



UNDERSTANDING TECHNOLOGIES IN CONTEXT: A CASE STUDY FOR ECOLOGICAL RESILIENCE IN THE MT. ELGON REGION OF EASTERN

A 2020 Engineering for Change

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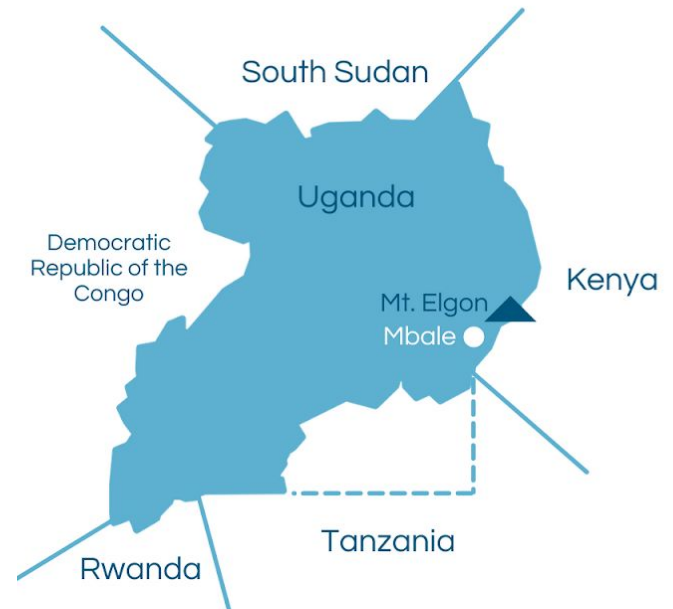
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Introduction

In 2020, MAPLE Microdevelopment founded the Mbale Center for Innovation and Design (MCID) with the aim to empower creative design thinking and community action related to environmental preservation and economic agency in the Mt. Elgon region of Eastern Uganda. With the increasing threat of climate change and the growth of the Ugandan economy and city infrastructure, MCID aims to bridge the gap between local community traditions and design for ecological and economic resilience in a region impacted by the legacy of colonisation and technology implementation that neglects ancestral knowledge, community needs, and socio-ecological values. Emphasizing community needs in the Water-Energy-Food nexus (WEF nexus), MCID aims to develop a breadth of opportunities for early-career Ugandans to train, practice, and explore opportunities in design thinking and social entrepreneurship.



To assist in the development of MCID programs and curriculum, Engineering for Change has partnered with MAPLE Microdevelopment to investigate the ways in which community traditions in the Mt. Elgon region of Uganda can influence and improve the design, adoption, and impact of technologies in the WEF nexus, with a focus on sacred natural sites, environmental preservation, circular economies, and economic agency. Desk research, practitioner interviews, collection of community narratives, and observations have informed the data presented in this report.

This report first provides an overview of MAPLE Microdevelopment's approach to community engagement and goals and motivation for establishing MCID. Next, we emphasize the importance of incorporating principles of ecological resilience, ancestral knowledge, and historical context of technologies into design methodologies by providing a high-level review of these considerations within the context of the Mt. Elgon region and its peoples. This report concludes with recommendations for contextualizing technologies by emphasizing community engagement. Six specific recommendations are given: (1) enable community voice and power, (2) center ecological and social values, (3) deprioritize Western knowledge, (4) consider historical context, (5) emphasize rights of nature, and (6) engage in active reflection.

Mbale Center for Innovation and Design (MCID)

Maple Microdevelopment¹ was established in Uganda in 2009 with the initial goal to provide microdevelopment financial services within communities that lack access to conventional banking and related services. Microdevelopment practices include building community-managed savings groups, internal lending and credit building, and establishing micro-business based on culturally respectful values. MAPLE operates in three locations: ancestral village communities in Uganda, indigenous communities in Chile, and low-income housing communities in Oregon, USA. Each location includes country-born staff dedicated to applying microdevelopment

¹ MAPLE Microdevelopment, [Home Page](#)

principles to their specific cultural, ecological, and economic contexts. In particular, MAPLE follows **four** guiding principles when working with communities²:

1. Participation: MAPLE staff is dedicated to working on sustained local projects with communities who participate at every stage of project design, implementation, and management, such that the outcomes fit their needs, values, and aspirations.
2. Shared wisdom: MAPLE works directly with people who share their wisdom of the local ecologies, focusing on sustaining the land, water, air, and regional biodiversity upon which their lives and livelihoods depend.
3. Capacity-building and access to finance: MAPLE staff adequately trains and works with communities such that people are able to sustain local projects through capacity-building and increased access to various forms of capital.
4. Regeneration: People reconnect across generations, localities, regions, ecologies, and cultures to regenerate the land and society based on deep respect.

In early 2020, Maple Microdevelopment-Uganda, a registered non-governmental organization based in the eastern city of Mbale, partnered with a number of organizations to create MCID, the Mbale Center for Innovation and Design. Since 2008, Maple Microdevelopment-Uganda has facilitated savings groups and entrepreneurial workshops in communities in Northern Uganda (near Lira) and Eastern Uganda. Their Eastern Uganda location serves communities surrounding Mbale, located in the foothills of Mt. Elgon. The new program, MCID, is intended to act as a catalyzing learning environment for entrepreneurs and young adults within the Mt. Elgon region to empower local innovators to design for financial, cultural, and ecological resilience. Core to MAPLE's philosophy, the planning of MCID aimed to center local community voices and investigate the ways in which community traditions in the Mt. Elgon region can influence and improve the design process, curriculum, and programs.

Ecological Resilience in the Mt. Elgon Region

Mt. Elgon is located on the border of Uganda and Kenya and boasts a diverse ecological system and tropical climate. The western foothills of the mountain merge into the Ugandan city of Mbale, where MCID is located. Mt. Elgon is densely populated with villages located on ancestral lands and dependent on subsistence agriculture. In Uganda, 68.7% of land is acknowledged by the government as indigenous and considered to be ancestral or community land³.

The prevalence of environmental degradation in the region comes as a direct result of agricultural production and is exacerbated by climate change. Since the 1970's, policies aimed at closing Uganda's agricultural export market have led cash crop farmers to switch to subsistence to maintain their livelihoods, which has contributed to land extensification with Mt. Elgon park⁴. While the park once belonged to the local communities, it is now considered nationally-protected land. These cultural shifts in land extensification continue today in four unique

² MAPLE Microdevelopment, [About Us](#)

³ LandMark, [Global Platform of Indigenous and Community Lands](#)

⁴ Connor Joseph Cavanagh & Tor A. Benjaminsen (2015) Guerrilla agriculture? A biopolitical guide to illicit cultivation within an IUCN Category II protected area, *The Journal of Peasant Studies*, 42:3-4, 725-745, DOI: 10.1080/03066150.2014.993623

zones of agricultural production on the slopes and area of Mt. Elgon⁵. These four main levels each contain varying degrees of intensification processes and vary by use of shading practices, incorporation of fertilizer, and accommodations for modern farming equipment. These cultivation practices have led to an increase in landslides in the area, representing an added danger to farmers. One study, which surveyed 35 different parishes within and around Mt. Elgon, found that 92% of the 24 parishes that perform this form of agriculture within the park experience landslides compared to only 20% of the 11 parishes that do not. Removal and flattening of soil as well as removal of tree cover to create new farming space creates unstable geotechnical environments and adds to deforestation problems in the area. In addition to land extensification, the increased use of commercial-grade agriculture with fertilizer and other chemicals has the potential to pollute local waterways with phosphorus and nitrogen, two chemicals that can inflate local algae populations and lead to regional illness in nearby indigenous villages.

Furthermore, the region is increasingly facing issues relating to the unsustainability of existing food-energy-water nexus solutions. Historical practices and technologies, such as the three stone fire and hunting have been sustainable; however, recent extreme population growth and the rise of extraction industries has left many communities in need of alternatives. Notably, climate change, largely caused by high-income nations, has disproportionately increased the frequency and intensity of natural disasters in low-income nations, such as droughts and rain storms, requiring communities to consider more preventative measures.

The concept of ecological resilience emphasizes a system's ability to respond and adapt to disturbances in the environment, such as drought, deforestation, or heavy rain storms. Importantly, humans are often considered a component of ecological systems within cultures that have sustained ancestral lands over generations. Some design engineers have argued that an approach rooted in the concept of ecological resilience is more appropriate compared to one simply rooted in sustainability⁶. Within the Mt. Elgon region, building ecological resilience is a key concern since the region suffers from a wide variety of environmental impacts due to colonisation, globalisation, economic changes, and climate change.

Traditions and Knowledge in Mt. Elgon Communities

Traditions and Indigenous Knowledge

Ugandan village communities hold deeply ecological and cultural knowledge that has enabled their societies to live in harmony with nature for centuries. Movements, such as ecological and community mapping facilitated by Gaia Fellows⁷ and many others, aim to protect ancestral knowledge about community territories, seeds, sacred natural sites, and seasons. In Ugandan culture, village Elders are viewed as custodians of ancestral lands, and their knowledge is highly regarded. Since communities are evolving quickly due to the legacy and current impacts of colonisation and globalisation, community mapping brings traditional ways of knowing and living to the forefront of community development and resilience. In terms of designing solutions for ecological resilience, scholars emphasize the need for centering ancestral knowledge and traditions within respectful and co-creative design processes⁸.

⁵ Christopher Sebatta, et al., (2019) Pathways to sustainable intensification of the coffee-banana agroecosystems in the Mt. Elgon region, *Cogent Food & Agriculture*, 5:1, DOI: 10.1080/23311932.2019.1611051

⁶ Lilly, B., & Gill, C. (2006). The Challenge of Sustainability: Designing for Resilience. In *DS 38: Proceedings of the 8th International Conference on Engineering and Product Design Education, Salzburg, Austria, 07.08.09. 2006*.

⁷ Gaia Foundation, [Interview: Eco-mapping for cultural and ecological revival in Uganda's Great Lakes Region](#), 2017

⁸ Reitsma, L., Light, A., Zaman, T., & Rodgers, P. (2019). A Respectful Design Framework. Incorporating indigenous knowledge in the design process. *The Design Journal*, 22(sup1), 1555-1570.

This research aimed to center community perspectives and ancestral knowledge by listening to community narratives regarding the role of natural sites, social values, and historical context of technologies. To do so, MAPLE staff members met with Elders from eight (8) different villages to learn about their own indigenous technologies and sacred natural sites. Interviews were conducted in languages the Elders' felt comfortable with (Lugisu, Luganda, or English). All interviews were held in the Elders' villages and many included impromptu tours of the sites, technologies, and resources.

Technologies in Mt. Elgon Region: Then and Now

Since understanding historical contexts of technologies is recommended, we mapped out various practices and technologies that were identified during field research and interviews with local communities.

Water

Water collection traditionally took place at local sources, including rivers, natural streams, waterfalls, and springs. Water was collected with clay pots and carried back to the home. Bathing took place in the rivers and streams so that water was not wasted. All agriculture was rainfed as irrigation was not utilized. One particular technology was a wooden pole attached to the trunk of a tree. During rain events, rainwater that fell down the tree trunk would follow the wooden pole into a bucket underneath it to collect the rainwater. Today, many communities collect water from implemented boreholes. Some communities have access to the national water grid; however, many tribal Elders prefer naturally sourced water as the taste is sweeter. Plastic storage (such as jerrycans) is used instead of clay pots today because it is more durable and less likely to shatter or break.

Energy

Traditionally, women used three stone fires for cooking and wood as a fuel source. Fires produced the energy for light during night time, with a certain dried nutshell used as a "lightbulb" (as described by one village community). Today, three stone fires are still the main method for cooking, with firewood or charcoal still maintaining the role of fuel source. Electricity has arrived to some houses in the area but is quite costly to obtain.

Food

Agricultural farming involved a large amount of digging in the field. A hand hoe composed of a hewn cow bone, leather, and a stick was the main instrument to accomplish this task. Fertilizer was seldom used by the elders and their families growing up. The crops consumed by the family were grown in the garden adjacent to the house. For some elders, formal working groups between neighbors would take turns to dig out each other's gardens, accomplishing the work much faster as a collective. In terms of food consumption, wooden utensils and cups with clay pots were used for cooking. Farmers today commonly use metal hand hoes, which are easier to use because they can be sharpened and last longer. Tractors are available, but are more frequently used on commercial sized farms. On the other hand, manure, which was often set aside for no special purpose in the past, is used in gardens today as a natural fertilizer for plants. Clay and wood-based instruments have given way to metal ones which are much more durable and do not burn when touched.

Communication

In the past, communication was often achieved by foot and/or face to face. Some elders describe walking distances of 80 km or more to relay information to relatives and loved ones concerning deaths in the family and other matters. All travel for communication was by foot, with the exception of a single bus that serviced the Mt. Elgon region (reserved only for the wealthy and royalty). Communication today has evolved to include the cell phone as well as television and radio as much faster means of exchanging information. Travel has shifted to the automobile, bus, and motorcycle (boda-boda) for many people in the region. Nevertheless, many still use donkeys for transport in highland areas of the region due to elevation challenges.

Sacred Natural Sites

To evaluate and plan community initiatives, a thorough understanding of underlying values and institutional structures surrounding sacred natural sites is required⁹. Understanding what is sacred and worth protecting will allow for a better understanding of how to support community ecological resilience in the Mt. Elgon region. In the communities surveyed, a number of shrines, both manmade and natural places such as caves, were used as places to communicate with aboriginal deities and ancestors. However, over time there has been more transition to buildings, such as Christian churches and Islamic mosques, which have joined natural spaces as places of sacred worship.

Aside from sacred sites, village Elders described important natural community sites, such as forests, springs, rivers, and caves, because of their impact on the local ecosystem. Respondents emphasized the importance of forests for maintaining proper rainfall levels and mitigated landslides. Caves were mentioned as places to collect guano and fertilizer. Rivers and streams were mentioned because their water, which is better tasting than water from the national grid, was important to the environment.

While the interviews suggest that, on average, nature has lost some of its sacred status that it traditionally had, important parts of the local ecology remain of high value to the communities for spiritual, historical, social, and cultural purposes. People depend on their ancestral land for their food, livelihoods, health, and extended family ceremonies. Many surveyed Elders commented on the importance of their personal connection that binds them to the land and their community. Whether it be a childhood memory, a connection to a loved one, or a sense of spiritual connection to the Divine, the Elders who adore and protect natural sites do so because of a personal, emotional link to nature.

Understanding Technologies in Context: Holistic design

In order to understand design and technology in context, it's important to consider holistic design methodologies and remember that technology is part of a larger ecosystem. There are growing bodies of literature and methodologies for engaging ethically and appropriately with people who view themselves as part of larger ecosystems. Desk research and interviews with expert practitioners have informed the following recommendations: (1) enable community voice and power, (2) center ecological and social values, (3) deprioritize Western knowledge, (4) consider historical context, (5) emphasize rights of nature, and (6) engage in active reflection.

Enable community voice and power

The more power and ownership a community has in the solutions that impact their well-being, the more prepared they will be to address problems they value, and the more capable they will be to survive and thrive through economic, ecological, and social crises¹⁰. Community members must have a say in both the problem-space, identifying what should be considered a valuable issue worth addressing, and solution-space, determining potential and final solutions of design initiatives. Importantly, they should have veto power when plans start to go in an undesirable direction because the successful implementation and sustainable management of plans depend in many ways on community engagement¹¹. Enabling community voice and power requires clarifying the role of the designer(s) and the participation level of the community. A variety of resources

⁹ Rutte, C. (2011). The sacred commons: Conflicts and solutions of resource management in sacred natural sites. *Biological Conservation*, 144(10), 2387-2394.

¹⁰ Rosa González, *The spectrum of community engagement to ownership*, Facilitating Power, 2019

¹¹ Interview with anonymous practitioner, August 2020

exist to assess community participation and give advice for enabling community voice and power, including the Spectrum of Community Engagement to Ownership,¹² informed in part by Arnstein's Ladder of Citizen Participation¹³.

Center ecological and social values

There is a prevailing view of technology and innovation that equates “value” with modernity, novelty, and profitability. However, to improve well-being and ecological resilience for the vast majority of Ugandans who live in rural areas, oftentimes on ancestral lands, technology in and of itself is not a complete solution. Rather, the technologies are part of a larger approach to preserving life that requires institutional and structural change. It is essential that the values that are front and center of a project are grounded in community experiences and desires, not novelty, innovation, and profitability alone. At its best, technology amplifies intent and capacity of human and institutional stakeholders¹⁴; therefore it is important to define the values and objectives of the projects based on the community's ecological and social goals.

Deprioritize Western knowledge

To date, mainstream design and engineering philosophy has been dominated by Anglocentric and Eurocentric (also referred to as “Western”) ways of thinking and acting in the world. Design thinking and human centered design are Western-born methodologies that aim to improve the social impact of technology; however they miss the mark by not incorporating key contextual factors, are not holistic enough, and impose Western technocentric ideologies. Movements, such as Decolonising Design¹⁵, Visibility STEM Africa¹⁶, and Lo-TEK¹⁷ highlight the importance of grassroots design and call for radical reconstruction of neocolonial structures to support public-interest innovation. Design workbooks, such as *A Social Designer's Field Guide to Power Literacy*¹⁸ and *Fumbling Toward Repair*¹⁹, provide definitions and activities for practitioners aiming to center the community's knowledge and voice. Embracing local communication practices and deprioritizing Western forms of communication, such as written design reports, are also essential²⁰.

Consider historical context

Far too often, even well-intentioned designers neglect to consider the historical context of the communities they work with. It is essential to remember that communities evolve over generations and the effects of previous technologies, traditions, and oppression remain. Deeply engaging and listening to community history (in MAPLE's case, interviewing village Elders) is an important step to understanding the context of any future projects. More specifically related to ecological resilience, literature recommends the incorporation of *recognition justice*²¹ assessments, which aim to characterize the historically neglected considerations, such as relationships, context, power, and vulnerability, during the problem-scoping stages of design. Importantly, recognition justice

¹² Rosa González, [The spectrum of community engagement to ownership](#), Facilitating Power, 2019

¹³ Sherry Arnstein, [Arnstein's Ladder of Citizen Participation](#), The Citizen's Handbook

¹⁴ Kentaro Toyama, [Technology is not the answer](#), 2015

¹⁵ Decolonising Design, [Editorial Statement](#), 2016

¹⁶ Visibility STEM Africa, [About page](#)

¹⁷ Julia Watson, [Lo-TEK: Design by Radical Indigenism](#), 2020

¹⁸ Maya Goodwill, [A designer's field guide to power literacy](#), 2020

¹⁹ Mariame Kaba and Shira Hassan, [Fumbling towards repair: A workbook for community accountability facilitators](#), 2019

²⁰ Interview with a human rights and environmental justice expert, 2020

²¹ Preston, C., & Carr, W. (2018). Recognition justice, climate engineering, and the care approach. *Ethics, Policy & Environment*, 21(3), 308-323.

emphasizes that effects of climate change are due to the behaviors and activities of wealthy nations, mostly at the expense of low-income communities²².

Emphasize rights of nature

Uganda is beginning to adopt a *rights of nature* approach, also referred to as earth jurisprudence²³. This approach gives specific “voice” to nature, in an attempt to protect and preserve it. This has important implications for designers. Traditional human-centered design, design thinking, and even sustainability design neglect necessary aspects of the rights of nature and focus the attention on people and society. However, it is essential to recognize that all people and technologies are deeply embedded in complex, interconnected systems of culture and nature. Emphasizing the rights of nature is particularly important now that we are experiencing the consequences of a human-centered, industrial-growth approach that has extracted far too much from the planet. In many communities, like those in the Mt. Elgon region of Uganda, the Elders assume the position of caretakers of nature; they are local custodians of their ancestral land and sacred natural sites. Their knowledge represents the needs and voices of the land, water, animals, and resources - this must be included in any design methodologies pursued.

Engage in active reflection

Critical reviews of traditional *design thinking* methodology suggest that it is in need of active reflection, such that designers cultivate critical awareness of their social positionality²⁴. It is essential that designers engage in critical personal reflection throughout their projects, and many community-driven design tools and methodologies provide recommendations for doing so. For example, in the Equity-Centered Community Design Field Guide²⁵, designers are encouraged to fill out reflection pages regularly. For example, as MAPLE continues to develop program materials at MCID, the institution should continue to reflect on any potential role it may have in perpetuating neocolonial practices that prioritize Western technological solutions over community values and traditions. Although the MAPLE staff developing these materials are Ugandan, their experiences (e.g., being university educated, living in urban areas, etc.) can introduce individual biases to the design process. Checking assumptions and engaging in critical reflection is a key component of ethical design. To get started on practicing critical reflection, Shane Reed outlines a variety of recommendations for design teams, including goal definition, prompting, and retrospective thinking²⁶.

²² The Times Editorial Board, Wealthy countries are responsible for climate change, but it's the poor who will suffer most, Los Angeles Times, 2019

²³ Gaia Foundation, Earth Jurisprudence

²⁴ Staton, B., Kramer, J., Gordon, P., & Valdez, L. (2016). From the technical to the political: Democratizing design thinking. Contested Cities, Madrid.

²⁵ Creative Reaction Lab, Equity-Centered Community Design Field Guide, 2018

²⁶ Shane Reed, How reflecting on your work can make you a better designer, 2018



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