

TEACHING CASE

Innovation in Resource-Constrained Settings: Coffee Farmers in Rural Colombia

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MIT D-Lab designing for a more equitable world

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This case was written by MIT D-Lab students Emma G. Rutkowski (MIT '19) and Jacqueline Shen (MIT '18) as an extension of their January 2018 field work in Guavio Alto, Colombia for the D-Lab: Development course.

About MIT D-Lab Teaching Cases

This case was developed as part of the MIT D-Lab Case Writing Initiative, managed by Laura Budzyna and Melissa Mangino. The goal of this initiative is to produce classroom teaching cases that provide students and practitioners with the opportunity to explore the messy, real-world challenges of design and development work. To accomplish this, the initiative engages student case writers to deeply investigate and communicate a MIT D-Lab field partner's dilemma.

MIT D-Lab Teaching Cases are developed solely for the purpose of class discussion and are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective practices.

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Introduction

Franklin Espito walked out of the wooden tool shed he had built himself, carrying a large saw in both hands. He was preparing to make some modifications to the wooden frame of a coffee bean sorting machine, a prototype he had built from scrap bought at a nearby junkyard. Franklin had conceived the design for the machine himself, making sketches in his notebook to capture the images in his mind. Now his prototype was more or less built, and he was just making adjustments. Noticing that the cord for the saw was not long enough to reach the machine, Franklin looked around for an extension cord. He found a cable and promptly carved the rubber off the end, deftly twisting the exposed wires together with those of the cord connected to the saw. After wrapping the spot with some white painter's tape, he plugged in the saw and got to work. Never one to let a lack of tools or resources get in his way.

Franklin, a coffee farmer in Guavio Alto, Colombia, had slowly been acquiring and building machinery to process his coffee himself: sorting, roasting, grinding, and packaging. He hoped to free himself from dependence on the National Federation of Coffee Growers of Colombia, which purchased raw beans from smallholders like him and then processed them centrally for export. He aimed to build his own independent brand, using sustainable and organic methods. He dreamed of a day when the rest of the community worked with him, forming an independent cooperative of coffee growers. However, many challenges still stood in his way. How could a local innovator like Franklin, with boundless ideas but limited resources, disrupt this entrenched system? And how could he motivate others to do the same?

Franklin Espito, Local Innovator

Franklin Espito lived with his family in Guavio Alto, a community just south of the town of Fusagasugá, Colombia. Once a stronghold for the Revolutionary Armed Forces of Colombia, or FARC, a guerrilla group involved in the 50-year Colombian armed conflict, the town had been primarily inhabited by smallholder farmers ever since the signing of the peace treaty ending the war in 2017. Franklin worked a relatively small plot of land with approximately 1,000 coffee plants.

Franklin was well respected as a leader and innovator in the farming community, having picked up many engineering and design skills on his own since his youth. At the age of 12, Franklin started work as a technician in coffee roasting. He then finished high school and worked as a plumber for several years before eventually starting his own coffee farm. Wanting to focus on organic farming, and hoping to expand his farm and coffee production process with technological innovation, Franklin eventually became involved with Tierra Libre, C-Innova, and MIT D-Lab, three organizations promoting local innovation by hosting design summits and workshops in rural Colombia.

In summer of 2017, C-Innova invited Franklin to attend an International Development Design Summit (IDDS Climate Change Adaptation) in Fusagasugá. Franklin had already cemented his reputation as an innovator with a hunger for learning through his work with Tierra Libre, and at the summit he was able to further connect to other innovators from around the world. Over the course of the summit, Franklin and his team developed the vertical farming and irrigation system for growing spinach seedlings. After the summit had ended, Franklin continued building on the prototype, experimenting and iterating.

Six months after the summit, signs of Franklin's innovations could be seen all over his property. Close to his house, spinach grew in the vertical garden. Near the irrigation structure, Franklin's makeshift tool shed harbored a few power tools—some with the rubber on the wires wearing off—with which he built his coffee processing machines.

Although his property was small compared to some, almost every inch of the farm was put to use for either production or innovation. On one side of the house, a pile of organic waste slowly decomposed into fertilizer, and on the other sat a small chicken coop and space for them to roam. The rest of the land was planted with bamboo, bananas, spinach and of course, coffee.

Coffee Growing in Colombia

In 2018, Colombia was the third-largest producer of coffee worldwide, producing 11.5 million bags¹ annually. Cundinamarca, the department that contains Fusagasugá and Guavio Alto, was one of the country's main coffee-producing regions.

In 1927, the National Federation of Coffee Growers of Colombia was established to support the coffee industry in the global market, taking charge of commercial logistics that smallholders would not have had the resources to handle individually. In 2018, the Federation represented more than 500,000 producers, most of which were small family farms.²

Coffee production is an intensive process involving several steps. Coffee farmers plant, grow, and harvest the plants. In Colombia, most farmers are able to harvest twice a year. Because soil pH and nutrients affect the quality of the coffee, fertilizer is an important input for coffee growers. After harvesting, the fruit is fed through a machine that separates the beans from the pulp, and then the beans are washed and left out in a sunny place to dry for several weeks. Once dry, the beans are roasted, ground, and packaged before being shipped off for sale. Each of these steps is labor intensive without the appropriate machinery.

Because most smallholders did not possess additional equipment to process the coffee themselves, they remained dependent on the Federation for processing their coffee. Coffee growers also relied on the Federation to handle sales and exports. Considering the United States is the major buyer of Colombian coffee, smallholder farmers are highly dependent on U.S. coffee prices for their livelihoods, and finding their own customers abroad would be very difficult when most have no overseas connections.

The Challenge of Guavio Alto

Most of the coffee farmers in Guavio Alto sold unprocessed coffee beans to the National Coffee Federation of Colombia for what they believe to be a less-than-ideal price. Franklin hoped that the

1 "World coffee trade (1963–2013)" (PDF). International Coffee Association. 24 February 2014.

2 Marco Palacios (1980). *Coffee in Colombia, 1850—1970. An economic, social, and political history*. Cambridge University Press. p. 22.

processing could happen within the community so that they could export coffee internationally for a better return.

Still, Franklin and the rest of the Guavio Alto farmers were acutely aware of the challenges which stood in the way of their goals of performing the entire coffee production process themselves, forming a cooperative, building a brand, and getting better prices for their coffee.

The first barrier was the community's lack of resources to invest in coffee processing machinery. Building—much less purchasing—new machines that could perform at the level required to meet export regulations, was out of the question. Additionally, due to its remote rural location, getting machines, tools, and materials to and from Guavio Alto was a challenge. And even if a few machines could be built, there was not a clear structure for sharing or disseminating technologies among multiple farmers.

Although Franklin had previously worked with outside groups like MIT D-Lab, C-Innova, and Tierra Libre to address these technical challenges, there were difficulties associated with this approach as well. Without follow-up from these groups, the technologies they worked on fell into disrepair, and other community members lost interest. Additionally, because Guavio Alto lacked internet or reliable cell service, regular communication with outside organizations was limited.

The second obstacle was the lack of a clear and profitable sales channel. Though Guavio Alto's farmers often sold small batches of coffee at farmers' markets in Fusagasugá and occasionally at fairs in Bogotá, they were able to sell much higher quantities through the Federation.

Another challenge was simply working together. The Colombian Civil War was recent history for most farmers, and the period of turbulence had driven many farmers apart and made them distrustful of each other. Guavio Alto was not a particularly tight-knit community, with most families keeping to themselves, but Franklin was determined to change that. He had begun trying to organize and bring together dynamic community members, many of whom had common gripes about the lack of political support for coffee smallholders.

In addition, cooperatives faced considerable pushback from the Colombian government. Years of armed conflict have created a political atmosphere hyper-sensitive to any mention of socialism, and government bodies strongly discouraged any organization of smallholder farmers like the kind Franklin hoped to build. Farmers who organized often faced difficulties obtaining the certifications necessary to sell their coffee directly to the final consumer. They ran the risk of losing the discounts they received for practicing organic farming, and those who left behind the Federation lost some of the benefits it offered, such as workshops, seeds, and tools. In more extreme circumstances, the leaders of rural cooperatives became the targets of violence. Paramilitaries and large companies sometimes attacked cooperative leaders involved with land protection and conservation efforts, seeking to discourage their efforts and seize land themselves for mining or coca farming. In 2017, over 100 social activists were murdered in Colombia.³

Still, Franklin was dedicated to continue working towards his dream and overcoming these challenges.

3 Rights groups decry murder of Maria Magdalena Cruz Rojas. Al Jazeera News. April 3 2018. <https://www.aljazeera.com/news/2018/03/rights-groups-decry-murder-maria-magdalena-cruz-rojas-180331194253566.html>.

Potential Solutions

The problems Guavio Alto faced were complex and intertwined, and they would require multiple approaches to solve.

One approach was to focus their energies on developing low-cost, locally-made solutions for coffee processing, reducing their dependence on the Federation's processing facilities. The farmers would benefit from cheaper alternatives to industrial drying, cleaning, and roasting machines; more automation would reduce their workload; and they would be able to garner a better price for a higher value product. Franklin and his neighbors could take the lead in designing these machines, and outside organizations could lend expertise and prototyping materials. However, this still left the issue of maintaining and disseminating the machines in the long term.

A second approach was community organization. Although the policy changes they sought would likely require activism on a national scale, local organization could help the community form a network of support and a pool of resources to work on improving their livelihoods and coffee process. Franklin had already begun working towards this, organizing meetings for the community to streamline any efforts to further develop the coffee roasting process and to garner support for the formation of a cooperative. There were, however, risks associated with organizing, and the community was limited by their isolation and limited resources.

A third solution would be to seek help from a third party to connect to markets abroad. Although Guavio Alto farmers sought to export their coffee as a means of gaining independence from Federation regulations, they lacked the communications infrastructure and business connections to find buyers themselves. An outside group could provide assistance. However, this would still leave the community in need of the tools to prepare their coffee for export and ship it.

Prototyping a Solution

Taking into account the resources he had on hand, and the skills he had already honed, Franklin began by tackling the technical challenge. If he could design low-cost versions of coffee processing machines, perhaps he could break down the cost barrier to local processing and inspire his fellow farmers to follow suit.

First, Franklin built an automated coffee roaster from metal scraps and other parts he had on hand. The roaster functioned as well as any, allowing for constant automated turning of the coffee and a more even roast, for a fraction of the cost. Yet the stringent regulations imposed on coffee exports eventually necessitated purchasing a commercial roaster.

Undeterred, Franklin quickly turned to his next project: an automatic coffee selection machine. The machine would shake beans through a screen to separate them by size, allowing for more even roasting and higher quality coffee. An industrial grade machine cost upwards of \$2000 USD, so Franklin set out to create his own with salvaged wood and parts from the local junk yard.

The first iteration of the machine did shake the beans, but more than desired: the tray was dislodged from its rack and the machine fell apart. Though the machine's design made sense, Franklin had relied on found objects and did not have enough bolts to hold the parts together. He could not rely

on other farmers for help, and because his farm was so remote, going into town to purchase the correct parts was arduous and expensive. So the project stagnated.

A Collaboration

In January of 2018, a group of students from MIT D-Lab visited Guavio Alto as part of a follow-up to the International Development Design Summit. They interviewed Franklin and other community members, who spoke of the need for better technology and changes to their coffee growing process, and the difficulty of working with the Federation and earning fair prices for their work. They wanted more support for small, organic farmers, as well as the equipment to improve their processes themselves and allow them independence from the Federation. More than anything else, they wanted political change: rights to their land, better prices for their coffee, and freedom from the overbearing regulations on coffee exports.

While the MIT D-Lab students could not address the political challenges, they could offer help to improve the coffee processing technologies. The coffee selector Franklin had been developing had a good design and lots of promise to address the farmers' concerns; it just needed a nudge forward.

For several days, Franklin and the MIT D-Lab team developed a second prototype, with Franklin providing knowledge and expertise on coffee selection and the original prototype, and the MIT D-Lab team working to obtain the materials Franklin did not have the mobility or time to obtain himself. Resource constraints quickly proved to be the main barrier to prototyping. Sample coffee selector machines had to be brought from Bogotá, and even buying the additional hardware took a half-day trip to Fusagasugá. Though he had a small workshop, Franklin still lacked many tools. The students improvised, working with what Franklin had and the materials they had had the foresight to bring.

After four days of breaking and making, adding and trying different spring systems, snapping, welding, and patching the prototype back together, the team had a working machine that separated coffee beans into four different-sized bins. The rest of the community was invited to see the project in action, and expressed appreciation for Franklin's ingenuity and resourcefulness, as well as interest in developing their own coffee-growing processes.

The next challenge became apparent: information dissemination. There was only one coffee selector, and the farmers were scattered over large areas, with minimal contact, and no structured organization. In addition, the Federation still existed and de-incentivized the adoption of new technologies and decentralized coffee processing.

Looking to the Future

As the community discussed the new technology and their hopes for the future, it became clear they needed someone like Franklin at the head leading them. Most, despite wanting to improve their growing process and get better prices for their coffee, still balked at the idea of making the major change to fully processing their coffee themselves. Franklin, however, was willing to take this risk. He discussed the possibility of establishing his own brand and then buying from his neighbors, with the goal of paying local growers more than the federation.

When the MIT D-Lab team left, the community was poised to forge stronger connections between families, although they still had several problems to solve. How would Franklin disseminate his machine to other communities? How could the parties involved ensure the machine didn't fall into disuse like the others, and that Franklin would be able to maintain it with his own resources, without the immediate support of MIT D-Lab and C-Innova? What else could the community continue to do to work towards greater economic independence? However, Franklin and the rest of Guavio Alto seemed hopeful. Despite a political climate discouraging deviation from the norm, with one point person willing to take risks and given a little extra help, it seemed possible for the entire community to see improvements.

Works Cited

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