



Autodesk Foundation
Impact Brief Series:
Resilient
Communities

What we've learned

An Autodesk Foundation Impact Perspective

This impact brief is the third in a three-part series that examines Autodesk Foundation's work in three key issue areas over the course of our five-year history: [future of work](#), [low carbon innovation](#), and [resilient communities](#). In each brief, we define the problem we are tackling and articulate our approach to supporting solutions and evaluating impact.

This third brief seeks to clarify the challenges and opportunities posed by climate change and articulates Autodesk Foundation's strategy for investing in actionable solutions that help vulnerable communities better adapt to the effects of a planet with increasingly extreme and erratic weather events. It also provides learnings and insights from our preliminary research and early investments to build resilient communities.

This brief is written with a diverse audience in mind. By openly sharing how we see the challenges and opportunities climate change presents and by articulating our investment thesis and commitment to action, we hope to drive more collaboration to solve critical issues facing the world today.

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Why resilient communities?

Introduction

Autodesk Foundation's mission is to support the design and creation of innovative solutions to the world's most pressing social and environmental challenges. We believe in the power of technology to help transform society in positive ways and tackle pressing challenges such as climate change. We believe that scalable technology innovation has a pivotal role to play if we're to achieve a low carbon future. Our work has several defining features:

- We invest in entrepreneurship and innovation, particularly at the early stages of a company or organization's development, where our resources can have the greatest effect;
- We help bring transformative technologies to scale with a thesis-driven approach and value beyond dollars;
- We drive flexible, risk-tolerant philanthropy by embracing both nonprofit and for-profit models, utilizing grants and impact investment structures to align incentives for scale.

The root cause of climate change is greenhouse gas (GHG) emissions, but communities and nations cannot bank on GHG mitigation solutions to solve the challenges immediately confronting us. Although we are steadfast believers in a just transition to a low carbon economy, we know that such a transition will take both time for new technologies to be adopted and political will to coordinate large scale action. The poorest parts of the world tend to be the most exposed to the negative effects of climate change. We cannot wait for climate mitigation. As a matter of equity, we need to prioritize adaptation and resilience for the most vulnerable communities, starting today.

Many adaptation solutions are rooted in improving infrastructure and systems through design and engineering. Autodesk Foundation's expertise in this realm makes us uniquely suited to support solutions to improve the resilience of low resource communities. Here's the impact we have had since 2018:



22

organizations supported to increase the resilience of vulnerable populations



5M

dollars in grants and direct investments to these organizations



5M

dollars in in-kind support to these organizations via software, training and the talent of Autodesk's global employee base



20M

individuals benefited by our resilience portfolio in 2018

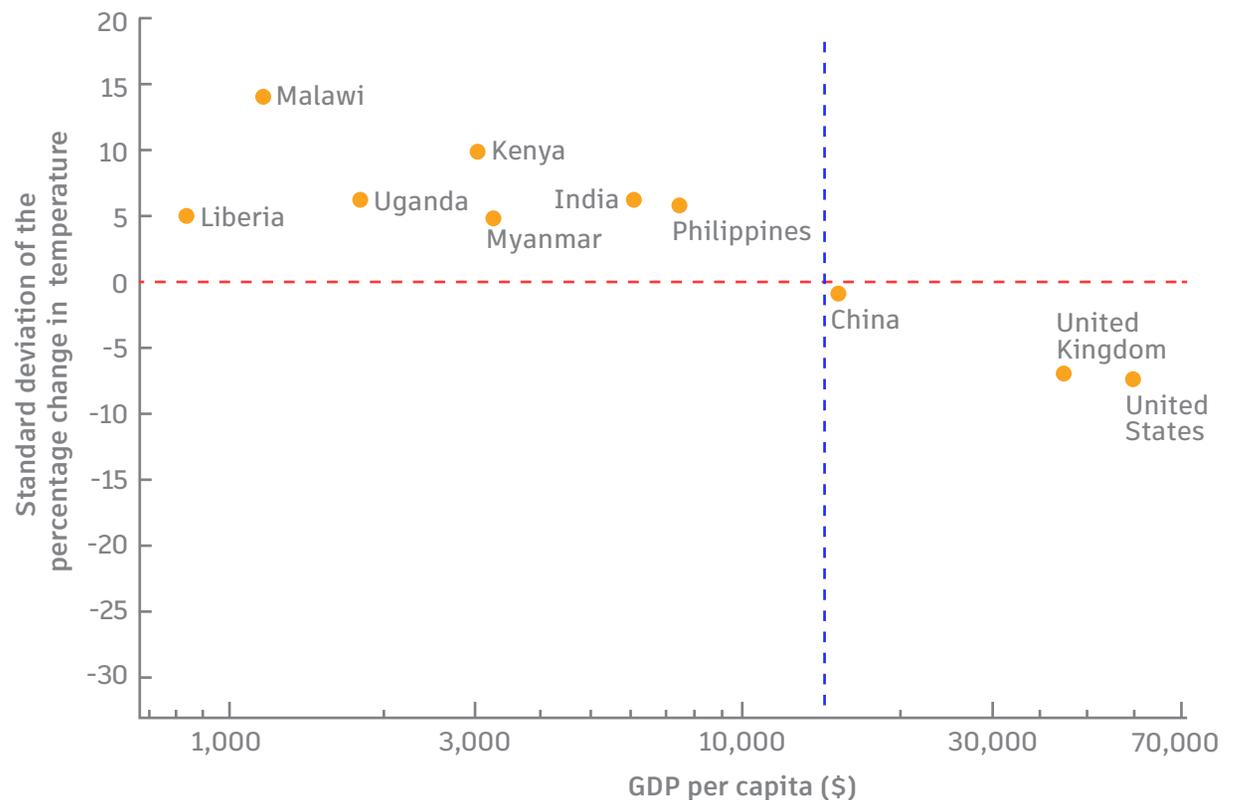
What is the problem?

July 2019 was the hottest month on Earth in recorded history.¹ Alarming, 2015-2018 were also the hottest years on record overall. There is overwhelming scientific evidence telling us that climate change is already happening. In many parts of the world, this is causing disruption and harm through extreme weather events leading to a rise in sea level, an increase in severe storm frequencies, and an altered food production system.

Additionally, climate impacts are not evenly spread around the globe. Low- and middle-income countries (LMIC) in the Global South that contributed least to the root cause of climate change are both disproportionately affected by it and have the least resources to allocate to help their populations cope. Tropical regions, which are prevalent in Sub-Saharan Africa, the Indian subcontinent, Southeast Asia, and South America, are more vulnerable to temperature swings caused by climate change.

“Climate models consistently project increases in temperature variability in tropical countries over the coming decades—the countries that have contributed least to climate change, and are most vulnerable to extreme

events, are projected to experience the strongest increase in variability. These changes would therefore amplify the inequality associated with the impacts of a changing climate.”²



Source: Climate models predict increasing temperature variability in poor countries – Bathiany, Dakos, Scheffer, Lenton, 2018

1. National Oceanic and Atmospheric Administration, “July 2019 was hottest month on record for the planet,” August, 15, 2019, <https://www.noaa.gov/news/july-2019-was-hottest-month-on-record-for-planet>
2. Sebastian Bathiany, Vasilis Dakos, Marten Scheffer and Timothy M. Lenton, “Climate models predict increasing temperature variability in poor countries,” Science Advances, May 2, 2018, <https://advances.sciencemag.org/content/4/5/eaar5809>

“Global warming has increased global economic inequality.”

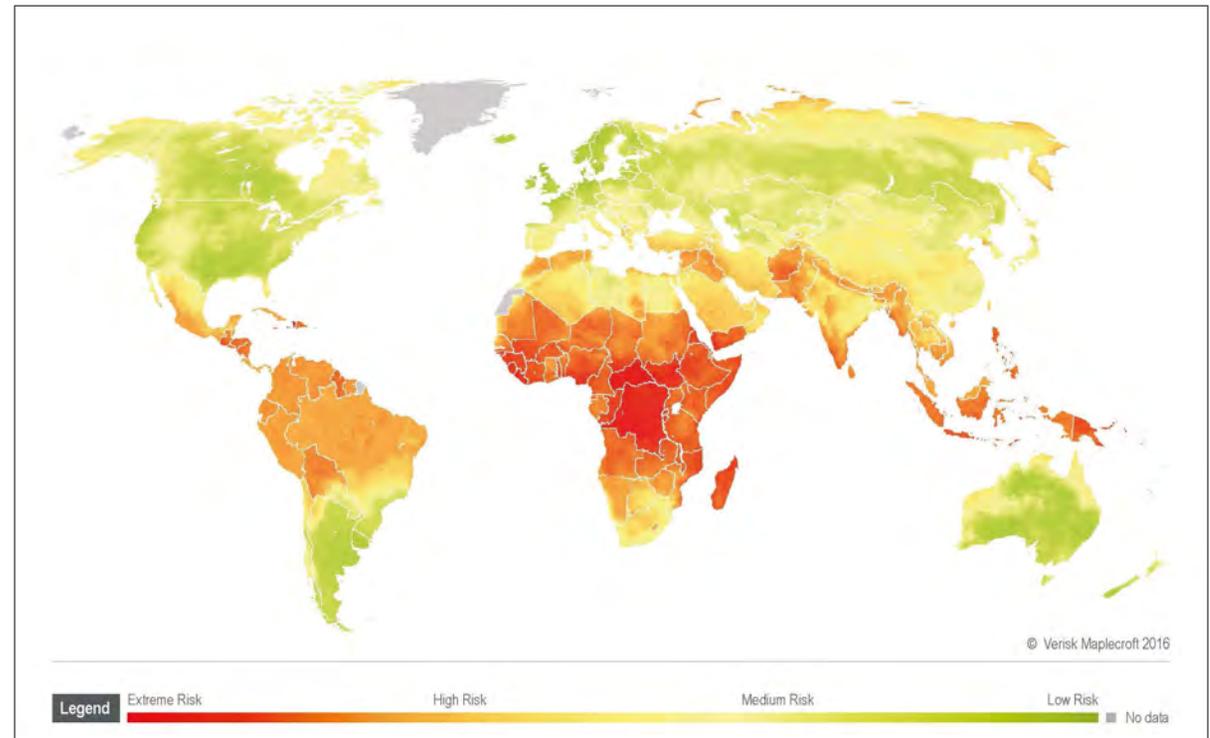
– Noah S. Diffenbaugh and Marshall Burke, Stanford University³

A 2019 study from Stanford University also found that from 1961 to 2010, global warming decreased the wealth per person in the world’s poorest countries by 17 to 30 percent.⁴ “...For

most poor countries there is >90% likelihood that per capita GDP is lower today than if global warming had not occurred.”⁵



Climate Vulnerability Index 2017



Source: Verisk Maplecroft, www.maplecroft.com

3. Noah S. Diffenbaugh and Marshall Burke, “Global warming has increased global economic inequality,” Proceedings of the National Academy of Sciences of the United States of America, May 14, 2019, <https://www.pnas.org/content/116/20/9808>
4. Noah S. Diffenbaugh and Marshall Burke, “Global warming has increased global economic inequality,” Proceedings of the National Academy of Sciences of the United States of America, May 14, 2019, <https://www.pnas.org/content/116/20/9808>
5. Noah S. Diffenbaugh and Marshall Burke, “Global warming has increased global economic inequality,” Proceedings of the National Academy of Sciences of the United States of America, May 14, 2019, <https://www.pnas.org/content/116/20/9808>

What is adaptation and resilience?

The UN Framework Convention on Climate Change (UNFCCC) defines adaptation in the broadest terms: “adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts.”

Resilience, in the context of climate change, is closely related to the concept of adaptation. While adaptation focuses on actions (“changes” and “adjustments”), resilience can be considered a result of

those adaptive actions. According to the UN’s Intergovernmental Panel on Climate Change (IPCC), resilience is defined as: “the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance...”

Given the mounting evidence of the socioeconomic burdens of climate change in the poorest regions of the world, we believe meaningful climate adaptation has to result in social,

physical, and economic resilience. We prioritize achieving resilience in low-income countries in the Global South. Making these vulnerable communities more resilient is more than just building higher sea walls or better storm shelters. It is also a matter of improving economic livelihood for individuals and essential infrastructure for communities as well as ultimately, tackling global inequality.



Image credit: Kickstart



Our investment thesis

Understanding the ecosystem

There are many adaptation approaches to building resilience in low resource settings with emergency preparedness or disaster response being the most obvious. But if we think climate change is not only creating natural disasters but also exacerbating economic instability, many more types of solutions are needed. We believe resilience is built through improving economic livelihood in combination with bolstering community infrastructure.

Autodesk Foundation has over time chosen to focus on a specific set of challenges that take advantage of our particular set of expertise and resources.

Some of these specific problems are most acute in the Global South’s infrastructure, agriculture, water, and sanitation systems. The IPCC has also reviewed the types of acute impacts these regions face, demonstrated in the chart below.

Geography	Climate-induced vulnerabilities		
Latin America	Reduced food production and quality	Reduced water availability and increased flooding	Spread of vector-borne disease
Africa	Reduced crop productivity and food security	Vector and waterborne diseases	Compounded stress on water sources
Asia-Pacific	Increased flood damage to infrastructure	Increased risks to low-lying ecosystems	Loss of ecosystem services and economic stability



To dig in a bit deeper, here are the ways we've seen particular challenges manifest within these distinct sectors.

Agriculture

Changing weather patterns and extreme storms disrupt what, when, and the quantity of food farmers are able to grow, particularly in the Global South where resources are scarce. Extreme weather impacts the efficacy of farm inputs and disrupt harvest and post-harvest. A climate-resilient agriculture strategy must help farmers stay productive in the face of climate threats and preserve as much of the food that is grown as possible.

Water and sanitation

Over 2.1B people lack access to clean water and 4.4B people lack access to safe and proper sanitation.⁶ Persistent droughts in addition to human activity exacerbate this problem, particularly in cities in the Global South experiencing a surge of population growth due to climate change and economic migration.

Housing and infrastructure

In the last decade, half a million people have died as a result of collapsed structures during extreme storms or earthquakes. It is estimated that by 2030, 3B people predominantly in the Global South will live in substandard housing, remaining vulnerable to increasing extreme weather events.⁶ Again, the confluence of inequality and climate change puts the most vulnerable populations at risk – in their own homes.

Energy access

Reliable energy infrastructure is the backbone of resilience, powering essential services to households and communities. Yet, more than 1B people live off-grid with no access to electricity. In addition, due to lack of access to fuel alternatives, 3B people cook over open fires with wood, charcoal, and biomass, driving significant deforestation and dire household health impacts.⁷



Image credit: Splash

6. World Bank, "Global Program for Resilient Housing," World Bank Brief, June 21, 2019, <https://www.worldbank.org/en/topic/disasterriskmanagement/brief/global-program-for-resilient-housing>

7. World Health Organization, "Household air pollution and health," May 8, 2018, <https://www.who.int/news-room/fact-sheets/detail/household-air-pollution-and-health>

Role of technology in driving resilience

While we have always acknowledged that technology alone is not enough to solve these complex social and environmental challenges, it can and should contribute to the creation of new approaches or improve the efficacy and scalability of existing solutions. In addition, lack of technical expertise and capacity in low resource settings can be a barrier to adoption of meaningful solutions. Below are some of ways we think about the importance of technical capacity and technology's role in building resilience, and the ways we've seen it in practice in the specific sectors we are focused on:

Opportunity area	Approach needed
 Agriculture	Use technology to help farmers be more productive and prosperous: productivity tools around farming practices include irrigation, input application, mobile tools for access to knowhow, market linkages, data tracking, and cold chain technology innovations for reducing post-harvest loss.
 Water and sanitation	Bolster local engineering knowledge for civil infrastructure; make affordable, locally adapted water and sanitation products such as alternatives to expensive utility-scale infrastructure; utilize emerging technologies in Internet of things, robotics, and artificial intelligence that can help improve, monitor, or monetize interventions and test different solutions.
 Housing and infrastructure	Innovative technology can help solve three of the most pressing problems in housing: quantity, quality, and affordability. Innovations in building materials, construction tech, and financial access can directly impact these challenges to bring safe and durable housing to millions.
 Energy access	Use technology for product refinement, affordable access, and breakthroughs that will enable energy resilience in the Global South.



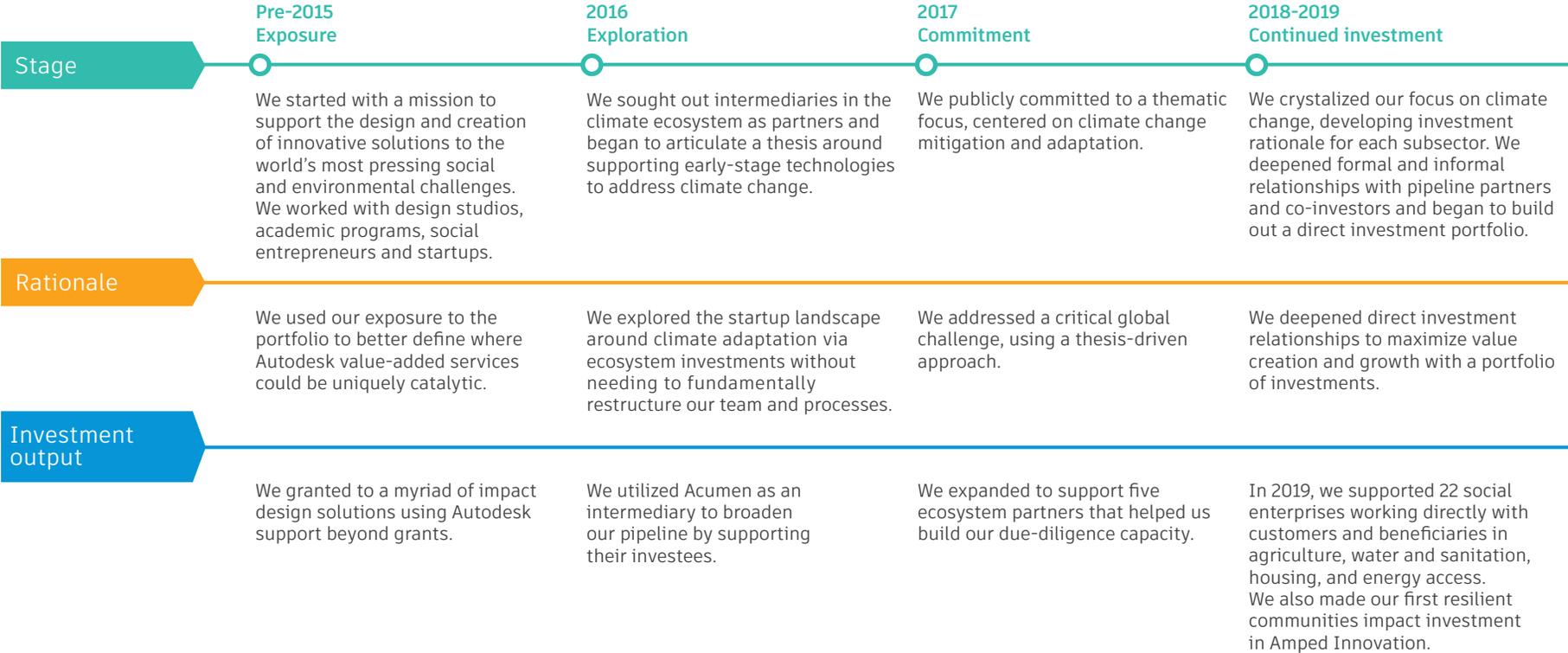
Investing in
solutions

Investment timeline

Our work in resilient communities is an evolution of our work from inception. When the Autodesk Foundation launched in 2014, we were issue-agnostic in our approach, but looked to support impact design, bringing together social, environmental, humanitarian, sustainable, human-centered, public-interest, and other related design disciplines focused on creating positive change and lasting impact.

Over time, we realized that in order to have clear impact through our philanthropy, we would need to identify the specific challenges we are seeking to address. The urgency of climate change presented the opportunity for us to define an investment thesis around resilience and screen funding decisions against that thesis.

Our grants and investment decisions in our resilient communities portfolio exemplify the defining characteristics of our philanthropy. In the following highlights and case studies, we will examine how our technology focus, ability to add value beyond dollars, and deployment of flexible capital manifests in our portfolio decisions.



Highlight: Flexible capital

A key aspect of our risk-tolerant philanthropy is a willingness to be flexible with how our capital is deployed. We believe in providing unrestricted grants, particularly to nonprofit organizations in our portfolio whose funding sources are often inflexibly tied to programs. Unrestricted funding allows these organizations to invest in their internal capacity, which strengthens their ability to deliver programmatic outcomes. Out of our portfolio, 70% of our funds have been unrestricted grants.

With our commitment to supporting entrepreneurship and innovation, we recognize that the most promising solutions to the challenges we focus on will not come in the form of nonprofit organizations only. Although not common practice in philanthropy, we believe grant capital can be appropriately applied to for-profit ventures whose products and services have a clear social and environmental impact potential. We have provided R&D grants to for-profit organizations to support early-stage technology innovation and product development for underserved markets where

commercial capital is not incentivized to go. In some cases, once our grant capital has been expended to fund a proof of concept pilot or help bring a new product to market to benefit a marginalized customer we have transitioned our support from grants to investment.

Besides funding organizations that directly serve customers and beneficiaries, we also support intermediaries that build the resilience ecosystem. This includes accelerators, incubators, and funds to bolster the growth of the entire field. We believe funding the ecosystem will create an enabling environment, allowing a larger number of organizations to be successful.



Image credit: Nexleaf Analytics

Highlight: Value creation through Autodesk, Inc.

Autodesk Foundation brings a unique combination of financial capital and corporate resources to bear in our philanthropy. These corporate resources include software, training, and related support to advance technology-driven solutions, and the talent of the company's global employee base. Autodesk, Inc. makes these corporate resources available to help create positive impact in the world as a corporate citizen.

Technology: Autodesk is a technology company with expertise in tools, solutions, and software to help our partners achieve their design goals and build lasting technical capacity. Specific programs offering support in this area, include:

- Technology Impact Program – software granting
- Learning Services Program – software adoption training and support
- ATC Impact Residencies – in-house use of advanced software and hardware

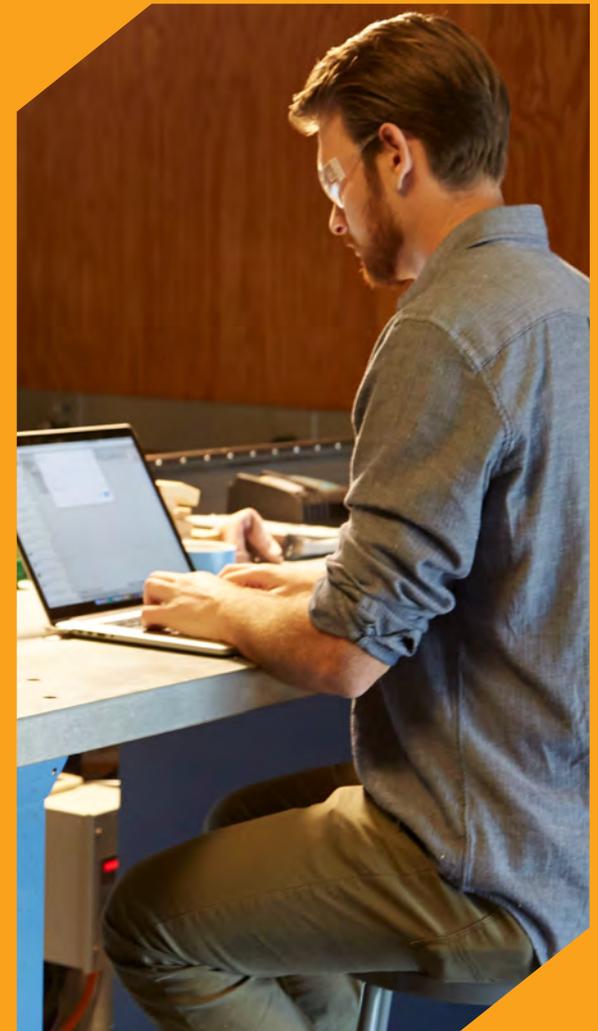
Talent: Autodesk's network of employees, students, and collaborators is extensive, each contributing unique skillsets, perspectives, and capabilities. Specific programs geared toward filling talent gaps include:

- Pro bono volunteering – 1:1, team-based, and immersion skills-based volunteering
- Impact Internships Program – Autodesk Student Experts resources

Beyond dollars, our support typically means we're enabling design and make solutions that improve health and economic output in vulnerable populations or supporting and elevating solutions that drive increased resilience for infrastructure projects. Our engagements typically focus on:

- Supporting scalable solutions that address resilience of agriculture, water and sanitation (WASH), energy access, infrastructure/built environment in low resource settings;
- Building design and make expertise in low capacity communities.

This integrated approach has now become the cornerstone of the way we work, highlighted in the following case studies.



“Build Change has relied on technology from the start, and we’ve used Autodesk products since day one. If we are to prevent disasters from happening, we need to reach as many vulnerable homeowners as quickly as possible—and technology is the tool that makes it possible for Build Change to scale to the demands of our rapidly changing climate.”

– Dr. Elizabeth Hausler, Founder and CEO, Build Change



Image credit: Build Change

Case study: Build Change

Impact objective

Radically transform how governments and homeowners build disaster-resilient housing using technology

The mission of Build Change is to reduce deaths, injuries and economic losses caused by housing and school collapses due to earthquakes and typhoons in emerging nations. Without the right tools and incentive-based financing, buildings in a disaster-hit area may be as vulnerable after reconstruction as before. The organization teaches the basics of disaster-resistant design and construction to homeowners, engineers, builders, and government officials in high-risk areas. Build Change also supports efforts to permanently change housing policies, building codes and construction practices in high-risk areas. It currently works in Indonesia, Micronesia, the Philippines, Nepal, Haiti, Colombia, St. Maarten, Dominica, Puerto Rico and Guatemala. By 2024, Build Change plans to help 10 million people live and learn in greater safety.

Investment rationale

Autodesk Foundation invested in Build Change not only to support investments in resilient housing but also to provide high value technical enhancements to their workflows.

Tech-based solutions have enabled Build Change to deliver on its mission at scale. Technology has helped more effectively conduct structural assessments, building models, as compared to hand drawings and other manual processes used previously.

The use of digital models that can easily be modified and shared has also improved workflows and facilitated collaboration among co-workers and with external partners, including local municipal agencies. Currently, Build Change is at the forefront of experimenting with Autodesk tools for new workflows and they are pushing boundaries on virtual reality (VR) for construction.

“Autodesk has rolled up their sleeves to support our Pioneer Energy Investment Initiative (PEII) investee companies scale their businesses. From training staff at Autodesk University to offering our entrepreneurs support iterating on their product design, Autodesk has been a true partner with Acumen in growing the next wave of energy access companies.”

– Leslie Labruto, Head of Global Energy, Acumen



Image credit: Acumen

Case study: Acumen

Impact objective

Changing the way the world tackles poverty by investing in sustainable solutions

Acumen is a global nonprofit investing in sustainable solutions in agriculture, education, energy, financial inclusion, health, and workforce development. During the last decade, Acumen invested \$26.4 million to address energy poverty, building the largest portfolio of energy companies serving the poor. This has enabled 24 early-stage companies to provide 109.5 million people with high-quality, affordable light, power, and improved cookstoves. Autodesk Foundation is a partner to Acumen in its Pioneer Energy Investment Initiative (PEII), which focuses on early stage companies innovating solar home systems, solar and hybrid mini-grids, and productivity-enhancing applications in new markets in East and West Africa, Latin America, and South Asia.

Investment rationale

Acumen understands technology solutions that offer the potential to transform people’s lives and leapfrog traditional energy infrastructure in

developing regions. It also has firsthand experience with approaches that have worked and those which have failed. In addition, to learning from Acumen’s deep knowledge about the interconnection between poverty and lack of access to energy, Autodesk Foundation invested in Acumen to build a quality pipelines of innovators in this space. The partnerships has augmented our due diligence, and aligned our funding with that of like-minded climate investors and philanthropists.

One of the key challenges for product-based startups is the lack of deep technical expertise. Products that come to market aren’t always customer-centric and hence, don’t get to scale. Working with Acumen pipeline companies has helped us share our core strengths in design, manufacturing, and automation to help companies deepen technical capacity at a moment when the sector is poised for commercial-scale investment.

A satellite view of Earth from space, showing the Americas and surrounding oceans. The image is dominated by white clouds and blue oceans, with the brown and green landmasses of North and South America visible. The Earth's curvature is visible on the left side. An orange rectangular box is overlaid on the right side of the image.

Way
forward

How we think about impact

Since 2018, we have invested over \$5 million in grants and direct investments and \$5 million in in-kind support and other resources to help 22 organizations increase the resilience of vulnerable populations.

These 22 organizations have reached over 20 million individuals since 2018. This metric is an indicator of the reach and scale of the solutions we have supported. However, it does not directly answer whether individuals or communities are more resilient in the face of climate change. In order to understand how our portfolio is contributing to this impact objective, we need to refer back to our investment thesis and examine the outcomes directly against what we set out to achieve.

As we stated in our investment thesis, we believe resilience is built through improving economic livelihood while bolstering community infrastructure in low resource settings. Impacting economic livelihood means increasing incomes for individuals and households living in poverty, primarily through the agriculture value chain. Impacting community infrastructure means improving the housing, energy, water, and sanitation status quo in climate

vulnerable regions. What this impact looks like on the ground can take multiple forms, including technology innovations and business models that ensure access, choice, and affordability for people who need better products

and services to meet their basic needs. The following table shows details for each of the sectors we work in, demonstrating the specific metrics that we believe contribute to impact on resilience.



Image credit: Build Change

Opportunity area	Action	# Metric	Impact
 Agriculture	Fund product development, customer engagement and sales/ distribution of tools and technology for farm use and ag supply chain	#product sales #farmers and beneficiaries reached #change in rural household incomes	Farm households have improved and achieved stable incomes Post-harvest loss is reduced Farmers have more knowledge, tools and data to cope with climate change
 Water and sanitation	Invest in affordable, accessible, locally adapted water and sanitation products Fund emerging technologies (IoT, robotics, AI) that improve the efficacy of solutions Support technical capacity of organizations	#people and households reached #new technologies adopted #people trained	Improved water and sanitation access in targeted communities Knowledge transfer Increased capacity of local communities to operate and maintain infrastructure
 Housing and infrastructure	Fund Innovations in building materials, construction tech, and financial access	#houses built or retrofitted #households touched #people trained #workers employed	Make safer and more robust housing, health facilities, and public infrastructure to withstand extreme weather Develop local talent and grow the skilled workforce serving the built environment
 Energy access	Fund product development, customer engagement and sales/ distribution of energy products and solutions to power households and businesses	#products sold #customers - household #customers - businesses	Increase accessibility and affordability of access to energy for bottom of the pyramid (BoP) customers Decrease the reliance of low resource communities on energy and fuel sources such as diesel, charcoal, and biomass

In conclusion

The battle against climate change is being waged on the front lines of communities in the poorest parts of the world. In order to be resilient, these communities must adapt, particularly in the systems that meet basic human needs and build a foundation for secure livelihoods. While the global development field comprising government, NGOs, and philanthropy has been tackling challenges of poverty, education, and health for decades, there is no coordinated effort to link these objectives to building climate resilience. There is a lot of work ahead to connect the dots between global development and climate change adaptation. We will continue to be a voice on climate resilience and prioritizing the Global South.

Lessons learned

We have learned several key lessons that continue to guide our work. These lessons cut across our entire portfolio and speak to our defining characteristics as a philanthropy—but they are particularly germane to how we support resilient communities:

Understanding the role of technology

Technology-driven innovation is a vital part of adaptation solutions. It needs to be paired with human-centered approaches and matched with capacity and expertise to drive adoption at scale.

Beyond funding

We utilize the platform, technology, and resources of our corporate parent strategically to advance our work across the entire portfolio. When it comes to resilience in low resource communities, our expertise in early-stage technology innovation and venture philanthropy uniquely positions us to support tech-enabled solutions and to build technical capacity where it's lacking.

Funding intermediaries and enablers

Stand-alone enterprises do not have a good shot at success without a developed ecosystem from which to launch. In addition to funding direct service organizations and B2C companies, we believe it's essential to support incubators, funds that create the operating environment. We also invest in emerging technologies that increase the impact of end-user solutions by enabling adoption, scale, and accessibility.

Next steps

In the last five years, we have evolved our thinking on how to evaluate the impact of our portfolio. Rather than only considering impact at the end, we define the problem we are trying to solve at the outset of a partnership. This is essential to identifying right types of solutions and outcomes we want to catalyze in the world. Only when we have a clear understanding of the solutions and outcomes can we then measure the impact that matters.

Looking ahead, our resilience work will be driven by a commitment to communities at the frontlines. Our impact evaluation strategy will be focused on strengthening the connection between economic and infrastructure resilience. We will continue to test different hypotheses, derive market-based intelligence, and iterate on our approach.

We will strive for cross-sector collaboration to push forward systemic change to drive toward a shared vision of impact.

We invite you to join us. Contact us at info@autodesk.org



Appendix



Image credit: KickStart International

Additional resources

There is a well-established body of scientific knowledge on the causes and effects of climate change, as well as the new financing mechanisms needed to support climate innovation. We have included a selection of resources undertaken by reputable public sector research bodies below.

- UNFCCC's [What do adaptation to climate change and climate resilience mean?](#)
- World Resources Institute on [Climate Resilience](#)
- NRDC on [Climate Resilience](#)
- UCSUSA's [Climate Resilience Framework and Principles](#)
- The Lancet Countdown: [Tracking Progress on Health and Climate Change](#)

A note of thanks

Thank you to several organizations who provided key insights and critical thinking that made this impact brief possible, including Acumen, and Build Change.