AFRICAN MAKERS AGAINST COVID-19

Exploring Open Source Responses to a Global Crisis

Executive Summary

The COVID-19 pandemic has become one of the most pressing global health, security, economic and political issues of 2020, and responding to this novel challenge has put significant financial, technical and logistical constraints on governments and their partners. A number of responses are being developed by grassroots makers to enable personal protection, sanitation, and medical services, using Do-It-Yourself (DIY) and Do-It-Together (DIT) approaches – demonstrating an open, rapid and bottom-up response to the crisis. Initiated by Africa Open Science & Hardware, the Berlin University of the Arts (Weizenbaum Institute), the Technische Universität Berlin (Einstein Center Digital Future), and in dialogue with the GIZ Togo and GIZ Ghana, the inaugural 'African Makers Against COVID-19' digital roundtable on 29 May 2020 brought together makers responding to the pandemic across the African continent to discuss approaches, opportunities and challenges. By identifying and connecting makers, researchers and development professionals, we sought to highlight:

1. the processes and mechanisms underlying making in response to COVID-19
2. how devices and technologies are implemented at health facilities and in communities
3. opportunities and challenges influencing further development and scale-up of innovations
4. interventions that could enable sustainability of grassroots African initiatives against COVID-19

The meeting was attended by over 40 participants, including makers, students, and researchers from across Africa and beyond. The invited speakers, from maker collectives and hubs in Ghana, Senegal, Togo, Nigeria and Cameroon presented the contexts, methods and impact of their work. This was followed by an open discussion on opportunities, challenges and sustainability of DIY/DIT initiatives against COVID-19. The speakers were Joshua Opoku Agyemang Otoo (IoT Network Hub, Ghana), Dr. Khadidiatou Sall (SeeSD, Senegal), Ousia Foli-Bebe (EcoTec Lab, Togo), Obasegun Ayodele (Vilsquare Makers' Hub, Nigeria), Nadine Mowoh (Mboalab, Cameroon), and Evans Djangbah, (Kumasi Hive, Ghana).

Some of the key insights gained from the presentations and discussions include:

- The use of open source designs, 3D printers, laser cutters, hand tools etc. in production
- The integration of community-building, volunteer engagement and collaborations in projects
- Flexibility and adaptability – incorporating local materials or modifying original designs
- Actual use of products depended on complexity – e.g. face masks and face shields are widely used while the ventilators are still in the prototype phase
- New income and skills-building opportunities opened up for young people from the projects
- The maker movement received some attention from the media, the African Union, UNESCO, etc.
- Shortage of essential parts due to global supply chain disruptions during lockdown and lack of access to well-equipped labs made it difficult to meet demand in some cases
- Absence of regulatory and product validation systems was a challenge in some countries
- Low technical capacity and the struggle to find enough volunteers affected activities across board

To leverage the opportunities presented and overcome identified challenges, it is recommended that:

1. makers work to strengthen lab-to-lab collaborations and regional networking. Focus areas of their collaboration could be sustainability measures to secure involvement, equipment and funding
2. governments and intergovernmental organisations should develop frameworks to support grassroots DIY/DIT innovators, and engage the maker movement in planning and decision making
3. these initial findings could be validated through further engagements with makers in other regions

1. Overview of Maker Spaces, Tools & Methods

IoT Network Hub, Ghana (Joshua Opoku Agyemang Otoo): IoT Network Hub is a diverse community of makers who explore emerging technologies to build innovative solutions to problems in Africa. They developed the HackCoronaV initiative to help combat the coronavirus in Ghana and the continent in general. They utilise different techniques and tools to produce amongst other things 3D printed face masks and shields, and smart touchless washing buckets with sensors. The impact of their projects goes beyond making products, to creating job opportunities for youth.

SeeSD, Senegal (Dr. Khadidiatou Sall): SeeSD leverages their existing community of entrepreneurs, artisans, universities and schools to form a citizen science and maker movement named SN3DCOVID19 to build PPEs in response to the crisis in Senegal. The SN3DCOVID19 project is a local volunteer-based production and supply chain, that managed to reach health facilities with 1.500 face shields, with plans to scale up to 20.000. They have created a local sourcing and decentralized production system, comprising local fab labs, startups, schools, universities and makers. In addition to face shields, they also make hand sanitizers, sanitizer dispensing machines and ventilator parts. SN3DCOVID19 has been able to crowdfund for the project, using gofundme and other fundraising sites. They have also built partnerships with the government (Ministry of Health), companies like local banks and startups, and international organisations like UNICEF.

EcoTec Lab, Togo (Ousia Foli-Bebe): EcoTec Lab is a maker space developing community solutions and educational workshops. One of their collaborations is the Molab project, which undertakes STEAM (Science, Technology, Engineering, Arts, Mathematics) educational tours to promote hands-on learning. By working with their community, the local university and the Ministry of Health in Togo, they have produced and distributed over 800 face shields during the pandemic. They are currently working on a ventilator project, for which they are developing the second prototype. EcoTec incorporates local materials and utilises 3D printers, CNC machines, laser cutters and hand tools.

Vilsquare Makers' Hub, Nigeria (Obasegun Ayodele): Vilsquare Makers' Hub seeks to build sustainable solutions across African communities, through empowerment, and transitioning them from analogue to digital processes. They have been prototyping and testing responses to communal challenges around Nigeria prior to the COVID-19 crisis. They therefore drew on this capability to put together educational and outreach programmes to help learners and families in Nigeria cope with the crisis. Their interventions include Volt, a DIY microscope enabling learners and teachers to explore practical science while at home during lockdown, and its accompanying education programme VoltSchool. They also organised a virtual art exhibition to create a reflective outlet as society negotiates the crisis.

Mboalab, Cameroon (Nadine Mowoh): Mboalab is a biology-focused makerspace that brings together researchers, scholars, educationists, policy makers and the general public to discuss, conceive and implement projects responding to the health, economic and social needs of the community, such as the coronavirus pandemic. Core to their approach is the integration of local knowledge by centring the local community, especially women, and the use of locally available and cheap materials (like African fabrics) in production. Their target

users are high risk groups such as health workers. Some of the products they have made against COVID-19 include face masks, hand sanitizers and touch-less water fountains. They are currently working towards developing rapid open diagnostic kits in partnership with Just One Giant Lab (JOGL) and research institutes in Cameroon.

Kumasi Hive, Ghana (Evans Djangbah): Kumasi Hive is a multi-space innovation hub which provides a platform for rapid prototyping of ideas, supporting local innovations and impact start-ups, and promoting entrepreneurship. Through the Ghana-based African Maker Spaces Network, they are connecting with other maker spaces to create a unified response (Makers Assemble!) to COVID-19. Development of products including face shields, mask straps, respirator valves, incentive spirometers, handwashing systems, ventilators and low-cost infrared thermometer guns, are at various stages of completion. Their most successful effort to date is the surgical mask strap, which makes mask wearing more comfortable for health workers. They use readily available designs that have been validated, rather than building from scratch in order to quickly respond to the crisis, and they are currently exploring how to use local resources and recyclable materials to make some products so as to overcome challenges faced in securing inputs. Kumasi Hive has been able to build strong partnerships with the government (Ministry of Communications), NGOs and international organisations like GIZ and SNV to support their activities.

Summary of Responses of Invited Makers against COVID-19
Tools: 3D printers, laser cutters, CNC, Arduino, sensors, sewing machines, biology lab equipment, hand tools
Products: Face masks, face shields, hand-washing stations, ventilators, DIY microscopes, respirator valves, mask straps, incentive spirometers, infrared thermometers, rapid diagnostic kits, etc.
Processes: Local volunteer-based production and supply chain, local sourcing and decentralised system of production, peer production, rapid prototyping, iteration
Good practices: ERP platform to establish transparency during fundraising & operations, adaptation of working (open source) solutions, use of local materials
Collaborations: Local communities, local experts, schools, universities, fab labs, government ministries and international organisations
Programmes: Virtual art exhibition, educational outreaches and collaborative maker gatherings
Funding: Contributions from networks, local organisations and governments, international grants and crowdfunding

2. Outputs and Outcomes

Some of the manufactured products such as masks, face shields/visors, and other Personal Protection Equipment (PPEs) were put to immediate use in health facilities and in communities. For example, over 1.500 face shields were distributed to health facilities in Senegal by SN3D-COVID19, while EcoTec Lab produced more than 800 in Togo. Some projects like HackCoronaV (IoT Network Hub) yielded additional benefits for contributors, including gaining new knowledge and skills, and access to new jobs and extra income

earning opportunities. Other initiatives (EcoTec, Mboalab) secured support from government ministries and/or agencies. This development has the potential to amplify their work going forward. Some of the projects received considerable media exposure, which resulted in increased visibility of the maker movement, and greater public appreciation of their contributions to the fight against COVID-19 on the continent. The Makers Assemble! Initiative led by Kumasi Hive could provide a template for the sort of inter-hub collaborations needed to pool resources, expertise, and amplify the work of local grassroots maker communities, working on common problems.

> *"We realised the importance of maker spaces and the community and the power that they have when they come together, and it is something that I never knew. So, this has been the impact of our projects to fight COVID-19. We learned and experienced a lot – we didn't know that we have this capacity to deliver something."*
> – Joshua Opoku Agyemang Otoo, IoT Network Hub, Ghana

> *"One thing is really important – that we demonstrate to people the usefulness of the maker movement. People often ask 'what are you doing for work, what do you make, what do you sell? You find a solution and you build something – sounds interesting but for me like, it is not serious work.' But now they can see that 'ah now these guys are making our people more innovative and bringing better solutions to our community.' And after all these actions with the COVID, people are [saying] 'ah what you guys are doing is actually interesting and practical and so useful.' So, you have more people [showing] enthusiasm [about] making and joining the maker movement!"*
> – Ousia Foli-Bebe, EcoTec Lab, Togo

3. Opportunities

Most of the initiatives that joined the chat were based in urban areas facing the greater burden of COVID-19 infections. This made it convenient to focus activities in these areas, with their already existing collaborative communities, and therefore there has been less focus on responses in rural regions. Some projects were able to attract monetary donations, locally and internationally, to fund part of their activities. All the initiatives benefited from readily available open source designs, which they adapted for their purposes. Use of local materials, and the eventual development of new materials (such as 3D printing filaments) out of locally available resources was identified as a strategic opportunity to overcome the challenge of availability of certain materials, as well as the costly and time-consuming option of ordering materials from outside the region. The availability of 3D printers and other fabrication technologies enhanced the production process, for example printing parts of medical equipment. Collaborations with more established labs, government bodies, and programmes such as JOGL's Open COVID-19 initiative provided access to additional equipment, technical know-how, bureaucratic support, or financial contributions to drive projects.

Furthermore, increasing interest and support of international organisations such as the African Union (AU) and UNESCO is a big boost for the open science and maker

movements. Involving people from local communities, including women and students, was shown to be an effective way of not only garnering much needed human resources, but also building equity and resilience into operations. There appears to be a growing need for products such as face masks, face shields, and smart handwashing stations, with increasing prevalence of the pandemic, which the makers have been unable to fill due to a number of challenges.

> *"The maker movement is taken really seriously around the world, and even in Africa, including open science, because the African Union has taken a stand on open science and how we are working … I am sure that in the coming years that maker movements will be really integrated, and practices will flourish."*
> – Thomas Mboa, Mboa Lab, Cameroon

4. Challenges

Consistent with the global trend, there seemed to be limited public understanding and appreciation of COVID-19, and visible distrust of health information, which made it difficult to properly engage local communities from the onset of the crisis. This situation changed with time, but other challenges emerged. Prominent among them was the difficulty in accessing parts and supplies as a result of supply chain disruptions due to lockdowns around the world. Closely associated with this were challenges with having access to advanced tools common in well-equipped laboratories. There were also issues with electricity and internet connection faced by team members of makerspaces working remotely rather than on site. Further, many initiatives are struggling to keep their staff and/or volunteers motivated due to financial challenges or the need to build confidence through adequate safety procedures. There is some evidence of fragmentation in local and regional innovation ecosystems, which when addressed could help labs overcome some of the individual technical and logistical challenges they face. Equally limiting was the absence of appropriate product validation and regulatory frameworks, in countries such as Senegal and Togo, without which it would be difficult to implement certain classes of devices made (e.g. ventilators) at health facilities. Together, the above challenges made it difficult to scale innovations, to meet the demand occasioned by the COVID-19 pandemic. What remains clear is the need to support makerspaces and innovators to strengthen their capacities to deal with broader contextual policy, planning, technical, and logistics issues associated with their inventions in order to make societal scale impact.

> *"What we are facing in many countries is that it is a challenge to get products validated. Compared to the USA, with the FDA, there is no organization that oversees this kind of product development."* - Dr. Khadididatou Sall, SeeSD, Senegal

5. Recommendations

It will be in place for maker communities to strengthen their ecosystems through stronger lab-to-lab collaborations, makerspace-university partnerships, and regional exchanges sharing knowledge, tactics and experiences, such as those promoted by Africa Open Science and Hardware (Africa OSH). This will facilitate exchanges and cross-learning to overcome mutual challenges. Makerspaces, networks and community organisations also need further support in order to develop, scale and implement strategies and systems to ensure the sustainability of their operations, particularly sustaining human resources and accessing technical equipment.

At the policy level, governments and international organisations such as the AU, GIZ and the UN can step-up ongoing support to innovation and development programmes, by including grassroots DIY makers and their communities. The maker movement should be invited to the table at the planning and decision-making phase, as they provide a valuable connection between on-the-ground needs of local communities and the necessary knowledge and skills for a bottom-up approach to transformation and empowerment. Therefore, it will be in place to develop and implement frameworks to support grassroots DIY/DIT innovators as part of larger STEAM and innovation ecosystem strategies, including the systematic support needed to safely prototype, implement and scale their innovations. Of immediate need in many countries is a regulatory body or system for validating inventions and equipment produced by DIY innovators to address challenges like COVID-19.

The wealth of information gathered during this conversation could be complemented with experiences from other regions, notably Eastern and Southern Africa, as well as other Low- and Middle-Income Country (LMIC) contexts.

Speakers:
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Obasegun Ayodele (Vilsquare Makers' Hub, Nigeria)
Nadine Mowoh (Mboalab, Cameroon)
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* With the help of the participating initiatives, a growing archive of initiatives and resources against COVID-19 was initiated. To add further suggestions of projects and/or resources to this list, please use this form.