The State of Open Source Hardware 2021
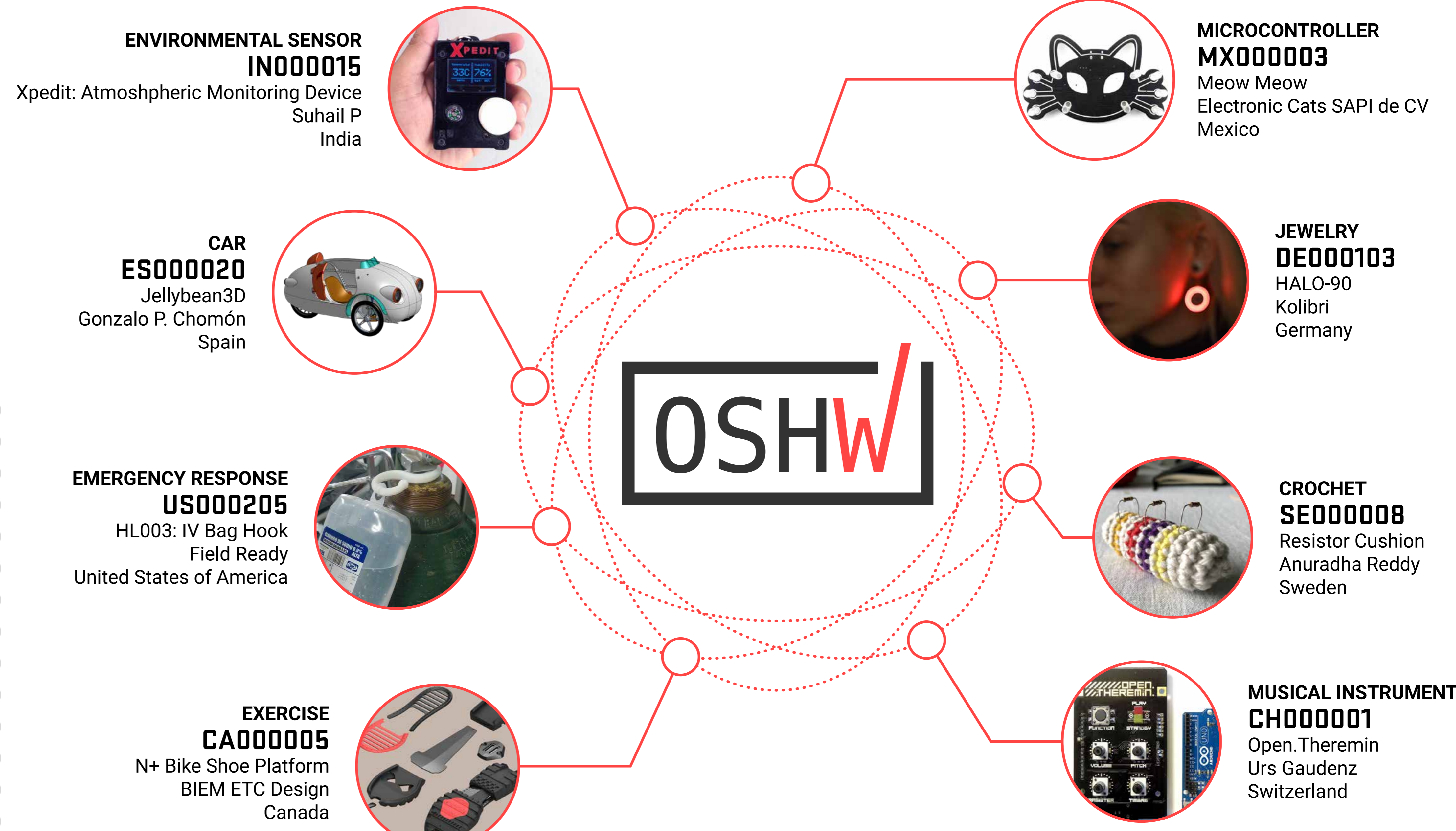
The open source hardware community has exploded into an incredibly diverse group of people working on an equally diverse set of hardware since the first Open Hardware Summit in 2010. From science researchers to musicians, from educators to designers, from multinational companies to local hackerspaces, open hardware has expanded in a multitude of directions.

This resource encourages you to step back and reflect on the growth of the community. It relies heavily on OSHWA's Open Hardware Certification Program, the annual Open Hardware Summit, and the annual Open Hardware Community Survey to understand how the open hardware community got here and where it might be headed. The Certification Program is a free way for open source hardware creators to confirm to the world that their projects comply with the community definition of open source hardware. The Open Hardware Summit is the place for the entire open hardware community to come together in order to learn, share, and grow. And the Community Survey is a snapshot of how the community has grown around open hardware. While no single resource can capture the full breadth of open hardware, we hope that everyone sees a bit of themselves here. Thank you for being part of the community.
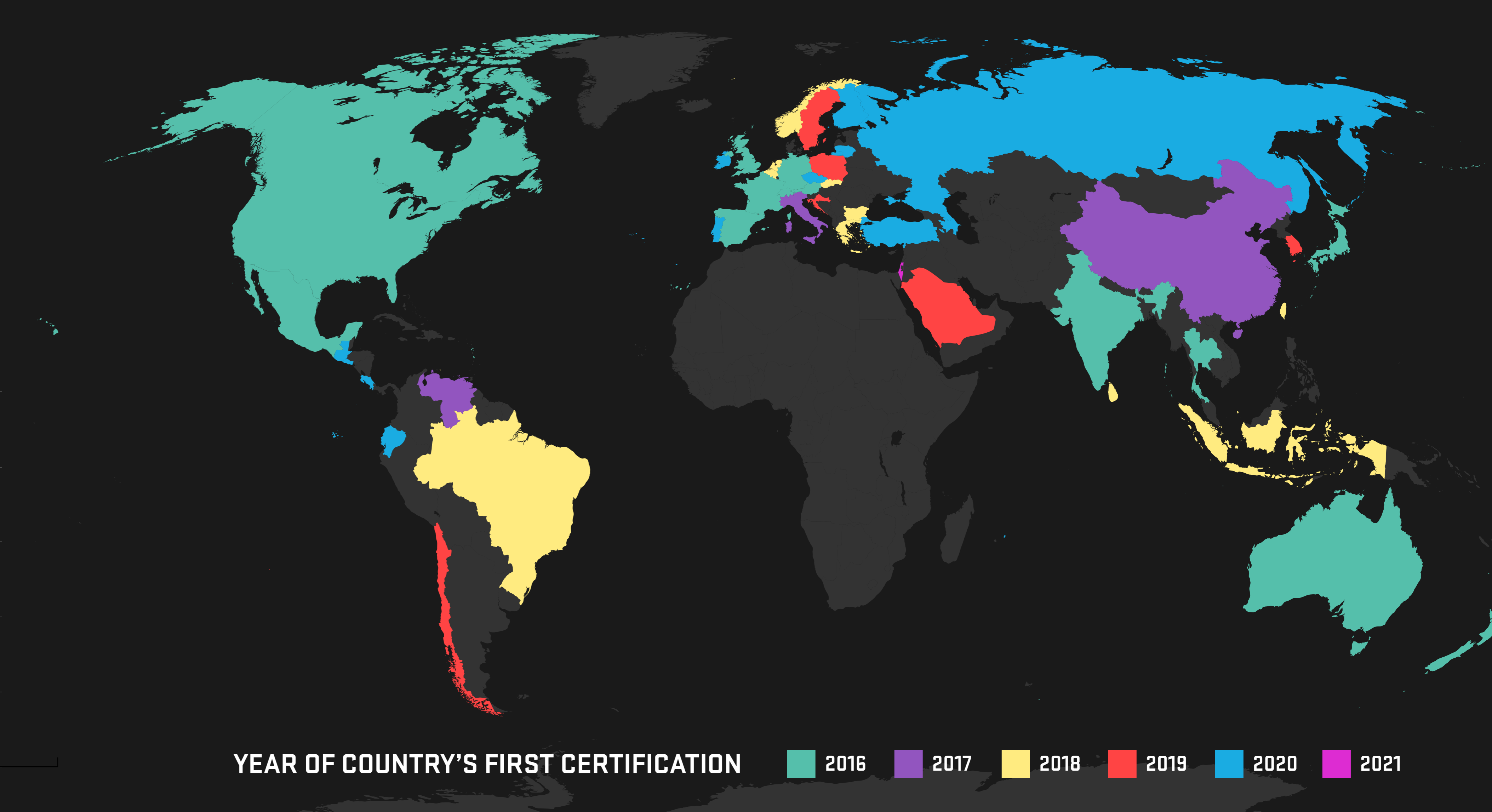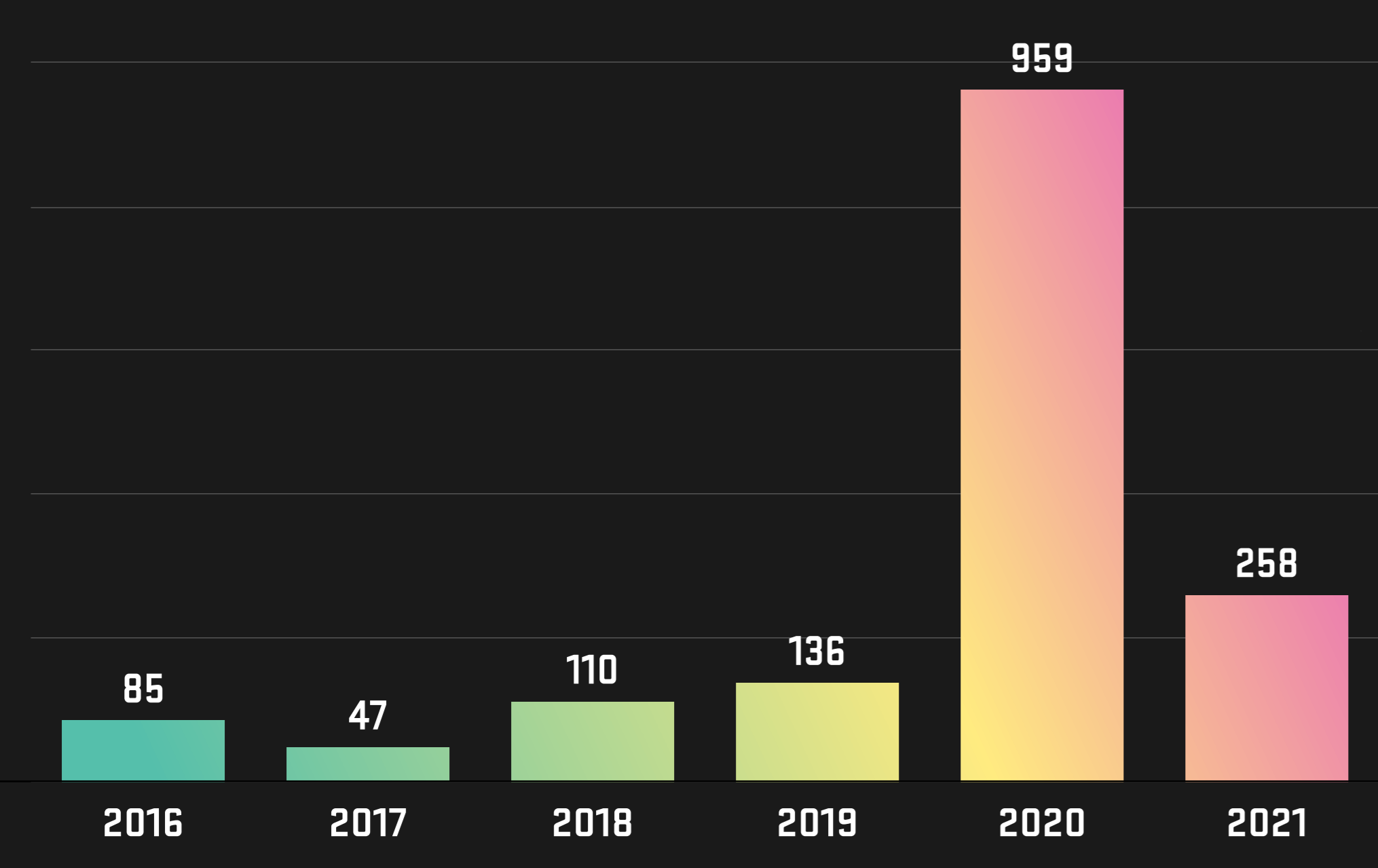
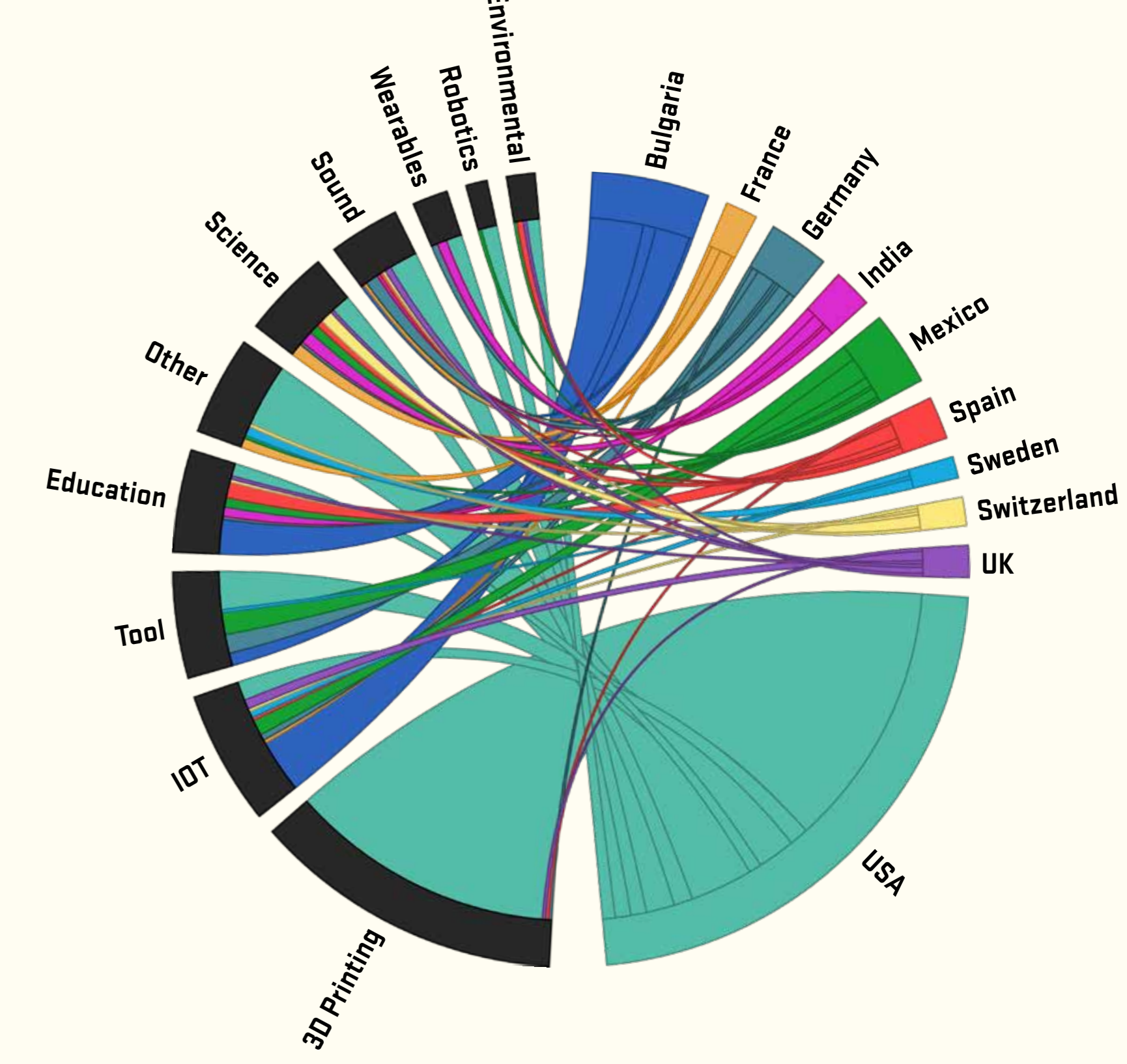## More Than Just Microcontrollers

ENVIRONMENTAL SENSOR
IN000015
Xpedit: Atmoshpheric Monitoring Device
Suhail P
India

CAR
ES000020
Jellybean3D
Gonzalo P. Chomón
Spain

EMERGENCY RESPONSE
US000205
HL003: IV Bag Hook
Field Ready
United States of America

EXERCISE
CA000005
N+ Bike Shoe Platform
BIEM ETC Design
Canada

MICROCONTROLLER
MX000003
Meow Meow
Electronic Cats SAPI de CV
Mexico

JEWELRY
DE000103
HALO-90
Kolibri
Germany

CROCHET
SE000008
Resistor Cushion
Anuradha Reddy
Sweden

MUSICAL INSTRUMENT
CH000001
Open.Theremin
Urs Gaudenz
Switzerland

OSHWI

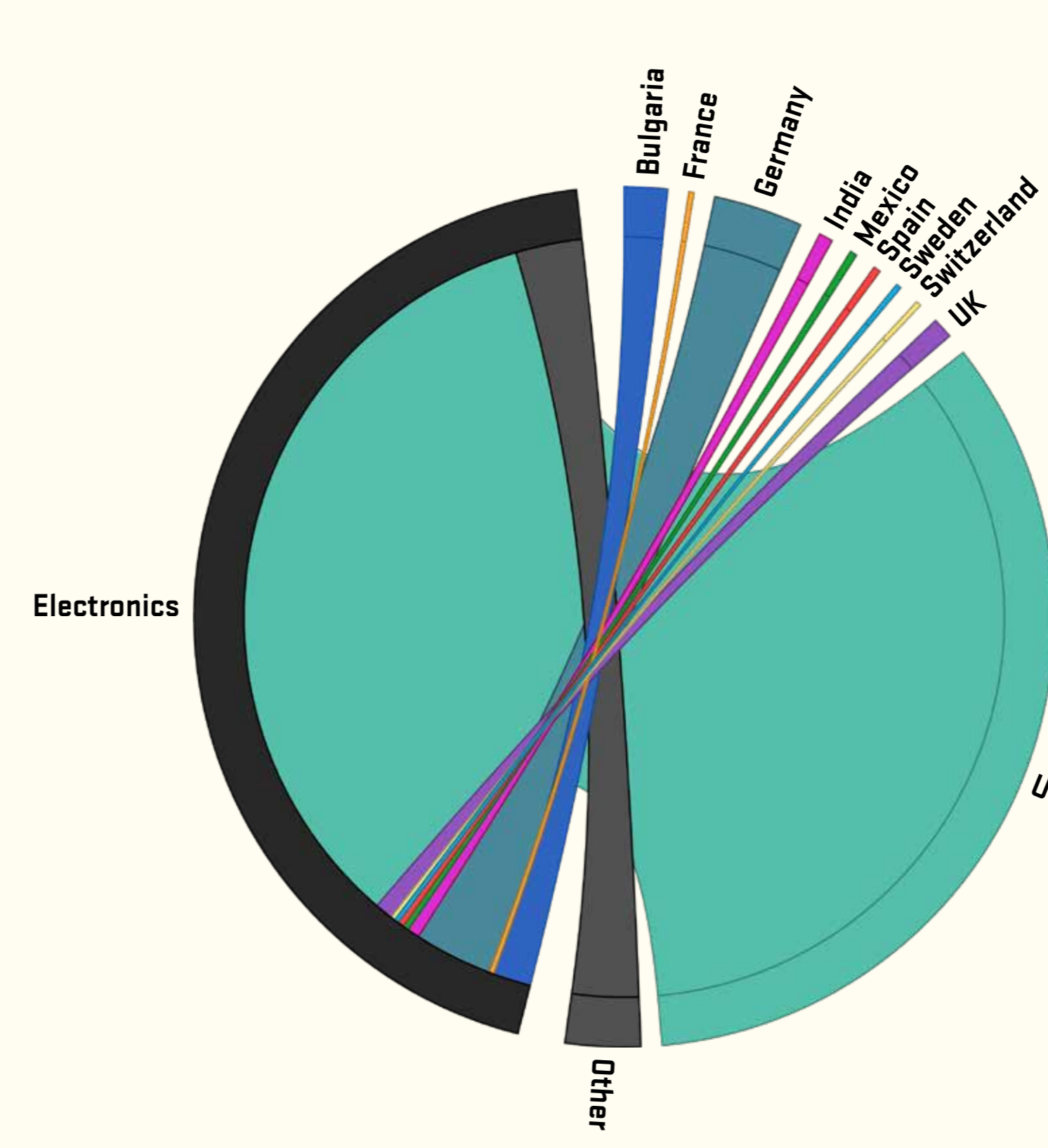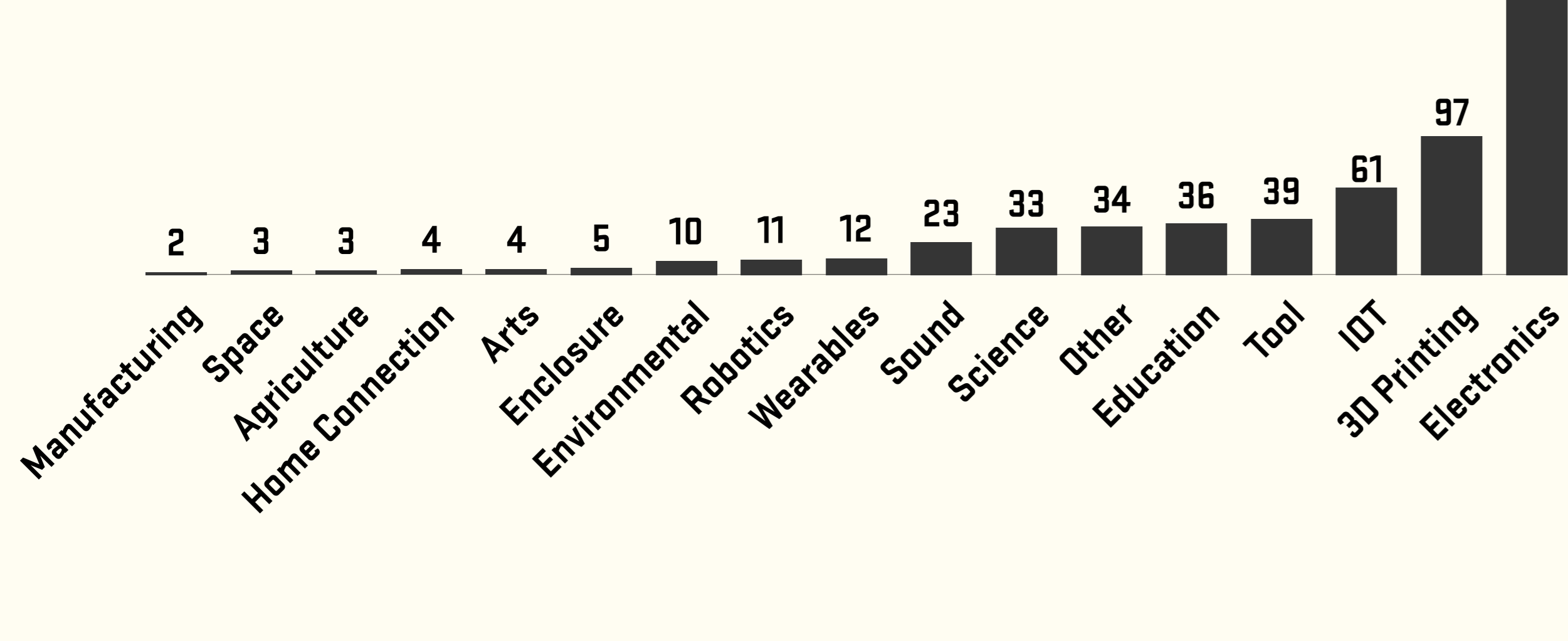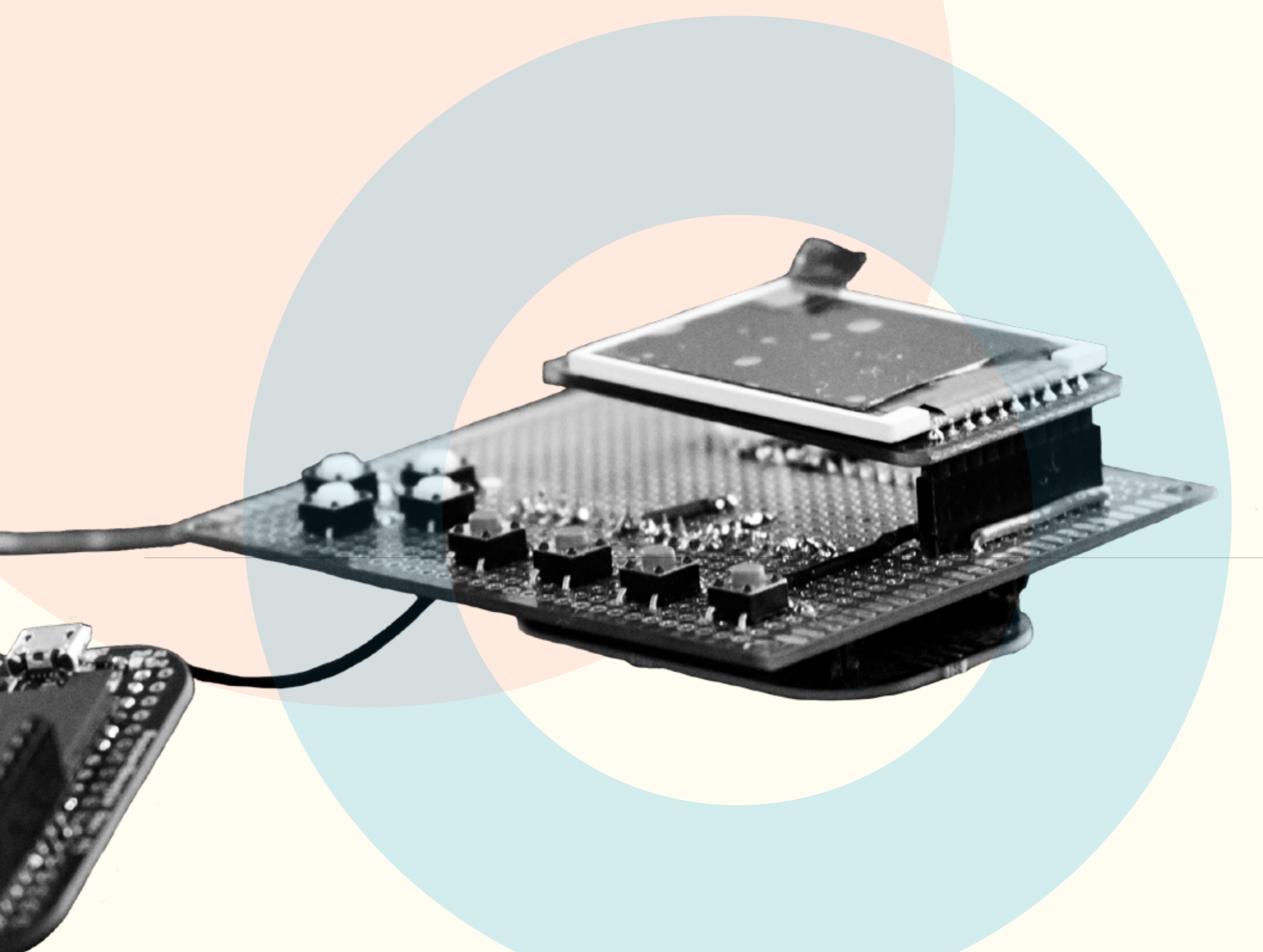## Growth of the Movement

The Open Hardware Certification Program gives us an easy way to track the worldwide expansion of open source hardware since the program launched in 2016. The data - now accessible via API - illustrates how the open hardware community has grown into a truly international movement. Today the community has certified hardware from over 45 countries on every continent except Antarctica.
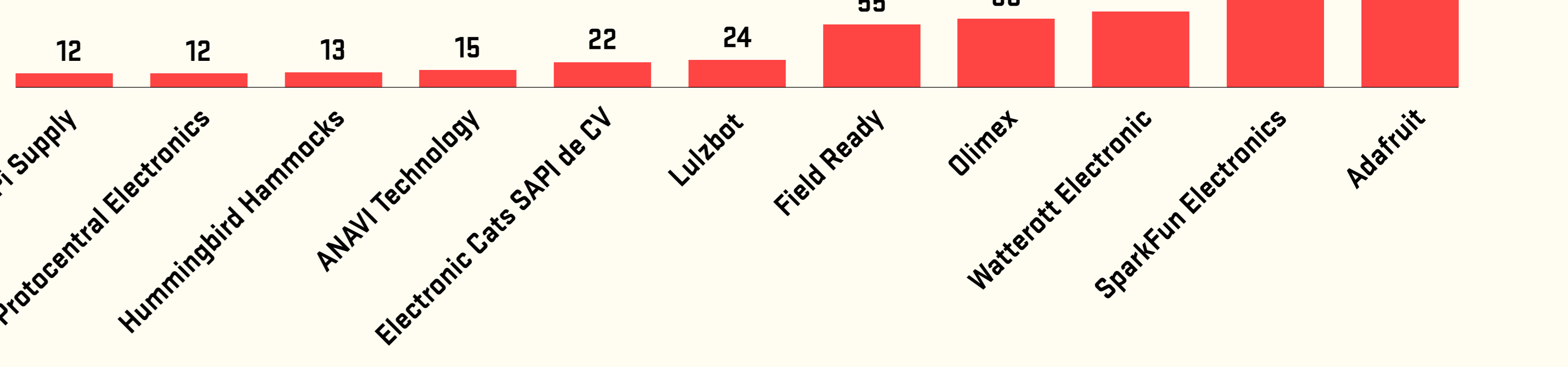
2016	2017	2018	2019	2020	2021
85	47	110	136	959	258

YEAR OF COUNTRY'S FIRST CERTIFICATION
2016 2017 2018 2019 2020 2021

The Projects Certified

OSHWA certifies a broad range of open source hardware. Perhaps not surprisingly, project managers identify their hardware as electronics most often. Moving beyond electronics helps us understand the breadth of the open source hardware community.

1218 Electronics

2 Manufacturing, 3 Space, 3 Agriculture, 4 Home Connection, 6 Arts, 10 Enclosure, 11 Environmental, 12 Robotics, 23 Wearables, 23 Sound, 34 Science, 36 Other, 38 Education, 39 Tool, 61 IOT, 97 3D Printing, 1218 Electronics

Electronics is the largest category of certified hardware. That umbrella category includes microcontrollers, musical instruments, jewelry, medical devices, and more from around the world.

Looking beyond the electronics category reveals the diversity of countries and categories that make up the open source hardware community.

TOP CERTIFIERS

Adafruit and Sparkfun Electronics are longtime pillars of the open source hardware community. Their longevity and depth of offerings help them to dominate the list of top certifiers. As we move down the list we find certifiers from many different countries working in areas as diverse as electronics, disaster relief, and outdoor gear. Olimex and ANAVI Technology help give Bulgaria one of the highest per capita certification rates in the world.

12	12	13	15	22	55	60	68	402	445

P/ Saget, Protoneer/ Electronics, Humningbird Instrument, ANAVI Technology, Electronic Cats SAPI de CV, Liebus, Field Ready, Olimex, Watterott Electronic, SparkFun Electronics, Adafruit
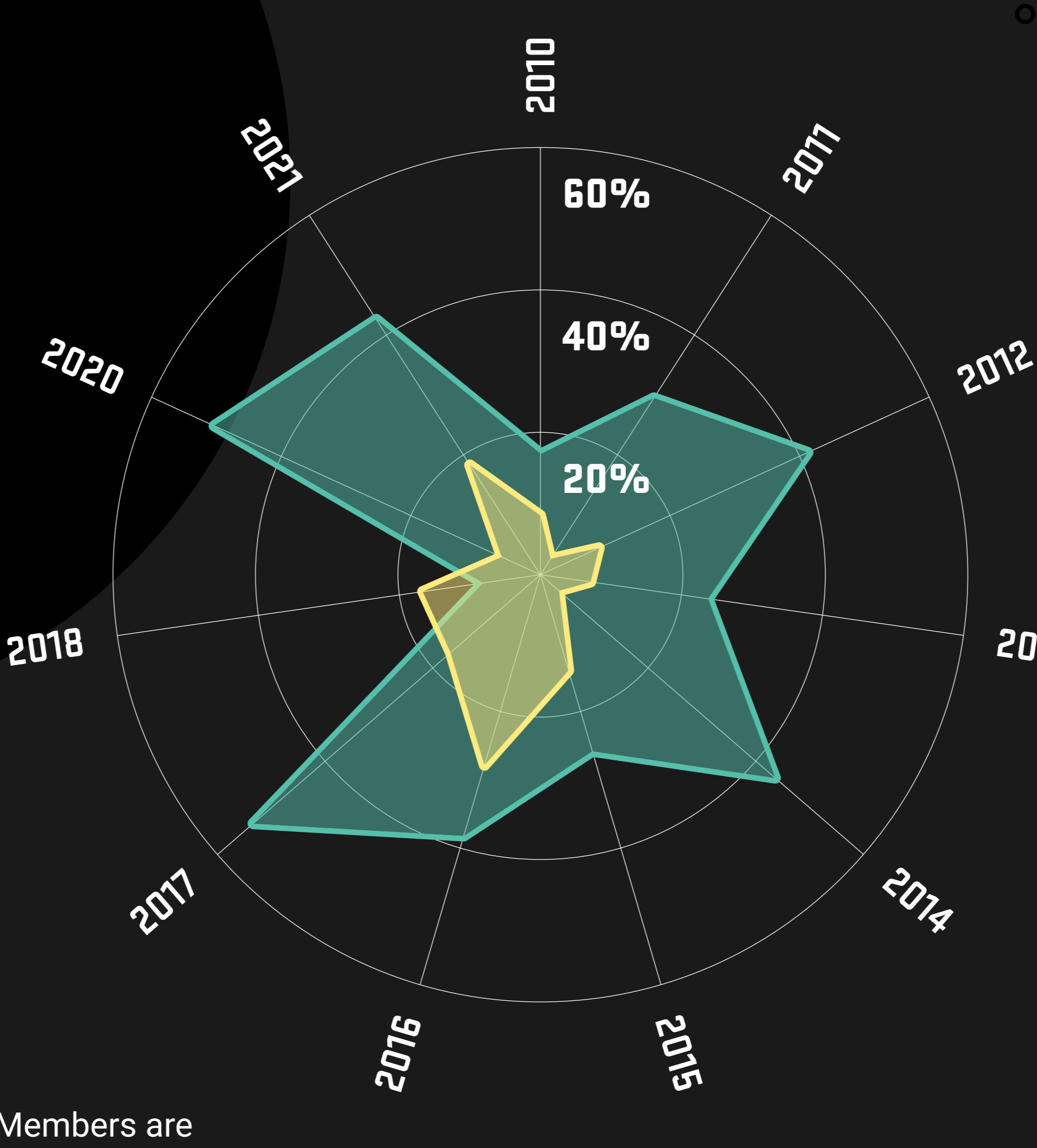
The People of Open Source Hardware

OPEN HARDWARE SUMMIT

Founded in 2010 by Alicia Gibb and Ayah Bdeir, the annual Open Hardware Summit brings the open source hardware community comes together in person. The Summit features speakers, demos, and discussions that help highlight some of the best of what is happening in open source hardware each year. With videos of talks available online, the Summit's archives also provide snapshots of the state of open source hardware over time.

OPEN HARDWARE SUMMIT SPEAKERS

Open Hardware Summit speakers come from diverse backgrounds and have wide ranging areas of focus. Each year OSHWA and the Summit chairs strive to create a program that highlights the breadth of the community and gives the community an opportunity to see itself represented on stage.

Women Non-white

OSHWA BOARD

The all-volunteer OSHWA Board is elected to staggered two-year terms. Board Members are responsible for operating OSHWA's programs, supporting the Open Hardware Summit, and acting as liaisons between OSHWA and the broader open source hardware community.

2020–2021 Board

Oluwatobi Oyinlola — Ibadan
Joe McManus — Moab
Saliman Faris — Malappuram
Javier Serrano — Saint-Genis-Pouilly
Nadya Peek — Seattle
Michael Weinberg — New York City
Drew Fustini — Portland / Berlin
Katherine Scott — San Francisco
Shah Selbe — Long Beach

73 Ada Fellows

ADA LOVELACE FELLOWSHIP

The Ada Lovelace Fellowship was founded in 2013 prior to that year's Open Hardware Summit by Summit Chair Addie Wagenknecht and OSHWA Executive Director Alicia Gibb. Since its inception there have been 73 Ada Fellows from around the world. The Fellowship encourages women, LGTBQ+, and/or other minorities in open technology and culture to actively participate in and foster a more diverse community within open source hardware. It provides tickets and travel support to help Fellows attend the Summit, as well as community-building opportunities at the Summit itself.

OPEN HARDWARE SUMMIT CHAIRS

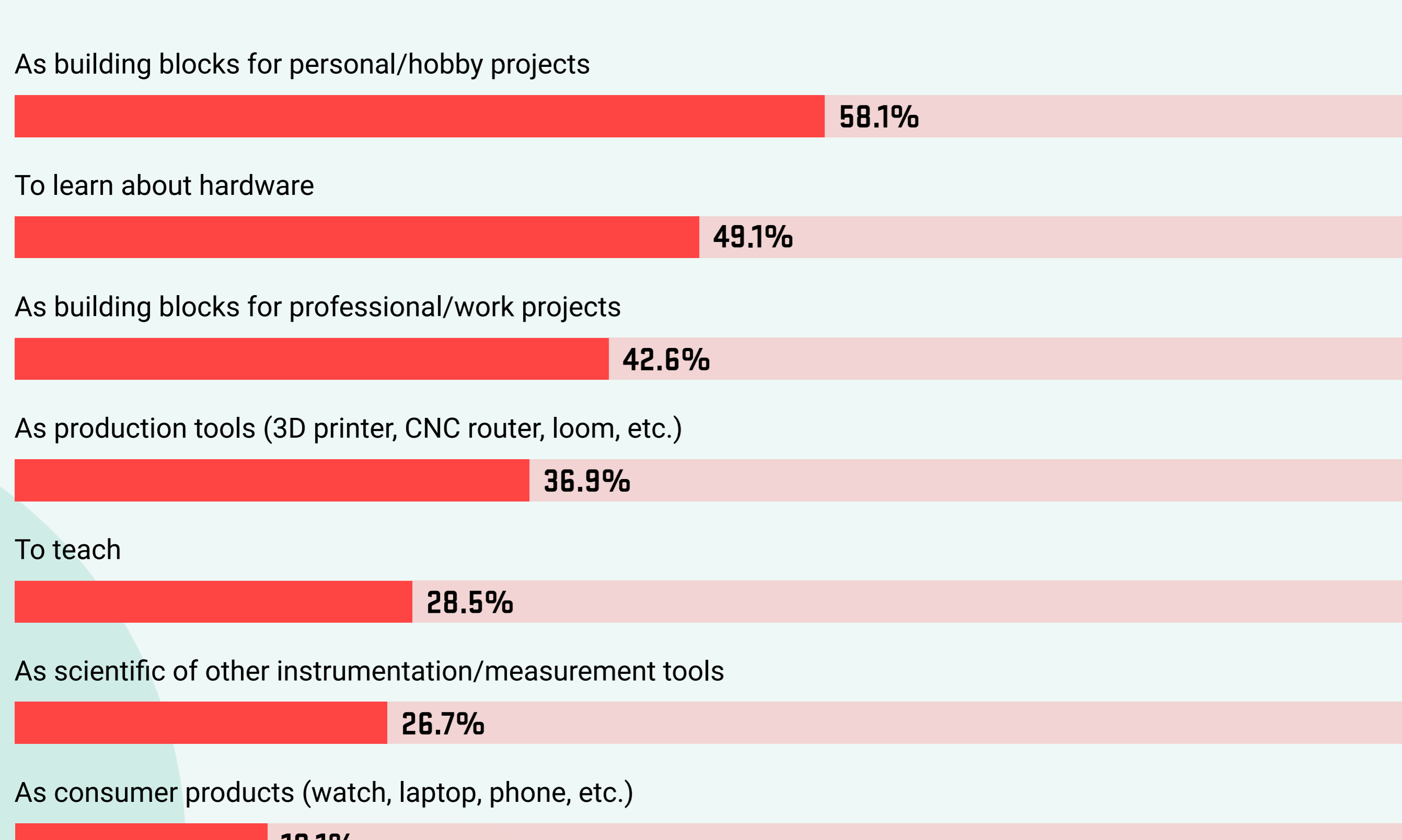| 2010 | Alicia Gibb, Ayah Bdeir |
2011	Alicia Gibb, Ayah Bdeir
2012	Catarina Mota, Dustyn Roberts
2013	Addie Wagenknecht, Jimmie Rodgers
2014	Addie Wagenknecht, Simone Cicero
2015	Addie Wagenknecht, Dustyn Roberts
2016	Addie Wagenknecht, Kat Miller
2017	Addie Wagenknecht
2018	Addie Wagenknecht
2020	Rolly Seth

Who Makes Open Source Hardware?

The annual Open Hardware Community Survey is an opportunity to capture a snapshot of the state of the open hardware community. The Survey provides insightful information and data into how community members found open source hardware and what they do as part of the community. These questions allow for multiple responses, so many respondents identify a number of ways they work with open hardware.
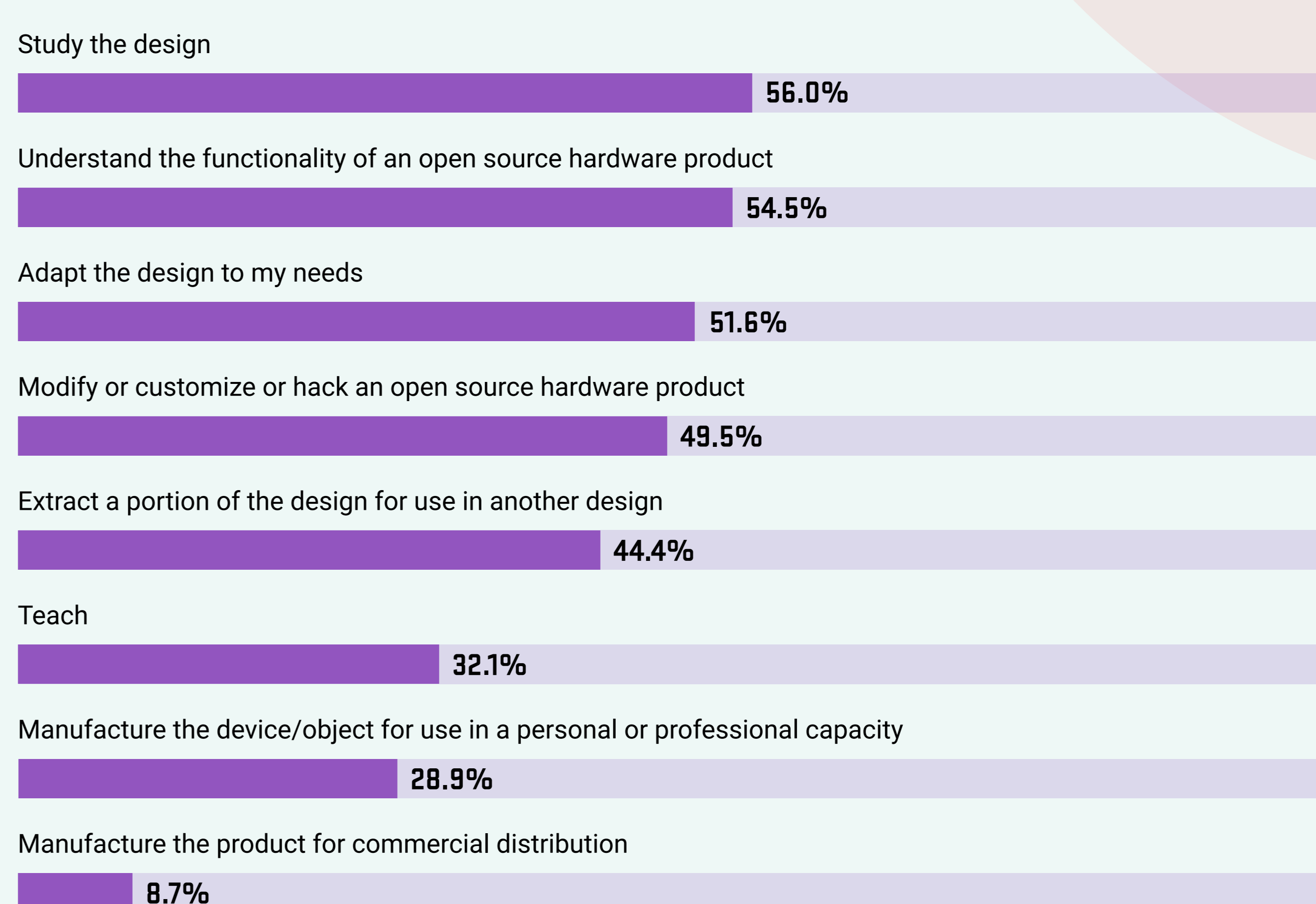
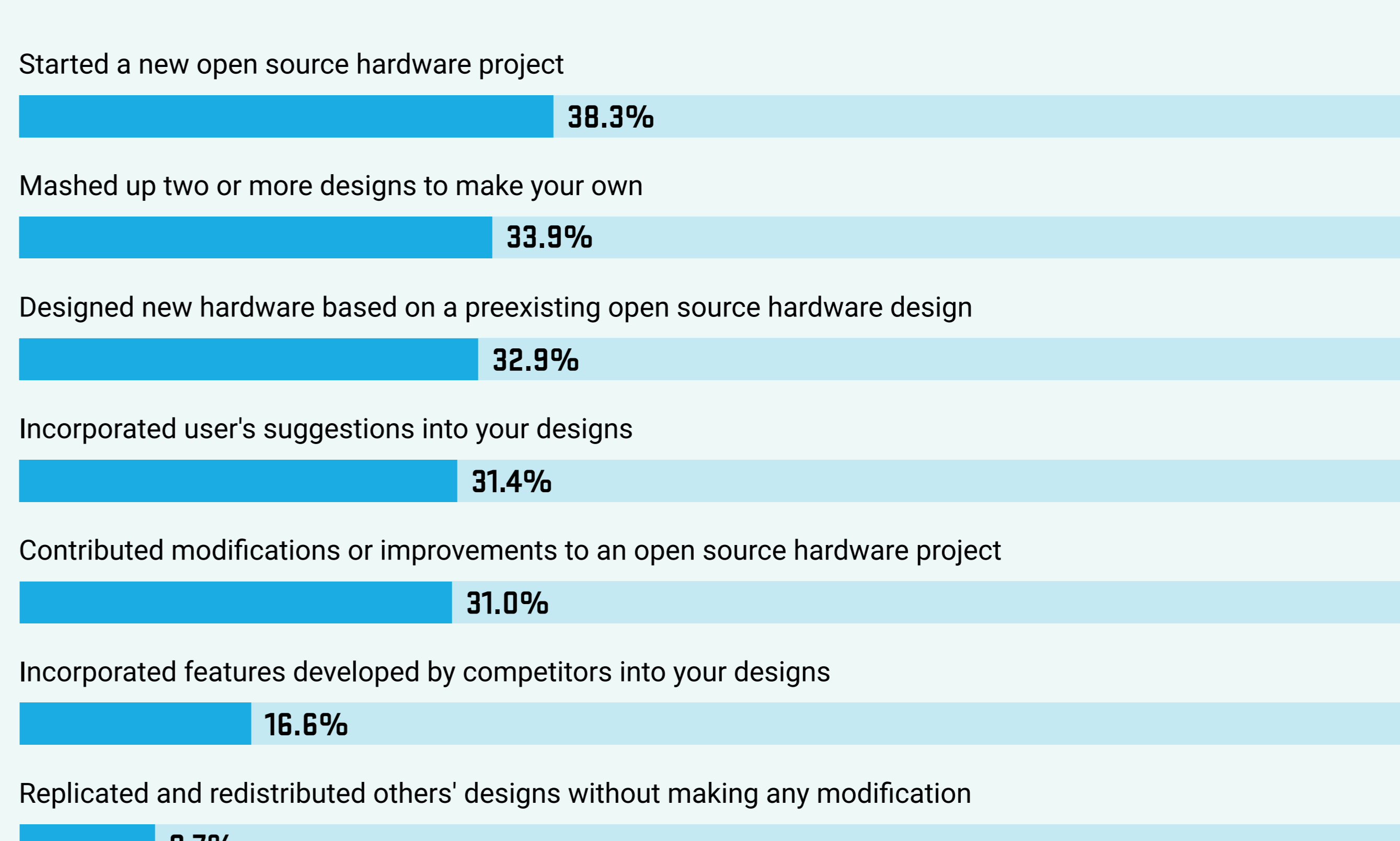### HOW DID YOU FIRST GET INVOLVED WITH OPEN SOURCE HARDWARE?

- Through the use of open source hardware products — 27.7%
- Through involvement with open source software — 15.5%
- Through online communities — 15.2%
- Through conversations with other people — 12.3%
- By reading about it — 6.5%
- By looking up hardware designs — 6.5%
- Through events, conferences, etc. — 2.9%
- I don't really know what open source hardware is — 0.0%

HOW DO YOU USE OPEN SOURCE HARDWARE PRODUCTS?

- As building blocks for personal/hobby projects — 58.1%
- To learn about hardware — 43.1%
- As building blocks for professional/work projects — 42.6%
- As production tools (3D printer, CNC router, loom, etc.) — 36.9%
- To teach — 28.5%
- As scientific of other instrumentation/measurement tools — 26.7%
- As consumer products (watch, laptop, phone, etc.) — 18.1%

HAVE YOU EVER USED OTHERS' OPEN SOURCE HARDWARE DESIGNS TO…?

- Study the design — 56.0%
- Understand the functionality of an open source hardware product — 54.5%
- Adapt the design to my needs — 51.6%
- Modify or customize or hack an open source hardware project — 49.5%
- Extract a portion of the design for use in another design — 44.4%
- Teach — 32.1%
- Manufacture the device/object for use in a personal or professional capacity — 28.9%
- Manufacture the product for commercial distribution — 8.7%

HAVE YOU EVER…?

- Started a new open source hardware project — 38.3%
- Mashed up two or more designs to make your own — 33.0%
- Designed new hardware based on a preexisting open source hardware design — 32.9%
- Incorporated user's suggestions into your designs — 31.4%
- Contributed modifications or improvements to an open source hardware project — 31.0%
- Incorporated features developed by competitors into your designs — 16.6%
- Replicated and redistributed others' designs without making any modification — 9.7%

The Growth of the Open Source Hardware Universe

The open source hardware community has grown rapidly over time, creating new organizations as well as welcoming existing ones. While no list will ever be complete, these are some of the governmental and nonprofit organizations that help make up that community. They join countless open source hardware companies, some of which are represented in the top certifiers chart.

Open Source Hardware Association (OSHWA)

Academic Journals in OSHWA
HardwareX
Journal of Open Hardware
Journal of Open Engineering

Bio, Medical, and Emergency Response
Field Ready
Get Us PPE
Global Community Bio Summit
Open Source Medical Supplies
Safecast

Community Organizations
Beagleboard.org
e-NABLE
Open Hardware Makers
Open Research Institute
OpenAir Collective
Open Ecology
Open Compute Project
RepRap.org
Wildlabs.net

Documentation Repositories
Materiom
Kitspace.org
NIH 3D Print Exchange
Open Know How

Ecology and Conservation
Arribada Initiative
AudioMoth
Conservify
FieldKit
FreakLabs
OpenCollar

Funding Organizations
Alfred P. Sloan Foundation
Chan Zuckerberg Initiative
Gordon and Betty Moore Foundation
Shuttleworth Foundation

Open Chip Design
CHIPS Alliance
Free and Open Source Silicon Foundation
Free Silicon Foundation
lowRISC
OpenHW Group
Open Source FPGA Foundation
RISC-V

Open Hardware in Science
AfricaOSH
CERN
GOSH
inGSH
Open Ephys
Public Lab

Standards Organizations
DIN
IEEE SA
OpenForum Europe

Think Tanks and Research Centers
Engelberg Center on Innovation Law & Policy, NYU Law
Public Knowledge
Wilson Center

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ENGELBERG CENTER on Innovation Law & Policy NYU Law