Evaluating Makerspace Interventions in Cerro del Cuatro

Anushay Irfan Khan, Mduduzi Mhlanga, Kanishka Sikri,
Ruy Cervantes, Kimberly Skead, Erica Di Ruggiero

April 2021

MASTERCARD CENTER FOR INCLUSIVE GROWTH

The Center for Inclusive Growth advances equitable and sustainable economic growth and financial inclusion around the world. The Center leverages the company's core assets and competencies, including data insights, expertise and technology, while administering the philanthropic Mastercard Impact Fund, to produce independent research, scale global programs and empower a community of thinkers, leaders and doers on the front lines of inclusive growth.

www.mastercardcenter.org

MUNK SCHOOL OF GLOBAL AFFAIRS & PUBLIC POLICY

The Munk School of Global Affairs & Public Policy at the University of Toronto brings together passionate researchers, experts, and students to address the needs of a rapidly changing world. Through innovative teaching, collaborative research, and robust public dialogue and debate, we are shaping the next generation of leaders to tackle our most pressing global and domestic challenges.

munkschool.utoronto.ca

Cover image: Parroquia Nueva Santa Maria, the church in Cerro that houses the FabLab

Contents

Executive Summary

Although youth living in the Centro del Cuatro community in Mexico face significant social and economic challenges, they also live in a community experimenting with entrepreneurship and improving socioeconomic conditions. We analyze how global makerspaces and fabrication laboratories are working to change the multiple forms of exclusion that marginalized communities face. We outline three case studies that can be used to inform further student research through the Professional Application Projects (PAPs — Proyectos de Aplicación Profesional) at ITESO University where learners seek to adapt contextually similar interventions to the local context of marginalized youth. The first case study looks at mask making in the United States to extend the supply of N-95 masks to meet people's needs during the COVID-19 pandemic. From the Cape Craft and Design Institute (CCDI) project in South Africa, we learn how the Nueva Santa María (NSM) FabLab can leverage human capital at ITESO university, make more space for women and capitalize on the community's creative potential. Scloop, the final US-based project, demonstrates how the NSM FabLab's innovative capabilities could be adapted to upcycle materials to produce items for use or sale by local communities.

FabLab's Context and Background

In June of 2018, researchers at the Center for Social Innovation (CISAI) at the Instituto Tecnológico y de Estudios Superiores de Occidente (ITESO), a Jesuit university in Guadalajara, implemented a project to co-create a Digital Fabrication Laboratory called the Nueva Santa María (NSM) FabLab, in partnership with Cerro del Cuatro, a community that faces significant social and economic challenges in Jalisco, Mexico.

As the 2020 Reach team put it in their description of the community, "the settlements in Cerro del Cuatro were developed under very precarious and adverse conditions, largely outside of government regulation and support." Cerro lacked basic public services "such as plumbing and electricity for almost twenty years and today its residents still face challenges with adequate garbage disposal, access to paved roads, etc. … A lack of safe, public spaces makes the youth highly vulnerable to drug cartel recruitment."[1] Cerro del Cuatro is also a particularly violent region in Guadalajara where many youths are at risk of becoming involved in local gangs.[2] Some members of the community have historically contended with an epidemic of suicide.[3]

These challenges are further exacerbated by the COVID-19 pandemic. While the Mexican government redirects resources for pandemic control, there is ongoing concern that gangs may take advantage of the pandemic to increase their political and social capital.[4] This is evident in the fact that some of these groups are opening food banks, enforcing curfews and handing out vital supplies in marginalized communities in Mexico.[5]

Fabrication Labs, like the Nueva Santa María (NSM) FabLab, create a space to imagine how the principles of design thinking, creativity and innovation intersect with social change to create the conditions for economic growth and social development while keeping the community's needs a priority. Inspired by models of social change and community innovation, the NSM FabLab creates the space and conditions where community members, leaders and ITESO faculty and students can come together to imagine initiatives, projects and approaches to community change that not only centre design thinking but also take a multipronged approach in addressing community needs.

The NSM FabLab tasked Reach Alliance researchers with investigating the interaction between the widespread distrust among community members and entrenched poverty in Cerro del Cuatro — cited by ITESO researchers as the two most pressing, intransigent problems there. In teasing out the interaction between these entrenched problems, we focused on how the NSM FabLab can most effectively mitigate these issues by serving as a safe community
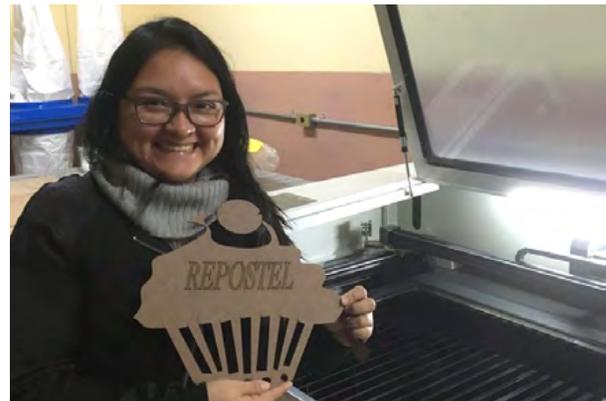
Figure 1. Young woman with a laser-cut piece that she produced in the training and design course offered by the Fablab at Nueva Santa María. (Photo: NSM FabLab)

---

1   "Guadalajara, Mexico: Digital Upskilling in a Conflict Zone," Reach Alliance 2020, 6–7.

2   Nathan P. Jones, "Understanding and Addressing Youth in 'Gangs' in Mexico." Woodrow Wilson International Center for Scholars, Working Paper Series on Civic Engagement and Public Security in Mexico, Washington, DC, 2013.

3   "Tasa de suicidios por cada 100 mil habitantes [Suicide rate per 100,000 inhabitants]," Gobierno de Jalisco [Government of Jalisco].

4   Falko Ernst, "Mexican Criminal Groups See COVID-19 Crisis As Opportunity to Gain More Power," *The Guardian*, April 20, 2020. ↗

5   Mark Stevenson, "In Mexico, a Cartel Is Taking Over: Jalisco New Generation," *ABC News*, March 18, 2020. ↗

space, and what role the NSM FabLab should play in supporting the community response(s) to the COVID-19 pandemic. Any responses require speed of iteration, implementation and scale to be successful in this context.

ITESO researchers implemented a co-creation process to design solutions that can foster a sense of community and provide youth with alternatives to gang involvement. Initially, the NSM FabLab founders sought to address what they believed were training participants' expectations to work in the "industry 4.0" (the fourth industrial revolution based on the rise of digital technology) which is growing in the state. However, they quickly realized that there is a need to first engage with communities and establish a foundation of trust to encourage participants to share their lived personal and professional experiences: the social fabric had been fragmented by intense violence and needed to be rebuilt.

While the NSM FabLab has operated in the Cerro del Cuatro community for approximately two years, its operations have been severely affected by the COVID-19 pandemic (as of July 2020). Although COVID-19 is indiscriminate in causing illness, it disproportionately exerts negative impacts on marginalized communities and further exacerbates existing health and social inequities. A shortage of doctors, nurses and personal protective equipment to fight the virus presents a severe challenge in Mexico. Approximately one in five confirmed COVID-19 cases in the country are among health workers.[6] The impact of the pandemic extends beyond the health sector. The World Bank predicted that marginalized communities, such as Cerro del Cuatro, will face a 6 per cent reduction in their economies.[7] Indeed, between mid-March and April 2020, almost 350,000 formal jobs were lost in Mexico. Although the impact on the informal economy, which is significant in Mexico, is incredibly

difficult to measure, it is reasonable to expect that it too is being devastated by the pandemic.

As of August 2020 Guadalajara had been spared the worst of COVID-19 but the regional government anticipated being further affected in the approaching winter months. With this in mind, the NSM FabLab implementers, together with ITESO researchers, sought to better understand the NSM FabLab's role in assessing community vulnerabilities to COVID-19 in order to inform responses to the health and socioeconomic impacts the pandemic is exacerbating.

Figure 2. Maria Luisa, a teacher, volunteering at the Nueva Santa María FabLab training and design course for the laser cutter course. (Photo: NSM FabLab)

Our Approach

To better understand what role the NSM FabLab can play in shaping the COVID-19 response, we collaborated with ITESO professors to answer the following questions:

1. Which determinants of social, health and economic vulnerabilities are arising in Cerro del Cuatro during the pandemic?

    a. How has the global FabLab community adapted to the effects of COVID-19?

    b. What resources, both community and FabLab specific, can be used and leveraged to increase FabLab's impact?

---

6   Natalie Kitroeff and Paulina Villegas, "'It's Not the Virus': Mexico's Broken Hospitals Become Killers, Too," *The New York Times*, May 28, 2020. 🔗

7   Falko Ernst, "Mexican Criminal Groups."

2. How can we develop an idea pipeline that can be brainstormed, tested and implemented at scale in Cerro del Cuatro?

3. What specific guidelines and recommendations can we implement that are aligned with insights from global FabLab community responses to COVID-19, in future outbreaks and/or as COVID-19 intensifies in the coming months?

The Reach Alliance is collaborating with the NSM FabLab team to identify mechanisms through which the FabLab can address community needs based on interventions that have been successfully implemented elsewhere. We examined in detail three cases from contexts that target problems that are similar to those permeating the social fabric of Cerro del Cuatro. Each addresses distinct challenges that the NSM FabLab shares.

1. US-based Scloop creates value out of discarded items.

2. Make the Masks increases community resilience to COVID-19 (in the US).

3. The Craft and Design Institute focuses on personal economic growth in South Africa.

Following our initial research we interviewed diverse stakeholders to gain an understanding of which aspects of each case study (i.e., the idea, process or implementation) could be

Figure 3. FabLab at Nueva Santa María introductory training to design and making with the laser cutter. (Photo: NSM FabLab)

adapted to NSM FabLab projects/interests. We aimed to map the bright points and pain points and then gather recommendations. Using the lessons learned from these case studies, students enrolled in professional application projects (PAPs — Proyectos de Aplicación Profesional) at ITESO University can create projects that incorporate local knowledge to ensure culturally responsive and relevant interventions.

In light of the ongoing COVID-19 global pandemic, we conducted interviews online through Zoom and Microsoft Teams. This format was not ideal — experiential learning through cross-cultural collaboration allows for a richer research experience and output — however, such online tools still allowed us to explore qualitative methodologies including interviews that painted a vivid picture of localized and bottom-up knowledge about Centro del Cuatro.

Response to COVID-19: Make the Masks (USA)

While COVID-19 may not be inherently discriminatory, certain populations, communities and areas have exacerbated conditions of poverty, inequality and precarity that make them more vulnerable to it. The racialized, classed and gendered dimensions of COVID-19 were central to our examination of the Make the Masks initiative in the United States. The initiative focused on printing 3-D N-95 masks. Unlike single-use masks, these can each be used six times, thereby providing both a cost-effective and longer-term solution to extend the use of valuable personal protective equipment (PPE). These masks allow for effective filtration and can be cleaned, sanitized and fitted directly to the user's face. Because the design is open source and free to use, the base design of the masks and similar PPE can be adopted in any makerspace that is equipped with 3-D printers and similar equipment. If it is feasible, implementing the Make the Masks initiative

in the NSM Fablab context would allow the community of Cerro del Cuatro to extend the existing supply of N-95 masks in the region, and also provide a more sustainable way to promote and continue mask use as it becomes a normalized facet of day-to-day life.

Bright Points: Operations

The Make the Masks initiative was successful in integrating printed PPE in major US hospitals. To understand the initiative's operations, both in its broad priorities and finer elements, we examined (1) the mechanisms through which the initiative was able to respond to community needs and (2) the bureaucratic process required to obtain approval for printed masks to be used in major hospitals. To address community needs during the pandemic, Make the Masks took a three-pronged approach:

- All designs were created as open source and free for use.

- The Make the Masks website provided comprehensive training in a multitude of formats (videos, audio, infographics, mask fit tests and frequently asked questions).

- Make the Masks partnered with organizations that had resources, access and capital they lacked (Spark R&D).

To discern whether the Make the Masks initiative could be replicated in Cerro's context, we examined the process required to approve these masks for use in hospitals. Specifically, the initiative recommends that groups:

1. Find a person who works at a local hospital.

2. Ask them if they'd be willing to take a 3-D printed mask to their supervisor or hospital administrator and show them the mask Respiratory and Fit Test Results.

3. Print a 3-D mask.

4. Download and print the research and usage instructions.

5. Download and print the list of other hospitals that are using the 3-D masks.[8]

Pain Points

A limiting factor in implementing the Make the Masks initiative is the lack of technical equipment in Cerro, such as 3-D printers to physically print masks. During our consultations, our stakeholders identified alternative pathways and mechanisms through which we could adopt a similar idea/intervention in Cerro del Cuatro's context — both in terms of technical resources and the social, political and economic context. Faculty at ITESO University suggested the following responses to these challenges.

RESOURCE LIMITATIONS

Since 3-D printers are scarce in the region, one of our ITESO stakeholders challenged us to think about what other types of PPE could be created. For example, the shape of the masks could be adjusted to something smaller, thus maximizing printing time efficiency, and could use recycled plastics by molding and injecting the plastic to create other types of PPE that would be less resource intensive, while still providing value during the pandemic. Another candidate item to make is a hand-held plastic stick that allows a person to touch surfaces without using their fingers, for example, to press elevator buttons. These could be created with laser cutters that are quite common in Cerro del Cuatro and can also serve a PPE function.

LACK OF COMMUNICATION ON THE IMPORTANCE OF PPE

The second challenge we encountered in Cerro del Cuatro (aside from the impacts of the disease itself) was that the community does not perceive face masks and other PPE, whether shields or gloves, as important. And when these items are used, they are not used correctly. During an interview, a professor at ITESO described how one of their friends purchased an N-95 mask three months earlier and continues to use it

---

8   Their website, which has now expired, described the process. However, its partner, Spark R&D, has a report on the process. ↗

today. Even though experts have agreed that N-95 masks should be worn only once and then discarded properly, this does not seem to factor into their friend's mask usage. In Cerro, people lack awareness about how to use masks correctly, whether it involves knowledge of masks' life cycle, where one needs to wear them or how to properly clean reusable ones. Stakeholders suggested that the NSM Fablab can:

- Connect with ITESO design resources to learn about the challenges they have encountered.

- Use 3-D printers at ITESO University to aid the NSM Fablab's production.

- Find Spanish-language resources that communicate the importance of wearing masks.

THE NEED FOR DIVERSE COMMUNICATION STRATEGIES

The third challenge we faced emerged as a natural solution to the previous challenge: a need for novel marketing solutions that would inspire the utilization of masks and other PPE in Cerro del Cuatro. Possible creative and diverse marketing strategies could include:

- Humorous mask designs, such as adding smiles, MMA (mixed martial arts) wrestlers, or drawn-on "lipstick"

- Social justice masks, for example, #BlackLivesMatter themed masks

- Themed fabrics of different colours

- Masks that match with bracelets and other fashion items

- Finding ways to communicate to the community that N-95 masks must be changed daily, and how these printed masks can extend this supply (showing the product's value).

These core challenges present a unique challenge for implementing a project such as the Make the Masks initiative within the socio-political, economic and resource climate of Cerro del Cuatro.

Key Questions

Our feasibility review of implementing the Make the Masks initiative in the NSM Fablab context highlighted the challenges, solutions and questions from local stakeholders to inspire local innovation and ownership in designing targeted solutions to a shared problem. The following core questions may help to inspire further discussion with ITESO students and faculty alike:

- How does the community view masks? Are they perceived as mandatory? Are they being used? Is there demand for them? Is there enough supply?

- Given that 3-D printers are scarce in the area, what other equipment (such as laser cutters) can be used to create these masks and other PPE?

- What other PPE can you create with this base design, such as plastic key holders to avoid touching surfaces?

- How could these masks and other PPE be marketed in areas where masks are not seen as important or needed?

- What other "short supply" items could we extend with this printing process?

We see this mask-making case study as a base for future projects to tease out the peculiarities of the initiative that add value to people's own lives, projects and interests. One of our final interviewees urged us to consider this initiative as a "bouncing board" of possibilities that the NSM FabLab and other makerspace communities could learn from. To begin considering possibilities, we suggest three questions to the NSM FabLab implementers:

1. Where can we take the NSM FabLab?

2. Where do we want the NSM FabLab to go?

3. What initiatives can be applied to the NSM FabLab that address where we can feasibly go, and where we want to go?

Personal Economic Growth: The Cape Craft and Design Institute (South Africa)

Fabrication labs and makerspaces can take many forms and serve many different functions. They can be a space for the community to gather, a place to create community and they can be a place where personal economic growth occurs. With twenty years of experience, the Cape Craft and Design Institute (CCDI or the CDI) has developed a makerspace focused on helping the South African community develop personal economic growth. We sought to investigate whether we could adapt their model to the Nueva Santa María (NSM) FabLab context. Both the CDI and the NSM FabLab have a mandate to empower and train people in the community, so we were curious whether the CDI's model could be replicated in Cerro del Cuatro. Based in Cape Town, South Africa, the CDI started in 2001 after the Western Cape Department of Economic Affairs, Agriculture, and Tourism found a serious lack of productive capacity, product innovation and high product quality in the area.

To address this, the CDI's first initiatives were workshops to give craft producers the means and resources to facilitate their creative processes. It has grown to support over 5,600 businesses and individuals in South Africa's crafting and design sector. The CDI's services help these businesses develop the right product/service for the right market using appropriate business and production systems. They also facilitate national and international market opportunities to help businesses grow. In a nutshell, they provide business, market and product support. Given the many similarities between the CDI and the NSM FabLab, CDI seemed like a feasible model to implement in the Nueva Santa María community with the right resources.

How CDI Works

CDI provides support through several workshops for makers across different facets of the making process. Business support helps makers develop business skills, but also includes creative and personal development, coaching and mentorship. For example, the CDI offers workshops on establishing makers' visions for their business, evaluating whether their products are ready for market and identifying their business structure — along with marketing and financial strategies to meet their goals. The CDI's desired outcomes for these workshops include learning about interpersonal communication, managing stock, break-even analysis, understanding types of costs and even photography skills so people can do their own product photography and marketing.

Every facet of running a business is supported and managed. Creative development focuses on teaching people how to put their thoughts to paper and conceptualize the creations in their mind. It helps spur creative and innovative thinking with respect to creative design, often starting from something as simple as a business logo design. Coaches assist with goal setting, time-management and business-operation challenges.

The market-support program opens a wide variety of opportunities for craft producers and designers to enter the market and to create platforms from which leads, orders and sales can be generated. Market support provides opportunities for all levels of designers and craft producers, from emerging ideas through to getting items export ready. CDI has workshops focused on (1) how to best engage the correct market segments, (2) time management and burn-out-avoidance strategies, (3) market entry points and more. They assist in matching businesses with a range of relevant channels, from local craft markets to national and international trade and consumer events, as well as supporting business-to-business matchmaking. Additionally, the CDI helps people prepare for these opportunities to get the most out of them.

We decided to focus on product support because of three direct links with Cerro's makerspace machines. Among a range of different machines the CDI provides are tools for 3-D printing, mould making, engraving, welding, sawing and

cutting. On their website, the CDI lists brief explanations of what these machines are and what can be done with them.

Possible Pain Points

CAPABILITIES

Interviews with key stakeholders in the ITESO community raised the concern that the NSM FabLab might not have the capabilities to put the entire CDI model into place because it requires an extensive knowledge of topics in business and financial management. For instance, the NSM FabLab has limited employee capacity to provide market analysis to help users sell their products in the most effective locations.

COST

A significant challenge was the cost of program implementation. While the CDI receives heavy subsidization from both the private and South African public sector, such resources are currently unavailable to the NSM FabLab. A program as extensive as the CDI model is unfeasible in the short and medium term and would require significant buy-in from a number of different actors. Implementing multiple programs at once could also cause information overload and misunderstanding about the NSM FabLab's central objectives. From a logistical standpoint, providing different services might also be difficult. It would therefore make sense to start with one aspect of the CDI model and build slowly over time.

WOMEN IN FABLABS

Because makerspaces with these tools are traditionally seen as masculine, women might perceive them as unapproachable. Mothers, in particular, can face significant challenges in getting involved owing to competing family responsibilities and traditional gender roles: the need for providing childcare and the possibility of husbands feeling insecure about their wives getting involved in personal economic empowerment projects. We heard from our key informants how women coming home without

their children or husbands — from, for example, a FabLab-led workshop — can experience neighbours' gossip which further exacerbates feelings of insecurity in their spouses. The barriers women face in becoming involved in makerspaces will greatly affect the success of the NSM FabLab if they mean to continue encouraging women's involvement in the community.

Possible Bright Points

These broad challenges make the CDI model difficult to implement in the Cerro del Cuatro community context. However, in the feedback about prototyping such a process, we heard different opportunities to address these challenges.

LEVERAGING RESOURCES AVAILABLE AT ITESO UNIVERSITY

There are many resources available to alleviate the skills gap for implementing the CDI model through ITESO University. Many of the stakeholders we spoke with believed that there was great potential for the PAP (Professional Application Projects — Proyectos de Aplicación Profesional) students and different departments of ITESO University to get involved in the CDI model's implementation. This would require a truly multidisciplinary approach to implement, including engineering and design for product support, and a knowledge of community history, marketing, business operations, effective communication and writing, art, public management and international relations.

ADDRESSING COST

The already-existing partnership between the NSM FabLab and ITESO could provide human capital for free or relatively low costs. For instance, students involved in the yearly PAP projects could volunteer to assist in the CDI model's implementation.

MAKING SPACE FOR WOMEN

Offering women-only hours or possibly mother-child hours at the NSM FabLab would be an opportunity to not only increase women's

involvement but also younger people's experience of the FabLab. With increased youth engagement, the CDI model could be very effective at giving youth a leg up in seeking employment within the community.

THE WHOLE MODEL WORKS

During the evaluation process, we received broad feedback about the importance of this kind of model providing a strong foundation for the different elements of personal economic growth. We heard that sharing basic business skills is critical in enabling participants to develop skills required to become self-sustaining business owners. We also heard that community-level champions, who can articulate their importance and effectiveness, could make a significant difference to the model's successful implementation.

EXPLOITING CREATIVE POTENTIAL IN THE COMMUNITY

Throughout our discussions, we heard how the Cerro del Cuatro community has a creative potential that has been underutilized because of a lack of opportunities. We received positive feedback on the CDI's model for "creative design thinking" workshops to teach community members how to iteratively develop new products in order to exploit their creative potential. There is already a community practice of "passing it forward" so that the skills learned in these workshops would be shared among community members for the betterment of their neighbours and broader community.

CONTEXTUALIZING THE CDI MODEL TO CERRO DEL CUATRO

Fully applying the CDI model in the local community includes: (1) tailoring the workshops to the local community's needs, (2) developing opportunities to provide product support to local business based on the machines available at the NSM FabLab and (3) ensuring that the FabLab has female representation to encourage women's involvement.

Key Questions

Given the challenges and opportunities we outlined, some key questions emerged about how the NSM FabLab can implement a model similar to the CDI.

1. Who are the stakeholders that stand to benefit from such a model, and how can they be most effectively reached?

2. What resources can be exploited in the community to implement this model in the most effective but low-cost way possible?

3. What different "lenses" need to be included in the implementation of a model like this? (i.e., marketing, personal development, women's studies, economics, arts and social sciences).

4. Would the implementation of a CDI model begin small and build up or start with all factors on a smaller scale?

5. Which local community partners (or higher-level actors) can help in funding or championing such a model?

Scloop: Upcycling for Social Change (USA)

The Scloop FabLab project — first imagined and executed in the United States — draws on common FabLab principles to address the challenges of climate change and waste management. Scloop began by examining a growing challenge in the community: namely, growing vandalism, misuse of electric scooters and the waste created as a result of damaged scooters that ended up in landfills. While e-scooters have a positive impact on CO_2 emissions, their net environmental impact continued to be negative when considering their journey into the landfill. To address this, Scloop decided to use principles of upcycling to address scooters' negative net environmental impact by reimagining how their byproducts could be

used to create scooter-charging stations. These charging stations would facilitate the extended use of e-scooters in urban centres and therefore mitigate the effects of climate change while also tackling ongoing waste management.[9]

Bright Points: Operation

The operation involved a few integral steps. It:

- identified "waste" as a result of electric scooters that was contributing to net negative environmental impacts — scooters were ending up in landfills as "waste";

- identified what parts of electric scooters could be upcycled to produce a new product, that is, scooter charging stations using parts of discarded scooters;

- used principles of design thinking to reimagine the creation of charging stations and docks using "good waste" as part of the process;

- collected "good waste" to give it a second life and

- reimagined how "good waste" could be used to extend e-scooters' lifespan, minimize CO2 emissions and contribute to a culture of electric scooter and bike usage.

Potential Pain Points

THE SPACE FOR PUBLIC GOODS

Stakeholders from ITESO and the broader community spoke about how the longevity and vitality of public goods have historically been threatened by structural violence, including but not limited to cartel violence. One specific example shared by the community included the destruction of street lights and public lighting infrastructure: unlit areas created spaces where cartel activity could continue in the shadows. Public goods such as street lights and scooters give tools to communities (who have been and

continue to be oppressed) to imagine freedom from the entanglements of violence. But cartels and other agents of oppressive power (such as corrupt governments) aim to dismantle public goods and limit access to anything that interrupts their hold on power and structural violence. Whether cartels would tolerate and allow public scooter-charging stations to thrive (in a system similar to many large northern cities' bike-sharing systems) is an integral question for this case. An e-scooter charging — or even sharing — program could give communities greater mobility and therefore access to employment.

LACK OF TECHNICAL EXPERTISE AND RESOURCES

An ongoing concern for the NSM FabLab and the Cerro del Cuatro community is a lack of technical expertise. Not enough people know how to use the machines and equipment that the NSM FabLab offers community members. Without creating community knowledge centred on using tools available in the NSM FabLab, supported by funding to mitigate high costs, it will continue to be a challenge to transform theory into action and bring the FabLab's full impact to life.

CONCEPTUAL FRAMEWORKS

While principles of design thinking allow for innovation and creativity, many questions relating to individual uses, needs and actions emerge. Can community members envision and drive principles of design thinking from knowledge to action?

TRANSFORMING PRINCIPLES OF UPCYCLING TO FIT INDIVIDUAL AND COMMUNITY ECONOMIC DEVELOPMENT

What are the key questions the NSM FabLab must ask to consider how these public goods will support individual and community gain? Do the FabLab's needs and capacities align with individual demands? How can the FabLab assist community members in seeing the value of upcycling principles to serve individual needs?

---

9   Scloop, FabLab Wiki.

PRE-EXISTING MOTORBIKE/ MOTORCYCLE USAGE

While electric scooters are on the rise in urban centres around the world, a competing trend in Mexico is the use of motorbikes and motorcycles. If community members see more value in investing in a motorbike for personal use, the needs for a program such as Scloop will be outweighed by community trends of purchasing individual motorbikes and motorcycles. In this case, Scloop's specific approach would not serve the community's evolving needs.

Key Opportunities

There are several impactful opportunities for utilizing principles from Scloop.

CENTRING PRINCIPLES OF UPCYCLING

Ranging from examples of converting plastic bottles to create reusable grocery bags and backpacks to converting soda cans to create pen holders and trinkets — multiple products and goods can be created that serve both community and individual functions. While climate change may not be in the forefront of people's concerns in the community, the principles of upcycling can address the challenges of waste management and climate change while using the resources of the NSM FabLab and centring community needs.

By relying on a pre-existing culture of re-use and repair, the community can further develop their skills and abilities by using principles of upcycling to aid the production of new goods. Several examples of upcycling have been popularized in the development context in recent years, such as the use of plastic bottles to create handmade consumer products, which can serve as an inspiration for this work. Principles of upcycling can be extended to the creation of handmade and artisan goods that can be sold in the community and generate income for community members.

ITESO AND NSM FABLAB COLLABORATION

There are a variety of internal and external resources available to alleviate the skills and

Figure 4. Electric Scooters lined up. Once they are no longer functional, scooters could be upcycled into other items like charging station. (Photo: Mack Male via Flickr ⬀)

costing gaps for implementing principles of upcycling and Scloop to the NSM FabLab. Stakeholders identified PAP students and a diverse range of departments at ITESO to support this implementation. Employing an intersectional lens to examine the identities and social location of community members, the socio-political landscape, resources available and opportunity costs calls attention to how gender, race and other social identities intersect and shape people's experiences, including discrimination. With this understanding in mind, stakeholders can use principles of upcycling to create positive individual and community impact. These include but are not limited to the technical aspects of upcycling such as engineering and design for product support, using pre-existing community history and knowledge to maximize impact, collaborating with local NGOs and PAPs that align with issues of climate change and waste management to support upcycling. Costs can be mitigated by fundraising with corporate sponsors as well as grants from local, national and regional governments interested in climate change, waste management, youth engagement and community development.

COMMUNITY PROGRAMMING

While a culture of upcycling, re-using and re-pairing currently exists, this culture must be further developed and nurtured to see positive long-term impacts. The NSM FabLab — while originating in principles of design thinking — must also turn its attention toward continued community engagement by creating programming that includes principles of upcycling and design thinking. This can be done via educational programming, women-only programming and collaborating with schools to facilitate early adoption while also building a positive brand and community reputation for the NSM FabLab.

COMMUNITY–INDUSTRY–UNIVERSITY PARTNERSHIPS

The principles of "good waste" can be used to seek partnerships with corporate partners who may have easy, safe, clean and sustainable access to "good waste." Examples include paper or recycling companies, aluminum-can-recycling companies and companies that use MDF and other cheap woods during the manufacturing or packaging process. In connecting with such partners, ITESO can spearhead community-industry-university partnerships that leverage the resources of multiple stakeholders.

Key Questions

A few key questions emerge when examining the possibilities of embodying principles from Scloop.

- How can Scloop's principles of upcycling be applied to the NSM FabLab?

- What aspects and parts of the upcycling process can be applied to the creation of new products that will benefit the NSM FabLab's users?

- How can upcycling create opportunities for public goods and socioeconomic development in the region?

These questions are fundamental to the theoretical opportunities and challenges that this case study raises and can serve as a foundation for further research and implementation.

Conclusion

The NSM FabLab, like all makerspaces, is fluid in the role it plays and the impact it can have in the community. Makerspaces can be places to gather, but they can also be places to build community, to network, to teach, to learn and to grow. The NSM FabLab could be a place to respond to local emergencies and local needs as they arise — a place that fills hard and soft skills gaps to help grow people's personal economic potential. COVID-19 has presented needs for face masks, work and new skills, all of which makerspaces can play a role in. They can also be a place that capitalizes on presently available goods that might not currently be used to their fullest potential. It can also be all of these. The next steps are up to the PAP students at ITESO University and their faculty.

Research Team

Anushay Irfan Khan is a community-centred educator and researcher currently pursuing a doctorate in social justice education at the Ontario Institute for Studies in Education at the University of Toronto. As a critical scholar whose work is rooted in antiracist, feminist, Indigenous, anticolonial ways of knowing, Anushay is passionate about examining the tensions and challenges that emerge in the pursuit of decolonization. With a specific interest in critical community engagement and education in South Asia and its connection to the global, transnational geopolitical praxes of power, her research draws on intersectional and anti-oppressive pedagogy to create change in the pursuit of decolonial futures.

Mduduzi Mhlanga is in his first year of the Master of Global Affairs program looking to specialize in global markets and innovation. He obtained his Bachelor of Arts degree in political science from the University of Toronto Mississauga. The most fulfilling role he has had thus far has been working as a researcher for the Reach Alliance. He's been involved in two projects, one in Mexico looking at digital upskilling and another in Rwanda examining health logistics. He hopes to make an impact in the capital markets and innovation sphere.

Kanishka Sikri (kanishkasikri.com) is a feminist writer, consultant and theorist unravelling the multiples faces and forms of raced-sexed-gendered violence so as to cultivate worlds without its mutilating bounds. She is formally trained as an International Development Specialist from the Centre for Critical Development Studies at the University of Toronto.

Ruy Cervantes is a researcher and consultant in innovation ecosystems, seeking to increase the innovation capabilities of diverse communities — from marginalized communities and high schools to start-ups and large enterprises. He works as a researcher at ITESO University in Guadalajara on a long-term intervention and research project with a marginalized community there to find how and why digital fablabs can create new social and personal development opportunities. He is also working on in the usage of digital fabrication and "maker culture" to empower high-school students and teachers. In his consulting practice he works with corporations to build their innovation capabilities, enabling leadership and teams with the appropriate mindset, practices and processes to deliver sustained business results. He received a PhD in Informatics from UC Irvine. For his dissertation research, he conducted an ethnographic study of the Mexican start-up community to understand how to accelerate the development of a culture of innovation in Mexico.

Kimberly Skead is a doctoral student in the Department of Molecular Genetics at the University of Toronto where she studies blood evolution and how changing patterns in our blood can inform cancer and cardiovascular disease risk. At the Ontario Institute for Cancer Research, she is the research program coordinator for the Canadian Data Integration Centre and the National Scientific Coordinator

for the Canadian Partnership for Tomorrow's Health. She previously completed an honours Bachelor of Science Degree in global health and genome biology at Trinity College, University of Toronto. Kimberly is one of two managing fellows of the Reach Alliance and previously was a member of the South Africa research team where she investigated the mechanisms employed to increase birth registration rates in post-Apartheid South Africa.

Erica Di Ruggiero is the director of the Centre for Global Health, director of the Collaborative Specialization in Global Health and an associate professor of Global Health, Social and Behavioural Health Sciences Division, and the Institute of Health Policy Management and Evaluation at the Dalla Lana School of Public Health. She is a global public health expert and opinion leader whose research focuses on evaluating the health and health equity impacts of different policy and program interventions on marginalized groups (e.g., labour policies; interventions that aim to reduce food insecurity). She is also interested in how different types of evidence shape global policy agendas and influence global governance in the context of the Sustainable Development Goals. Before joining the university, she was the inaugural deputy scientific director with the Canadian Institutes of Health Research-Institute of Population and Public Health.

Reach Alliance

The Reach Alliance began in 2015 at the University of Toronto as the Reach Project, a student-led, faculty-mentored multidisciplinary research initiative. Reach's unique approach uncovers how and why certain programs are successful in getting to some of the world's hardest-to-reach populations. Research teams, comprised of top students and faculty from across disciplines, spend twelve months investigating each case study. Once the data-collection process is complete, teams write case reports that are published and disseminated across the Reach Alliance's diverse network of policy makers, practitioners, academics and business leaders.

Inspired by the United Nations' call to eliminate global poverty by 2030 as part of a set of Sustainable Development Goals (SDGs), our mission is to pursue the full achievement of the SDGs by equipping and empowering the next generation of global leaders to create knowledge and inspire action on reaching the hardest to reach.

reachalliance.org

Reach Alliance