January (IAP MIT period), spring break semester, and summer break

5.3.1 Technologies for Coffee Production (2019)

Preparations for the course began in 2018 with a field research period of six months. During that time, members of the team at Diversa ran a series of activities with our two community partners to find suitable projects to work on within the class, build the curriculum together, set goals for them and the students, and detail logistics. The course was offered in the Fall of 2018 during the period known at MIT as the Independent Activities Period (IAP), which runs for almost the entirety of January every year. The course itself ran for a total of 4 weeks. Students were asked to express their interest in advance and to signal their engineering, design, business, or social sciences expertise. This categorization was built based on the projects in which local communities had expressed interest. The entirety of the event —including travel to Colombia— was free for students and anyone in the communities who wanted to attend it. Funding for the course was provided as part of an MIT J-WEL grant.[14] Due to housing in each community, we were limited to a group of 16 people maximum.

14: MIT J-WEL website

Upon arrival in Bogotá, Colombia, participants took part in a series of team-building activities to help highlight the expertise of each student and to begin forming a community around the group. Most of these activities were also attended by members of each community. Ultimately, our goal was to help them understand who was in the room in preparation for selecting which community to work with. The first week of the course took place at the offices of a small coffee roastery and espresso machine manufacturer, who agreed to offer the space to hold meetings and workshops. This was an open space with multiple tables and chairs. The outer part of the space was a cafe featuring the machines the company manufactures and specialty coffee from farmers around the country. Along with team building activities, students attended talks from representatives from each community presenting their work and the projects they were interested in working on. Small-scale farmers growing and selling different varieties of coffee were also invited to meet with students. The hosting place held a workshop on mechanisms for coffee roasters and coffee tasting. Guerrilla filmmakers and photographers also held workshops to help students and communities spark ideas on how to document the experience. The week concluded with a field visit to Colombia's National Coffee Federation to better understand coffee's economics at local, regional, and national scales.

The following weeks were spent almost entirely in the field, and the second week featured a visit from the whole group to each community partner. During these visits, they learned about the entire process of coffee production at each place, experienced first-hand the challenges and opportunities shared earlier by partners, and were exposed to the culture of each territory. Mid-week, students were asked to select a community to partner with. The final makeup of each team was produced by the organizing team with attention to the balance of skills and gender.[15] After team selection, each team spent the remaining time with their community partner. The Diversa team installed a small workshop with basic fabrication tools at each location. Each facilitation team included someone who could teach and assist students with tooling and material selection if needed. One of the course sponsors, the Universidad Jorge

15: Notably, this course was heavily attended by women with a ratio of 2.5 to 1 women/men. More demographic details in the course report on Appendix B

Tadeo Lozano, opened their rapid prototyping and fabrication lab for teams if needed.

Figure 5.1: Selection of projects developed at Technologies for Coffee Production, 2019 course. From left to right: low-cost coffee roaster with smoke extraction and coffee bean cooling systems integrated; guide to onboarding and management of association members; module for sensorized angel bee beehive; manual honeycomb press, beehive-inspired mobile POS booth, vertical mobile POS booth, bamboo-based vertical garden, sensorized angel bee beehive

Facilitators at each location helped teams establish a schedule of activities for the days ahead. Some of these activities were pre-set and agreed beforehand with communities. More on this in the section "co-building a curriculum" below. As facilitators, our role was to provide students with feedback on what activities could help them better understand each opportunity space, prioritize what information was needed and how to get it and help arrange implementation logistics. We also helped students integrate into the flow of the community, share meals, participate in community work, walk around the territory meeting people and places, and build a historical, social, environmental, and political context for their projects.

By the beginning of the third week, each team was asked to have a clear path of what they would be co-designing with communities. The bulk of week three was making these plans real. Teams had scheduled time with each of their partners for co-creation sessions in which they built sketch models of each idea. Students will create rapid prototypes to determine technical specifications as they agree on details. Once these were agreed, they moved into the fabrication process. Not all teams worked on technology-based projects. Because communities had voiced interest in projects looking at their work's business and organizational aspects, sub-teams focused on those aspects. Furthermore, since we factored this concern into the recruitment process, we were able to assure community partners that we would have teams capable of working on those areas. Given some manufacturing limitations, we decided to begin week four at our university partner's campus in Bogotá and prepare for the final project fairs (one at the university, another at each community).

During week four, all projects came together. All teams and subteams presented their work at a university at mid-week. Projects included a sensorized bee-hive to help farmers collect and track information about how bees interact with their coffee crops; improvements to a low-cost coffee roaster designed by one of the local farmers; low-cost shelves to display local products; presses to ease the process of extracting honey from honeycombs; establishment of digital markets and payment options for farmers to sell coffee products online; and development and graphic design of training materials for farmers to educate each other around issues of cooperativism. The fair was then held in each community so that everyone interested could learn about the work done. Following

the fair, each community gathered to celebrate the work. Upon return to Bogotá, each team focused on wrapping up documentation of their projects, passing along information to the Diversa team, and providing feedback on their experience with the course.

5.3.2 Technologies for Rural Sustainability (2022)

Following our analysis of the 2019 course,[16] we began the design of the 2022 edition in the summer of 2021. We chose to design a long-form course to act upon our goal of putting relationships over projects.[17] The first part will meet virtually twice a week during the same IAP January period. Students will then attend the course as any other Spring offering. Fieldwork will occur during spring break in late March and during the summer. Students will be offered the chance to work on projects during the fall with an opportunity to travel back to Colombia during the winter. Like the 2019 course, students were asked to express their interest and expertise in advance to ensure an overall balance of gender and skills. For this edition, we slightly expanded the group to 24 students. The program ran fully funded, once again, with the support of the MIT J-WEL division.

16: Details on this in the section "Experimenting With Qualitative Evaluations: Using the Equity-by-Design Framework" below

17: More on this in the section "Relationships over projects (and everything else)", also in this chapter

The January sessions were focused on creating a common language among students. Because this version of the course spilled over the spring, it was necessary to establish a more formal theoretical framework for all students. During the sessions, new models in Design were discussed, including the fundamentals of Transition Design, Autonomous Design, Barefoot Economics, and Decolonial Design practices, among others. We also held a series of group activities along with community partners, primarily for team building. During this time, students had the chance to watch videos made by the community, interact with them, and ask clarifying questions.

During the spring, I met with students once every week for three hours. On top of this in-person time, students had to dedicate another hour to a meeting with their community partner. All teams and the overall group communicated constantly over WhatsApp, following a methodology developed by Diversa during the pandemic to provide design education online. The fall course meetings were focused primarily on methodological aspects of design. Using lessons learned from the work I presented in Chapter 2 and Chapter 4, we prepared students to engage in participatory research —in the field and online. For example, we designed a module that taught how to approach data collection inspired by Indigenous research methods mentioned in Chapter 4, such as the Shod Yatra [98]. We also offered modules teaching methods from the Transition Design, the Creative Capacity Building, the equityXdesign, and the Value Sensitive Design frameworks [87, 122, 183, 232]. We provided tools to distill this information in respectful, actionable ways and turn them into collective visions for projects they could work on with community members. We focused on two key milestones: the spring break and summer field trips. In-class work was structured to ensure that students and community partners were in sync with the goal of each project and that teams had clear, detailed plans for each trip. One experimental aspect of this edition of the course was having a designer-in-residence —Alexander Freese— from Colombia, who had previously

[98]: Gupta (2006), *From Sink to Source: The Honey Bee Network Documents Indigenous Knowledge and Innovations in India*

[87]: Friedman and Hendry (2019), *Value sensitive design: shaping technology with moral imagination*

[122]: Irwin (2015), *Transition Design: A Proposal for a New Area of Design Practice, Study, and Research*

[183]: Ortiz (2017), *equityXdesign: Leveraging Identity Development in the Creation of an Anti- Racist Equitable Design Thinking Process*

[232]: Taha (2011), *Creative capacity building in post-conflict Uganda*

worked with many of the partnering communities and who was able to support technical and manufacturing aspects. Through Alexander's participation, we provided students with sessions focused on using tools and materials and applying different manufacturing techniques at one of MIT's fabrication labs. The class also offered optional activities for students connected with cultural, political, and historical aspects of the territories where their community partners were located. Activities included field visits to the Colombian community in East Boston, movie nights, online workshops on coffee tasting and weaving, a reading circle focused on relevant articles about Colombia, a webinar series about the history of appropriate technology and technology transfer in the region, and seminars on topics specific to projects (e.g., strategies for management of invasive species). The purpose of the offering was to provide a comprehensive context to students, an abundance of opportunities to interact with communities, and as many tools as possible for them to collect information and turn it into collaborative projects along with partners.

Figure 5.2: Selection of projects developed at Technologies for Rural Sustainability, 2022 course. From left to right: pressure washer for cleaning and preparing lettuce; hand tool for removing the 'retamo' invasive plant; low-cost modular fish pond; remotely operated greenhouse weather station

The spring break trip was prepared under the "learning and experimentation" theme. The idea was to use the time in the field to gather data as detailed as possible to inform prototyping back at MIT and to equip better teams traveling during the summer. Also, each team traveling over spring designed a series of experiments —whenever appropriate— that teams traveling during the summer could collect and learn from. Experiments varied from installing modules to determine their robustness and decay or adding sensing capabilities to infrastructure to inform decisions based on data collected over time. Following the return from the spring field trip, teams regrouped around the data they were able to collect and began working solely on preparing prototypes to be implemented during the summer. The workflow remained the same, with teams gathering with community partners weekly at a set time and maintaining constant communication over WhatsApp. Weekly in-person meetings shifted from focusing on designing to focusing on prototyping and manufacturing. The summer break took place at different moments between June and August of 2022. Part of the reason we structured it that way was to create a sense of continuum among the group and reinforce the message that the core aspect of the work was long-term relationship building. The last team to travel visited Colombia around August 2022.

After wrapping up field trips, we moved to a strategy to ensure proper deployment of projects throughout September. The first part included follow-up visits to evaluate the performance of each design and collect information to help resolve issues. The second part involved teams of

local students on some of these follow-up projects or side projects that emerging along the way. Through this strategy, we were able to implement one of the course projects, which was unsuccessfully installed (air cable), iterate on another one (banana chip slicer), and create prototypes for two new projects (a biodigester filter and a cardboard compactor). Building on the Indigenous method of the minga —mentioned in Chapter 3 and Chapter 4— we named this latter activity the minga tecnológica. I further expand on this approach in the "Relationships over projects (and everything else)" section below. Lastly, the project offered MIT and local students the chance to attend workshops on local manufacturing techniques. These took place between October and November and were the last activity we implemented for the course. Figure 5.3 shows a timeline of activities for both courses.

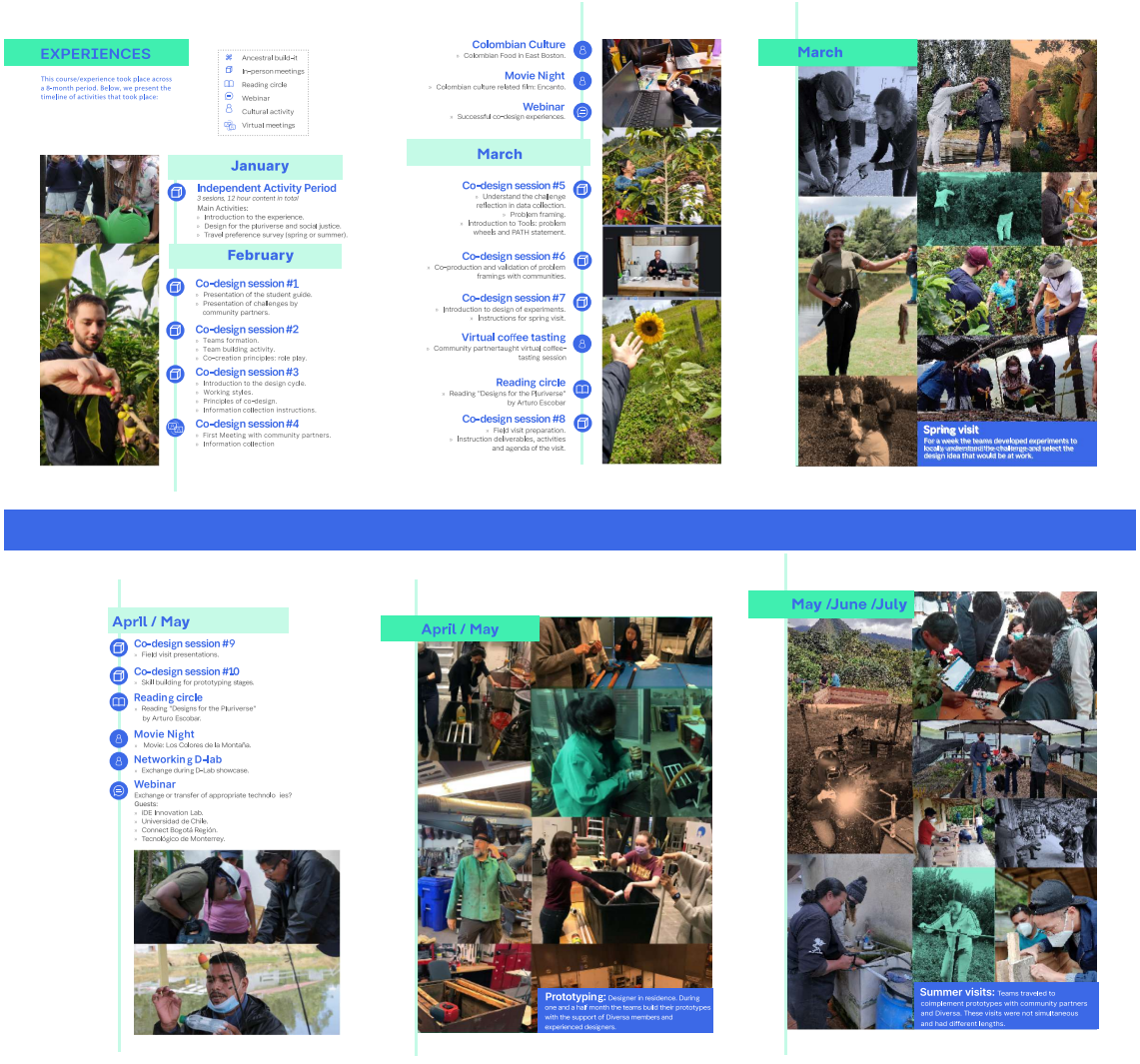


Figure 5.3: Detailed schedule and timeline of activities included in the 2022 course, Technologies for Rural Sustainability. Taken from the course report in Appendix B

5.3.3 Co-building a curriculum

Before this course, most of the work we did on teaching how to co-design technologies was almost entirely based on the Creative Capacity Building

methodology behind the IDDS summits. One of the limitations of this approach is that, while there is room for localization, the core of the curriculum is set. To disrupt this practice, and in preparation for the 2019 coffee-themed course, we decided to start fieldwork by collaborating on the design research with our two partners six months in advance. As a result, our partners identified a series of activities they could facilitate during the course. Some included teaching skills related to coffee production activities such as planting, harvesting, or tasting coffee. Others were related to contextual knowledge of the territory, including visits to sacred places, workshops on local collective governance models, and political agendas, to mention a few. Another component we included for the 2022 course was teaching students about local manufacturing techniques. This process took place through what we called "ancestral technology workshops," which I will detail in the section 'shifting the goals of design research' below. Community members also taught these.

Discussing finalized versions of the curriculum made it easier for everyone to agree and have agency over the flow of activities and logistics, as well as stated learning goals for the students and goals for community partners. This part of the process was essential since commitment to local partners is, for me and the Diversa team, the most significant concern in these experiences. Knowing their vision of the future allowed us to negotiate our commitments to them and their commitments to the course. An immediate result of this process was including the follow-up activities after the course wrap-up that I mentioned in the previous section. Importantly, this negotiation over the curriculum also allowed our organizing and community teams to synchronize our timelines. The truth is that time works differently in many of these geographies.[18] Admittedly, the 2022 course version featured fewer of these curriculum negotiations due to the larger set of partners we included. Inevitably, this led to small frictions, which reminded us that sometimes doing more means doing less.

18: Not only the work in rural places usually takes place at different moments throughout the day, but also the time-frames for agreements or logistics will look differently. If a community operates under a council-type of governance —as some Indigenous communities do— the time between a request and its potential acceptance, for example, will vary according to collective timelines

5.3.4 Involving local community members as facilitators

While we started experimenting with this idea in the 2019 course by involving students in community work and pairing them with community members to learn about the coffee production cycle hands-on, we were far more intentional about it in 2022. We began by integrating teaching/learning models already used by the community. One of the follow-up strategies I mentioned, the "minga tecnológica," was modeled after the organizational strategy of the 'minga,' used by numerous farmers and Indigenous peoples in the Andean region [201]. The reading circles, which took place at MIT, were also modeled after the dynamics used in the 'word circle,' a ceremonial strategy for discussion and consensus-building, considered an ancestral technology by many Indigenous communities in Colombia [97]. You will note that while local dynamics inspire these strategies, community members do not necessarily lead them. We provided space for this particular dynamic through what we called the 'ancestral technology workshops': hands-on learning experiences on local manufacturing techniques organized and taught by members of our partnering communities. In 2022, we featured two of these workshops, one on using textiles and weaving with the traditional

[201]: Reynolds-Cuéllar et al. (2024), *Investigative Mingas*

[97]: Grisales-Bohórquez et al. (2022), *Participation reimagined: co-design of the self through territory, memory, and dignity*

Indigenous Muisca loom and the second on bio-construction with local materials. Lastly, community partners also led two webinars, one on managing invasive species and another on discussing technology transfer. Partners suggested some panelists, often people they had worked with or knew about and wanted to meet or learn about their work. One activity we envisioned but were unable to implement was the student-community consultations. These were planned as spaces where MIT students could discuss projects they were working on campus and solicit feedback/insight from community members. While I think this would be a great way to double down on the idea of community partners as rightful knowers and having a space within the overall narrative of Design, I must recognize that all other strategies were successful. This has shown me that sometimes doing less is doing more.

Figure 5.4: Ancestral technology workshop promotional materials. Left, bio-construction; right, Indigenous Muisca loom

5.3.5 Shifting the Goals of Design Research

As I mentioned in the previous chapter, one of the unfortunate, uncontested trends in mainstream Design —at least until recent moves towards a discourse engaging Design differently— has been the prioritizing of designers' goals during research stages [260].[19] The tensions and challenges emerging from design practice in collaboration with historically marginalized populations, while more broadly discussed, are not a staple in the literature, and the positionalities from which this topic is discussed are diverse [106]. While the outcome of the research leading to the courses is directly beneficial to communities, we (1) recognize that the value for designers and communities might not be equalized, especially when considering the long history of class marginalization in Colombia [10], and (2) acknowledge that research is a historically problematic practice with opportunities for reparation and rectification moving forward. We are working to be part of this change.

The first concrete action we took in 2019 was to devise a research output that, intentionally, could be more beneficial to communities than to us. The idea of visualizing the entire process of coffee production at each site appeared as one of the first alternatives. Making these diagrams required

[260]: Waycott et al. (2015), *The Challenge of Technology Research in Sensitive Settings: Case Studies in 'ensitive HCI'*

19: One notable moment for me was the 2020 edition of the Participatory Design Conference (PDC), which brought this conversation right and center with the theme "Participation(s) Otherwise". You can learn more about it at the PDC Conference website

[106]: Harrington et al. (2019), *Deconstructing Community-Based Collaborative Design: Towards More Equitable Participatory Design Engagements*

[10]: Archila Neira (2005), *Idas y venidas, vueltas y revueltas: protestas sociales en Colombia ; 1958 - 1990*

extensive research centering on local knowledge and geared towards an output that added value primarily to communities. Figure 5.5 shows examples of the final designs that were produced. This in-depth research process was recreated in 2022 with our pull of six partners. The common product we developed for that course iteration was a series of videos introducing each organization. While focused on the course, these videos could then be used by partners in the future for other purposes.[20] Lastly, the field research on ancestral technology —many of which animates the ethnographies presented in Chapter 3— was done to support ways in which these collectives could revisit and document their histories. One poignant example of this, not included as part of the course but featured as a case study in Chapter 3, was the history of the use of the 'minga' as a research tool and a technology for social organizing and policy making [201]. The topics selected in the end for these workshops (the Muisca traditional loom and local materials bio-construction) were selected with an eye on financially benefiting members of community partners, as well as to visualize aspects of local knowledge they considered important.

20: You can see the playlist of videos created for each partner at this YoutTube playlist

[201]: Reynolds-Cuéllar et al. (2024), *Investigative Mingas*

Figure 5.5: Foldable diagrams providing contextual information, along with detailed flow of the coffee production process at each of our partners farms

5.3.6 Relationships Over Projects (and everything else)

As Indigenous approaches to research taught us in Chapter 4, relationality should be one of the critical aspects of research and community-oriented work. An oversimplification of this value is the prioritizing of relationships.[21] In order to help establish meaningful relationships between students and community partners, we began socializing both groups early in the process and maintained a structure that ensured a constant flow of communication. Along with the January team-building sessions, we designed a series of WhatsApp content snippets sent to students and community members. These included basic information on the design methods taught in class to MIT students to maintain a shared language. Each group also had a WhatsApp channel that included representatives of each community and a design facilitator from Diversa and myself who moderated it. Our role was to provide translation, help maintain a

21: Note that when I refer to relationships here I do not mean only human relationships. There is an extensive body of work highlighting the importance of considering relationships with non-human entities which encompasses relationships with the natural and spiritual, as appropriate cross-culturally. The writings of Marisol de la Cadena are particularly enlightening in this matter. See Cadena [34] as a primer

sense of community and purpose, and nudge the work towards meeting deadlines stated by each team.

As mentioned before, dividing the field trip component into two different timeframes helped ameliorate the sense of seasonality accompanying community projects in partnership with universities. While at D-Lab and in some of my work in Colombia, I noticed how communities perceived collaborations as an ephemeral strategy in this context. Intentionally extending the course beyond the traditional, arbitrary box of academic calendars helped communities gain a sense of accountability and commitment from our work that I consider a success. This was, of course, not without friction. This stretching of the course calendar made it difficult for students to consider partaking in activities beyond the spring semester. Some dropped the course halfway as they began to understand the scope of the commitment. While I remain skeptical of the university model in the United States as appropriate for engaging in meaningful community work, I found these strategies to move us in the right direction. The question remains: Are universities, particularly prestigious universities like MIT, ready to enter this level of commitment?

Figure 5.6: Example of content distributed over WhatsApp to communities and students. From left to right: call to communities to participate as partners in the course; infographic of different types of participatory design practice; diagram reminding students at which stage they were along a design process

5.4 Experimenting With Qualitative Evaluations: Using the Equity-by-Design Framework

The "Co-Design Experience" courses were a form of response to the research I was developing. The course on technologies for coffee production, for example, is a direct response to the need for greater recognition and integration of place-based, ancestral knowledge into the design of course curricula. On the other hand, the course on technologies for rural sustainability is an answer to the call for an expansive look into design research methods and engagements that are committed, responsible, reciprocal, and relational. Both of them further the involvement of partnering communities in the design of curricula and take an approach to design research that maximizes benefits for community collaborators.

Specifically regarding assessment, we decided to continue experimenting with different ways to evaluate our programs. In 2018, during preparations for the coffee course, I had the chance to attend a workshop taught by Jennifer Roberts, Founder and CEO of Versed Education Group at our MIT Civic Media group. In it, she went through the work she and her team were doing using the equityXdesign framework to design products, services, and events seeking to be more inclusive. I was impressed by their antiracist take on design practice, especially since that language was less mainstream than in 2024. In late 2019, as I was going through the learnings of the first course, I decided to reach out to my colleague Rubez Chong to ask if she, from her perspective as a course participant, wanted to work with me to reflect on how things went, using the lens of the equityXdesign framework [183]. In the following sections, I present an overview of the framework and show how we used it to dissect the course.

[183]: Ortiz (2017), *equityXdesign: Leveraging Identity Development in the Creation of an Anti- Racist Equitable Design Thinking Process*

The equityXdesign framework

EquityXDesign, developed by Christine Ortiz, Caroline Hill, and Michelle Molitor in 2016, addresses the gap between traditional design methodologies and societal inequalities. It builds from design thinking, adding a layer to highlight and address racism and inequity: "EquityXDesign: an additional layer of checks, tools, and activities that, when laid on top of traditional design thinking methodologies, will illuminate racism and inequity — individual, structural, and institutional — that exists in the individuals involved in the design team and potentially shapes the way problems are framed and solutions are proposed" [75]. The framework integrates equity with design thinking methodologically, guided by three core philosophies: (1) Learning to see: Historical context matters; (2) Be seen: Radical inclusion; (3) Foresee: Process as product; and five design principles: i) Design at the margins; ii) Start with yourself; iii) Cede power; iv) Make the invisible visible; v) Speak to the future [75]. These philosophies emphasize understanding historical context, ensuring inclusive design, and valuing the process as much as the product. The principles advocate for designing for marginalized groups, recognizing personal biases, redistributing power, revealing hidden power dynamics, and fostering long-term equitable change in design methodologies.

[75]: equityXdesign (2019), *Racism and inequity are products of design. They can be redesigned*

[53]: Costanza-Chock (2020), *Design justice: community-led practices to build the worlds we need*

Although not initially based on the EquityXDesign framework, the coffee course was retrospectively analyzed using it. In doing so, we considered other frameworks, including Design Justice [53] and Consentful Tech [146]. However, we chose EquityXDesign for its potential to evolve through case studies like this one. The following section reflects on the course through the EquityXDesign lens, aiming to contribute to the framework's development and offer a new approach to co-design research and collaboration. In this section, we present our course analysis using the EquityXDesign framework. An overall view of its beliefs and values is shown in Figure 5.7. We navigate through each principle, reflecting and driving insights based on the work done throughout the course.

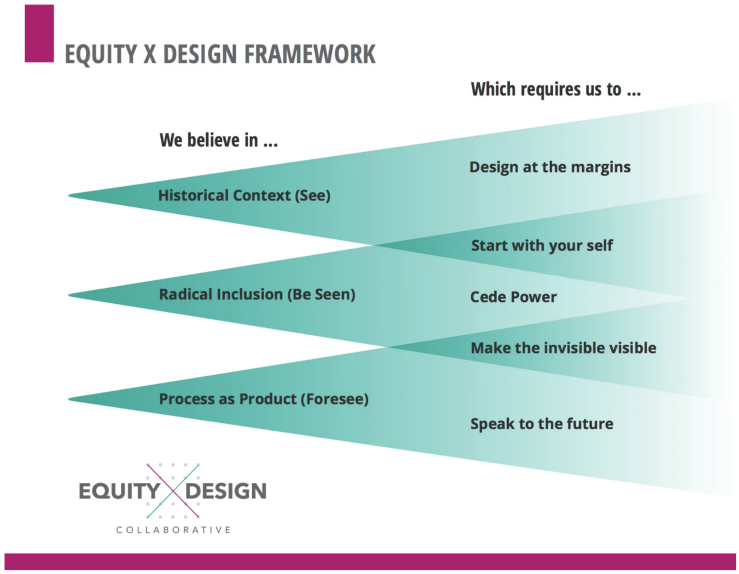


Figure 5.7: Equity by Design framework philosophies and principles. Reproduced with permission from equityXdesign [75]

5.4.1 Design at the Margins

[75]: equityXdesign (2019), *Racism and inequity are products of design. They can be redesigned*

"Our current innovation conversation is exclusive, accessible only to the powerful and privileged" [75]. This was one of the most prominent aspects of the course. Although coffee is one of the defining features of Colombia's economy and culture, coffee farmers have not been centered by the industry due to the decentralized nature of the agricultural practice of coffee. By living and working alongside coffee farmer collectives, the course sought to convey the wealth of knowledge and experience these groups hold, even when living far from urban centers. Inverting the equation of the privileged being an educator and the underprivileged being a learner is fundamental to dismantling this notion of power, particularly within higher education. In centering the territories and geographies of community partners, we stressed the significant value of knowledge often considered invisible. By recognizing the centrality of the self-determination projects of these farmers' associations and their imminent participation in imagining, designing, and building their future, we answer Schultz's call to turn design education to focus on "techno-mediations" as they "relate to designing autonomy and plurality and to futuring" [216].

[216]: Schultz (2018), *Mapping Indigenous Futures: Decolonising Techno-Colonising Designs*

5.4.2 Start with Yourself

[75]: equityXdesign (2019), *Racism and inequity are products of design. They can be redesigned*

"Our identities (race, gender, upbringing, social status, home language, etc.) create our lens for the world and how we make sense of it." [75]

This is one of the aspects where the course fell short. The curriculum considered spaces where participants could reflect individually and collectively about their work and presence in a historically marginalized community. Additional informal spaces were provided for students to voice concerns or ask questions about the history of the relationship with partnering communities, trust, continuity, and power dynamics, among others.

Throughout the course's organization, we were intentional about maintaining healthy relationships with community partners we had built, collectively planning for continuity, and mitigating power relations we identified. For example, we engaged in local communal activities such as sowing and harvesting, collaborated on smaller projects driven entirely by local communities, and discussed local politics impacting the region. However, in the design and implementation of the course, we should have intentionally acknowledged or deconstructed these principles, missing an opportunity for participants to integrate them into their professional practice. In summary, we should have translated these decisions into potential participant learning. This lack of surfacing prior work also holds true to gender dynamics, even though the equityXdesign framework accounts for the importance of highlighting this aspect. Gender imbalance is common in rural Colombia, and one of the objectives of the work done prior to the course was to intentionally dismantle it. Thus, ten of the sixteen participants and four of the six-course organizers were women or women-identifying. Several community leaders and collaborators were also women. Part of our reflection in this section is a call to future researchers to build or maintain this dimensionality in their future work.

5.4.3 Cede power

[75]: equityXdesign (2019), *Racism and inequity are products of design. They can be redesigned*

"Equity requires a nonviolent, action-oriented spirit of co-creation and co-invention, necessitating an inversion of legacy power structures." [75]

From its very title, "a co-design experience," the course sought to make clear that the act of designing will lean towards shared agency. As discussed, initiative, branding, and resources to implement change already manifest a certain dominance. Through a continuous emphasis on the need for collaboration and the centering of local knowledge, the course actively attempted to diminish these dynamics. The most basic expression of this was a focus on asking questions rather than providing answers or "solutions" and on listening rather than speaking. Further, the research materials we provided —closely developed with our partners— emphasized the importance of local knowledge(s). The decision to run the course in Spanish was another expression of ceding power. The legitimacy of local language over efficiency or pragmatism was established through translation and facilitation. Another potential source of power differential was institutional brands, more specifically from educational institutions. Coming from a solid institutional brand such as the Massachusetts Institute of Technology (MIT) involved many contradictions and opportunities. De Finca and APRENAT used institutional branding to further relationships with coffee distributors and build on their marketing efforts where appropriate. Further, they used institutional branding to secure new grants and relationships, strengthening their coffee production supply and value chain.

5.4.4 Make the invisible visible

"The relationships between people and problems are often governed by sets of heuristics — techniques that allow problems to be solved with speed, agility, and economy." [75]

[75]: equityXdesign (2019), *Racism and inequity are products of design. They can be redesigned*

Two salient "invisible" dynamics were made visible to all stakeholders throughout the course—first, the complex relationship between some coffee farmers' associations and Colombia's National Coffee Federation. Though we did not hear this directly from our partnering communities, countless interactions with farmers in the region and many others who attended the course as speakers and spectators revealed a hegemonic, dominant, and sometimes coercive relationship between small coffee farmers and the Federation. Although this circumstance might be common knowledge to farmers across the region, it does not match the perception of the Federation on the national and international stage. Conversations with several small-scale coffee farmers made this relationship's anatomy starkly visible, bringing to light the marginalization and power dynamics at play. The second, less surprising dynamic was the rural and urban divide. By oscillating between the city (Bogotá) and rural farms, it was evident to participants that the challenges rural farmers face are not only in connecting their economies to mainstream consumers but also in the disconnection between urban citizens and the struggles of their rural counterparts. These challenges go beyond the economic, transcending to the cultural, political, and even environmental stages. Some of these complex connections were deconstructed along the course; others were made evident to participants through personal interactions with farmers.

5.4.5 Speak to the future

This was an area where we could have been more intentional as designers and organizers of the course. The entire design of the course was present-oriented and made little acknowledgment of the future in terms of the longevity and sustainability of the projects and also in acknowledging the differing understandings of "the future." While the course recognizes the importance of self-determination and autonomy as key pillars of co-design, we should have anchored these within the framework and understanding of the coffee communities. In fact, most of the language surrounding the design of the course continued to be heavily influenced by "Western" academic fields of thought. Here, we are presented with the opportunity to decenter Design. We discuss this further in our modifications in the next section.

5.5 equityXdesign As a Lens: A Reflection

EquityXDesign provided a lens through which to critically reflect on the design and implementation of the coffee course. However, several dimensions of our work did not fit neatly within the definitions of the five principles. We realized that we both fell short in embodying the principles proposed by the framework, but also that the framework was an incomplete lens to assess the multiple dimensions of the coffee course,

cutting across geographic, industry, and cultural lines. In this section, we modify the five principles to provide a more robust framework for future researchers to design and evaluate community-based co-design initiatives.

5.5.1 Design at the margins without over-glorifying design

As designers, we have a strong bias towards the possibilities of Design, both as a process and tool. In many ways, this bias has served us well in helping to break down complex problems and turning them into innovative solutions. We worked with the De Finca community to co-innovate solutions in the categories of the production of coffee, marketing, and branding of their business, as well as supporting the growth of an association of coffee farmers in the Guavio Alto region. Despite the usefulness of Design methods, they are not a panacea for societal problems. Many of such problems are complex and multi-faceted and, as such, require multi-faceted approaches. While design as a problem-solving framework aims to plug many of these gaps, it is more effective when complementary to other skill sets. In the case of De Finca, mainstream Design methods gave us a framework to conceptualize the problem we were trying to solve, along with potential solutions. One of the problems we chose to work on involved improving the quality of coffee beans. Traditional Design methods helped us define the key problem: we needed to build a cooling system for the coffee roaster so that the beans could cool down at a consistent rate. While these methods are a valuable framework to frame problems and consider solution(s), we also needed technical engineering skills to build a cooling system for the coffee roaster. Thus, as much as design is a powerful tool, it cannot exist in a vacuum and needs to work hand-in-hand with other disciplines.

5.5.2 Start with yourself and build relationships

Building relationships and fostering trust with local communities are at the core of co-design. These relationships must be fostered over time and require years of engagement. The coffee course's success resulted from years of deep relationship-building that the group of Colombian practitioners at Diversa cultivated with the De Finca community. While self-reflection is an integral part of the fieldwork process, researchers also need to be able to step out of themselves in order to build authentic, long-term relationships with their community collaborators. De Finca's community was extremely welcoming and open to collaborating with foreign researchers because of the trust fostered over the years.

5.5.3 Cede and redirect power

Ceding power is merely step one of leveling power dynamics when working with communities. Beyond ceding power, we needed to redirect power to these communities by carving spaces for their voices to be amplified. As much as we were intentional about ensuring equal representation of local vs. foreign participation at all co-design exercises, we failed to

fully account for the language barrier between English and Spanish speakers despite the choice of Spanish as the language of instruction. English was used in some co-design exercises. As participants grew tired and impatient from long co-design activities, they reverted to their native tongue. Since many of the Colombian participants, coffee farmers, and Colombian university students felt more comfortable speaking in Spanish than in English, their participation in these exercises took more work. Language reinforced power structures of the global "North-South" divide and muted the voices of the communities we were working with. These are the covert ways in which power manifests, and language excludes and includes. In order to mitigate future power inequality, we will intentionally recruit participants with Spanish-speaking experience. Thus, it is not enough for researchers to cede power to local communities; they should take it a step further by redirecting and re-centering the roles and voices of communities in co-design.

5.5.4 Make the invisible visible by listening to community wisdom

The importance of listening to community wisdom was another learning point for us. As researchers from the "Global North," we brought our personal biases and institutionalized forms of knowledge into the field. As we encountered technical challenges, we immediately responded to hi-tech solutions. However, our work with the De Finca community re-centered the value of local forms of knowledge and working within the local ecology and landscape. For example, one of DeFinca's leaders showed us a broken Arduino project built by researchers a year before. The researchers built a device to monitor the temperature of the cooked coffee beans. While the researchers had good intentions, they did not account for the long-term unintended consequences of their solutions. Unfortunately, the device stopped working a few weeks after the researchers had left, and Franklin did not have the tools or knowledge to repair it. This example highlighted the importance of working within the knowledge framework of the local communities. Further, we sought feedback from the De Finca community during each step of the design process. Instead of working with hi-tech tools, we worked with Franklin's available materials, re-designing a roastery cooling system made out of an old pot and a fan. This modification enabled a consistent cooling speed and temperature of the coffee beans, improving the quality of coffee produced. The cooling system was co-built with Franklin and the De Finca community and within local frameworks of manufacturing and production.

5.5.5 Speak to the near and far future

In the EquityXDesign framework, design principle number five: "Speak to the Future," addresses the importance of discourse in shaping the narrative of the future. However, it does not account for the differences in the meaning of "future" for the researchers vs. coffee farmers. As mentioned, time and temporality are felt and experienced differently in different contexts. For researchers on an academic calendar, taking three weeks to a month to work on a project feels like a long commitment. However, from the perspective of the local communities, these

collaborations are seen as limited and short-term. Further, these short-term collaborations disrupt their workflow, especially if there are no plans for future engagements. Local communities have to take time from their daily harvesting schedule to spend time with researchers, introduce them to their tools and technologies, and educate them on the local context. Thus, we must clarify what it means to "Speak to the Future" and, further, what that means in the context of "near and far future(s)." One of the pitfalls of co-design is the short-sightedness of these collaborations. Many collaborations, particularly in academia, as I mentioned before, tend to be one-off projects with no plans for future engagements. Such collaborations reinforce extractive and exploitative frameworks while co-opting the narratives of co-design. We, therefore, propose a framework of near-to-far futures to get researchers to consider the time and temporality of their engagements and mitigate exploitative relationships. Communities need to see the value in investing time with researchers and tangible outcomes from each co-design collaboration. As opposed to using vague terms like "future," researchers need to define the "nearness" and "farness" of these collaborations by coming up with explicit roadmaps for current, short, and long-term engagements. These engagement plans are critical to equitable co-design.

5.6 Conclusion

When looking back to this body of work, what 'commitment' implies in the context of community-based work in design practice has claimed an entirely different meaning. Over time, I have realized that acting in solidarity —politically and in designing— is a key part of commitment in design practice. While the amount of time, effort, and resources required to meet commitments aligned with the themes and values I introduced in this chapter are discussed in various Participatory Design literature, they are rarely reported in practice. Commitment is easy in writing but much more challenging in practice.

The depth of these commitments points to a blind spot for universities interested in engaging in this line of work. In the case of both of these courses, very few of the goals we set out to achieve would have been realized had I not had the support of the Diversa organization. Without their ability to be on the ground on short notice, closely interface with community partners on an ongoing basis, and critically approach cost/benefit relations when working with community partners, this chapter would have been much shorter. Not only are universities challenged with building these kinds of partnerships, but they also face shortcomings when it comes to continuity and accountability —given the seasonal aspect of academic calendars. When universities fall prey to these dynamics, they might inadvertently exacerbate the negative perception of research that many historically marginalized communities already hold. In this dissertation's closing remarks, I look at this and other phenomena in the context of higher education institutions.

There is much space for collaborations between universities and communities. However, while comprehensive, detailed, and intentional, these courses call for a large number of resources, human and financial. This is both a challenge and an opportunity. It demonstrates the advantages

of immersion in preparing students to engage in community-based co-design projects respectfully. It also highlights the possibilities of extending the classroom to rural places while serving a social purpose. In exploring ways to improve collaborations between academia and community partners, my colleague Diana Duarte and I present in the next chapter a tool, a digital platform to help systematize community-based co-design, the relationships built in the process, and much more. This way, we continue to contribute towards more equitable ways to design.

Así como el Colibrí de Páramo (Charcostigma Herrani) solo puede desplegar el tornasol de su corbata cuando recibe los rayos del sol, así se basa la plataforma digital que muestra su importancia cuando la iluminan las propuestas de todas las comunidades

Just as the Páramo Hummingbird (Char-costigma Herrani) can only display the iridescence of its tie when it receives the sun's rays, this is how the digital platform is based that shows its importance when illuminated by the proposals of all communities

Pablo Jojoa

6 Digital Tools for Rural Knowledge

Written in partnership with Diana Duarte

In Chapter 2 and Chapter 5, I explored in practice ways in which we could better connect to ancestral knowledge via greater involvement of local participants within community-based participatory design experiences. I also argued that in longitudinally evaluating these programs, we will gain a more granular understanding of where the benefits are allocated across participants. This can help us intersect power dynamics, acknowledge privilege, and improve the overlapping of goals and outcomes. Moreover, in light of how Indigenous research methods approach design projects, there is a rising need for accountability, reciprocity, respect, and relationality in design encounters. In this chapter, my collaborator Diana Duarte and I propose a digital system to support accountability, relationality, and reciprocity processes —in the form of long-term commitments or continuity— in the context of participatory design projects: the Retos platform.

The experiences with participatory design programs in Colombia I reported in Chapter 2 and Chapter 5 left lingering questions about how to increase the value for and accountability to community partners. My colleagues at Diversa also share this question; some have been actively exploring through their work in Colombia. For example, rural development specialist Aura Mora and her team explored mechanisms to make visible rural innovations and share technical knowledge between rural and urban communities through what they called the Co-Rural Festivals—in-person fairs for practical knowledge sharing and exchange, political action, and relationship-building.[1] My colleagues, Diana Duarte, Carolina Gonzáles, and David Osorio, successfully ran the 'Distancia Cero' nonprofit, which facilitated a program brokering alliances between university students and rural communities. In the context of this work, Diana and I began to have in-depth discussions about how to systematize and record the work that was coming out of these collaborations.

Diana and her team had identified a rising interest from universities in providing their students with hands-on, outside-the-classroom experiences where they could apply what they were learning, particularly in the context of theses or capstone projects. This coincided with increased national attention to rural issues, partly a result of former guerrilla fighters' transition to civic life —which took place in rural areas— following the peace agreement between the Colombian government and the FARC armed forces.[2] We also attribute this rise to historical institutional connections and alliances between universities and their surrounding communities, which we discuss further in the findings of the work we report in this chapter. This increased interest enabled many projects that benefited rural communities through technical support or physical infrastructure. However, as projects rolled out, we saw most results, successful and otherwise, trapped on shelves or briefly mentioned in internal institutional reports. Moreover, when projects were

1: Co-Rural Festival https://www.c-innova.org/festival-co-rural-1

2: In 2016, after the peace agreement was ratified, the Colombian government established 19 hamlet-sized "Hamlet Transition and Normalization Zones" (ZVTNs), and 7 encampment-sized "Temporary Normalization Zones (PTNs) sites, later known as Territorial Training and Reincorporation Spaces (ETCRs). Located in rural areas, their goal was to facilitate training, resources and technical support to demobilized FARC (Fuerzas Armadas Revolucionarias de Colombia) guerrilla fighters to develop economic projects and reincorporate to civic life. These sites received support from various instances in government, academia, and the private sector, driving attention to historical inequities in rural contexts

not completed, there needed to be more documentation as to what was done, what worked, and what did not, nor why a given project did not reach completion. This was further compounded by accounts from some of our community partners reporting needing to learn how to repair or maintain infrastructure developed in partnership with external actors. These experiences highlighted an inherent power differential between external collaborators and rural communities. Agencies produce reports and statistics, which allows them to secure progress and continuity. They then turn the page. Students receive a grade, a degree, and academic stature out of centering themselves in the narrative surrounding the outcomes of these projects, which positions them favorably in the job market. They move on. Communities, on the other hand, while benefiting in the short run from the produced infrastructure, are left for the long run to deal with the outcomes of these collaborations. Outcomes that, as we just mentioned, could be a black box with no instructions, no prospect for future improvement, and no one to hold accountable for it.

With these issues in the background, Diana and I began looking for ways in which co-design projects addressed these issues: sustainability of projects, long-lasting documentation, and accountability. While we found references in the literature —which we discuss in the related work section below— we found very few tools outside examples in the private sector. So, in 2019, we seriously considered building a solution ourselves. We produced a few mockups and began searching for funding. That same year, we were awarded the MIT Solve competition, and we started designing our take on this problem.[3]

Retos[4] is a digital platform built to address documentation, continuity, and accountability issues within co-design experiences, particularly those in partnership with rural communities. It builds on Distancia Cero's insight around the opportunity to connect work done by university students with communities surrounding the university. The platform uses a challenge —defined and framed by communities— as a proxy to enable and facilitate co-design projects across various collaborators, most notably university students and community members. The platform offers tools for documenting information about every challenge, community, student, or organization participating in these projects. As a participant in a challenge, you can record the motivations leading to it, how the challenge is collaboratively framed, and an assortment of media to support understanding the context in which each challenge takes place. Perhaps more importantly, teams can record critical information throughout the co-design process, from challenge framing to technical specifications of artifacts built. Using the context of various design and engineering projects, we aim to uncover the advantages a digital documentation tool can offer participants in participatory design projects. The Retos platform houses 292 challenges across twenty institutions and fifty-three courses, close to a thousand students, and over a hundred community organizations. Figure 6.1 shows general numbers about data and participation currently facilitated by the platform. As projects unfold, participants document a variety of assets, including field notes, surveys, videos, pictures, technical drawings, and sketches, among others. These collections serve as a point of departure for new cohorts of participants. Professors, facilitators, and communities simultaneously use this documentation to reflect and assess the process. In developing Retos,

3: MIT Solve Competition https://solve.mit.edu/challenges/community-driven-innovation/solutions/10245

4: Retos is the Spanish word for 'challenge' https://retos.co

we maintained three design principles: continuity, accountability, and making relationships visible. These principles allowed us to support the goals of various stakeholders within projects, including how to connect with prior work on a given project, prioritize quantifiable deliverables, and emphasize the relational aspects of co-design practices.

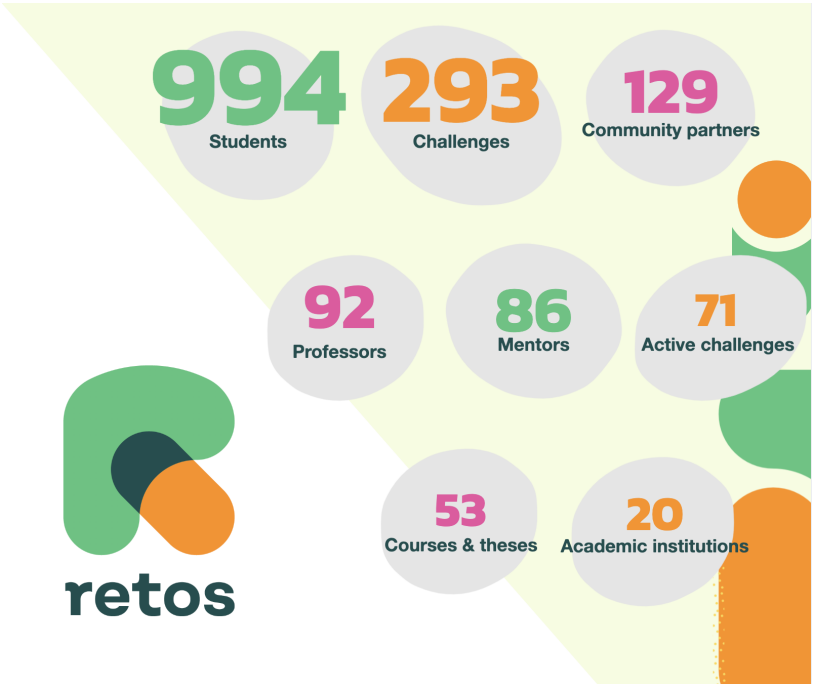


Figure 6.1: General statistics of data and participation through the Retos platform as of May, 2024

In what follows, (we will) present some of the research animating the design of the Retos platform, report on the process leading to the platform's deployment, and feedback from members involved in projects across two pilot tests, one in Colombia and another in Guatemala.[5] We discuss key themes arising from this feedback, including the challenges of privacy and misaligned expectations, the tension between the platform's potential to streamline communication and the quality of information circulating through it, and the possibilities of the platform for research in rural innovation at scale. With this work, we contribute (1) a novel documentation tool for designing projects in collaboration with rural communities; (2) Results from surveys and feedback provided by students, facilitators, and rural community members about the value added and challenges of using the tool. And (3) insights into how digital tools can help support continuity, accountability, and relationships within co-design projects.

6.1 Tools for Design Education Environments

As mentioned in Chapter 1, one of the ways in which Design began to proliferate across multiple fields in higher education was in the form of project/challenge-based courses. While beneficial, this strategy is not a silver bullet. Outcomes of work done this way can still end up confined to the classroom or university libraries. The seasonal nature of academic courses —a class engages in a project and moves on after the class is over— can result in repetitive work cycles, with students

5: The research and/or writing of this article was supported in part by the United States Agency for International Development (USAID)'s Research Division within the Innovation, Technology, and Research Hub (ITR/R) under cooperative agreement number 7200AA21CA00009. USAID staff were not involved in any aspect of planning or implementing the research described in this article, nor in its preparation

often revisiting the same design challenges and conducting similar needs assessments, essentially reinventing the wheel and fatiguing external collaborators. One possible way to address some of these weaknesses is by maintaining thorough documentation of projects at all stages. This can enable students to build on each other over time, giving partners a sense of continuity and longitudinal change and providing opportunities for visibility of the work done by everyone involved. Even though some courses require students to produce documentation, it is uncommon for a course or department to maintain a consolidated record of student projects that could facilitate continuity and/or build upon previous work. This is particularly true for universities with limited resources. Moreover, given that there is no standard for reporting co-design processes, even if documentation existed, it would likely be scrambled across multiple platforms, formats, and styles.

It is known that tools can have significant effects on how design processes unfold [59, 143]. In this particular context, documentation tools can enable highlighting collective and individual efforts, identifying points of creative branching, project contextualization, and reuse of information and artifacts, among others [131, 135, 229]. These advantages are particularly acute when students co-design with under-resourced communities, where prior work can help save time and supplies. Across Design-connected disciplines, teachers use various tools to gain insight into students' design processes. Some of the standard documentation tools include templates, digital collaboration workspaces (e.g. Miro)[6], visual analysis tools to recreate design studio settings, digital workbooks (e.g., Jupyter)[7], and annotated portfolios, among others [84, 163, 259]. These tools allow teachers to manage students' progress and support reflection and communication across teams [32, 210]. More recently, suites of tools offering documentation across all stages of the design process have started to appear. The Design Compass, Kaleidoscope, and e-scape are tools developed within academia for these purposes [56, 60, 230]. This is the space where our work on the Retos platform is situated.

As Design education gains popularity across various disciplines (e.g. engineering, design, human-computer interaction), many of these fields rely on project-based offerings to have students apply their skills in real-world settings. Documentation tools that can help emulate a studio environment that fosters critique and reflection across these projects then become essential to design education [198, 252]. We deployed Retos to support this idea and to expand it beyond the classroom. In exploring this space, Sterman and collaborators designed and implemented the Kaleidoscope tool in the context of a User Interface Design course. They found that while studio-style documentation can create tensions regarding the privacy of the work exhibited and could overwhelm students given the large amount of information flowing, it also enables valuable reflection spaces and opens opportunities for new learning incentives in the classroom [230]. We took insights from these works and applied them to the design of Retos. While documentation tools are often used by students only, we extend this characterization by centering in our design features that can support the participation of teachers and partnering communities in an effort to bring all stakeholders closer to the process. Despite the availability of documentation tools, more work needs to be done to explore this dimension.

[59]: Dalsgaard (2017), *Understanding the Nature and Role of Tools in Design*
[143]: Latour (1994), *On Technical Mediation*
[131]: Kery et al. (2017), *Variolite: Supporting Exploratory Programming by Data Scientists*
[135]: Klemmer et al. (2002), *Where do web sites come from? capturing and interacting with design history*
[229]: Sterman et al. (2022), *Towards Creative Version Control*
6: Miro https://miro.com
7: Jupyter Notebooks https://jupyter.org
[84]: J. Ferreira et al. (2016), *A visual tool for analysing teacher and student interactions in a design studio setting*
[163]: Menning et al. (2014), *Introducing the LogCal: Template-Based Documentation Support for Educational Design Thinking Projects*
[259]: Watts (2020), *Using Adapted Studio Critique to Teach Peer Review in the Document Design Classroom*
[32]: Buchal and Perkins (2009), *Tools and Methods for Paperless Student Design Projects*
[210]: Royo et al. (2011), *New collaboration tools applied to design teaching*
[56]: Crismond et al. (2010), *The Design Compass: A Computer Tool for Scaffolding Students' Metacognition and Discussion about their Engineering Design Process*
[60]: Davies et al. (2012), *Assessing scientific and technological enquiry skills at age 11 using the e-scape system*
[230]: Sterman et al. (2023), *Kaleidoscope: A Reflective Documentation Tool for a User Interface Design Course*
[198]: Reimer and Douglas (2003), *Teaching HCI Design With the Studio Approach*
[252]: Vorvoreanu et al. (2017), *Advancing UX Education: A Model for Integrated Studio Pedagogy*
[230]: Sterman et al. (2023), *Kaleidoscope: A Reflective Documentation Tool for a User Interface Design Course*

6.2 Supporting Co-Design Processes

Documentation tools can cover a wide array of specific elements within the co-design process. To narrow down the development of Retos, we center on three specific ones: documentation, accountability, and continuity. Below, we detail each of these components.

6.2.1 Increase Documentation Throughout

Research has shown that tools used in problem-solving tasks can affect how those problems are approached, including how communication flows, social norms, or the degree of team members' participation occurs [20, 59]. This is true across multiple domains and disciplines in design, engineering, the social sciences, and the arts [131, 179, 196, 229]. In our work, we have experienced how documentation tools provide structure but can also create confusion due to increasing amounts of information becoming available. This is, of course, not the case across all design-connected fields. Software engineering, for example, benefits from established norms and best practices, whereas domains like service design feature less standardized methodologies. Multidisciplinary collaborations, such as community-based co-design projects, have even less established best practices. Adopting frameworks like design thinking and value-sensitive design often fills this gap. While these frameworks offer structure to design practice, they are much less concerned with being conducive to proper documentation. Moreover, co-design documentation can be difficult to reuse, mainly due to the diverse tools and resources designers employ [118, 220]. Retos addresses this by offering templates for tool-agnostic information and simplifying documentation for designers. Despite documentation being time-intensive—a common barrier in educational and professional contexts—Retos aims to be a valuable resource for students, enhancing their design process.

Documentation also influences various aspects of the co-design process, including the sequencing of steps throughout and the nature of student outputs [42, 140, 214]. It also impacts social norms within design teams, including communication flows, transparency —via information disclosure— and how and if continuous feedback takes place [134, 181]. These effects extend to documentation practices beyond educational settings to places such as makerspaces, online communities, and workplaces [132, 133, 245]. With Retos, we build upon this body of research, applying these insights to community-based design spaces.

6.2.2 Establish Relational Accountability

Steady commitment to external collaborators is a challenge in community-based co-design for students and educators. In our practice, we have learned that aligning student work within course contexts to commitments made to partnering communities demands considerable time and effort. Research shows that reports can help bridge this gap by making deliverables transparent and ensuring agreed-upon process adherence [18, 117, 181]. However, this process still needs mechanisms for partners to

[20]: Bernal et al. (2015), *On the role of computational support for designers in action*
[59]: Dalsgaard (2017), *Understanding the Nature and Role of Tools in Design*

[131]: Kery et al. (2017), *Variolite: Supporting Exploratory Programming by Data Scientists*
[179]: Nicholas et al. (2022), *Creative and Motivational Strategies Used by Expert Creative Practitioners*
[196]: Rawn et al. (2023), *Understanding Version Control as Material Interaction with Quickpose*
[229]: Sterman et al. (2022), *Towards Creative Version Control*
[118]: Inie and Dalsgaard (2020), *How Interaction Designers Use Tools to Manage Ideas*
[220]: Sharmin et al. (2009), *Understanding knowledge management practices for early design activity and its implications for reuse*

[42]: Chen et al. (2021), *Probing Documentation Practices: Reflecting on Students' Conceptions, Values, and Experiences with Documentation in Creative Inquiry*
[140]: Kumar et al. (2021), *Implementing studio-based learning for design education: a study on the perception and challenges of Malaysian undergraduates*
[214]: Sawyer (2022), *Teaching creative thinking: how design professors externalize their creative thinking in studio classroom talk*
[134]: Klemmer et al. (2006), *How bodies matter: five themes for interaction design*
[181]: Norval et al. (2022), *Disclosure by Design: Designing information disclosures to support meaningful transparency and accountability*

[132]: Keune et al. (2022), *Connected portfolios: open assessment practices for maker communities*
[133]: Kim et al. (2017), *Mosaic: Designing Online Creative Communities for Sharing Works-in-Progress*
[245]: van der Schaaf et al. (2017), *Improving workplace-based assessment and feedback by an E-portfolio enhanced with learning analytics*

[18]: Beckers et al. (2016), *Data Accountability in Socio-Technical Systems*
[117]: Hulstijn and Burgemeestre (2014), *Design for the Values of Accountability and Transparency*
[181]: Norval et al. (2022), *Disclosure by Design: Designing information disclosures to support meaningful transparency and accountability*

evaluate the work and commitments made, making accountability one-sided [106]. Historically, this absence of shared responsibility mechanisms has led communities, particularly those historically marginalized, to disengage from academic collaborations [57, 159]. A factor in this disengagement is the unclear direction of accountability—specifically, identifying to whom the process is accountable [76]). Retos addresses this issue by elevating the role of community partners from mere collaborators to active participants who actively have a role in enacting and assuring accountability. This involvement includes, for example, formalizing two-way commitments and participating in the assessment of students.

[106]: Harrington et al. (2019), *Deconstructing Community-Based Collaborative Design: Towards More Equitable Participatory Design Engagements*

[57]: Criss (2018), *Shaping New Forms of Citizenry through Community Co-Creation and Participatory Design Processes*

[159]: Masterson and Cooper (2020), *Ethics of community-based research*

[76]: Eriksén (2002), *Designing for accountability*

Traditionally, accountability is ensured through formal mechanisms such as Institutional Review Boards (IRBs), peer review, or through providing access to key resources (e.g., datasets). While these mechanisms are important and can play a role throughout co-design processes, none offer direct accountability to community partners. In response, scholars have suggested that accountability can be integrated into the design process by transparently documenting critical design decisions [253]. Digital interfaces can effectively reinforce accountability when done this way and further expand their scope by making relations visible [246]. In designing Retos, we leverage this insight by encouraging teams to document crucial design decisions often taken collaboratively with community partners.

[253]: B. Wagner (2020), *Accountability by design in technology research*∗

[246]: Vance et al. (2015), *Increasing Accountability Through User-Interface Design Artifacts: A New Approach to Addressing the Problem of Access-Policy Violations*

6.3 Promote Continuity in the Long Run

Over time, the challenges of sustaining community-based co-design projects have long been debated within the Participatory Design (PD) community. Despite a definitive answer, considerable scholarship has explored the challenges and prospects for scaling and sustaining these efforts. A key challenge identified by Zahlsen and collaborators in their systematic review surrounding this question is the turnover in group members participating in co-design projects. Discontinuity in who takes part in projects complicates maintenance and shared understanding over outcomes. This issue arises notably in "knowledge in the head," where information is not effectively transferred between cohorts [268]. Although not commonly discussed in the context of university courses engaging in community-based co-design, our experience highlights this as an important challenge. Academia's 'seasonal' approach to projects in this context, while beneficial for student learning and teaching at scale, can lead communities to experience a sense of fatigue, finding themselves repeatedly providing basic information to new teams and renegotiating ideas.

[268]: Zahlsen et al. (2023), *Challenges of Scaling Participatory Design: A Systematic Literature Review*

With our work on Retos, we aim to address these challenges by emphasizing collecting and strategically displaying key information from previous teams, allowing new ones to gain context and build on prior work rapidly. Making information visible allows community members to direct students to the platform as a source of ground truth. Cycling between consuming and documenting information across the cycle of each project offers the possibility of evaluating progress at every step. Traditionally, this assessment is made by students, often aided by teachers, based on their interpretation of results. By granting external collaborators, mainly rural communities in our case, greater participation in the assessment

of each project, we seek to enhance community agency and ensure that their perspectives and feedback are integral to the project's continuation and evolution.

6.4 Methods

We followed a Participatory Design methodology for this project as it is integral to our (Diana's and my) design practice. In the following sections, we describe the context of the two projects we studied and the process leading to the platform's design. The continuous feedback and use of the platform across our three design principles have allowed us to closely investigate the tool in real time over a deployed system.

6.4.1 Context of Pilot Projects

The development and piloting of the platform took place in the context of two initiatives. The first is a partnership between the participatory design collective Diversa[8] and a handful of universities in Colombia in the context of capstone undergraduate courses in design and engineering. Universities included the Universidad Nacional de Colombia, Universidad de los Andes, and Universidad Sergio Arboleda, among others. Courses included Engineers Without Borders, Socio-Environmental Responsibility in the Arts, and Humanitarian Engineering, each registering an average of 20-25 students. Some of the data included comes from students working on theses at these universities. These courses took place between 2019 and 2023 and were structured around collaborations with rural communities in co-developing a solution for a challenge/opportunity presented by the community. Courses lasted one semester and comprised in-person attendance and several community visits.

8: Also involved in work mentioned in Chapter 2 and Chapter 5. Website

The second initiative is part of the project' Alianzas Sostenibles para la Innovación, Investigación y Emprendimiento' (ASPIRE), led by the MIT Local Innovation Group,[9] the Universidad del Valle de Guatemala,[10] and the Asociación Guatemalteca de Exportadores (AGEXPORT).[11] The project is tasked with "Creating replicable models for how Latin American universities and their collaborations with the private sector, government, and local communities can respond to local and regional development needs."[12] As part of the project, university students and facilitators from AGEXPORT collaborate with rural communities that are interested in developing innovations for their contexts. The workflow follows a similar pattern as that of university courses. The project has been running since 2022 and is ongoing.

9: MIT's Local Innovation Group https://localinnovation.mit.edu

10: UVG https://www.uvg.edu.gt

11: AGEXPORT https://www.export.com.gt

12: Aspire Project https://aspire.uvg.edu.gt

We collaborated with professors, facilitators, and communities at both pilot tests as we began the development of the Retos platform. We also relied on feedback from members of the Diversa team as pilots moved along. These four groups, students, facilitators and professors, community members, and the Diversa team, provided feedback throughout the timeline we report in this chapter. All these groups communicated to us directly, through suggestion boxes, or in response to surveys we designed and administered.

Retos was introduced to students at the beginning of each project/semester as a co-design documentation tool. We described the platform as a place where teams will document their progress along the way, which will, conversely, help all parties involved —teachers, community members, and other stakeholders— to agree upon outcomes and deliverables along the way. Members of the Diversa team demonstrated how to create a user, log in, and use the platform. The platform itself features a self-guided tour to reinforce these instructions. Although all members can see each team's information logged into Retos, students are its primary users. They are responsible for setting up projects, collecting information, producing deliverables, and updating the platform. All courses required students to turn in deliverables across the semester according to the schedule of each class. In order to standardize what is reported, the platform enforces a template that collects information in a way that is software and methodology-agnostic (to solve diverse requirements in tools and approaches as instructed in courses) and sufficiently structured for future teams to use and act upon. Table 6.1 details all the information collected throughout the semester. Figure 6.5 shows screens of the reporting space within the platform.

6.4.2 Initial Design Principles

Given the broad nature of the audiences the platform is designed to serve, we decided to develop a set of design principles and use them to guide the process. These principles are informed by our extensive field experience —which we discussed in our introduction— as well as by research at the intersection of tools for documenting co-design projects. They have also been informed by numerous conversations with our partners at both pilots and with design facilitators at the Diversa team. Our final design principles include accountability, continuity, and making relationships visible. Below, we discuss each of them in further detail, motivating why we considered them important in the context of the design of the Retos platform.

Accountability

Co-design projects are inherently collective, which can lead to a sense of ownership over their process and outcomes. Retos should provide a set of features that visualizes what is being collectively created, what spaces are shared by teams, and the commitments acquired throughout the process. Accountability provides a sense of stability that benefits collaborations. In the context of communal approaches to co-design, it can also help mitigate teams' internal conflict [222]. Also, research shows that clearly outlining the responsibilities of co-design team members helps better understand each participant's role moving forward and decide future commitments [154, 178]. Through careful documentation, Retos can support transparency throughout the process. This can lead to an increased sense of trust, which is beneficial for co-design teams.

[222]: Singh et al. (2023), *Potentials and challenges of using co-design in health services research in low- and middle-income countries*

[154]: Maher et al. (2017), *Increasing sustainability in co-design projects: A qualitative evaluation of a co-design programme in New Zealand*

[178]: Ní Shé and Harrison (2021), *Mitigating unintended consequences of co-design in health care*

Table 6.1: Information required by the platform to complete project reporting

Section	Category	Details
Starting point (review of prior work)	▸ Initial status ▸ Driving question for the previous team ▸ Goal of the project ▸ Possible paths ▸ Images ▸ Support Documents	▸ Driving question for the previous team ▸ As determined by prior teams ▸ Paths considered by prior teams ▸ Fieldwork images ▸ Key documentation from prior teams
Leadership teams	▸ Students ▸ Community	
Solution	▸ Title ▸ Description ▸ Added value and innovation ▸ Deliverables	
Understanding of the challenge	▸ Findings ▸ Reference ▸ Stakeholder mapping ▸ Fieldwork images ▸ Focus of the challenge ▸ Support Documents	▸ Information and source ▸ Idea and inspiration boards ▸ Diagram image file
Design methodology	▸ Title ▸ Description ▸ Related links	▸ Methodology used, traditionally instructed in courses
Implementation and Analysis	▸ Initial user ▸ Potential new users ▸ Strengths ▸ Weaknesses ▸ Opportunities ▸ Threats ▸ New challenges	▸ Initial target audience considered as part of the project ▸ Possible target audiences based on the results of the project ▸ Possible paths future teams can consider
Implementation minimum needs	▸ Materials and tools ▸ Budget ▸ Skills ▸ Management	▸ In case of physical prototypes, raw materials and tooling required to replicate ▸ Details related to management of processes over prototype manufacturing
Supporting files	▸ File ▸ Description ▸ Links	▸ Computer-Aided Drawings (CAD), wireframes, technical drawings
Assessment	▸ Deliverables assessment ▸ Decision ▸ Actions to take	▸ Assessment of results provided by commnity members ▸ Community decision moving forward. If challenge is paused or stopped, it won't be offered to future cohorts

Continuity

As mentioned before, continuity over co-design projects remains a challenge. Retos should provide an environment that structures data and presents it effectively to users who want to review prior work. This should give participants a sense of continuation over previous approaches to a challenge. Research has shown that the display and use of information —especially in asynchronous environments— to build towards a better outcome enhances the willingness of co-design participants to engage [153, 254]. From the perspective of communities —as primary beneficiaries of outcomes— the platform should provide a sense of progress and help reduce the fatigue of repeated negotiations over design decisions or contextual information gathering. In their report on the design of the ThisMyMob digital platform, Professor Paul Dourish and collaborators reflect on the negative affective consequences of underserved groups being continuously "iterated" upon [66](Dourish et al., 2020). Retos is an effort to ease some of these tensions.

[153]: Madsen and Aiken (1993), *Experiences using cooperative interactive storyboard prototyping*

[254]: Walsh et al. (2012), *DisCo: a co-design online tool for asynchronous distributed child and adult design partners*

[66]: Dourish et al. (2020), *On Being Iterated: The Affective Demands of Design Participation*

Making relationships visible

Collaboration is a core tenet of any participatory design experience. As participants move from one experience to another, it can be challenging to keep track of all the people, geographies, organizations, and communities they come in contact with throughout the process. The design of Retos' environments should provide participants with mechanisms to visualize these relationships. Studies have shown that representation of data and its relationships can help support broader participation within design processes, providing participants with increased opportunities to influence processes and outcomes [217]. From a community perspective, the visualization of institutional relations and connection to participants with technical expertise builds on findings pointing to the beneficial aspects of participation for increasing individual and collective social capital [223]. Lastly, following insights around the importance of centering relations in design practice discussed in Chapter 4, the Retos platform should provide a space to unearth and make visible these relationships to all actors within co-design projects.

[217]: Seidelin et al. (2020), *Foregrounding data in co-design – An exploration of how data may become an object of design*

[223]: Skidmore et al. (2006), *Community Participation: Who Benefits?*

6.4.3 The Retos System

Retos is an online, collaborative documentation tool to support the longevity and systematization of co-design projects in collaboration between university students and external collaborators, mainly rural communities. Retos is written in Django and Vue.js, uses MySQL for databases, and is hosted over Google Cloud. At the beginning of each course, students are provided with a link to create their users. These will give them access to the projects they are connected to, the report environments attached to them, available surveys, and other critical information. All these pieces of information can be accessed from the 'my space' screen (Figure 6.4).

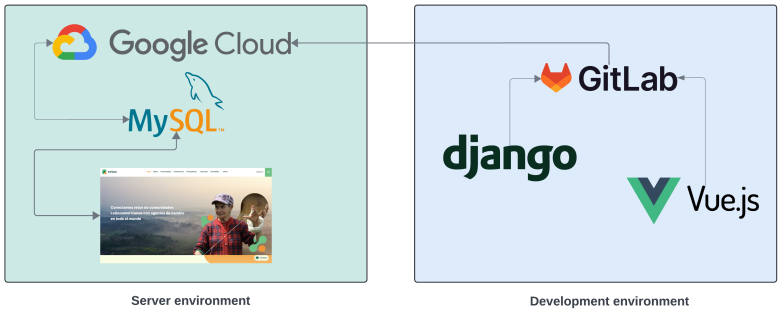


Figure 6.2: Development infrastructure, environments and interactions of the Retos platform

My space

As mentioned, one of the platform's core design principles is making relationships visible. To that end, the design establishes several environments and provides users with a User Interface (UI) to navigate them. The core feature in this relational design is the user's personal space or 'my space.' Acting as a 'user's headquarters,' this environment enables navigation across all the platform's challenges, databases, documents, and

suggestions. Figure 6.3 shows the connections between different assets and environments for a user throughout the platform. These include the databases of all previous challenges, communities, participants, and institutions that have taken part in any challenge before. While most of these databases are public, registered users can see them in the context of the projects they have participated in, highlighting each user's networks as they interact with them.

The environment also gives users direct access to challenge reports, which is the main object of documentation for each challenge, along with information on how far along users are to the deadlines of each report. Figure 6.4 shows users' available information from the 'my space' environment.

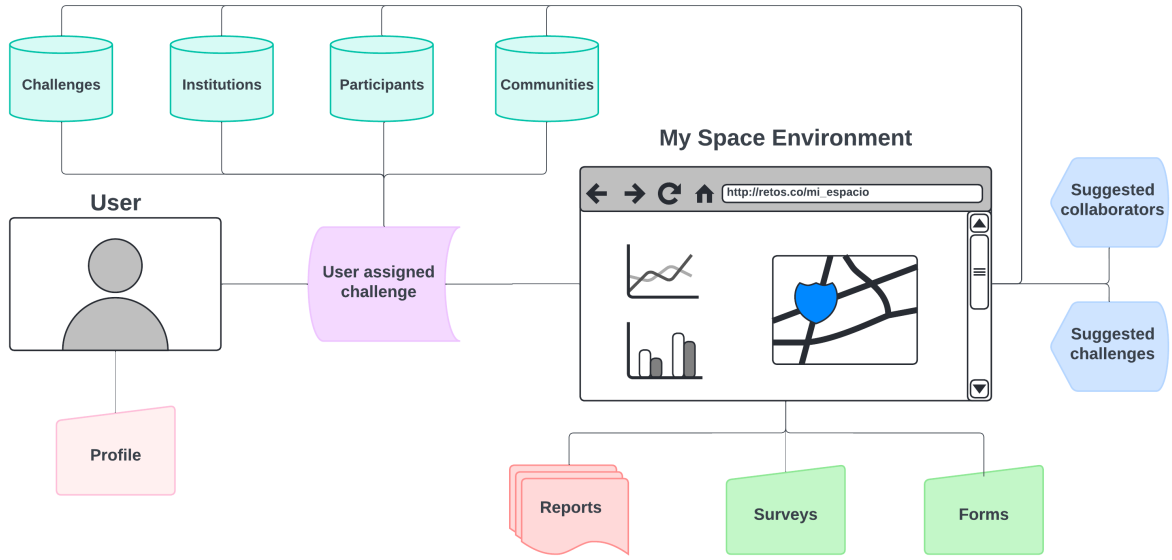


Figure 6.3: Resources available to users registered to the platform. All reports, surveys and forms are linked to the challenges users are currently working on. Suggested collaborators and challenges are updated from term to term based on a tagging system and a function over the relationships established by users at each challenge

Documentation Zone

Following another one of Retos' design principles, continuity, the documentation zone constitutes another key environment. This feature provides users with as much information as possible regarding the status of any given challenge they are working on at any given time. From there, users can access information prepared by prior teams and follow the structured workflow to document their current challenges. The space keeps track of deadlines and nudges users to complete their reports on time. Each part of the reporting workflow consists of examples and/or templates explaining in detail what is required at each step. Figure 6.5 shows the options available to users in the documentation zone. Each asset accepts various formats according to its category. Technical documentation accepts source files (for example, from popular CAD software).[13] For each asset uploaded as part of this workflow, users are required to detail what the asset is and any specifications required to use it. This way, we ensure that future teams can use all information

13: CAD: Computer-Aided Design

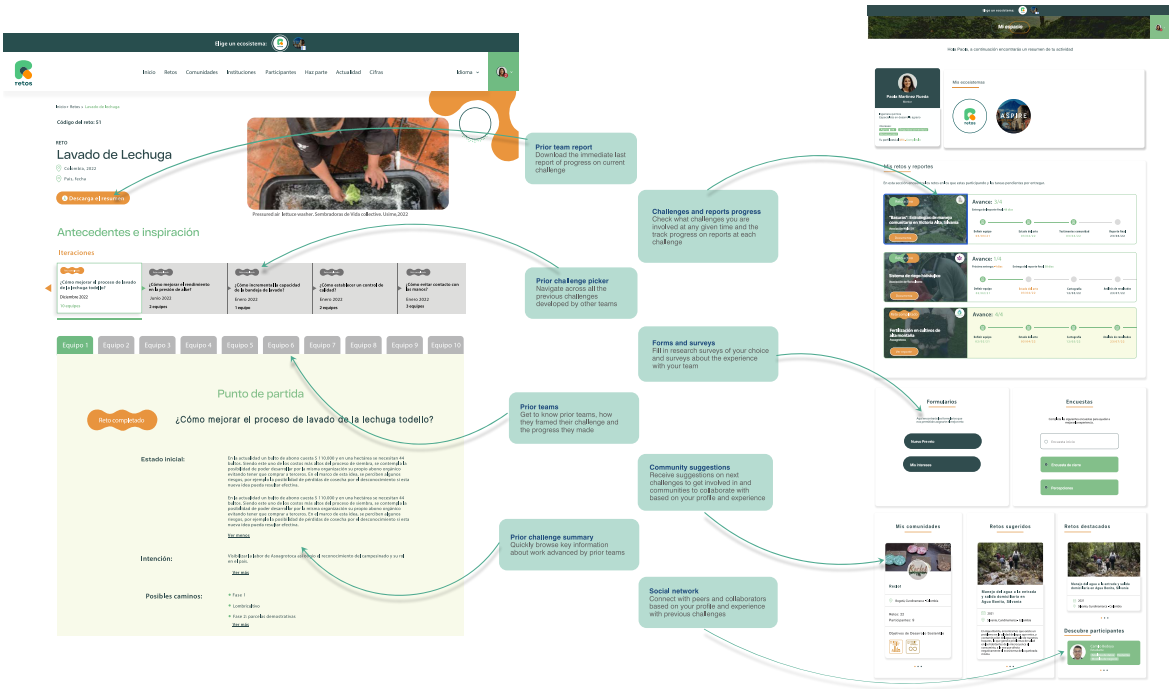


Figure 6.4: Left: "Report" environment showing data from prior teams' available to current teams. Right: "My Space" environment showing challenges surveys, ecosystems, and other features available to users

attached to a report. At the end of a challenge, all assets and specifications are compiled into a full report. While the report does not embed the assets themselves, it does provide specifications and links to access them directly on the platform.

Profiles and Localization

Following another design principle, making relationships visible, we designed two features: user profiles and localization environments or ecosystems. Profiles (individual, institutional, or from a community) allow users to provide information that can be used to suggest future challenges, communities, or institutions. Conversely, this information allows these groups to see participants' profiles, what challenges they worked on, and in collaboration with whom. This visualization of relationships contributes to the development of 'social capital' across the platform. If a user represents a community or institution, their connections to other roles will be visible through that specific profile. Profiles also allow users to control their privacy settings and/or select specific information they want displayed on the platform.

As mentioned before, we report in this chapter on the deployment of pilots across two countries. In order to factor for localization of all vectors of information (e.g., communities, challenges, participants, and institutions), we used the notion of 'ecosystem' as a self-contained environment that extends all the platform's functionalities and can interact with the primary Retos ecosystem. This environment allows for personalization and control over what information is displayed in the main Retos ecosystem, among other specifications. Figure 6.6 shows the home page of one of these environments. Our goal with these localization features is to support the

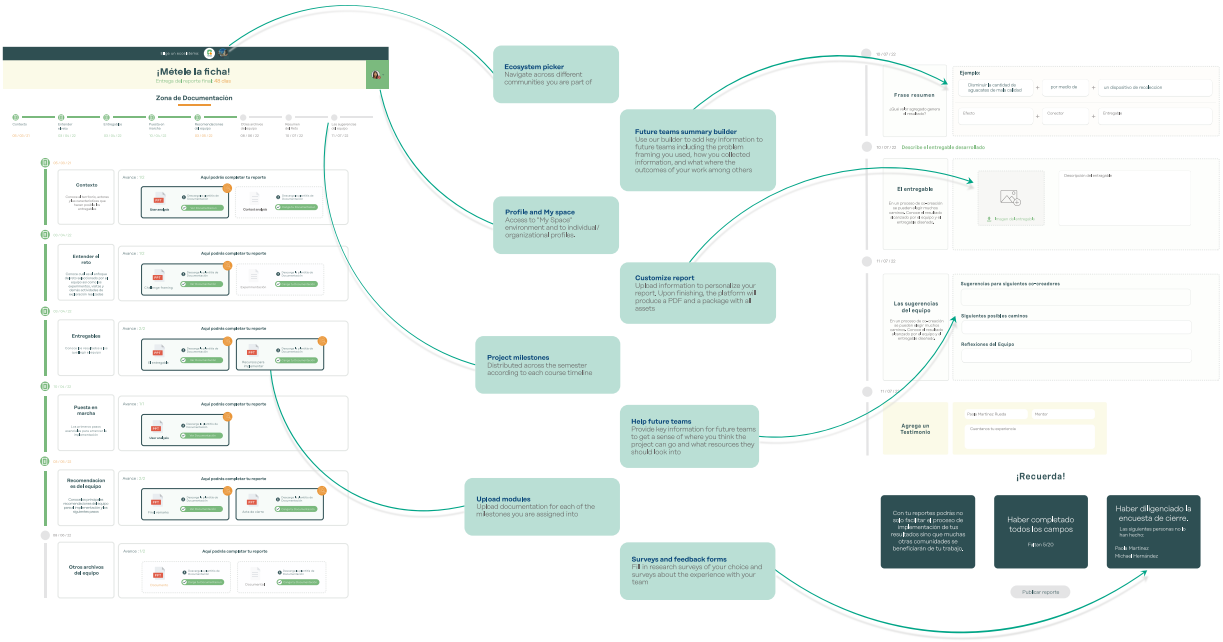


Figure 6.5: Left: "Report" environment showing report stages tracker and options for uploading materials. Right: "Report" environment continued showing summary prompt maker and options for suggesting future paths to future teams, leaving testimonials, and describing deliverables

localization of relationships built around collectives, invoking the local nature of innovation.

6.4.4 Pilots Assessment Methods

Data collection

As we rolled out the platform, we set up several strategies to receive user feedback. As the platform is used, we have also collected descriptive statistics about the number of challenges, participants, communities, and institutions using it. Before deploying testing pilots, we ran a series of user testing groups to validate each environment's workflows. We briefly report on those results. The data we present in our early findings was collected through:

Co-design sessions. At the beginning of the Guatemala pilot, Diana facilitated a co-design session in which the platform was introduced to the team. Following that session, attendees were given access to a form recording perceptions around the potential use of the platform in the context of their project and the use of the platform as part of co-design processes. Suggestion boxes and bug reporting. We provided the Guatemala pilot and Diversa team members access to a digital suggestion box on Google Forms. The form allowed them to input information about an idea or feature they considered important to add to the platform based on their experience. Usage data. We collected data through a logging system, keeping track of the activity across different platform environments. General information of data collected through the pilot can be found in Figure 6.1 User testing sessions. Prior to the start of the Guatemala pilot, we ran a user testing session with fifteen

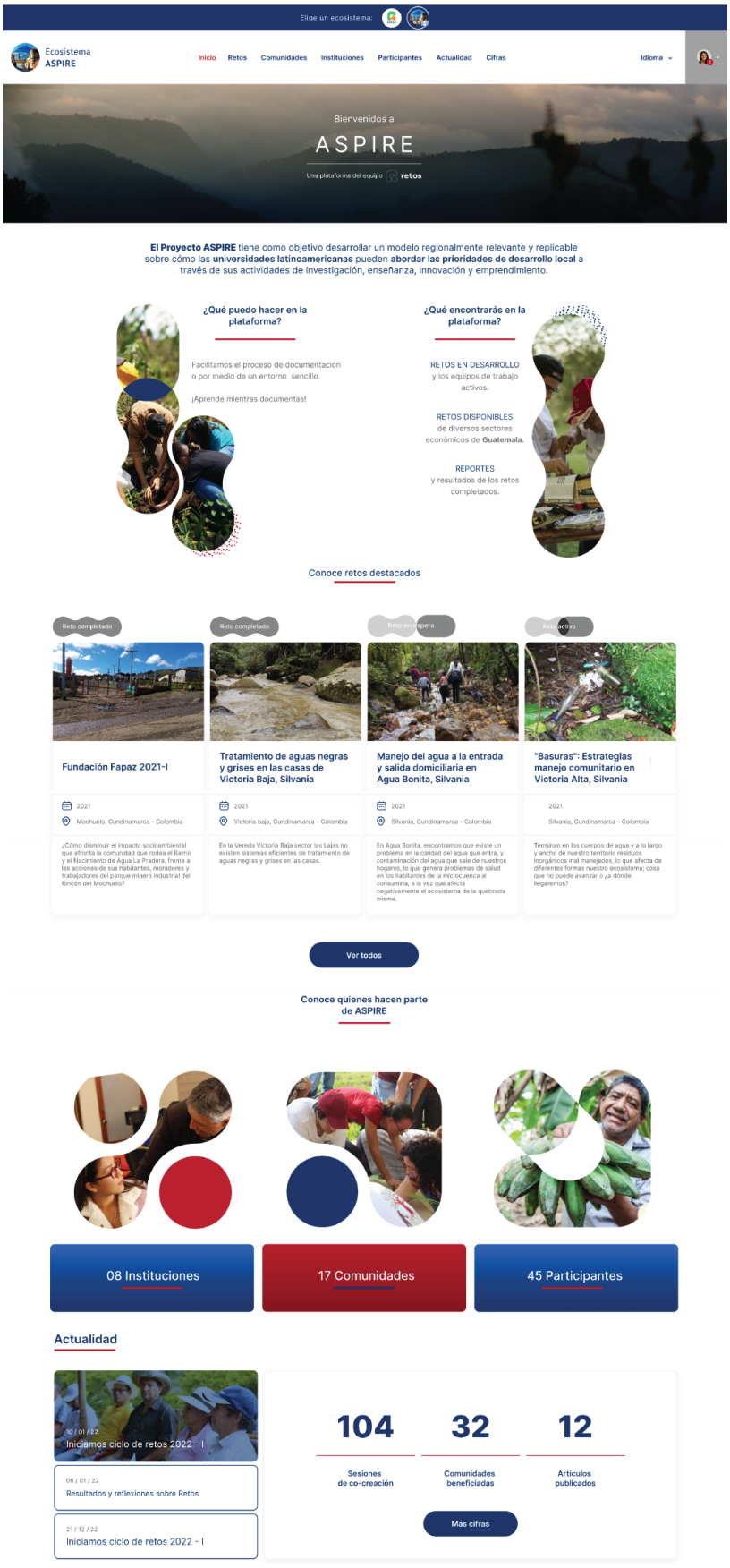


Figure 6.6: Localization environment as an "ecosystem" function of the Retos platform for the Guatemala pilot

participants from Guatemala and nine from Colombia. The methodology was structured as a series of tasks users needed to accomplish using the platform's functionalities, as well as other tasks where users freely explored the platform. The tests were run in an isolated environment to track clicks and workflows and properly determine failure or success on each task.

Analysis

All the qualitative data collected through the abovementioned methods was processed in live meetings between Diana and me. Throughout the implementation of the pilots, we held ongoing meetings to revise the results from user testing, discuss the information collected through the suggestion boxes, and evaluate the following stages in software development. These meetings aimed to use these learnings to develop the platform around them actively. Along with notes from these meetings, most of the findings reported in the section below come from the information collected in suggestions boxes, user tests, and co-design sessions. Since all this data was gathered in the context of a narrow purpose ('how can/is the platform serving documentation purposes in the context of co-design challenges), I compiled it and analyzed it using a simplified narrative analysis method [206]. I looked at each suggestion as a narrative unit and annotated it accordingly. I then looked across all narratives, establishing relationships between them.

[206]: Riessman (2008), *Narrative methods for the human sciences*

6.5 Findings

In this section, we report on the main connection points across the qualitative data collected. These findings reflect tensions between participants' expectations and the platform's current features. It also highlights the challenges of developing a product where different audiences can see benefits from different features that are not all-inclusive or compatible with each other. Table 6.2 (inspired by [230] compiles some of the challenges and successes of this process in reference to the design principles driving the platform's design.

[230]: Sterman et al. (2023), *Kaleidoscope: A Reflective Documentation Tool for a User Interface Design Course*

Table 6.2: Summary of features, successes and challenges of Retos in relation to its design principles. Inspired by [230]

Design Principle	Retos Features	Successes	Challenges
Accountability	Community members assessment tools, public reporting	Streamlined communication, ground-truth information, increased stakeholder agency	Privacy concerns, challenges with quality of information
Continuity	Documentation report, challenge-level views	Repository of prior work, ability to capture key information across different stages	Challenges with displaying prior work, documentation can be tedious, tensions over intellectual property
Making relationships visible	My space view, user profiles, collaborators and challenges suggestions	Sense of community through high-level views, opportunities for further collaboration through suggestions	Bugs displaying suggestions hampered the feature, differences in user shared data can limit suggestions

6.5.1 Streamlined Communication Leading to Accountability

As a primary documentation tool, Retos serves as a communication channel for all parties involved in co-design challenges. The detailed nature of the reporting that takes place in Retos aids in facilitating collective understanding. Data confirms this is an expectation from users as a value-added:

"[...] it is important for community members to see how their challenges are being worked on, and by whom, and to have access to the results of that in real time." P019

"[the platform] serves as a primary mode of documentation, ensuring continuity and effective communication in the entire project, and archiving it for future use." P030

Centralized communication comes with its challenges. Participants mentioned that the tone of the reports felt "technical" and unsuitable for corporate partners, for example. Therefore, communication needs to happen in a language accessible to all audiences. This poses a challenge from the standpoint of the design principles from which we departed in creating the platform. As we move towards more intentional ways to build the platform around serving rural communities, we might have to compromise what can be offered to other audiences. We discuss this further in the context of privacy issues in our discussion section below.

Communication and public display of information helped convey a sense of accountability across all participating groups. Data shows that teachers and facilitators, for example, see an opportunity in using the tool for this purpose. While we did not explicitly share the design principles behind the platform, several members returned to the themes of continuity and visualization of information, leading to accountability:

"[...] it is important for community members to see how their challenges are being worked, and by whom, and to have access to the results of that in real time, not needing to wait for donor reports or sharing back from the [...] team. The platform, therefore, enables horizontal, real-time learning between the various project stakeholders and helps avoid centralization of project updates [..] in places [...] that are not accessible to all project stakeholders." P059

While public information does not necessarily guarantee that process and outcomes follow an equitable participation process across all parties involved, it does provide a 'ground truth' source of information. This is further complemented by assessment features extending agency to communities, in this case, over the evaluation of outcomes.

6.5.2 Aligning Expectations Remains a Challenge

Despite leading multiple sessions at both pilots explaining the platform's possibilities, data shows that expectations shifted as we rolled it out. Part of this is attributed to a continuous pace of feature development, which

created bugs in users' experience. Moreover, this shifting reveals gaps in how we present the tool and how users conceive it at use time. It also indicates that the platform itself might not accurately communicate its purpose. Some users, for example, expressed expecting the platform to guide the co-design process methodologically:

"Guide the PD process (stage by stage) and allow documentation of the process and the results. I see the platform providing guidance on each stage of the process for both students/communities but also for facilitators. I see the platform helping not only to achieve positive results (service, product, strategy, business model, etc.) but also to help people learn about participatory design. So, with each stage, it could suggest or remind you of key activities, objectives to keep in mind, tips, and tricks. A true guide" P022

Other users conveyed that these relational aspects of the tool presented an opportunity to automate the process of matching challenges and communities with students. We found references to this matching potential to be a common theme. Users remarked on the value of using the platform to establish the most viable pairings between institutions, communities, and participants in the context of a given challenge. This is something we have explored since the beginning of the development of Retos and was, in fact, one of our core ideas at the beginning. However, this poses questions about the right information and weight allocated to each information bit to establish a viable match. Therefore, this remains an open question. Currently, the matching process is based on implicit knowledge of the communities, challenges, and institutions available within facilitation teams at Diversa and the Guatemala deployment team. This begs the question of the amount of human mediation required in matching collaborators and the differences between a potentially automated match and a match done with a human-in-the-loop.

Figure 6.7: Current workflow for including challenges in the Retos platform, demonstrating the need for a human in the loop when facilitating connections between students and communities and when including challenges in the platform. From left to right, four steps: (1) Tell us your idea, (2) Getting to know each other, (3) Publishing your challenge, (4) Collaborate with a team

Several users and members of teams at both pilots expressed an expectation that the platform would serve as a vehicle to connect with communities around the universities. Across Latin America, it is common

for universities to include extension divisions in their institutional organization. These units are tasked with taking research and resources on campus and putting them in neighboring communities' service. We hypothesize that because this community service model is pervasive across the region, and the platform is geared towards increasing the agency and accountability to communities, participants expect Retos to mediate that gap. While we certainly see this as a possibility, we recognize that the needs of extension divisions are broader than what the platform can do without compromising its core philosophies. Serving course offerings, consultancies, research, and thesis projects, all common within extension divisions, will require changes in the language and a host of new features, adding complexity to the platform.

6.5.3 When and How to Educate Users

When to educate users on how to use a product and how to do it is a challenging question. While some users could hit the ground running, others needed help to navigate and effectively use the platform. This difference was reflected in that none of our testers succeeded in tasks included in the user testing study. These required them to use functionality across all environments to achieve a specific task (e.g., "find a challenge in the area of agroecological fertilizers" or "find and download a report of a model for a small coffee roaster"). As a solution, we developed a small series of videos showcasing the platform's usage. However, the videos were ineffective and we had to move to in-person platform walkarounds.

"Teachers don't have time: they are not going to watch videos or train themselves. They need the service. Ideas that emerged: add to emails [specific steps] about using the platform, along with onboarding sessions [...]. Here's a great conclusion: the videos are a good idea to clarify [...] but at the level of adding value to the process... I think it didn't work very well" P025 (Translation is ours)

This is not a new problem, and our solution is not far from what other digital platform services are doing. As digital systems like Retos become more complex, onboarding sessions to new users, particularly potential power users, is now a standard industry practice.

Another finding emerging from this theme was the importance and possibilities of localization. Initially, our strategy was to fold all the work done within the Guatemala pilot into the larger Retos ecosystem, offering options for filtering and displaying information specific to that group. As opposed to the challenges included in the Colombia pilot (single course offerings), the Guatemala pilot is constituted by a large group of stakeholders across different roles. This meant that group members felt the need to represent themselves on the platform according to their collective goals and narrative. As feedback started rolling in, it became clear that having a space that could be fully customized in terms of our User Interface, but also in terms of the language and tone provided to those taking part, was key for these ecosystems of agents to establish their presence in the platform appropriately. This insight led to the 'ecosystems' feature (see Figure 6.6). However, participants in our user test reported not having clarity about this feature or the functions and

relations between different ecosystems. As a result, the majority of them failed these tasks.

6.6 Discussion

Building on the findings presented as part of our analyses in the previous section, we now discuss a series of insights from our work reflecting on these themes and thinking forward about the development of the Retos platform.

6.6.1 Privacy and the Need for Mediation

Both through feedback received at pilots and in internal conversations between Diana and me, the tensions surrounding what information is added and displayed on the reports have come up repeatedly. For example, pilot users reported the advantages of field notes in the report to help log how decisions are made. Running on this example, questions about privacy constraints in reporting begin to arise as you approach more detailed information about decision-making. This is true not only for decisions but also for documentation related to outcomes. In their study of implementing Kaleidoscope, a tool to aid documentation in design studios, Professor Sarah Sterman and collaborators also identify this tension. They reported how their assumption of students feeling comfortable sharing work within their groups was challenged by a sense of pressure to only show finished work to each other. They identified that "to make a more effective shared record of progress will require careful sensitivity to the balance between privacy and visibility even among group members" [230]. In our current model, all documentation about challenges is shared on the platform over a Creative Commons license. Data shows that this decision creates friction with these and other privacy concerns. Other scenarios include the potential for patents due to collaborations between university students, the private sector, and communities or the need for companies to share information to advance challenges while protecting it due to proprietary constraints. At the same time, and as mentioned before, data also showed that private sector members find the language used in the reports, and across the platform overall, to be foreign, especially as reports can become technical very quickly, given that students largely prepare them. While both issues of intellectual property and tone in language cannot, in our view, be solely resolved by a documentation tool, the tensions surrounding them reveal the importance of consistency and commitment to design principles and philosophies. Community members also brought up potential privacy issues in the context of challenges leading to creating businesses. To some, having a public repository creates a situation in which people living in your vicinity can engage in competition by having access to detailed information about a technological artifact. This issue further compounds when a challenge has been developed collectively. Who has the right to make a challenge private? We recognize the need for further engagement with communities around this issue. While free and open source is an excellent option for technologists and innovators in positions of privilege, our data shows there is more nuance when we enter rural,

[230]: Sterman et al. (2023), *Kaleidoscope: A Reflective Documentation Tool for a User Interface Design Course*

often historically marginalized geographies. The work of the Honey Bee Network in India (mentioned in Chapter 4) is an example of the need for systemic changes that account for legal, formal ownership over rural innovations whenever appropriate [98].

[98]: Gupta (2006), *From Sink to Source: The Honey Bee Network Documents Indigenous Knowledge and Innovations in India*

6.6.2 Quality of Information: Towards Standardization

Following the feedback we received over this two-year pilot, one of our main insights has been how crucial the quality of the information included in the report is, especially as users see the information on the platform as a way to streamline communication. Since the platform's inception, we have been tinkering with different frameworks and templates to simplify the process. This has been driven by data showing users felt the documentation process was tedious and could mean double work —especially in the context of university courses where students are also required to report for teacher assessment. While the current documentation model —which we reported in this chapter— has been slightly more successful, establishing a quality standard remains an area for improvement.

One way this can be mediated is by moving towards standardization. This is not only a function of the data uploaded to the platform but broadly as a community of practice in participatory design. While co-design processes are broad and can be hard to operationalize, we are beginning to see patterns emerge. Splitting documentation into broad umbrellas (e.g., data gathering, data analysis), using guiding questions that build on specificity while carefully describing artifacts or assets created along the way so that others can reuse them (e.g., detailing tools needed to use an asset, creating technical drawings for physical artifacts), can be made into generalities that apply to most participatory design experiences. The purpose of standardization in this context is not to flatten nuance. It is to agree and establish a core specification for what information is required in the context of various co-design experiences. In a sense, we see our work with the Retos platform as an effort to move towards this standard.

6.6.3 Research on Rural, Local Innovation at Scale

The idea of the platform as a research resource is emerging from the process of scaling the platform both in the number of challenges and stakeholders, as well as in geographical coverage. On the one hand, in standardizing the type of information reported across all challenges, we are beginning to see the possibility of providing insight into co-design decisions based on approaches taken by prior teams. By querying an extensive knowledge base, we can provide teams with aggregated, specific information about projects in a specific domain. On the other hand, as Retos grows across audiences and through the platform's current 'surveys' feature, we open the opportunity for researchers in the areas of rural and local innovation to run experiments in-the-wild with real audiences at scale. Because a lot of the work done in these research fields can be sparse or lack proper, standardized documentation, it is hard to do scale studies.[14] The tendency to one-off community-based co-design

14: If you are curious, Chapter 2 is an example of a study done as a multi-year research project in this area

projects within academia and the limited availability of centralized repositories where diverse groups collaborate on these projects are also current barriers. With a rolling basis of students, communities, institutions, and challenges year-round, this is an opportunity space we are actively exploring with Retos. Research around Retos can also occur outside of the platform but as an effect of its usage. In some of Diana's field visits to the Guatemala pilot, she observed the emergence of in-person collaborations —beyond the challenges worked within the pilot— but as a result of interactions within it. While more complex to capture, these external effects are part of the value added by the tool and, in our view, represent an exciting space for co-design research.

6.7 Limitations and Future Work

The development and piloting of the Retos platform over the past couple of years, and in the two sites we presented in this chapter, allowed us to receive data directly from users in the context of courses and projects running live. Using this feedback, we continue to iterate over the system's functionality. However, constant changes in features meant that participants were prone to encounter bugs more easily, and the tool's usability was negatively affected.

In including a large amount of challenges in our pilots, we limited our ability to monitor them closely. While we provided descriptive statistics, we did not conduct a detailed observation of a select few challenges, for example. We are designing an experiment for both pilots, encompassing interviews with various stakeholders and a detailed analysis of specific challenges at each site. Also, software issues during a database migration hindered our capacity to log detailed information, preventing comprehensive reporting across all challenges in the pilots. Furthermore, in the initial phase of the Guatemala pilot, we had technical difficulties with the reporting environment, which led us to use offline templates. Having addressed these problems, future studies will offer detailed statistics regarding interactions within the reporting environment.

Our findings highlighted potential opportunities for new features and interactions within the platform. However, the specific contexts of each pilot and the design principles guiding Retos limit the scope of functionalities we can develop. That said, other projects can build on our insights to explore these opportunities further. Future research can explore how the platform might address privacy concerns by providing prompts and resources to assist participants' decision-making. Although Retos aims to simplify the documentation process through a tool-agnostic approach, further refinement is needed to make documentation more seamless. Moving forward, we can consider including mobile features for live capture of information during fieldwork, conversely facilitating documentation. Additionally, future work should examine the broader impacts of the platform beyond the immediate tool-mediated interactions. Longitudinal surveys of challenge participants could yield valuable insights into these extended effects.

Lastly, while we recognize platforms like Retos offer great potential for achieving accountability, foreground relationality, and supporting continuity of engagements, we recognize this is a step towards creating a

larger culture around these principles. Only in moving us in that direction will we be able to create systemic change that normalizes these values across different spheres of influence and power.

6.8 Conclusion

In this chapter, we introduced Retos, a collaborative documentation tool to support co-design experiences. We tested various aspects of the platform in the context of two pilots over a span of two years. The platform provides features that allow for the documentation of outcomes across different stages of the co-design process ('documentation zone'), visibility of relationships ('my space'), and controls over personal information shared in order to establish these connections ('profiles'). We report on data collected across the process of designing and rolling the platform. Data was collected through logs, suggestion boxes, co-design sessions, bug reports, and user testing tasks. We analyzed this data with an eye on recurrent themes in response to the use of the tool. Whenever possible, we connected these findings to the design principles from which the design of Retos departed: continuity, accountability, and making relationships visible. We discuss these findings in light of the overall practice of co-design/participatory design in an effort to highlight insights that can benefit co-design practitioners. As we move along with the design of Retos, we hope the lessons we shared can encourage and inform alternative designs in the space of co-design documentation.

Importantly, beyond the practical benefits offered by the platform mentioned throughout this chapter, the acknowledgment and visibility it offers to place-based knowledge is an effort to connect Design and technology studies to ancestral ways of thinking and making things. The type of artifacts and mechanisms that this close relationship with local, culturally-informed modes of creation offers is an expression of what is possible when technology practice is done in close conversation with the ancestral —when we design for Ancestral Technology.

7 Conclusions

Across this dissertation, I have explored several ways to weave the ancestral throughout design and technology studies. In this chapter, I bring together the takeaways from this work and its implications for both domains. Altogether, I make five main contributions to this work:

- First, I proposed an evaluation model for longitudinal, quantitative analysis of participatory design experiences to understand further the allocation of benefits across participants in these initiatives.
- Second, I identified connections between Indigenous research methods and Design to provide designers with culturally aware pathways into their practice.
- Third, I advanced the notion of Ancestral Technology to expand current definitions within technology studies and technology design.
- Fourth, I designed and implemented a documentation system for co-design projects to facilitate accountability, continuity, and relationality within these programs.
- Fifth, I utilized participatory approaches to develop the curriculum of two immersive technology co-design courses in rural Colombia.

To put these contributions into context, I return to the three motivation points I offered in Chapter 1, which I used as anchors throughout the dissertation.

7.1 Expanding Recent Shifts Within Design Education

The work developed in this dissertation takes advantage of a moment in which Design education is expanding. It proposes novel ways to engage in community-based work —in the face of increased interest in these kinds of collaboration within Design—by connecting design to ancestral knowledge in more meaningful, equitable ways.

In Chapter 1, I discussed how we arrived at this moment, bringing attention to the proliferation of design across multiple disciplines, primarily aided by project/challenge-based courses. I highlighted that one effect of this rapid increase has been an appeal within universities to seek partnerships with external collaborators with a recent focus on Global South geographies. Using the lens of postcolonial computing, I discussed some potential harms and adverse effects from these design engagements, including the carrying of colonial legacies and the effecting of extractive dynamics in knowledge, to mention a couple. In response to this trend, I designed and implemented two participatory design courses aimed at increasing involvement from collaborators, specifically within regions in rural Colombia. I showed how we can neutralize some of these drawbacks by involving community members in curriculum design and

content delivery while being immersed in the environments where these projects take place. It also provides an avenue for legitimizing ancestral knowledge and working with it, exposing students to new imaginaries within technology design. I called attention to the need for this kind of reflexive practice in the type of design engagements advanced in these two courses and presented an experimental assessment using the equityXdesign framework (equityXdesign, 2019).

Throughout the dissertation, I make the case that participatory design is an approach to designing technology that can help us counteract common narratives around modernity and globalization. However, I acknowledged it is not without issues and is, as most narratives, prone to co-optation. To meet this challenge, I argued that our most robust line of defense is studies that assess participatory engagements rigorously and over time. In Chapter 2, I proposed a model to do this in the context of a multi-year co-design program where local community and international participants work together co-designing low-cost technology. I found that, despite the program being designed with community members as its primary target audience, learning gains could have been more evenly distributed. Notwithstanding this misalignment between values and outcomes, I also reported on several of the program's benefits, including unintended outcomes such as promoting communities of practice and local institutionalization around participatory design goals and values. I contended that designing and deploying assessments that look beyond short-term outcomes and focus on learning gains across audiences can help legitimize and make participatory design encounters more accountable.

7.2 Towards the Ancestral in Technology: Extending the Notion

With this dissertation, I posit that there is a case to be made for a renewed outlook into what we count as technology, specifically within technology and design studies. In Chapter 3, I discussed three prominent positions on what is understood as technology within the field of philosophy of technology. I proposed that in amalgamating these lines of thought, we will be brought closer to encountering, being inspired, and designing with ancestral knowledge. I conceptualized the notion of Ancestral Technology as "an approach that characterizes elements of material culture that primarily support cultural cohesion, are rooted in a bounded geography, and hold a history that lives through collective memory." To explore this nascent notion, I mapped these characteristics onto two ancestral technologies, the 'guanga' and the 'batea,' as I encountered them during fieldwork in rural Colombia. I then offered an in-depth account of the 'minga investigativa,' a mechanism for social organizing understood and employed as a technology by farmers and Indigenous Quillasinga groups in the Nariño region of Colombia. I demonstrated how these artifacts respond to contrasting narratives, accomplish functions beyond the instrumental, and significantly expand the realm of possibility and imagination within technology studies. I advocated for engaging this ancestral knowledge head-on when thinking about designing technology. In putting this claim to the test, I intentionally included material in one of

the courses I reported in Chapter 5, directly connected to the findings of my fieldwork. As a result, the curriculum of these courses was enriched with modules teaching ancestral manufacturing techniques, including bio-construction and weaving. To ensure the continuity of projects that started in these courses, we followed the model of the 'minga' I mentioned before. Altogether, these strategies were developed as an effort to center placed-based knowledge and expertise within design and technology studies.

7.3 Design Research Methodologies Expanding

For these transformations to occur, we might be required to look outside the current methodological spaces in which design research takes place. I turned to Indigenous research methods to illuminate possible avenues we can take as a community of practice (Chapter 4). I explored the intersection of these ways of doing in connection to making in the world (design). Engagements through these methods prioritized values of relationality, respect, reciprocity, and responsibility. Building on Māori academic Sir Mason Durie's formulation of 'research at the interface,' I proposed we advance towards a 'design at the interface' in which we embrace and gain inspiration from some of the values and ways of knowing animating Indigenous research methods.

In thinking about how we can better maintain the commitments these methods invite us to assert in the context of designing, my colleague Diana Duarte and I reported on the design of a digital platform to aid the process of documenting co-design project/challenge-based programs. In light of how Design has disseminated across various disciplines through project/challenge-based approaches, often in partnership with external collaborators, we argued it is needed to develop strategies and tools to document better what is collectively produced. Given the turn within Design toward collaborations with communities in the Global South, we must develop mechanisms to assert accountability and continuity in the context of these partnerships. This is especially important in light of the seasonal characteristics of projects within higher education and the often transactional nature of these encounters I discussed in Chapter 5. With limited resources and time, community partners are often at risk of burden when co-design projects do not enact appropriate documentation mechanisms from the onset. We argued that without a robust mechanism for recording critical information about these projects, co-design engagements open themselves to poor accountability, pervasive power dynamics between participants, and weak ways to maintain outcomes over time.

Overall, this dissertation is an effort to open new pathways for our practice as designers and technologists by connecting us to placed-based knowledge in respectful and relational ways. To guide us into imagining new ways to create together in the future, and for the future. To remind us of the power of contesting the present. My hope is that we can use the work advanced in this dissertation as a portal to a post-design(s) moment.

Appendix

A

IDDS M&E Questionnaires

This set of questions was developed by the Monitoring and Evaluation (M & E) team at the International Development Design Network (IDIN). More information about it in the IDIN website. Questions are formatted according to the Qualtrics survey system [1] categorization system.

1: Qualtrics https://www.qualtrics.com/

Question ID	Phase	Question
D1	Demographic	Participant's ID
D2	Demographic	Participant's origin
D3	Demographic	Participant's work sector
D4	Demographic	Participant's gender
D5	Demographic	Participant's age
D6	Demographic	Participant's nationality
D7	Demographic	Participant's hometown
D8	Demographic	Active member until
D9	Demographic	Summit's project
D10	Demographic	Project's sector
D11	Demographic	Project active until
D12	Demographic	Summit's topic
D13	Demographic	Summit's country
D14	Demographic	Summit's city

Question ID	Phase	Question
D15	Demographic	Summit's year
Q1	Prior phase	Between now and the end of the IDDS, what is what you expect to achieve the most. Please select between 1 and 4 answers.
Q1_1	Prior phase	Develop or improve my design skills
Q1_2	Prior phase	Interact with local communities in a useful and meaningful way
Q1_3	Prior phase	Keep developing a project on which I have already worked
Q1_4	Prior phase	Develop or improve my building skills
Q1_5	Prior phase	Learn how to facilitate the design process
Q1_6	Prior phase	Learn about the theme of this IDDS
Q1_7	Prior phase	Join an outgoing network of innovators
Q1_8	Prior phase	Meet and work with people from other cultures
Q1_9	Prior phase	Produce a project that can continue to develop after the summit
Q1_10	Prior phase	Generate an innovative idea to solve a problem
Q1_11	Prior phase	Learn about effective co-creation strategies working as a team

Question ID	Phase	Question
Q1_12	Prior phase	Learn more about myself as an individual
Q1_13	Prior phase	Other
Q2	Prior phase	Please tell us a little more about your short-term goals for the summit (1-3 sentences)
Q3	Prior phase	What do you expect to achieve the most 12 months after the IDDS? (please select 1 to 3 answers).
Q3_1	Prior phase	Work in an innovation or company.
Q3_2	Prior phase	Get involved in studies or research on design, sustainability or development.
Q3_3	Prior phase	Teach what I have learned about design and co-creation to other people.
Q3_4	Prior phase	Introduce new collaborative development techniques to my work.
Q3_5	Prior phase	Start a new job/internship in the fields of design or sustainability.
Q3_6	Prior phase	Get involved with a local community of designers or former IDD students where I live.
Q3_7	Prior phase	Continue the co-design of the prototype generated in the IDDS.

Question ID	Phase	Question
Q3_8	Prior phase	Get involved in an initiative related to the theme of IDDS.
Q3_9	Prior phase	Other
Q4	Prior phase	Please tell us more about your goals and vision 12 months after the meeting (1-3 sentences).
Q5	Prior phase	Please finish the following sentence: For me, the IDDS would be a success if
Q6	Prior phase	For me, the IDDS topic means
Q7	Prior phase	For me, co-creation is
Q8	Prior phase	How comfortable or safe do you feel performing the following activities:
Q8_1	Prior phase	I can use manual tools to work with wood, metal and other materials.
Q8_2	Prior phase	I can materialize something when I have an idea of it in mind.
Q8_3	Prior phase	I can work creatively with locally available materials.
Q8_4	Prior phase	I can design and begin a business
Q8_5	Prior phase	When I face a problem, I can consider points of view of different actors.

Question ID	Phase	Question
Q8_6	Prior phase	When I face a problem, I can see many opportunities to generate creative solutions.
Q8_7	Prior phase	I can gather information and feedback from people who are affected by a problem.
Q8_8	Prior phase	When my solution doesn't work, I can use feedback to keep improving it.
Q8_9	Prior phase	I can express my ideas to a group of people.
Q8_10	Prior phase	I can be empathetic with the points of view of others even if I disagree.
Q8_11	Prior phase	I can work in teams of people who have very different stories and backgrounds than mine.
Q8_12	Prior phase	I can lead a team.
Q8_13	Prior phase	I can stay focused on and achieve my goals.
Q8_14	Prior phase	I can teach others what I know.
Q15	Middle phase	Please rate the following aspects of the IDDS experience:
Q15_1	Middle phase	Accommodation
Q15_2	Middle phase	Food
Q15_3	Middle phase	Communications

Question ID	Phase	Question
Q15_4	Middle phase	Health
Q15_5	Middle phase	Teaching
Q15_6	Middle phase	Schedule
Q15_7	Middle phase	Balance between free time and work
Q15_8	Middle phase	Security
Q15_9	Middle phase	M&E
Q15_10	Middle phase	Opinions and feedback for the IDDS until now
Q16	Middle phase	Please rate the following activities from the IDDS curriculum:
Q16_1	Middle phase	Morning circle
Q16_2	Middle phase	Design Challenge
Q16_3	Middle phase	Build-it
Q16_4	Middle phase	Stakeholders analysis
Q16_5	Middle phase	Observe, ask, try
Q16_6	Middle phase	Visit to community
Q16_7	Middle phase	Problem trees
Q16_8	Middle phase	Design challenge #2
Q16_9	Middle phase	Intro to Design Process
Q16_10	Middle phase	Design book
Q16_11	Middle phase	Empathy exercise

Question ID	Phase	Question
Q16_12	Middle phase	Preparation of field visits
Q16_13	Middle phase	Presentation of field visits
Q16_14	Middle phase	Generation and experimentation of Ideas
Q17	Middle phase	Which build-it did you do?
Q18	Middle phase	Please provide feedback about the following activities:
Q18_1	Middle phase	Morning circle
Q18_2	Middle phase	Design challenge #1
Q18_3	Middle phase	Build-it
Q18_4	Middle phase	Stakeholders analysis
Q18_5	Middle phase	Observe, ask, try
Q18_6	Middle phase	Visit to community
Q18_7	Middle phase	Problem trees
Q18_8	Middle phase	Design challenge #2
Q19	Middle phase	Please rate the following aspects of your group experience:
Q19_1	Middle phase	Project selection
Q19_2	Middle phase	Preparation of the visit
Q19_3	Middle phase	Team work
Q19_4	Middle phase	Facilitation

Question ID	Phase	Question
Q20	Middle phase	Please provide feedback about the following aspects of your group experience:
Q20_1	Middle phase	Project selection
Q20_2	Middle phase	Preparation of the visit
Q20_3	Middle phase	Team work
Q20_4	Middle phase	Facilitation
Q21	Middle phase	Commentaries about your team/project
Q22	Middle phase	In general, how do you feel about the project until now?
Q23	Middle phase	In general, how do you feel about the IDDS until now?
Q24	Middle phase	What role has the community member played in your project? Which specific contributions has they given. (if you are a member of the community, how do you see your role in the team? What specific contributions have you given?)
Q25	Middle phase	Please feel free to use the other side of this sheet to comment on any other aspect of your IDDS experience.
Q26	Posterior phase	Please share your thoughts about the value of the IDDS. Which aspects of the IDDS experience have been the most valuable to you, and why.

Question ID	Phase	Question
Q27	Posterior phase	Which skills and/or knowledge do you feel you have gained or developed during the past two weeks as a result of participating in the IDDS. Please be as specific as possible.
Q28	Posterior phase	Did your attitudes or perspectives change in some way during the last two weeks as a result of participating in the IDDS? Please explain.
Q29	Posterior phase	How comfortable or safe do you feel performing the following activities:
Q29_1	Posterior phase	I can use manual tools to work with wood, metal, and other materials.
Q29_2	Posterior phase	I can use the design process to resolve a problem.
Q29_3	Posterior phase	I can work in teams of people who have very different stories and backgrounds than mine.
Q29_4	Posterior phase	I can gather information and feedback from people who are affected by a problem.
Q29_5	Posterior phase	I can design new educative materials and experiences.
Q29_6	Posterior phase	I can teach others what I know.
Q29_7	Posterior phase	I can co-create solutions with others.

Question ID	Phase	Question
Q29_8	Posterior phase	I can clearly define and identify a problem.
Q29_9	Posterior phase	I can work creatively with locally available materials.
Q29_10	Posterior phase	I can adapt and change toward different specific situations.
Q29_11	Posterior phase	I can design for my own well-being and survival.
Q30	Posterior phase	Do you feel that you reach the following achievements proposed for the IDDS?
Q30_1	Posterior phase	Develop or improve my building skills
Q30_2	Posterior phase	Interact with local communities in a useful and meaningful way
Q30_3	Posterior phase	Meet and work with people from other cultures
Q30_4	Posterior phase	Join an outgoing network of innovators
Q30_5	Posterior phase	Learn more about myself as an individual
Q30_6	Posterior phase	Generate an innovative idea to solve a problem
Q30_7	Posterior phase	Learn how to facilitate the design process
Q30_8	Posterior phase	Develop or improve my design skills

Question ID	Phase	Question
Q30_9	Posterior phase	Keep developing a project on which I have already worked
Q30_10	Posterior phase	Learn about effective co-creation strategies working as a team
Q30_11	Posterior phase	Produce a project that can continue to develop after the summit
Q30_12	Posterior phase	Learn about the theme of this IDDS
Q31	Posterior phase	When did you feel that you contribute to the design process the most? When do you think you could have contributed more? What are the things that made you feel comfortable (or uncomfortable) when sharing your contributions and help with your group?
Q32	Posterior phase	Please help us to improve the teaching, curriculum, and learning in the IDDS. What worked well and what can be improved? What is missing? What could be covered in more depth? Are there things that we can remove?
Q33	Posterior phase	Your projects are the core of the IDDS, and they affect most of your experience. In the experience with your team, what worked well? And what could be improved? How can the IDDS better support the development of your project?

Question ID	Phase	Question
Q34	Posterior phase	Communities are one of the most important parts of the IDDS, and we are always working to make the involvement more significant in the community. In your experience of interacting with communities, what worked well? And what could be improved?
Q35	Posterior phase	Please rate the following curriculum's activities:
Q35_1	Posterior phase	Design for [X]
Q35_2	Posterior phase	Canvas business model
Q35_3	Posterior phase	Feedback of prototypes/Group presentations
Q35_4	Posterior phase	Design Requirements
Q35_5	Posterior phase	Intro to critical experiments
Q35_6	Posterior phase	Concept evaluation
Q36	Posterior phase	Now that you have completed the IDDS, what are your main goals for the next 12 months? Please select 1 to 3 answers.
Q36_1	Posterior phase	Work in an innovation or company.
Q36_2	Posterior phase	Get involved in studies or research on design, sustainability, or development.

Question ID	Phase	Question
Q36_3	Posterior phase	Teach what I have learned about design and co-creation to other people.
Q36_4	Posterior phase	Introduce new collaborative development techniques to my work.
Q36_5	Posterior phase	Start a new job/internship in the fields of design or sustainability.
Q36_6	Posterior phase	Get involved with a local community of designers or former IDD students where I live.
Q36_7	Posterior phase	Continue the co-design of the prototype generated in the IDDS.
Q36_8	Posterior phase	Get involved in an initiative related to the theme of IDDS.
Q36_9	Posterior phase	Other
Q37	Posterior phase	Please tell us more about your goals and vision 12 months after the meeting (1-3 sentences).
Q38	Posterior phase	How do you plan to continue working on your project of the IDDS in the future?
Q39	Posterior phase	Please explain how do you plan to keep being involved in the future?
Q40	Posterior phase	Do you usually have access to the internet?

Question ID	Phase	Question
Q41	Posterior phase	Are you interested in helping the IDIN/IDDS as a volunteer? Please select up to 3 ways you could help.
Q41_1	Posterior phase	IDDS organizer
Q41_2	Posterior phase	Mentor
Q41_3	Posterior phase	Workshop's facilitator
Q41_4	Posterior phase	Translator
Q41_5	Posterior phase	Graphic designer
Q41_6	Posterior phase	Web designer
Q41_7	Posterior phase	Resource manager
Q41_8	Posterior phase	Researcher
Q41_9	Posterior phase	I am not interested in participating as a volunteer at the moment.
Q42	Posterior phase	Is there something else you would like to share with us about your experience in the IDDS? or any ways in which you would like to get involved with the IDIN/IDDS in the future?

B

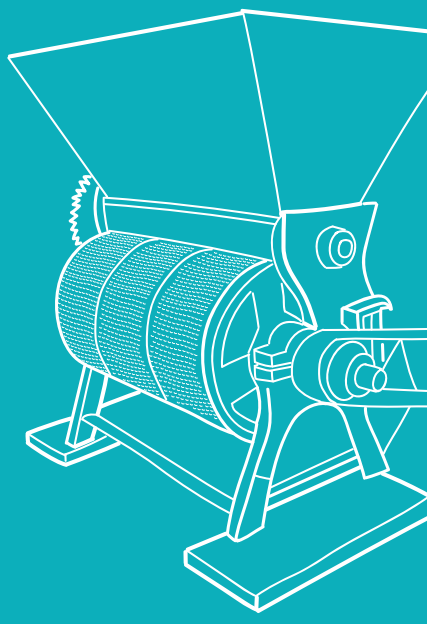
"A Co-Design Experience" reports

The following are the reports produced in collaboration with the Diversa team for the 2019 *"Technologies for Coffee Production"* (in Spanish), and the 2022 *"Technologies for Rural Sustainability"* (in English). Both courses are discussed in Chapter 5. Expanded information at the "Regional Technology Co-Creation and Transfer Ecosystems in Latin America" website at the MIT Media Lab website.

Diseño de tecnología para la producción de café en colombia:

Un experiencia de Co-creación

Reporte final



MIT | J-WEL | MIT D-Lab designing for a more equitable world | International Development Innovation Network | C-INNOVA

mit media lab | APRENAT | De Finca | UTADEO Universidad de Bogotá Jorge Tadeo Lozano | UVG Universidad del Valle de Guatemala

MIT JWEL

MIT Media Lab

MIT D-Lab

C-Innova
Centro de Innovación de Tecnologías Apropiadas y Educación

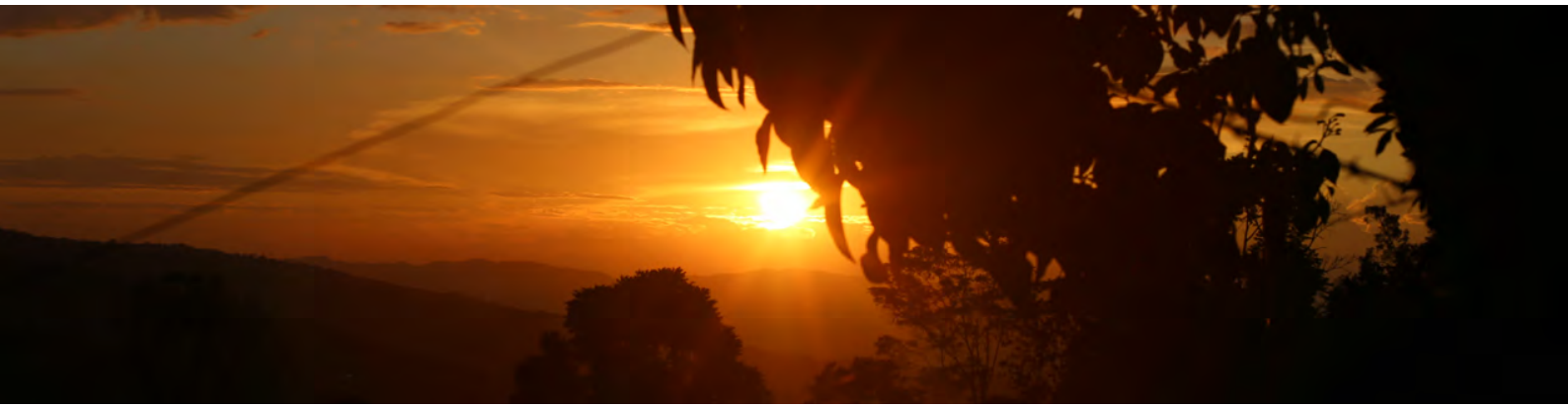
Universidad Jorge Tadeo Lozano

TÍTULO
Diseño de tecnología para la producción del café en Colombia: Una experiencia de co-creación
Reporte final

EQUIPO FACILITADOR
Alejandra Villamil Mejía / *Facilitación*
Alex Freese Bello / *Facilitación y taller*
Angela Camargo Calderón / *Facilitación y trabajo previo comunidades*
Aura Flechas Aguilar / *Facilitación y trabajo previo comunidades*
Liliana Murcia Ortega / *Finanzas*
Pedro Reynolds-Cuéllar / *Organizador principal*
Silvia Buitrago / *Registro audiovisual*

DISEÑO Y DIAGRAMACIÓN
Aura Flechas Aguilar

2019

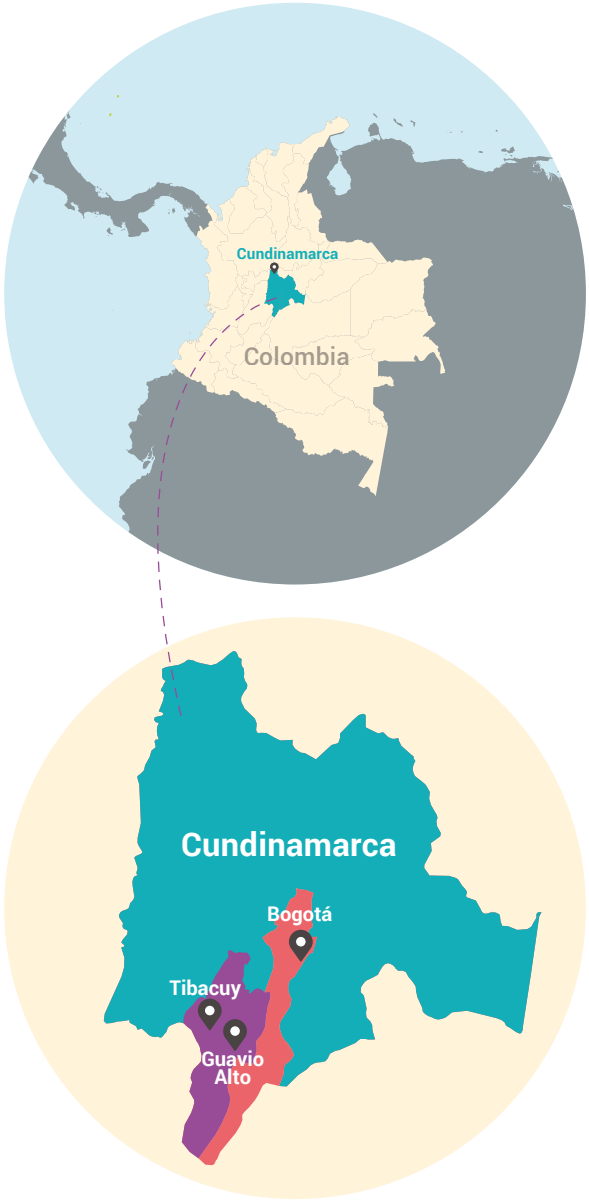


Sobre este lugar...

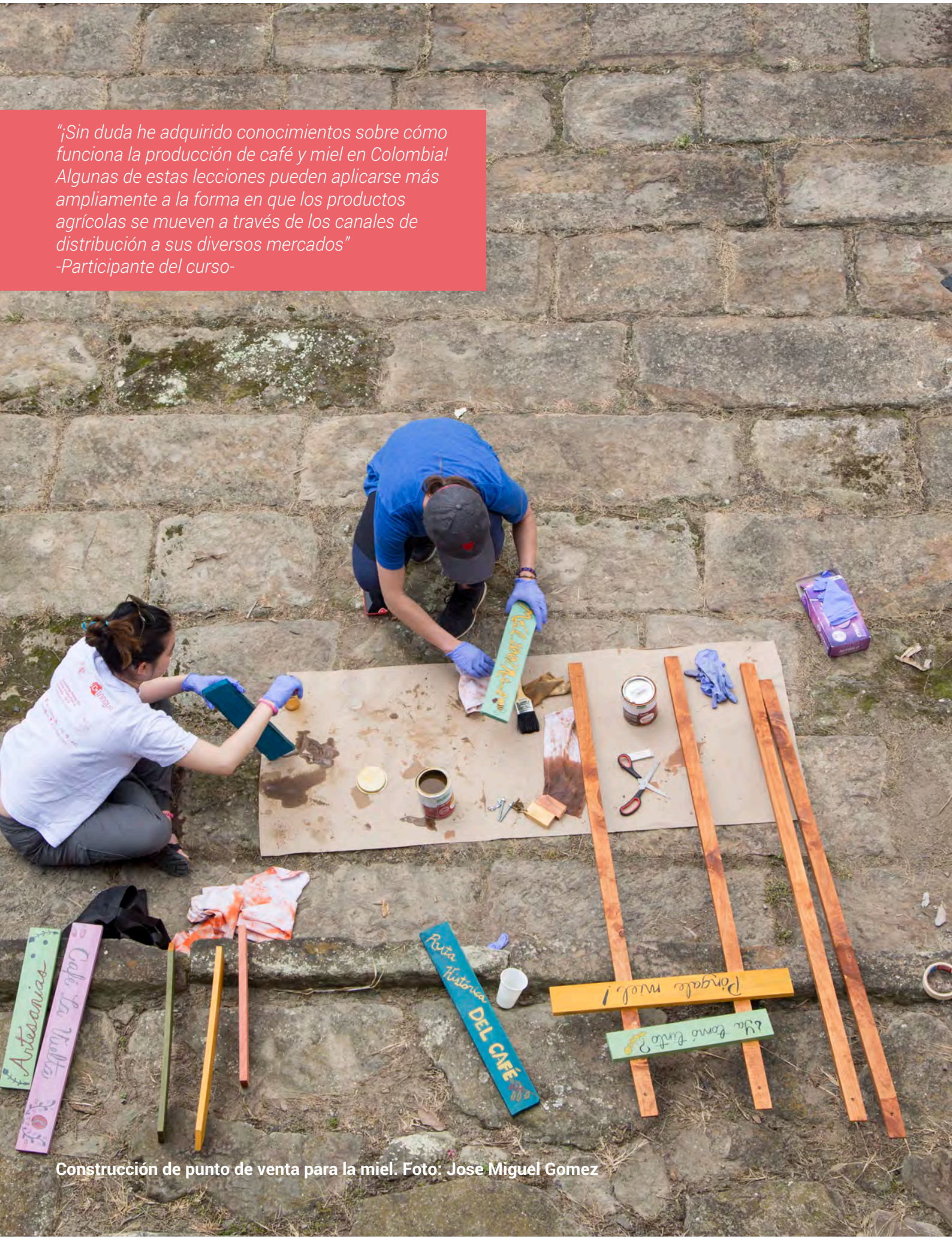
El curso internacional Diseño de tecnología para la producción del café en Colombia, se desarrolló en Cundinamarca, uno de los 32 departartamentos del país.

A su vez, este departamento está dividido en 15 provincias, la provincia de Sumapaz, ubicada al suroccidente de Cundinamarca, limita con Bogotá (Distrito Capital), se caracteriza por ser tener un relieve variado y amplia diversidad de flora y fauna por la variedad de climas.

Al interior de la provincia del Sumapaz se encuentran los municipios de Tibacuy y Guavio Alto, hogar de dos asociaciones dedicadas a la producción de café.



"¡Sin duda he adquirido conocimientos sobre cómo funciona la producción de café y miel en Colombia! Algunas de estas lecciones pueden aplicarse más ampliamente a la forma en que los productos agrícolas se mueven a través de los canales de distribución a sus diversos mercados"
-Participante del curso-



Construcción de punto de venta para la miel. Foto: Jose Miguel Gomez

1. Descripción

El curso internacional "Diseño de Tecnología para la Producción de Café en Colombia: Una Experiencia de Co-creación" fue una experiencia de diseño única, multidisciplinaria y multicultural en la que personas de diferentes rincones del mundo se unieron para co-diseñar tecnologías, modelos de negocios e intervenciones artísticas / sociales para apoyar el mejoramiento del proceso de producción de café en comunidades ubicadas en la provincia de Sumapaz.

El objetivo del curso fue reunir a estudiantes de diferentes orígenes, competentes en sus áreas de trabajo y conectarlos con comunidades rurales expertas en la producción de café a pequeña escala a través de la experiencia de campo inmersiva para co-crear soluciones sostenibles, contextualizadas, tangibles, confiables y de alta calidad para las oportunidades y desafíos que enfrentan los pequeños productores en la región de Sumapaz

Este curso es el resultado de un compromiso de casi tres años con las comunidades cafetaleras en la provincia de Sumapaz, Colombia, que ha llevado a una amplia gama de acciones colectivas que van desde las cumbres internacionales de diseño hasta las ferias locales de invenciones rurales.

Etapa de contextualización en Bogotá. Foto: Silvia Buitrago

Trabajo de campo en Guavio Alto. Foto: Silvia Buitrago

Prototipado de tecnología en Bogotá. Foto: Silvia Buitrago

2. Participantes

Adedoyin Olateru-Olagbegi
Computer science, Economics, and Data Science
MIT / USA

Andrea McClave
Integrated Design & Management
MIT / USA

Anping Wang
Integrated Design & Management
MIT / USA

Brianna Love
Architecture
MIT / USA

Caroline Jaffe
Media Arts and Sciences
MIT / USA

Dennis Bland Miron
Ingeniería mecánica industrial
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Diego Armando Quintero
Ingeniería mecánica
Independiente / Colombia

Diego Muñoz
Bioingeniería
UTEC / Perú

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MIT / USA

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MBA
MIT / USA

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Kendyll Hicks
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MIT / USA

Laura Vanessa Flórez Torres
Administración de empresas
Universidad del Rosario / Colombia

Régulo Romero Cepeda
Diseño Industrial
Independiente / Colombia

Rubez Chong Lu Ming
Media Arts and Sciences
MIT / USA

Xiqing Wang
Mechanical Engineering / Computer Science
MIT / USA

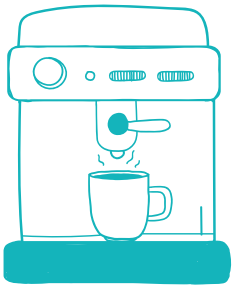
Participantes realizando las actividades diarias de los caficultores. Foto: Jose Miguel Gomez

"Lo más valioso de este curso es que es intensivo, enfocado, colaborativo, integral, en un escenario real, trabajando con comunidades reales"
-Participante del curso-

¿Cómo se toman el café los participantes?

Con galletas

Con crema y azúcar



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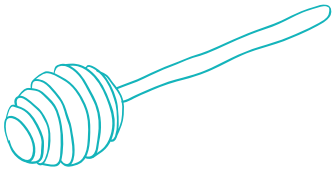


Con leche y miel

Expresso

Café de olleta

3. Socios

C-Innova
Centro de Innovación para Tecnologías Apropiadas y Educación. Organización sin fines de lucro dedicada a brindar servicios de diseño tecnológico y educación en diseño de tecnologías a comunidades vulnerables y marginadas en Colombia. El Centro conecta a las personas con su capacidad creativa, con el diseñador dentro de ellos y con su poder para transformar el mundo.
www.c-innova.org

J-WEL
Iniciativa de MIT y Community Jameel, el Laboratorio de Educación Mundial de Abdul Latif Jameel (J-WEL) que trabaja con organizaciones miembros para promover la excelencia y la transformación en la educación en MIT y en todo el mundo. J-WEL Involucra educadores, tecnólogos, políticos, líderes sociales, empleadores y empleados a través de colaboraciones en línea y en persona, talleres, investigación y eventos de intercambio de información.
https://jwel.mit.edu

Universidad Jorge Tadeo Lozano
La Fundación Universidad Jorge Tadeo Lozano es una institución de carácter pluralista, que busca la formación de profesionales éticos, competentes, críticos y creativos que asuman su compromiso con la sociedad con una conciencia clara de respeto por los seres humanos y sus derechos, por el medio ambiente y por contribuir al bien común y al desarrollo social, cultural, empresarial, científico y estético en el contexto internacional, basado en los ideales de la Expedición Botánica.
https://www.utadeo.edu.co

MIT Media Lab
El MIT Media Lab es un laboratorio de investigación interdisciplinaria en el Instituto Tecnológico de Massachusetts, que surge del Machine Group del departamento de Arquitectura en MIT en la Escuela de Arquitectura. Su investigación no se limita a disciplinas académicas fijas, sino que se basa en la tecnología, los medios de comunicación, la ciencia, el arte y el diseño.
www.media.mit.edu

MIT D-Lab

4. Comunidades: *Aprenat*

APRENAT (Asociación de Protectores de los Recursos Naturales y del Ambiente de Tibacuy) es una organización de la sociedad civil sin ánimo de lucro, cuyo objetivo principal es la defensa de los intereses legítimos de los asociados y la comunidad en relación con el ambiente mediante proyectos turísticos, agropecuarios, educativos, de generación de empleo y entre otros. Su misión es contribuir a la preservación y conservación de los recursos naturales, la diversidad biológica, la cultura campesina y ancestral del municipio de Tibacuy.

La mayoría de los socios de APRENAT habitan en la verdad La vuelta, quienes hace más de diez años, empezaron el trabajo de beneficio y transformación del café, por medio de la organización del trabajo han logrado recibir el apoyo de diferentes instituciones que los ha llevado a consolidar una planta de transformación del café y obtener certificaciones de turismo.

www.aprenat.org

aprenatQUININI
aprenatquinini

América y Nancy de APRENAT. Foto: Anping Wang

Eisenhower en su finca en APRENAT. Foto: Anping Wang

Flor y César en APRENAT. Foto: Anping Wang

5. Comunidades: *De Finca*

De Finca es una asociación de caficultores apasionados por la producción de un café orgánico de calidad, artesanal y sostenible.

Esta organización está conformada de familias de pequeños caficultores de la Provincia de Sumapaz, ubicados en la vereda Guavio Alto del municipio de Fusagasugá, un pequeño pueblo situado entre 1.800 y 2.000 metros sobre el nivel del mar. Las características del territorio han permitido a la comunidad cultivar una amplia gama de productos agrícolas que no solo sirven como fuente para su propio consumo, sino también como una oportunidad de ingresos para sus familias.

De Finca nace como uno de los primeros pasos hacia una acción organizada para el bienestar de la comunidad en Guavio Alto. Creada por Franklin Espitia y su familia en 2016, esta iniciativa sin fines de lucro tiene el potencial de unir el trabajo productivo de cada familia en la aldea y de actuar como un puente comercial que permita a la comunidad llegar a mercados más amplios.

www.defincacolombia.weebly.com

definca

Café De Finca en harina y en grano. Foto: Silvia Buitrago

Franklin Espitia, líder de De Finca. Foto: Silvia Buitrago

Comunidad de Guavio Alto y el equipo del curso. Foto: Silvia Buitrago

6. Currículo

Etapa 1: Contextualización

1 semana Bogotá

1. Introducción y bienvenida
2. Visita lugares turísticos
3. Cata de café
4. Ciclo de diseño y co-creación
5. Antecedentes del curso
6. Presentación comunidades
7. Preparación visitas
8. Charla con expertos
9. Visita FNC
10. Talleres prácticos

Etapa 2: Inmersión

1 semana Guavio Alto / Tibacuy

11. Integración
12. Rutas interactivas
13. Identificar el problema
14. Generación de ideas
15. Evaluación de propuestas
16. Categorizar propuestas
17. Elaboracción de modelos

Etapa 3: Prototipado

1 semana Bogotá

18. Presentación visitas de campo
19. Plan de trabajo
20. Lista de materiales
21. Construir
22. Presentación en la Universidad

Etapa 4: Implementación y evaluación

1 semana Guavio Alto / Tibacuy

23. Presentación prototipos en las comunidades
24. Senderismo
25. Feria de comunidades
26. Entrega de certificados
27. Evaluación del curso

Los participantes aprenden a descerezar café.
Foto: Aura Flechas

"Creo que los procesos participativos agregan valor a la comunidad, además de contribuir al desarrollo de soluciones que empoderan a la comunidad, especialmente a los jóvenes"
-Participante del curso-

El currículo de este curso tuvo 4 etapas diferentes:

En la ***etapa 1*** buscamos contextualizar a los participantes, por lo cual realizamos distintos tipos de actividades para introducir el tema del café, hicimos algunas visitas a sitios de interés turístico en Bogotá, degustamos distintos tipos de café, hablamos acerca de las comunidades, sus necesidades, oportunidades y los antecedentes de este curso. También escuchamos las opiniones de expertos del mercado, la producción y las instituciones alrededor del café.

En la ***etapa 2*** fuimos a campo y visitamos a las comunidades en los municipios de Tibacuy y Guavio Alto, durante una semana nos involucramos en sus actividades cotidianas, aprendimos a cosechar y transformar café, conversamos y juntos identificamos los problemas en los que podríamos trabajar

En al ***etapa 3*** regresamos a Bogotá, socializamos las experiencias en cada comunidad, y construímos los prototipos para plantear soluciones tecnológicas, de mercado y sociales, estos prototipos fueron presentados en la Universidad Jorge Tadeo Lozano, donde recibimos retroalimentación y preguntas de algunos colegas.

Finalmente en la ***etapa 4*** regresamos a las comunidades, compartimos las ideas que habíamos construído en Bogotá y realizamos ajustes que fueron sugeridos por las personas, tuvimos tiempo para compartir, agradecer y realizar el cierre del curso en el que hicimos una evaluación de todo el proceso.

7. Trabajo previo con comunidades

Como antecedente a este curso, C-Innova (Centro de Innovación de Tecnologías Apropiadas y Educación) contactó a las comunidades de Tibacuy y Guavio Alto para ser parte del IDDS Adaptación al Cambio Climático, realizado en Fusa, Cundinamarca en Julio de 2017.

A partir de este contacto se han desarrollado diferentes actividades de co-creación en conjunto con las comunidades (Centro de Innovación Rural, Festival Co-Rural, Curso de cata de café, intercambio de estudiantes de MIT D-Lab)

Para la preparación del curso Diseño de Tecnología para la Producción del café en Colombia, el equipo realizó tres visitas previas a las comunidades, en las que se recopiló información en tres ejes: producción y tecnología utilizada actualmente para el proceso del café, aspectos de mercado para la comercialización de sus productos y dinámicas sociales de cada una de las asociaciones.

Esta información fue compilada en un plegable que se entregó a cada uno de los participantes y comunidades para establecer una contextualización inicial.

Consulte los plegables aquí

Plegables de Aprenat y De Finca. Foto: Silvia Buitrago

Construcción de tecnologías antes del curso en Aprenat. Foto: Aura Flechas

Identificación de problemáticas en el proceso del café en Guavio Alto. Foto: Alex Freese

Aprenat

Problemática identificada

Después de varias sesiones de trabajo con la comunidad de Aprenat en las que se identificaron distintas problemáticas sobre el café, la comunidad decidió trabajar alrededor del tema de las abejas teniendo en cuenta tres factores:

1.El impacto ambiental de la polinización en otros cultivos
2. La inclusión social de jóvenes y mujeres en la producción y comercialización de miel
3. El aumento de ingresos y diversificación en la venta de productos

Proceso de extracción de la miel. Foto: Anping Wang

8. Resultados: Aprenat

Tecnología

- **Colmenas de abejas**
  El equipo diseñó y construyó dos tipos diferentes de colmenas: una colmena elaborada a partir de guadua y una colmena en forma de trapecio que facilita la producción y extracción de miel

- **Sensores para colmenas**
  Se construyeron sensores para medir la temperatura y humedad de las colmenas, dos indicadores claves para la salud de las abejas. Estos sensores funcionan a partir de energía solar y fueron programados en Arduino.

- **Prensa para extraer miel**
  En busca de extraer la miel del panal de manera que implicara menor esfuerzo físico, se diseñó una prensa manual que separa la miel de la cera que constituye el panal mediante la presión de un tornillo sin fin.

Mercado

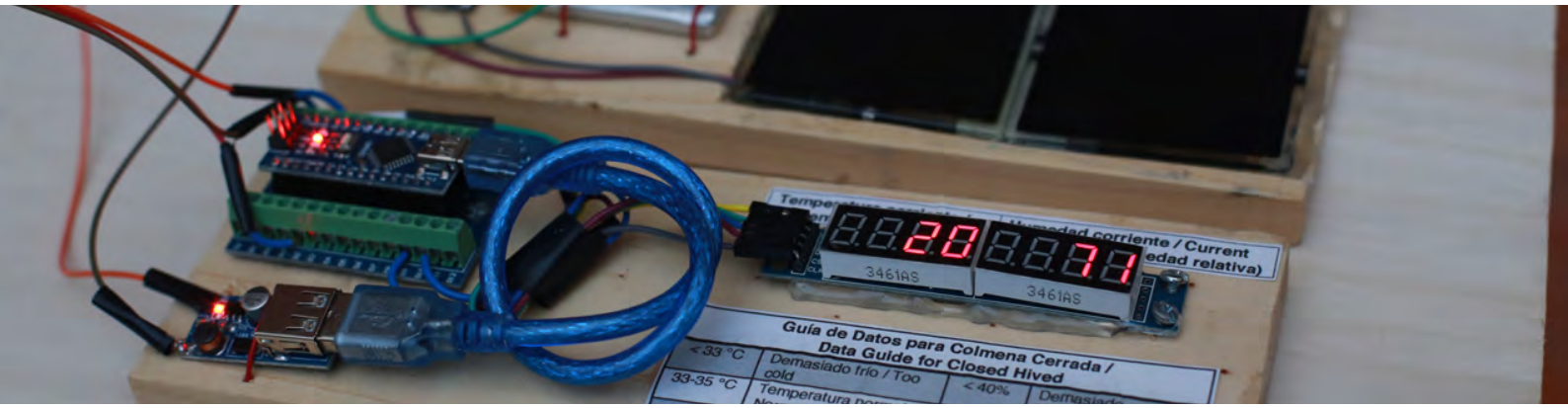
- **Miel**
  La producción y empaque de la miel es un proceso en el que es posible incluir a mujeres y jóvenes, de esta manera todos pueden aprender y participar mientras se genera un ingreso adicional, se plantea la idea de vender kits de café y miel

- **La ruta de la miel**
  Al tener colmenas adicionales y aumentar la producción de miel es posible tener una actividad turística llamada “La ruta de la miel” en la que se guía al turista a través del proceso apícola

Sesión de identificación del problema en APRENAT. Foto: Aura Flechas

Visita a los apiarios en Tibacuy. Foto: Anping Wang

Sesión de socialización del rediseño de colmena de abejas. Foto: Aura Flechas



9. Resultados: *Aprenat*

- **Sugerencias de productos relacionados con la miel**
  Se elaboraron velas a base de cera de abejas, como subproducto comercializable

- **Guía de empaque y recomendaciones de marca**
  Se establecieron recomendaciones con respecto a los envases e identidad gráfica de los productos de la asociación

- **Guía de recomendaciones de Precio**
  Se establecieron pautas de precios del café y la miel con respecto a los precios de referencia de los competidores

- **Marketing**
  En conjunto con la comunidad se diseñó un punto de venta móvil que permite promocionar diferentes tipos de productos en conjunto con información de las rutas turísticas de la zona

- **Estrategias de distribución**
  Se incorporó un sistema de compra de productos en línea y un sistema de reserva de alojamientos rurales en línea en el sitio web de APRENAT

- **Guía de relación con los clientes**
  Se realizó una guía para enumerar y sugerir técnicas para mejorar la relación con los clientes

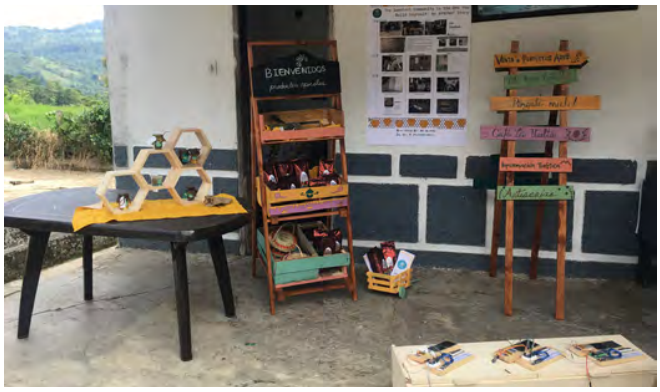
Social

- **Talleres con la comunidad**
  Para la socialización y apropiación de estos productos se realizaron talleres sobre: Construcción de colmenas, fabricación de sensores y personalización de punto de venta

Consulte el reporte completo aquí

Prensa para extraer miel. Foto:

Taller de sensores para las colmenas. Foto: Aura Flechas



Punto de venta móvil para APRENAT. Foto: Aura Flechas

De Finca

Problemáticas identificadas

*1. **Tecnología:*** falta de un orden lógico en el proceso de tostado del café, desconocimiento sobre el uso de equipos de protección personal y dificultades con el sistema de extracción de la cascarilla del café

*2. **Negocios:*** Falta de comprensión sobre el mercado, los consumidores y la marca; base de clientes pequeña y de difícil acceso

*3. **Social:*** Carencia de estructura organizacional y desconfianza entre los miembros de la comunidad

Sesión de co-creación en Bogotá. Foto: Silvia Buitrago

10. Resultados: De Finca

Tecnología

• Reorganización de la sala de tostado

Disposición de las máquinas siguiendo un orden lógico de producción, con un flujo de trabajo que optimiza los tiempos, cuenta con elementos de seguridad y dispone de programación de mantenimiento preventivo

• Uso de equipos de protección personal

Se dictaron capacitaciones sobre el uso de equipos así como en buenas prácticas de transformación del café

• Sistema de ciclón para capturar material particulado y extracción de la cáscara

Funciona con un motor de corriente continua que está acoplado a un eje que permite realizar el movimiento del café de manera uniforme, de esta manera se reduce el tiempo de enfriamiento.
El enfriamiento se realiza por contacto con el aire y por extracción de calor. Finalmente, cuando el café está frío, una compuerta se abre manualmente para que las paletas puedan vaciar el contenedor rápida y automáticamente.

Extractora de cisco y sistema de enfriamiento. Foto: Xiqing Wang

Render de reorganización de la sala de tostado. Foto:

Mercado

• Investigación de mercado

El proceso de investigación se llevó a cabo a través de investigación en línea, entrevistas en cafés y encuestas en línea (80 respuestas)

• Incremento de la presencia online

Se actualizó la información del perfil de Facebook y se creó el sitio web de la asociación *www.defincacolombia.weebly.com*

• Diversificar los canales de distribución y ampliar la base de clientes

Construcción del sistema de ciclón. Foto: Angela Camargo

11. Resultados : De Finca

Se crearon cuentas en las plataformas Mercadolibre y Comproagro para aumentar las ventas entre compradores a través de canales virtuales

Social

- **Taller de los sueños**
  Taller donde a los miembros de la comunidad se les proporcionó un espacio para la visión individual y colectiva de De Finca y el futuro de la producción de café Guavio Alto

- **Taller de finanzas**
  Taller donde se presentó a los agricultores un conjunto común de terminología financiera y métodos sólidos de registro y seguimiento de los datos financieros. También se desarrolló una guía práctica para diseñar y facilitar talleres.

- **Manual de asociación De Finca**
  El manual presenta la arquitectura fundacional de De Finca. Se definió la misión, la visión, los objetivos, los beneficios y los derechos de los miembros.

Consulte el reporte completo aquí

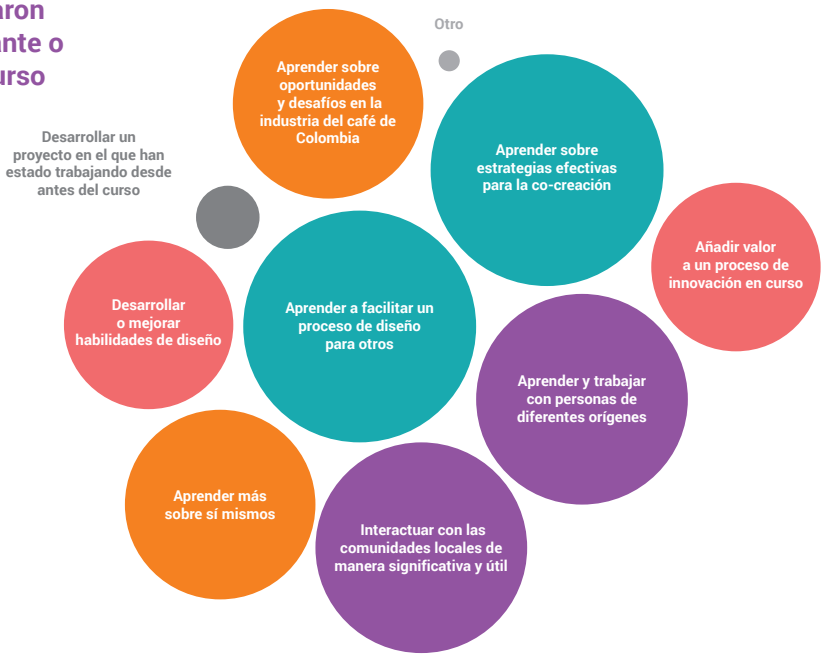
Co-creación con la comunidad de Guavio Alto. Foto: Silvia Buitrago

Taller en la comunidad de Guavio Alto. Foto: Rubez Chong

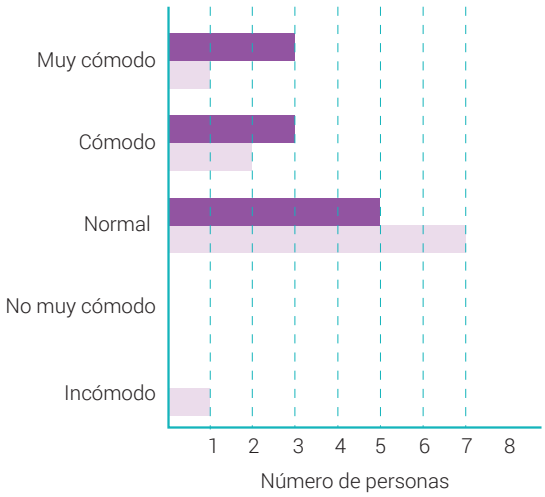
Foto: Aura Flechas

12. Evaluación

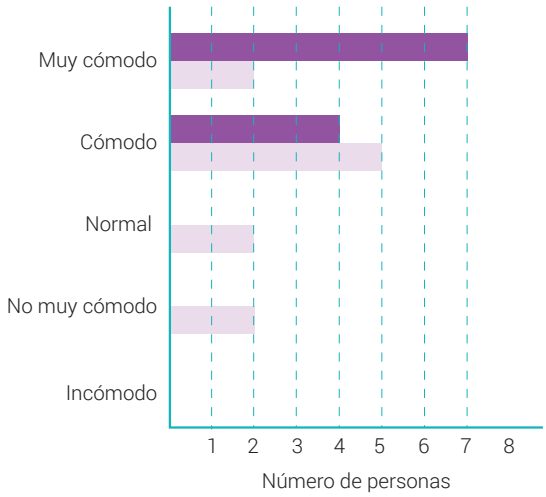
Objetivos que alcanzaron los participantes durante o como resultado del curso



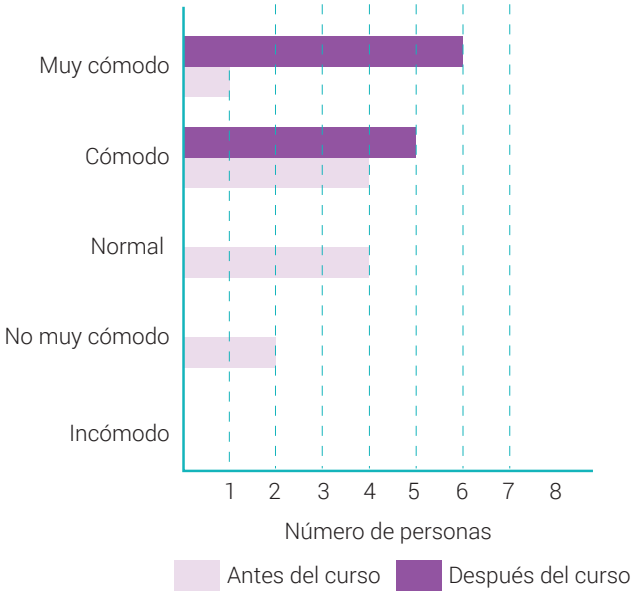
¿Cómo se sintieron los participantes con el uso de herramientas manuales?



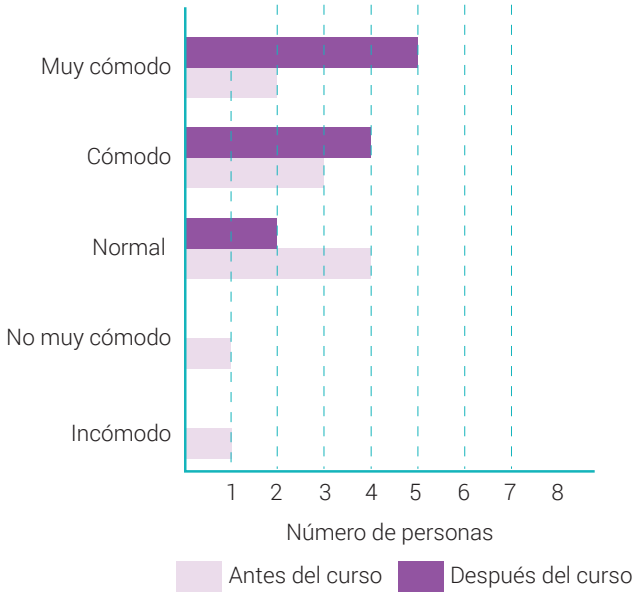
¿Cómo se sintieron los participantes trabajando con personas de diferentes contextos?



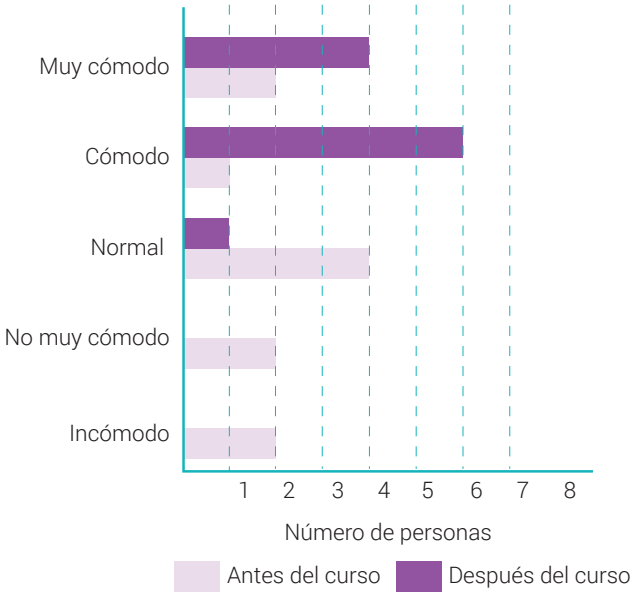
¿Cómo se sintieron los participantes diseñando, construyendo e implementando soluciones con otras personas (co-creación)?



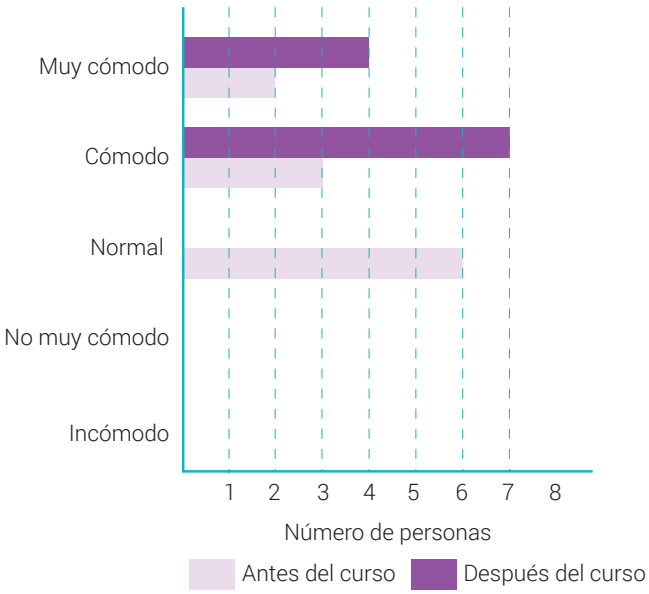
¿Cómo se sintieron los participantes trabajando de manera creativa con materiales locales?



¿Cómo se sintieron los participantes recolectando información de miembros de la comunidad en campo?



¿Cómo se sintieron los participantes definiendo y enmarcando un problema?



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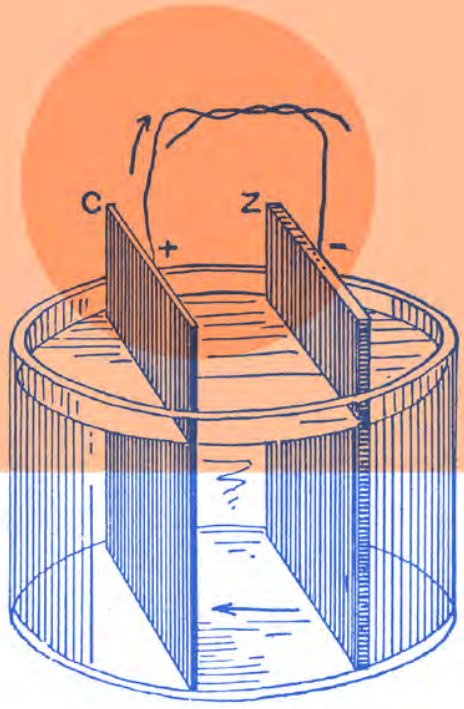
A Co-Design Experience:

Technologies for Rural Sustainability in Colombia | 2022 Edition

January - December



MIT | J-WEL

mit media lab

diversa
co-creación comunitaria

MIT J-WEL
MIT Media Lab
Diversa
Title
A Co-Design Experience: Technologies for Rural Sustainability in Colombia

CONTENTS

Summary 4

Summary

Starting in January 2022, a group of 24 students from MIT started a journey into how to design technology differently. Building on lessons learned from the 2019 first experimental course *"A Co-Design Experience: Technology Design for Coffee Production"*, we proposed a set of learning o jectives for this new version of the course that responded to student's and our own self-criticism. The overall goal of the course was to provide students with the practical and methodological tools to design technology by focusing on building community relationships through an immersive learning experience. In order to make this goal possible, this 2022 course version "*A Co-Design Experience: Technologies for Rural Sustainability in Colombia"* proposed the following set of learning objectives:

1

Cultivate Relationships:

To provide the tools for students to build and maintain meaningful relationships between them and the communities they collaborate with. We did this byemphasizing the importance of understanding community needs, values, and aspirations.

2

Apply Decolonization Ideas and Participatory Design:

To provide conceptual and practical tools to engage in more equitable, inclusive, and respectful technology design. We did this by discussing key issues related to knowledge production and offering on-site facilitation.

3

Foster Immersive Learning Approaches:

To demonstrate the transformative effects of immersive education in understanding and approach technology design. We did this by stressing the role of fieldwork and lived experience in designing technology.

4

Center Local Manufacturing:

To provide examples of technology following alternative design trajectories, analyzing its drawbacks and advantages. We did this by exposing students to locally made infrastructure, lectures, and ancestral manufacturing workshops.

5

Designing Community Technology:

To develop technology designs and engineering projects from community insights, align with community members and for community purposes. We did this by taking justice, social, cultural, environmental and economic aspects into consideration.

Throughout the report, the reader will be able to reconstruct these learning objectives through the recount of activities that took place as part of the course, the technology outcomes each team produced, and a myriad of content and learning spaces facilitated in support to these objectives.

24 MIT students

12 MIT-JWEL member students*

9 Community Partners

[*] MIT J-Wel university partners:
Universidad Nacional de Colombia
Universidad de los Andes

7 Impact on MIT

Impact on MIT

"I learned a lot of soft skills, had the opportunity to experience life in a different part of the world, and made some friends along the way. All in all, I would say it's an experience I greatly appreciate having the opportunity to be a part of"
MIT Student

The ***"Co-Design Experience: Technologies for Rural Sustainability in Colombia"*** program gives students practical and methodological tools for designing technology while building strong community relationships through experiencing immersive learning. It is all in line with MIT's commitment to generating, sharing, and preserving knowledge. It shows a fresh and unique way of engaging with underrepresented and marginalized communities in Colombia by centering relationships over technology outcomes, all while maintaining technical rigor.

We build on MIT's design and engineering traditions by equipping students with the technical skills necessary to develop and deploy functional prototypes. We also contribute to participatory practices in the institute by complementing technical skills with methodological abilities for students to effectively co-design with communities in rural environments. Political economy aspects related to autonomous communities in rural geographies in Colombia such as alternative economic models, local policy and decentralized governance, are also part of the exposure MIT students experienced as part of the program. These elements are wrapped around the ethics of relationships, a core principle in communal collectives such as farmers or Indigenous groups among others. By highlighting relationships as the nexus of all technical, methodological, and socio-political dimensions of participatory design, we begin to test a new approach to community collaborations. One of the key components of this approach is a tight collaborations with organizations on the ground. This time around, with the support of the Diversa Foundation, a social and technology design collective based in Colombia, we demonstrate the importance of local leadership for community-based technology initiatives.

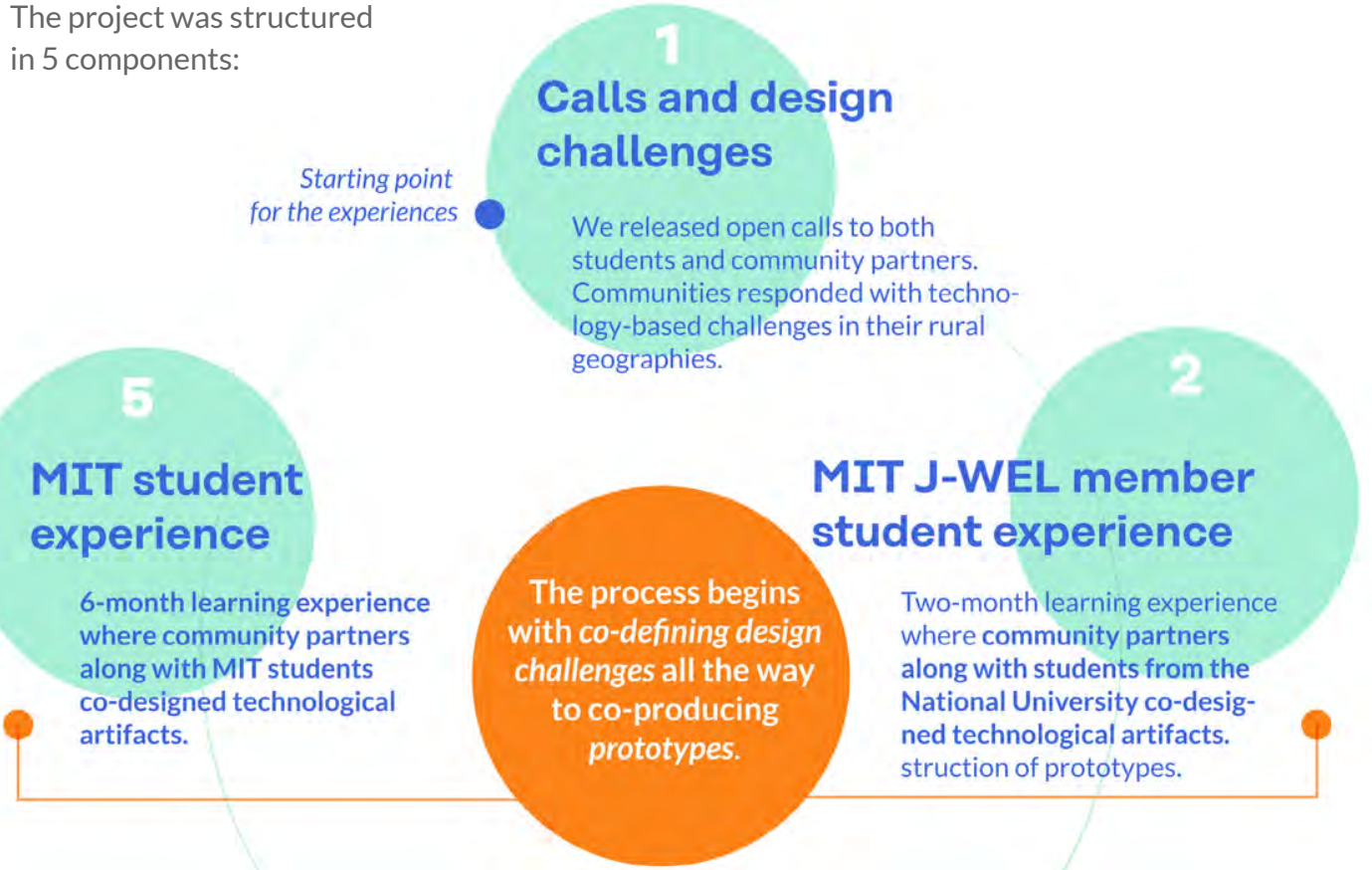
Finally, we contribute to the MIT community materials related to the process of bringing this experience together, along with instructional and technical documentation of the projects we developed. Additionally, other outputs including academic articles, guides, instructional videos, and workshop designs, are also offered to the members at MIT and beyond in an effort to broaden the pool of resources for researchers, educators, and learners interested in innovative, participatory, and inclusive educational practices aroundtechnology design.

Components 9

A Co-Design Experience:

Technologies for Rural Sustainability in Colombia 2022 Edition

The project was structured in 5 components:



Each of the components is explained in the next chapters.

Calls

Calls

As a first step, we launched a call for **MIT students and community partners.**

Community Partners Call

Diversa has a network of over 100 community partners. The call for the MIT experience took place at the end of 2021. The call for the MIT J-WEL members experience in August 2022.

Resources

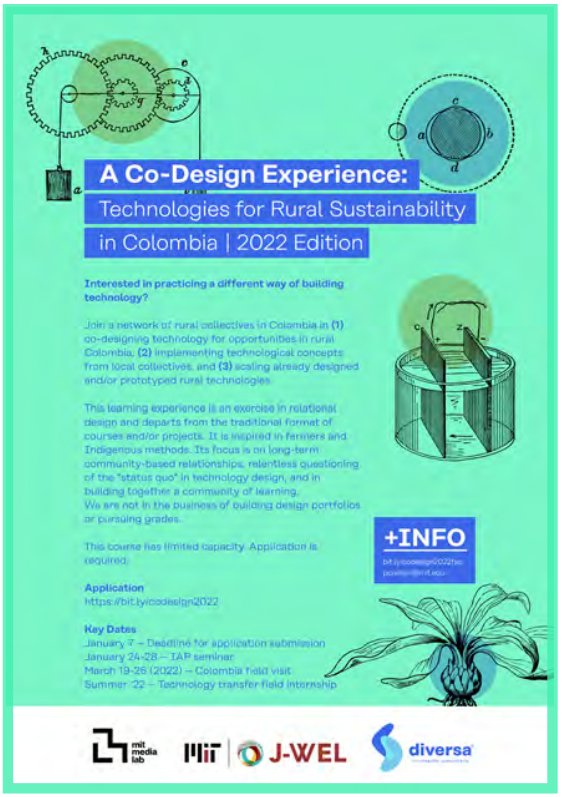
» Landing page MIT experience
» Application form
» WhatsApp pieces

Students Call

The call was disseminated through different means, including physical posters.

Resources

» Landing pages MIT experience and MIT-J-WEL members experience
» Application form
» Posters



Participants in numbers

24 MIT students

12 MIT-JWEL member students*

9 Community Partners

[*] MIT J-wel university partners:
Universidad Nacional de Colombia
Universidad de los Andes

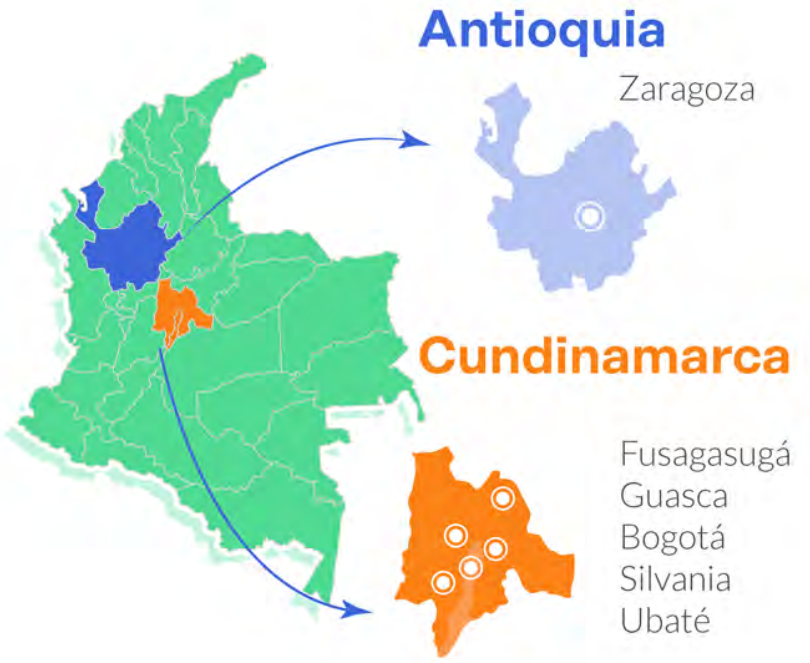
The design challenges

The challenges

We supported the community partners on creating their challenges within the following categories:

» Open challenge
» Improvement of a existing technology

Below is a map that makes visible the challenges and partners along the resources created:



1 *Centro de Innovación Campo Emprende*
Artisanal fish pond
Description
Video

2 *Sembradoras de vida*
Lettuce washing optimization
Description
Video

3 *Asoreciubaté*
Waste compaction
Description
Video

4 *Corporación Red Mujer*
Invasive plant control: retamo espinoso
Description
Video

5 *De Finca*
Air transport of agricultural products
Description
Video

6 *Asociación de Productores y Comercializadores De Finca*
Production of banana chips
Description
Video

7 *Colectivo de Mujeres Punto R*
Gas production in rural areas
Description
Video

8 *Institución Educativa Departamental el Carmen*
Climate measurement in schools
Description
Video

9 *Ruralcoop S.A.S*
Bee hive monitoring
Description
Video

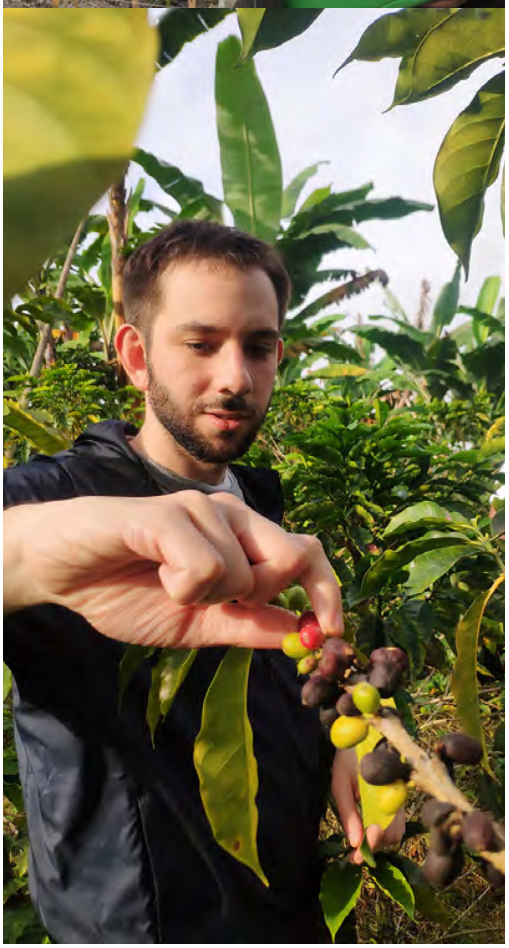
9 challenges | **6 municipalities**

A co-design experience MIT students

EXPERIENCES

This course/experience took place across a 6-month period. Below, we present the timeline of activities that took place:

- Ancestral build-it
- In-person meetings
- Reading circle
- Webinar
- Cultural activity
- Virtual meetings



January

Independent Activity Period

3 sesion, 12 hour longer in total

Main Activities:

» Introduction to the experience.
» Design for the pluriverse and social justice.
» Travel preference survey (spring or summer).

February

Co-design session #1

» Presentation of the student guide.
» Presentation of challenges by community partners.

Co-design session #2

» Teams formation.
» Team building activity.
» Co-creation principles: role play.

Co-design session #3

» Introduction to the design cycle.
» Working styles.
» Principles of co-design.
» Information collection instructions.

Co-design session #4

» First Meeting with community partners.
» Information collection.

Colombian Lunch

» Colombian Food in East Boston.

Movie Night

» Colombian culture related film: Encanto.

Webinar

» Successful co-design experiences.

March

Co-design session #5

» Understand the challenge reflection in data collection.
» Problem framing.
» Introduction to Tools: problem wheels and PATH statement.

Co-design session #6

» Co-production and validation of problem framings with communities.

Co-design session #7

» Introduction to design of experiments.
» Instructions for spring visit.

Virtual coffee tasting

» Franklin Espitia, a coffee farmer offered the students a virtual tasting session of Colombian coffee.

Reading circle

» Reading “Designs for the Pluriverse” by Arturo Escobar

Co-design session #8

» Field visit preparation.
» Instruction deliverables, activities and agenda of the visit.

March

Spring visit

For a week the teams developed experiments to locally understand the challenge and select the design idea that would be at work.

April / May

Co-design session #9
» Field visit presentations.

Co-design session #10
» Skill building for prototyping stages.

Reading circle
» Reading “Designs for the Pluriverse” by Arturo Escobar.

Movie Night
» Movie: Los Colores de la Montaña.

Networking D-Lab
» Exchange during D-Lab showcase.

Webinar
Exchange or transfer of appropriate technologies?

Guests:

» iDE Innovation Lab.
» Universidad de Chile.
» Connect Bogotá Región.
» Tecnológico de Monterrey.

April - May

Prototyping: designer in residence. During one and a half month the teams build their prototypes with the support of Alex Fresse, Diversa member and experienced industrial designer.

May /June /July

Summer visits: The teams traveled to complement prototypes with community partners and Diversa. These visits were not simultaneous and had different lengths.

A co-design experience MIT members students

We invited students from two MIT J-WEL members in Colombia: Universidad Nacional and Universidad de los Andes for two co-design experiences.

1 The Technology Minga

A four-days immersive experience inspired by the Indigenous traditional “Minga’ which elevates collaboration over competition. The goal was to co-design rural technologies and/or improve upon existing ones. It took place in the San Francisco, Cundinamarca. Diversa Rural Lab from August 12th-15th, 2022.

The experience included:

» Camping.
» Team building activities.
» On-site prototyping in Diversa’s rural Laboratorys.

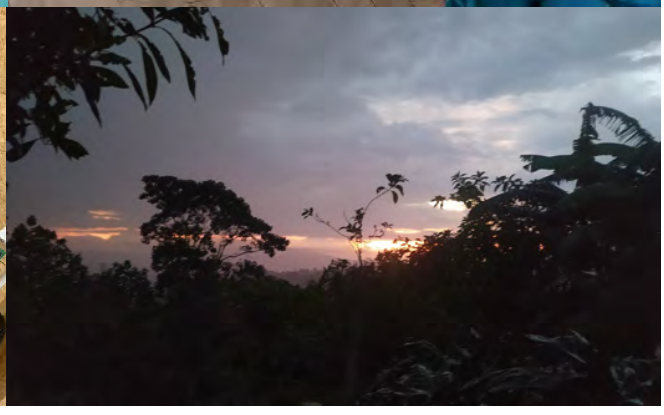
12 Students

4 challenges and community partners









2 Artisanal Build-its

Two workshops were held:

» Basic technique of the Muisca loom.

» Principles of clay construction through the quincha and bareque technique.

Cross-cutting strategies

For both experiences these cross-cutting strategies were implemented:

Covid 19 management
All the procedures corresponding to monitoring and early detection of infections were carried out.

Asynchronous communication
Each team had access to a WhatsApp group which allowed permanent communication between the teams and community partners. They also had a dedicated learning resources channel used to galvanize learning and expand content. All groups featured simultaneous translation and facilitation.

Visual communication
Continuous exploration on graphic identities to represent the meaning of technology, technical artifact and rurality in a locally appropriate way.

Team meeting weekly session for MIT students
Weekly virtual meeting where each team between communities and students met in order to advance projects.

Implementation support
After student participation in the program concluded, Diversa supported each project's further implementation. This process was highly complex since each design required different scoping and timelines..

Transfer implementation

1. Artisanal fish pond

How to improve artisanal fish farming ponds through a modular structure and its monitoring?

Co-design experience result:
Modular handmade fish pond

+ INFO (retos.co)

Community partner:
Centro de Innovación Campo Emprende, Bajo Cauca

The inhabitants of the Zaragosa municipality have been organizing as a community to carry out projects that improve their quality of life through the diversification of work, sovereignty and food security projects, as well as environmental projects with children, among others. All this in large part thanks to the relationship they have had with Diversa.

MIT Students

» Cheng Huang
» Delight Nweneka
» James Vincent Brice

Implementation supported by Diversa

August 2022
March 2023

» Don Gilberto (community member) held a workshop to teach the new design in his municipality.
» As a result, three new ponds were built.
» The latest novelty (March 2023) the families of the village of La Maturana, have developed by themselves 5 new ponds, that is, 8 in total.

2. Lettuce washing optimization

How to optimize the washing of Tudela lettuce?

Co-design experience result:
“Hot Tub” for washing lettuce

+ INFO (retos.co)

Community partner:
Sembradoras de vida

It is an association of women dedicated to agriculture with clean practices, its main crops are vegetables and the best-selling one is lettuce. They have a production of approximately 500 lettuces per week that are sold to a large fast food chain.

MIT Students

» Madison Reddie
» Eunah Kim
» Bella Carmelita Carriker
» Liane Peng
» Paula Rivarola

Implementation supported by Diversa

August 2022 March 2023

» The “hot tub” helps to clean up the lettuces but the motor lack of strength. Option: Buy a more powerful motor to ensure that the lettuces are 100% clean.

» The association identifies a new idea: cover the lettuce with plastic so it requires less washing. A 3-month planting pilot is successfully carried out.

» As a result: combining the plastic coverage with a more powerful “hot tub”.

3. Waste compaction

How to create a low-cost multifunctional packer for different recycling materials?

Co-design experience result:
Packer- Solid waste compactor

+ INFO (retos.co)

Community partner:
Asoreciubaté

Asoreciubaté is one of the 3 recyclers associations in the municipality of Ubaté. It was founded in 2012 by 22 people and currently has 6 active recyclers and an environmental advisor. The association recovers and sells the following types of materials: pet, cardboard, glass, archives, scrap metal, aluminum and plastics..

Universidad Nacional Students

» Luis Alvaro Cárdenas Gómez
» Diego Felipe Sarmiento
» Cristhian David Parra Chaves

Implementation supported by Diversa

August 2022
January 2023

» The students worked for several weeks in Diversa's workshop to improve first prototype.

» The second prototype proved functionality and was delivered into Asorecibaté's facilites.

» The packer functioned for three months but it got a small damage the association is looking for repair it.

4. Invasive plant control: retamo espinoso

What alternative to control the invasive plant Retamo Espinoso (Gorse) could be proposed to be implemented by women in the rural areas of Bogotá and beyond?

Co-design experience result:
Tools for extracting the Retamo Espinoso

+ INFO (retos.co)

Community partner:
Corporación Red Mujer

We are an organization of women who feel motivated by the prosperity of quality strawberry crops, as a product of the effort we have put into investment and in an autonomous way. It motivates us to consolidate ourselves as an independent team that is willing to get ahead. We dream of having beautiful farms with which we can live well, generate employment in the territory and do our own things.

MIT Students

» Alice Wu
» Ipshita Karmakar
» Leandra Tejedor
» Susan Su

Implementation supported by Diversa

August 2022 March 2023

» Several visits were conducted to support the implementation of the tool by Diversa.

» It has been identified that, although the Retamo Espinoso should be eradicated, the organization has been unable to progress in the use of the tool due to other needs in its everyday reality.

5. Air transport of agricultural products

How to develop a simple and low-cost aerial cable system that allows the movement of products from the area where products such as coffee and bananas are collected to the collection and processing center of the farm?

Co-design experience result:
Aerial cable

+ INFO (retos.co)

Community partner:
De Finca

We are an association of coffee growers passionate about the production of quality, artisanal and sustainable organic coffee.
Our coffee beans are harvested by hand and produced with care on family farms belonging to the Guavio Alto village of the municipality of Fusagasugá. Every packet of coffee we produce is on a mission to empower our coffee farmers and celebrate the joy of enjoying great coffee.

Universidad Nacional Students

» Sofía Gaviria Grisales
» Nicolás Moreno Molina
» Diego Felipe Alvarez Torres

MIT Students

» Ololade Abdulai
» Sudhir Jain
» Tomás Guarna

Implementation supported by Diversa

August 2022 May 2023

» Universidad Nacional students worked for several weeks in Diversa's workshop to improve the first prototype.

» The cable was installed in May 2023 and is currently being used.

6. Production of banana chips

How to improve the plantain chip slicing machine that allows optimizing the production of plantain chips and other products from member farms?

Co-design experience result:
Plantain chip slicing improved

+ INFO (retos.co)

Community partner:
Asociación de Productores y Comercializadores De Finca

We are an association of coffee growers passionate about the production of quality, artisanal and sustainable organic coffee. Our coffee beans are harvested by hand and produced with care on family farms belonging to the Guavio Alto village of the municipality of Fusagasugá. Every packet of coffee we produce is on a mission to empower our coffee farmers and celebrate the joy of enjoying great coffee.

Universidad Nacional Students

» Héctor Fabio Chaparro
» Laura Daniela Rueda Rincón
» Luis Gabriel Maldonado

Implementation supported by Diversa

August 2022 January 2023

» Students worked for several weeks in Diversa's workshop to improve first prototype.
» The prototype continued with a new iteration in a Universidad de los Andes Class in Mechanical Engineering. The result is a funtional product ready to be used by the community partner.

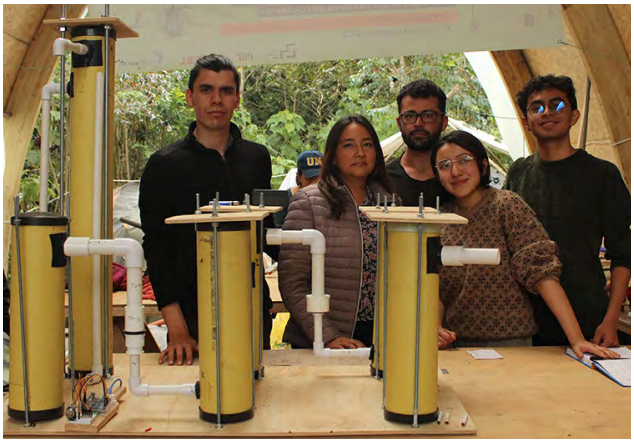
7. Gas production in rural areas

How to generate a biodigester at low cost that can be replicated by different families in rural areas?

Co-design experience result:

Low - cost filter that allows to increase the proportion of methane in the gas

+ INFO (retos.co)



Community partner:
Colectivo de Mujeres Punto R

We are an autonomous organization made up of women, which establishes dialogues and mediation between the municipal administration and the community for the management and implementation of public policy around women. We have promoted the agreement and public policy for women in the municipality of Silvania. In addition, we help empower women in their self-esteem and economics, so that they can get out of situations of intrafamily violence.

Universidad Nacional and Universidad de los Andes Students

» Cristian Daniel Ayala Reyes
» Fabian Camilo Fagua Camargo
» Karol Dayan Soler Orozco

Implementation supported by Diversa

August 2022 March 2023

» Students worked for several weeks in Diversa's workshop to improve first prototype.
» Pending the final adjustments and installation (march 2023).

8. Climate measurement in schools

How to develop a tool that allows college students to measure and understand the behavior of the climate in their region?

Co-design experience result:

- **Kit and tools based on Arduino for measuring atmospheric variables in a greenhouse.**
- **Platform prototype for showcasing date collected.**

+ INFO (retos.co)

Community partner:
Institución Educativa Departamental el Carmen

The El Carmen Departmental Educational Institution is characterized for being an institution that leads innovative educational projects in the region. It has 13 campuses in the municipality of Guasca, where 1,252 students study and it has a staff of 60 teachers.

MIT Students

» Azfar Sulaiman
» Franny Xi Wu
» Gabriel Ildefonso Andrade
» Oreoluwa Odeyinka

Implementation supported by Diversa

August 2022 April 2023

» The kit final adjustment were made.
» The kit was delivered to the professor Juan Camilo and students during a visit to a Library lab in Bogotá.
» The kit for climate measurement is being transferred and scaled to a bigger number of students.

9. Bee hive monitoring

How to optimize honey production and monitor hives without opening them in temperate and cold climates?

Co-design experience results:

- **Artificial ecosystem for beehives**
- **External temperature insulation box for beehives**

+ INFO (retos.co)

Community partner:
Ruralcoop S.A.S

They are a group of peasants who seek to have sustainable agricultural practices free of artificial and potentially harmful chemicals. They are united in order to promote the commercialization of their products and achieve the common benefit.

MIT Students

» Ada Azania Umoja
» Jin Gao
» Natasha Ansari
» Shi Shu

Implementation supported by Diversa

August 2022 April 2023

» Both prototypes were implemented but their performance wasn't successful due to local climate variables.
» The community is studying if they want to have a second iteration.

Learning 38

On Co-Design Experiences and students: mixed results

Technological co-design processes do not guarantee functionality. Results may not be successful or may need many more iterations to be responsibly deployed. Similarly, some of these experiments might result in negative, usually unintended ramifications. Setting expectations to community partners and students around these possibilities allows for greater understanding of results and ensures proper engagement across both groups. This is a key lesson for future co-design programs, and an insightful commitment from Diversa to enact change without harm and to repair any potential negative effects from these experiments. There is no true co-design without accountability.

Creating standards defining what low-cost, intermediate and commercial technologies are, can further clarify the process and results.
Our work in this program suggests that planning potential outcomes in light of value chain analyses can increase understanding of the differences between these three stages of technological design and reveal the value —or lack thereof, of co-design processes.

Here, we provide a sample of possible scenarios:

» Designing technologies at lower cost than commercial ones in order to increase access.

» Designing for smaller scales (e.g. family, village) against large-scale commercial designs.

» Designing for invention, where community partners pursue ventures as an economic possibility or as a way towards self-determination.

» Designing for adaptation, where designs focus on improving an already existing solution.

Similarly, it is essential to state clear budget requirements for technological co-design processes and for the actual production of final designs. Often times, community partners are not clear about this, leading to misunderstanding at production time. To solve for this, students and community members leading the co-design process should develop a clear financial plan that considers these aspects and that is easy to understand for all team members. For example, while the beehive Project developed an interesting design monitoring the hive's health, it exceeded the budget of the other designs by almost 50%. This effectively prevented the partner from continuing its implementation.
A new version of this prototype is currently underway to solve for this.

This co-design experience relied on students committing to the work beyond grades, instead prioritizing the value of experiences and relationships with community partners. This model was successful to the extent that students' schedules and other personal and academic commitments allowed. These fluctuations in student engagement pose a important question about the effectiveness of academic programs for the type of change that these co-design experiences are designed for. It is precisely this conundrum what makes the involvement of a local partner, in this case Diversa, to ensure that commitments and expectations are met in the end. As of March, 2023, the status of the 9 projects is as follows:

» 3 Implementation 100% complete.
» 1 in new iteration with students in the framework of a class.
» 1 paused.
» 4 still in implementation.

About technology transfer between community and students: a successful story

Co-design theory and practice has conclusively established that transfer of technology designs between students (or other practitioners) and communities is most successful when community partners are highly involved and engaged in the process, and when they have the capabilities to maintain, adapt, and adjust final designs. Success can be further amplified when working from an initial design or on top of existing ideas from community partners. This is reflected in the case of Don Gilberto's artisanal fish pond project. Its initial design was proposed and developed locally in the municipality of Zaragoza Antioquia. In the first stage of the process, during the spring visit, students had the opportunity to build this first design under Don Gilberto's supervision. From this experience, students gained technical and practical information to make proposals for improvement while on campus in the United States and bring them as improvement proposals during the summer visit. Due to dafety concerns, this design was implemented in an area close to Bogotá and not in Zaragoza. However, Don Gilberto was able to gain practical experience manufacturing this new design take these innovations back to his community. Later, Don Gilberto held a workshop to teach this new design in the neighboring village of Maturana. This transfer process was financed from the project. As a result, three new and improved ponds were built. In the project's latest update (March, 2023), community partners reported that families in the Maturana community self-organized and developed five new ponds. This diagram explains the transfers given under this design:

On the complexity of implementing designs made by students

Diversity of contexts and different approaches to designing technology coming from community partners constitute an interesting offering for students. However, capitalizing on these benefits implies a significant challenge, especially when it comes to project implementation. Traditionally, these experiences takes students from challenge/opportunity to creating a first prototype or iteration. Depending on the complexity of the design, it is possible that investing further resources on further designs, iterations or tests is required. This implies the need for a wide range of technical knowledge, facilitation and implementation experience. During 2023, Diversa will explore the creation of an implementation team or the generation of alliances with othe institutions to support technical aspects of the program's projects. In this scenario, the involvement of universities at both design and implementation levels is ideal. This is an interesting avenue to explore in the context of university courses which, at least in the case of the US, tend to be seasonal and self-contained.

To date, the Retamo Espinoso challenge has been the only one without any progress in implementation and use. It was identified that the reason is because the extraction of the root, although it is something that must be done, is not immersed in the daily routines of community partners. This prevents the existence of day-to-day incentives to use the tool. From here, it is worth noting that as an academic exercise it was a very interesting challenge and an enriching experience for the students. In future experiences, we propose to identify some projects serving only as exploration or learning around a topic, without the commitment of implementation.

Products 43

Products

The following 6 deliverables were developed as products of this project:

1. Student guide.
2. Participatory Design Session Tools.
3. Participation in Mexico congress.
4. Photography portfolio.
5. Videos about the experience.
6. Report of the 9 solutions along with design manuals.

2022 -2023

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