



GOSH

Gathering for Open
Science Hardware

COMMUNITY AMBASSADOR HANDBOOK



Contents

4

Welcome



5

Why an Ambassador Handbook?

6

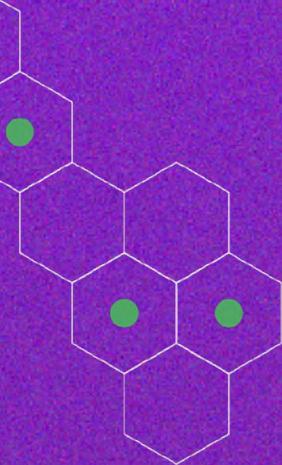
How the Handbook Works



7

What is GOSH?

>>> >>>



08

What is Open Science Hardware?

10

Examples of Open Science Hardware Projects

23

Resources

14

The Open Source Future

16

The Ambassadorship Journey

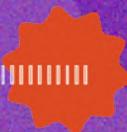
20

Communicating GOSH

25

Final Thoughts

0010001110001 1111111111



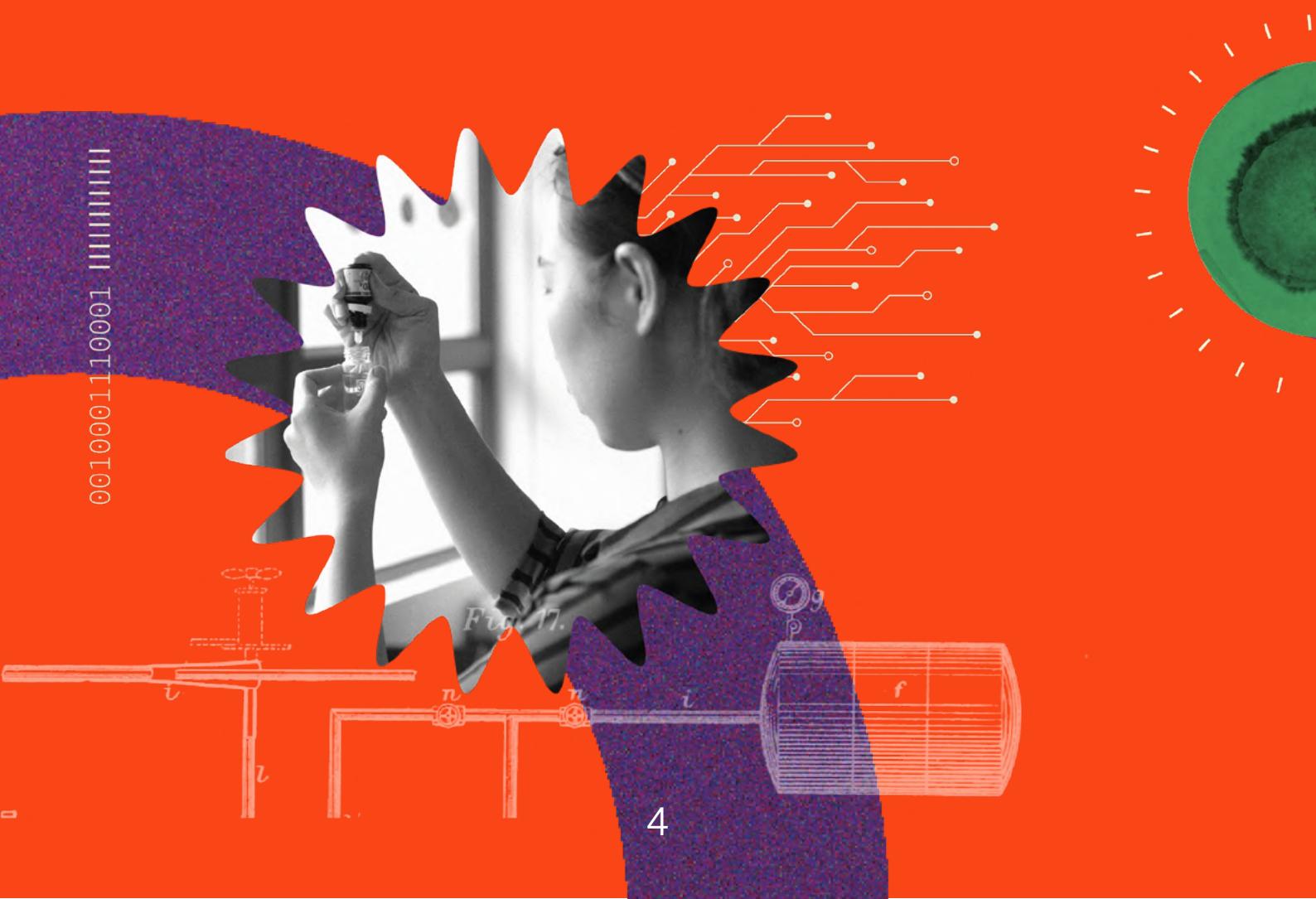
0010001110001





Welcome

Welcome to the Gathering for Open Science Hardware (GOSH) Community Ambassador Handbook. This booklet describes how community ambassadors can and should represent GOSH. This handbook was put together over the 2023 - 2024 calendar year thanks to the hard work of the GOSH community. Please refer to this Handbook when acting as an ambassador of the GOSH Community. We intend for this guide to assist not only those who are part of the GOSH ambassador program, but anyone who wishes to bring open science hardware and its applications into their organisations and communities. Together, we can make open science hardware ubiquitous!





00100001110001 |||||

Why an Ambassador Handbook?

As the first resource for our ambassadors to set the tone and represent GOSH around the world, this booklet is meant to help us attain our goals. As a community of different actors, stakeholders and professionals, GOSH tries to reach as many people as possible. Because we cast a wide net, it is important to confirm we are all on the same page about our goals and mission. By highlighting our community's needs in this document, we can attract ambassadors who are aligned with our principles and actions.



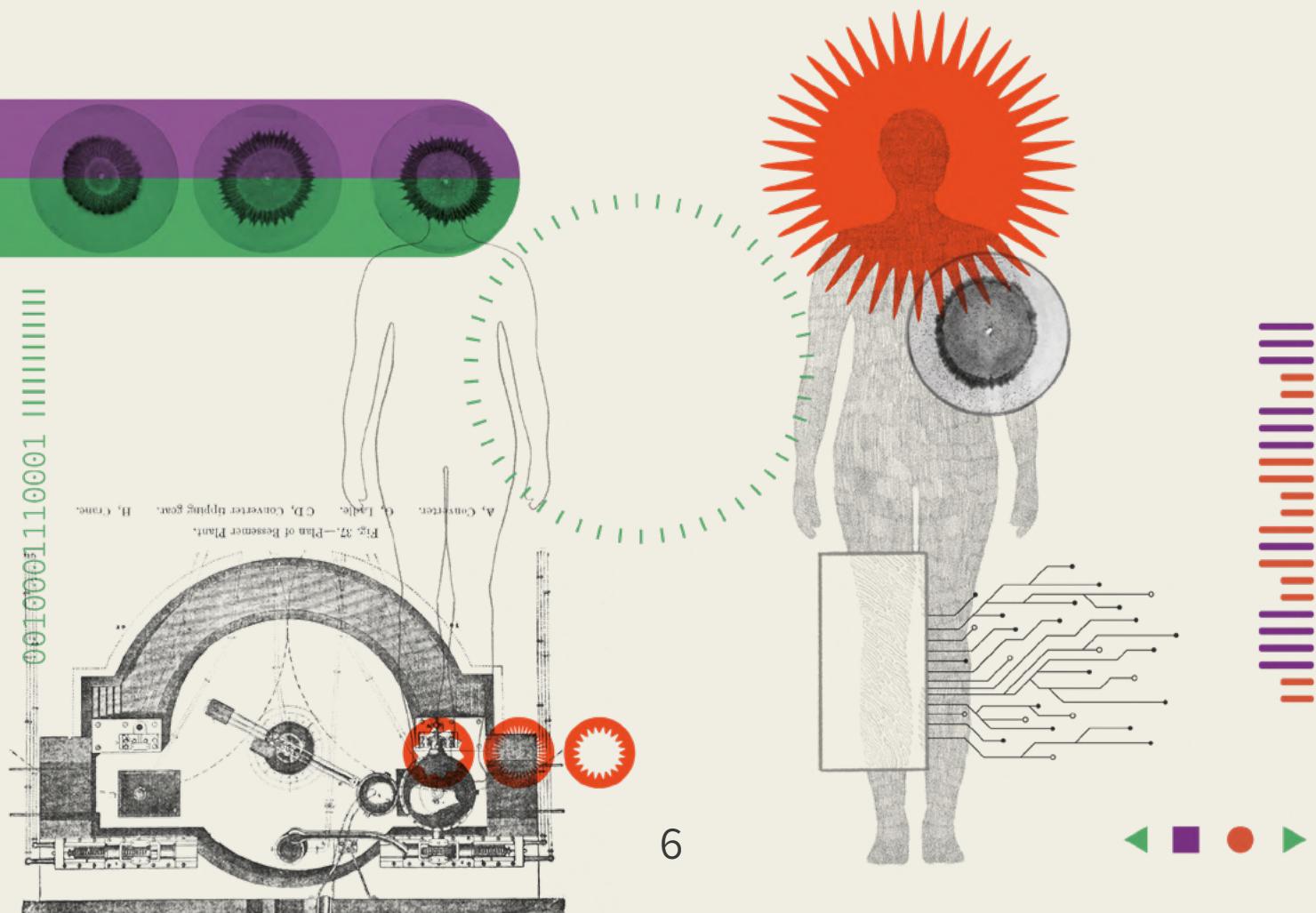


How the Handbook Works

This handbook provides a step-by-step guide on how anyone can become an ambassador. It includes an introduction to the GOSH community, and a brief introduction to terms like "open source" and "open science".

Later in the book, we will highlight GOSH initiatives and examples of workshops, projects, and events that the organisation hosts with other groups and communities.

Through the handbook, anyone interested in open science hardware can learn how to become an ambassador with GOSH and what that means for them and their community.





00100001110001 |||||

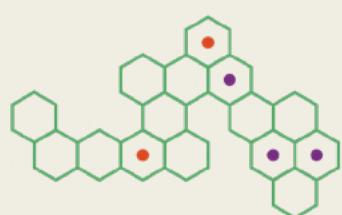
What is GOSH?

GOSH, or the Gathering for Open Science Hardware, is a community of scientists, innovators, and educators who are dedicated to supporting an open source future, specifically a world where open science hardware is the norm. The global open science hardware community supports open science hardware by convening meetings such as the Gathering for Open Science Hardware (GOSH), publications, activities and providing a forum for the community.

A hallmark of GOSH is our Global Gatherings held around the world. In 2016, we convened 60 members of the open science hardware community at CERN in Geneva, highlighting commonalities in approach and leading to the publication of the GOSH Manifesto. During GOSH 2017 in Santiago, Chile, the community was cemented together. By creating a [Roadmap](#), we united researchers and advocates globally behind our goal to make open science hardware ubiquitous by 2025. At GOSH 2018 in Shenzhen, China, the community pledged over 150 actions focused on pursuing our shared goals and vision of open scientific technologies. The most recent Gathering took place in 2022, in Panama City, where we celebrated what we've achieved so far and set new goals for making open science hardware ubiquitous.

As an organisation dedicated to an open source society, the GOSH spirit values ideals of equity, democracy, and open access for all. The global open science hardware movement seeks to reduce barriers between diverse creators and users of scientific tools and support the pursuit and growth of knowledge. By developing this ambassador program, we hope to attract people from all walks of life who believe in our mission.

TO READ THE GOSH MANIFESTO, [click here](#).





What is Open Science Hardware?

Empowerment of individuals is a key part of what makes open source work, since in the end, innovations tend to come from small groups, not from large, structured efforts.

Tim O'Reilly

Open-source hardware or **open-science hardware** are used interchangeably but are different in many ways.

"Open source hardware" refers to a category of technology that is free to use, change, distribute and innovate.

"Open science hardware" is a specific subset of open source hardware that deals specifically with publicly accessible scientific tools.





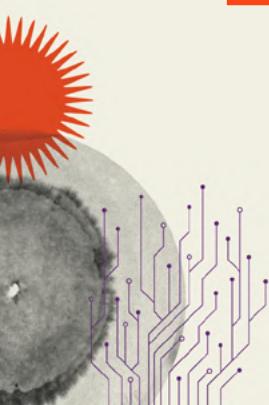
"Open source" is a counterpart to "proprietary" or "closed source". Closed source technology is highly guarded. Only the owners of the technology's patent have the legal right to access that technology. Much of our technology today is closed and owned by individuals and corporations. Technology that is closed source cannot be legally altered or copied, and the user pays only to use the technology as it is intended—they cannot modify it for new uses nor share it with their communities.

At GOSH, we specifically deal with **open science hardware**. Science hardware encompasses the tools and machinery we use for scientific endeavours (for example, a microscope or environmental sensor). Open science hardware refers to science hardware that is open source – or free

of proprietary ownership. Open science hardware is a subset of "open source hardware"—you could technically call it "open source hardware for science", but that is not catchy.

It is important to consider the open science hardware movement within the larger open source movement and part of a larger alternative practice known as a '[return to the commons](#)'. A political and economic principle, a return to the commons calls for an end to the private acquisition of societally beneficial properties like water, land, food, and scientific tools. The practice aims to decommodify societal necessities for the betterment of those in need. The 'Return to the Commons' movement aligns with GOSH's ideals of community, equity, and democracy, and we hope to work with the larger community to improve the practice.

A political and economic principle, a return to the commons calls for an end to the private acquisition of societally beneficial properties like water, land, food, and scientific tools. The practice aims to decommodify societal necessities for the betterment of those in need.





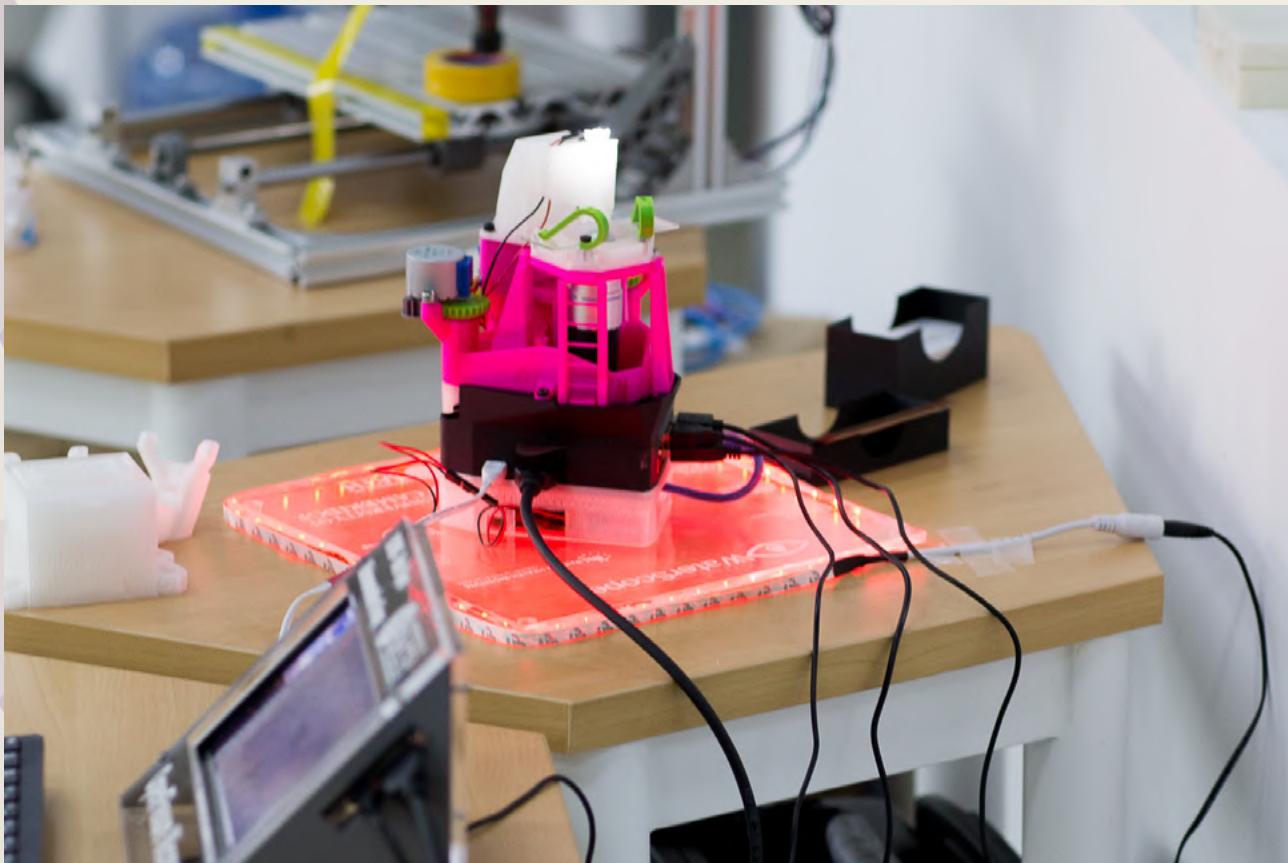
Examples of Open Science Hardware Projects

THE WHITE RABBIT PROJECT

[The White Rabbit](#) is a technology developed by CERN (European Centre for Nuclear Research) to provide accuracy and precision of synchronisation for the Large Hadron Collider particle accelerator. The creation of this technology led to one of the first licenses for open science hardware anywhere. First used in 2012, the technology has since expanded its applications outside the field of particle physics and is now deployed in numerous scientific infrastructures worldwide. The R&D process and all the knowledge gained throughout its development have been made available [through CERN's Open Hardware Repository](#).

Part of a tube of an accelerator of CERN with the CERN logo, CC BY 2.0 DEED, source:
[https://commons.wikimedia.org/wiki/File:CERN_\(7825770258\).jpg](https://commons.wikimedia.org/wiki/File:CERN_(7825770258).jpg)



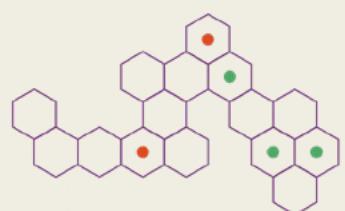


OpenFlexure Microscopes at GOSH 2018, Public Domain, source:

<https://www.flickr.com/photos/goshcommunity/43574896230/in/album-72157674579730208/>

OPENFLEXURE MICROSCOPE

The [OpenFlexure Microscope](#) is a flagship project in the open science hardware community due to its ability to be constantly evolved and built upon. The OpenFlexure Microscope is a customisable, open source optical microscope, using either very cheap webcam optics or lab quality. It's quite customisable and modular, is entirely 3D printed and has a sliding stage. It's an incredibly useful tool in places where access to expensive diagnostic equipment is limited. The majority of the expense is in the Raspberry Pi and its camera module; the design requires only around 200g of plastic and a few nuts, bolts and other parts.





0010001110001 |||||

OPEN SOURCE INCUBATOR

Mboalab in Cameroon created this [open-source incubator](#). Most biology labs in Cameroon and elsewhere in resource-constrained contexts are under-equipped due to the high cost of lab equipment, and many protocols, including open enzyme manufacturing, need to have optimal growth temperatures for important microorganisms such as E. coli bacteria.

Open source and low-cost incubator, source: <https://github.com/FOSH-following-demand/Incubator>

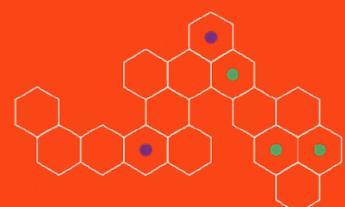




Image of the NinjaPCR, Source: <https://najapcr.tori.st/en/index.html>

NINJA PCR

A low-cost diagnostic tool, the Ninja PCR from Japan can run a real-time Polymerase Chain Reaction (PCR) and costs just 300 USD, while closed source versions start at \$5000 USD. PCR tests are diagnostic tools significant when trying to diagnose COVID-19 or even HIV. The console also works on web browsers on smartphones, tablets, and PCs.





The Open Source Future

GOSH aims to make open science hardware ubiquitous worldwide by 2025. These large ambitions are driven by our hope for a better world through open source. The benefits of open source can change people's lives for the better, and include lower costs, learning & community-building.





COST:

The cost of a good is defined by its supply and demand, but with closed source technology, only a select few can produce and distribute these tools to the wider society. The constraint on supply increases the costs for scientists, researchers, and communities across the world.

In an open source future, open science hardware will be available to the wider society. Owners of proprietary technology will open their patents to new manufacturers who can increase supply so that everyone can use technology affordably.

LEARNING:

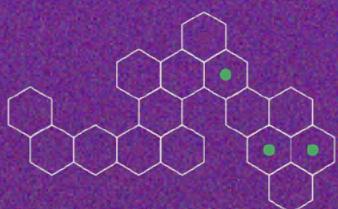
One of the best learning methods involves taking things apart and putting them back together, known as reverse engineering. New learning models like makerspaces are already trying to improve learning outcomes by using reverse engineering in their lesson plans. Proprietary scientific tools often come with clauses that prohibit users from taking apart or even repairing equipment. A famous case involves American farmers, farming tool monopoly John Deere, and the Right to Repair movement.

In an open source future, all scientific tools could be taken apart and learned from. This hands-on experience is important to build lessons on understanding concepts and engineering through experimentation.

COMMUNITY-BUILDING:

When technology is in the hands of a select few, then it is only those few who are empowered. Not only is this a model opposed to innovation, but it destroys communities by making them dependent on the private holders of technology.

In an open-source future, any community can access whatever resources they require according to their will. Because community groups are free to build, their creations will be relevant to their organisations and facilitate local problem-solving.





The Ambassadorship Journey

Now that you know more about who we are and what we are working toward, it is time to get into the ambassadorship journey. Joining GOSH and networking with our community requires specific kinds of people who are critical thinkers, good advocates and strong believers in our mission. This part of the handbook will highlight what an ambassador is, why you should become one, and how you can do so:

THE TWO ROLES OF AN AMBASSADOR

The number one role of a GOSH ambassador is to be an **advocate** for both our community and their own. What is the role of an advocate?

The role of an advocate is to offer independent support to those who feel they are not being heard and to ensure their rights are respected. Below is a list of qualities that are important but not exhaustive for advocates to have:

Advocates' idea of success doesn't come from money or status but from seeking fulfilment, helping others, and being a force for good in the world.

Advocates see helping others as their mission in life, and they look for ways to step in and speak up for what is right, especially in their field of interest.

Advocates aspire to fix society's deeper problems, hoping that unfairness and hardship will become the past.

Advocates value deep, authentic relationships with others and aim to expand their networks of ideas and people so that they can grow together.



As an ambassador, you do not need to be the most knowledgeable about open science hardware or even the most outspoken. As an advocate, you simply need to stand up for our common values.

The second role of an ambassador is as a **networker**.

The role of a **networker** is to form contacts & connections through meetings and interactions. These can be formal, like at university or work, but they can also be informal amongst friends and family. This is a list of qualities that are important but not exhaustive for networkers to have:

Networkers value holding their families and their communities together.

Networkers act like axons in the brain, connecting different regions together to share knowledge and create cross-community solidarity.

Networkers are happy to host others by putting individuals in contact with other specific people working on similar issues so they can help each other.

As a networker, you do not need to know everybody or constantly correspond with multiple people. As a networker, you simply need to be able to introduce like-minded groups to each other and facilitate sharing between communities.



AMBASSADORS BRING COMMUNITIES TOGETHER

You may be ready to take on the two roles of an ambassador, but is being a GOSH ambassador right for you? To answer that, you should ask yourself several questions:

WHAT COMMUNITY OR COMMUNITIES DO YOU BELONG TO?

As an ambassador, your role would be to connect GOSH to other community groups and organisations like local schools, maker spaces or nonprofits. Everyone belongs to a community, whether it is your family, friends, university, or neighbourhood. Look for organisations and groups inside your community and get to know them. Understanding your community is the first step towards becoming a GOSH ambassador.



WHAT ISSUES DOES YOUR COMMUNITY TACKLE?

Figuring out what issues are important to your community can help you decide whether being a GOSH ambassador is right for you. Sometimes, communities deal with issues related to civic rights, human health, or biodiversity. When taking on initiatives in your community, there will be problems. Scientific researchers may run out of funding for experiments, so the community may have a funding problem. Education groups may not understand how to support makerspaces, meaning knowledge mobilisation is the big issue. Assess the situation in your community and what problems require solutions.

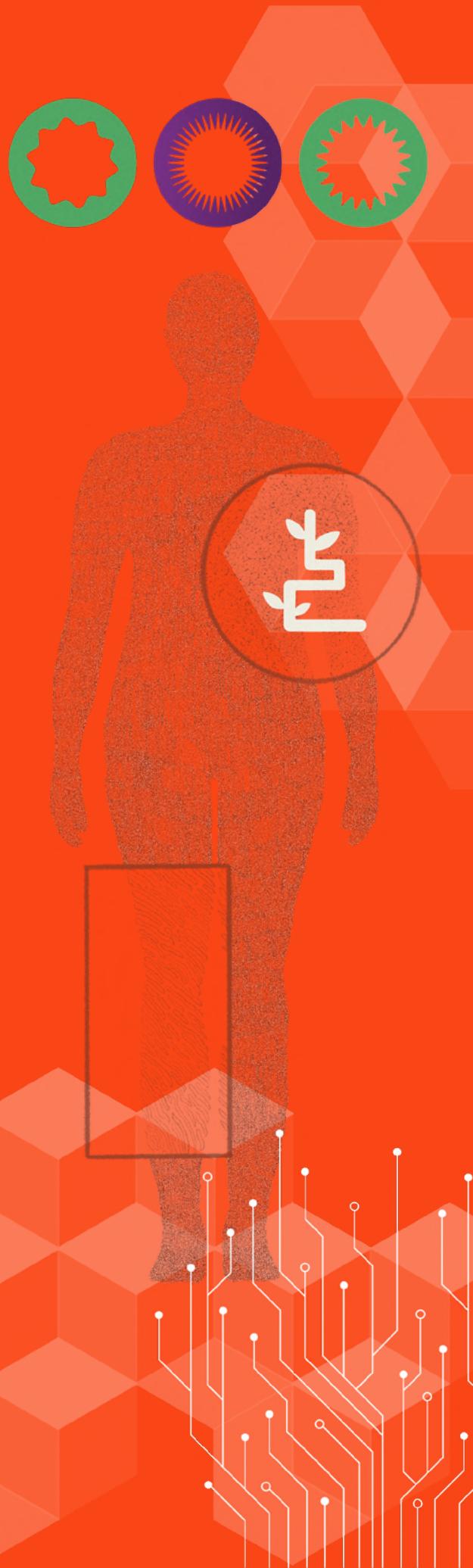


CAN OPEN SCIENCE HARDWARE BE A SOLUTION

Once you know the specific problems your community is dealing with, ask yourself whether open science hardware can help solve that issue. For many in the science and education space, open science hardware can be a no-brain solution, but you may be surprised how useful it can be. Maybe you are a community of bikers who want to fix their electric bicycles or a cooperative that wants to understand how to access building fixtures without having to call maintenance workers. You can be surprised how open science hardware can fit into any solution. Ask yourself how having access to hardware can alleviate your community problem.

If you went through these questions and believe GOSH is a perfect partner for your community, then it is time to contact the [GOSH Ambassador Program Working Group \(WG\)](#). If you are still trying to figure out any of these questions, it is still worth contacting GOSH, and we can work towards finding out if the ambassadorship is suitable for you.

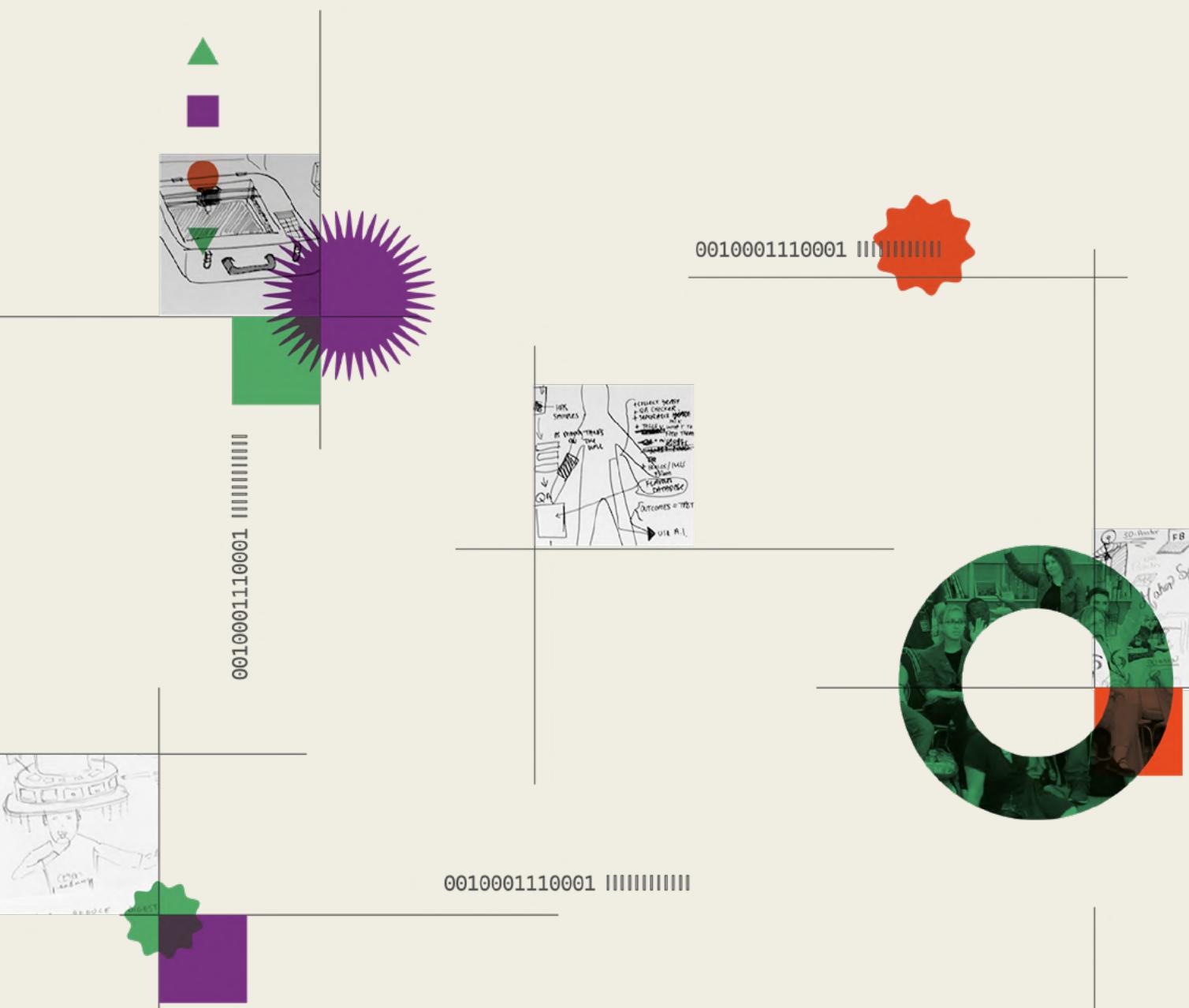
After remaining in the program for Attend Organise workshops with local community members when requested by institutions not connected to GOSH.





Communicating GOSH

Speaking about GOSH to other groups can be difficult. As an ambassador, you must communicate GOSH's mission, goals, and methods to audiences who may know little about open science hardware or open source. Here are a few exercises that highlight how to best communicate to others what GOSH is all about and how networking with us can help your communities:





SPEAKING TO COMMUNITY/ NON-PROFIT GROUPS:

Community & nonprofit groups are organisations that work directly with clients in their respective areas to further social goals. Communicating with these organisations should centre around how scientific tools can cut operational costs and help empower clients.

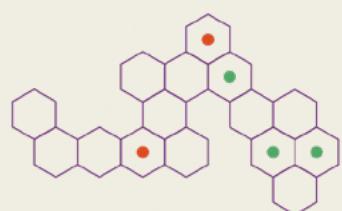
Ambassadors should focus on the well-being of people and suggest open science hardware or knowledge sharing as possible solutions. When approaching one of these groups, concentrate on specific social problems that community groups/non-profits face, like food insecurity, digital gap or health inequalities. Listen carefully to representatives speak on their particular issues and how they want to address the problem, and after that, propose how open science knowledge sharing could help improve outcomes for their clients.

For example, a community health centre may have issues diagnosing COVID-19 in their community. As an ambassador, you can offer to help them understand and build relationships to build a Ninja PCR.

SPEAKING WITH YOUTH MAKERSPACES/SCHOOLS:

The rise of STEM & STEAM education is trying to bring scientific education closer to youth from ages as young as three years old. Whether you are an ambassador speaking directly to youth or their representatives, you need to speak their language. Most youth-based groups like schools will be interested in knowledge sharing, so it helps to offer educational workshops, lectures, and other knowledge-sharing activities. Makerspaces will have a better understanding of what they may want, making your job easier. If groups know how they want to associate with GOSH, you only need to help arrange meetings and funding for them. If groups are interested in more hands-on workshops and projects, help them select projects that are youth-focused.

For example, a 9th-grade class may be interested in creating diagnostic tools for their bicycles. As an ambassador, you can offer to help set up a workshop where students can learn how to make, use or understand such tools.





SPEAKING WITH RESEARCHERS/ UNIVERSITIES:

Communicating with researchers, universities, and institutes could be the easiest relationships to build for ambassadors.

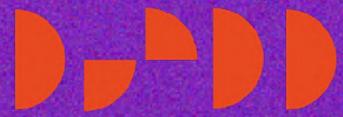
Researchers make up a big portion of the GOSH community, and they will be looking for us much of the time. When speaking to individual scientists or university administrators, speak professionally and assume they have a certain level of scientific knowledge.

Universities may be interested in general knowledge sharing and doing workshops for students or other faculty, while individual researchers may have specific open science hardware needs. If you are unsure whether GOSH can help them build whichever scientific hardware they are looking for, ask another GOSH member or suggest they visit the GOSH Forum.

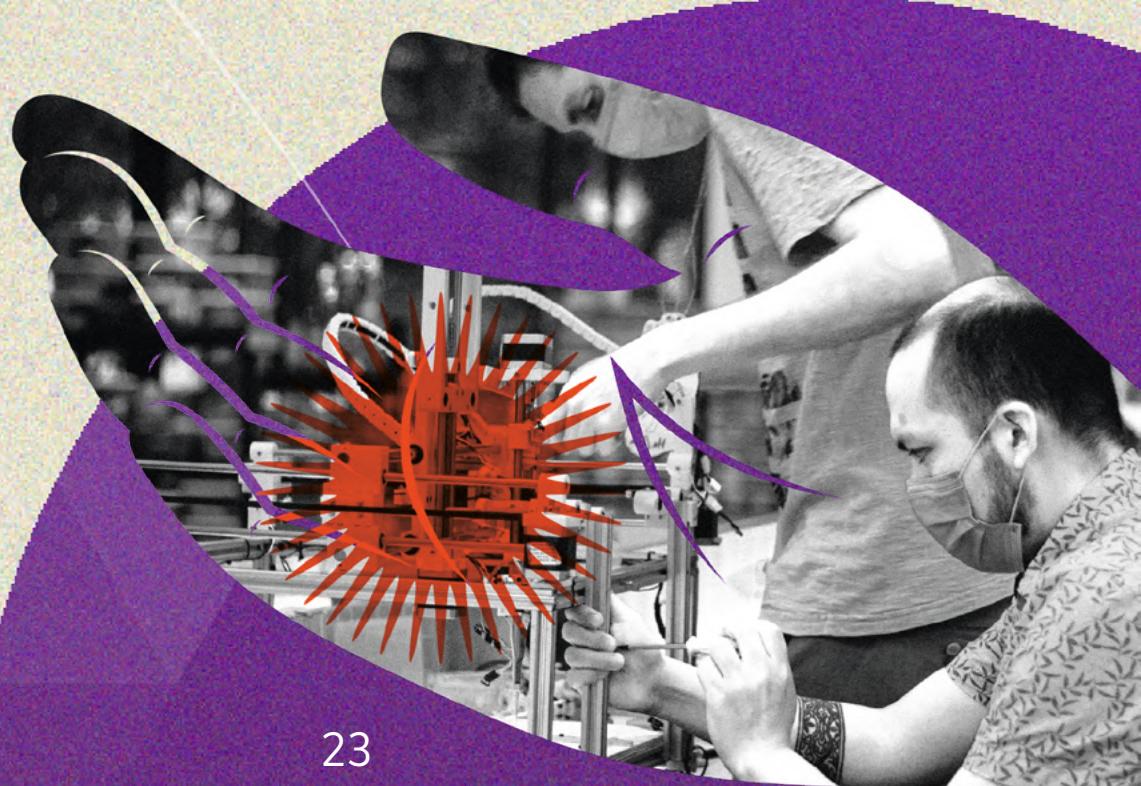
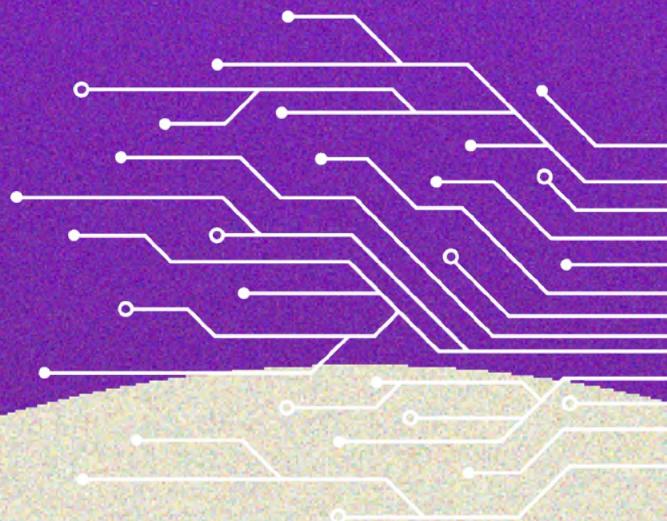
For example, a small university may want to hold a conference on the applicability of open source hardware and want GOSH to help. As an ambassador, you can help them find speakers and funding and connect them with more information on the open source movement.



Resources



Please use this list of resources to get a better picture of our community and the goals we want to achieve:



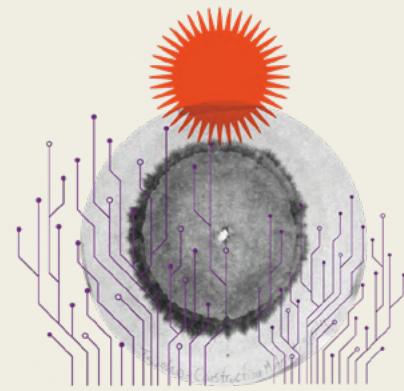


MATERIALS

[GOSH Welcome Package](#) is a webpage full of resources and links for those new to GOSH or those who want to help spread the word about open science hardware.

[GOSH Welcome Guide](#) is a two-page document highlighting key aspects of GOSH, including events, communication channels, publications, and other resources.

[List of GOSH materials](#) for advertising, including stickers, banners, and flyers.

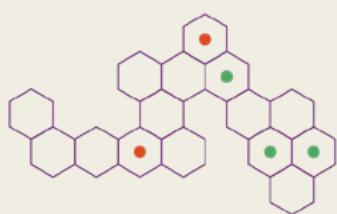


VIDEOS

These short [animated videos](#) explain open science hardware to a more general audience.

[GOSH 2022 documentary videos](#) showcase the event and explain what open science hardware is.

[GOSH 2018 video](#) explaining GOSH and open science hardware.



PRESENTATIONS

[Slides](#) that you can use in your next presentation on GOSH/open science hardware



CALLS TO ACTION

Sign [the manifesto](#) to help make open science hardware ubiquitous.

Sign up for the [GOSH newsletter](#) to receive the latest open science hardware news.

Sign up for the [GOSH Forum](#), the virtual convening place for GOSHers all over the world.



Final Thoughts

We at GOSH want to welcome everyone and anyone interested in an open source future to join our ambassador program and help bring about a more equitable, collaborative and understanding society. We especially encourage people from the Global South and marginalised communities to join us and have their voices included.

We want to thank all those who have helped make this handbook happen, and the many members who worked together to bring shape to our ambassador program.

SOURCES

This handbook is the result of discussions that took place during online workshops organised by the Gathering for Open Science Hardware community in April and May 2023. The session gathered 11 key participants to develop the handbook.



0010001110001 1111111111



PARTICIPANTS

Darin Lobo, Independent

Fernando Daguanno, Founder, Alquimétricos

Jason Whitson, Senior Maker, Blue Box Labs; Major Burnable Sculpture Build Team & Regional Pyrotechnics Technician team, SOAK - Portland Burning Man Regional

Juan P. Maestre, Research Scientist, University of Texas at Austin.

Marcela Basch, Nexialist, El Plan C, LAIA - Laboratorio Abierto de Inteligencia Artificial

Pablo Cremades, Researcher, Maker, Professor, reGOSH and Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Cuyo

Rachel Aronoff, Ph.D., Chief Scientific Officer, Action for Genomic Integrity through Research! (AGiR!); President & Biosafety Officer, Hackuarium

Toko Koutogui Abdoul Kafid, Africa Liaison, GOSH; Project Manager Assistant School of Collective Intelligence - UM6P & Founder of Africitizen

In addition to the workshop participants, members of the GOSH Ambassador Program Working Group (WG) helped develop and write the ambassador program framework. These WG members are listed below.

GOSH Ambassador Program Working Group (WG)

Brianna Johns, Community Coordinator, Gathering for Open Science Hardware (GOSH) Community

Jason Whitson, Senior Maker, Blue Box Labs; Major Burnable Sculpture Build Team & Regional Pyrotechnics Technician team, SOAK - Portland Burning Man Regional

Juan P. Maestre, Research Scientist, University of Texas at Austin.

Maria Castelló, Associate Professor of Research (IIBCE), Researcher Grade 4 (PEDECIBA), Founder (ANT, ANT4Kids and Fibras), Ideologist and Member Strategic Planning Steering Committee (LATBrain Initiative), Montevideo Uruguay

Pablo Cremades, Researcher, Maker, Professor, reGOSH and Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Cuyo

Salman Faris, MakerGram

Tapas Kumar Mohanty,. Informatics & Data Science Liaison Officer, NIHR Global Health Research Unit on Respiratory Health (RESPIRE), University of Edinburgh, UK; KEM Hospital Research Centre, Pune, India

Toko Koutogui Abdoul Kafid, Africa Liaison, GOSH; Project Manager Assistant School of Collective Intelligence - UM6P & Founder of Africitizen

Ms. Uddhavi Ajay Kand, Project Coordinator, KEM Hospital Research Centre, Pune, Maharashtra, India

Mathew Lubari, Co-Founder and Executive Director, Community Creativity for Development (CC4D)

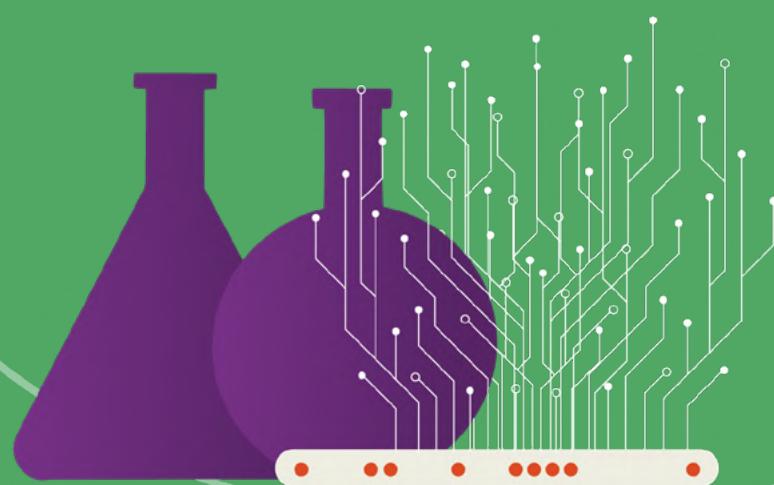
Karl Kaddu, Communications Manager, Environment for Development, University of Gothenburg

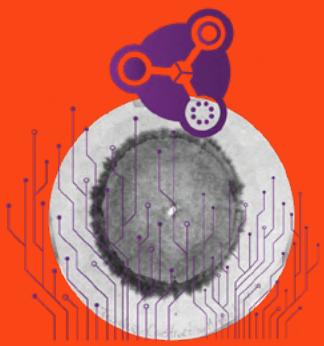


This document was written by Likam Kyanzaire with editorial support from Brianna Johns and designed by [La Propia Agencia](#). It is licensed under CC-BY 4.0.

This work was made possible by support from the Alfred P. Sloan Foundation to the Open Science Hardware Foundation.

For more information, please visit <https://openhardware.science/>





GOSH

**Gathering for Open Science
Hardware Community Ambassador
Handbook**