Local manufacturing of open-source devices for medical labs in Africa: prototyping stage in Cameroon.

Organization description

1. **Organization description** (this should include the mission statement, brief history, description of the issue(s) your organization is addressing and major ongoing activities)

MboaLab is an open and collaborative space located in the village of Mefou-Assi, Yaoundé, Cameroon. The word “Mboa" has different meanings in native Cameroonian languages: in Matakam, it means “new”; in Ewondo, it means “unique”; in Duala, it means “village”. Literally translated, MboaLab is a unifying village dedicated to creation; even better, it is a laboratory for social innovation, community education, collaboration and mediation at the service of the community.

Aim and missions

The aim of MboaLab is to catalyse sustainable local development and improve people’s living conditions through open science. To this end, the main missions of Mboalab are as follows:

- propose solutions that meet the needs of communities, using local knowledge and open digital technologies;
- serve as a platform for exchanges on issues related to local context;
- provide community and lifelong education for the population, as well as formal education for the younger generations;
- mediate between local communities and academia;
- raise public awareness of environmental issues.

Our vision of sustainable local development

We advocate for the character of a local development, which is conferred by the imperative to have it emerge from the communities themselves; this is what ensures its relevance and sustainability. In other words, sustainable local development needs to be thought by and for the members of a given community. To do so, it is important to break the unenthusiastic spirit that

exists among many Cameroonians, by training healthy, educated citizens capable of critical thinking on issues related to their immediate environment. By choosing education and health as priority axes, associated with its role as a mediator between Science-Technologies-Societies; we can say clearly that Mboalab could be a powerful catalyst for local sustainable development.

Major ongoing activities

Established at the end of 2017, our work at the Mboalab is focused on making biotechnology research and tools more accessible to labs around Africa through scientific research and development and local production of reagents. We are committed to the development of open educational resources as well as simple and cost-effective biological protocols and equipment that can be applied in resource-limited laboratories. We also provide scientific research projects targeting local health issues, internships opportunities, and training sessions to young local scientists in order to equip them with molecular biology and DIY- Biology skills, and prepare them for employment.

Context

2. **Context/niche** (briefly describe the context in which the work is being carried out, your organization's unique contribution to these issues, and specific partners your organization collaborates with)

Medical devices are scarce in resource-limited healthcare facilities across Africa because they are expensive and those devices that are present are not in a usable state the majority of the time. Indeed, medical labs across Cameroon and Africa are facing a lack of equipment due to high up-front costs, lack of consumables, limited local maintenance skills and proprietary technologies. This situation strongly contributes to deepening inequalities in access to quality healthcare; and is intensified by the lack of training to maintain these equipment locally ; spare parts are hard to obtain, and the fact that service engineers may need to charge thousands of dollars for international travel to get appropriate training or expertise. In addition to the maintenance issues, a lot of medical devices are patented and licensed to a company, making the final product closed by default. In order to address this situation, we have identified local prototyping and manufacturing of Open Source devices for medical labs as a key solution which was materialised by our project entitled "**Local manufacturing of open-source devices for medical labs in Africa"** funded for the first phase early this year by the Open Society Foundations (Grant Number: OR2021-81365).
During this first phase of our project, we released a set of prototypes of high quality and inexpensive open-source devices enabling us to perform some important medical analysis and tests. With this fundings, we have already succeeded to build 80% of the expected equipment. They are :

- The Openflexure microscope;
- Electrophoresis systems;

- Microbiology Incubator;
- Autoclaves;
- Orbital shaker;
- Rotator
- Differential counters for microscopy;
- 3D Printed Pipettes;
- DIY Incinerator;
- 3D printed Pipettes and tube racks;
- 3D printed DIY Automatic antibiotic disk dispensers
- Magnetic heating stirrer

We are still working to finish to build the remaining 20% of the equipment; they are:

- Tabletop centrifuge
- Hematocrit centrifuge with scale
- Sterile hood/ Safety cabinet

For this phase II, we are applying for funding to follow-up the devices we built and to show the evidence that local manufacturing addresses the infrastructural barriers that prevent imported or donated equipment from being properly used, and can facilitate the diffusion of innovation into healthcare practice.

Governance

3. **Governance** (description of the organization's structure, decision making process, and background of personnel in leadership roles)

Advocating for the increasing use of collaborative, dynamic, multidisciplinarity and inclusive approaches in science, including employing a majority of women scientists in our projects and targeting women and young people in our capacity building activities. The team at Mboalab is made of highly skilled and dedicated individuals with backgrounds including Molecular Biology, Microbiology, Physic, Programming and computer engineering and information technology. The Mboalab is organised in three main departments:

a. The Electromechanic and Artificial intelligence Department;
b. The Biotechnology and Biomanufacturing Department
c. The Scholarly communication department

For the full time positions mobilised for this project we are planning to have **Élisée Jafsia, as the project coordinator**. The Project Coordinator will be **assisted by Minette Shalo**. For the quality control of produced equipement we will have our quality manager **Nadine Mowoh**. Finally, Dr. **Thomas Mboa,** co-founder of Mboalab, will ensure that the documentation is well conducted and that Open science values and ethics are respected during the project.

- Elisée Jafisia holds a M.Sc in Physics and a M.A. in Education; he has interests in mechanics, modelization, Artificial Intelligence and Machine Learning. He has a strong experience in 3D printing and coding. He has always been a volunteer at the Mboalab and used to work with us on short projects related to building open-source equipment.
- Minette Shalo holds a B.Sc in Biochemistry, she has interests in molecular biology, molecular epidemiology and diagnostic sciences. She has been part of the first

batch of interns at the Mboalab; since then, she has always been a volunteer at the Mboalab and used to work with us on short projects related to medical biology.

- Nadine Mowoh holds a B.Sc in Microbiology and Medical Laboratory Technology, with strong working experience and interests in molecular and synthetic biology and Quality management and Production. As part of Mboalab's core team, Nadine is currently exploring open source research tools and methods in resource limited settings.
- Thomas Hervé Mboa Nkoudou holds a PhD in Social Sciences, M.A. in Education and B.Sc in Biochemistry; he has interest in the Maker Movement in Africa. Thomas Mboa is working on digital technologies as a powerful tool of sustainable local development; with a critical approach through the concepts of technocoloniality and cognitive injustice. Due to his background in Biochemistry, Mboa is also deeply engaged to promote DIYbio and democratize Biotechnology in Africa; he is the co-founder of the Mboalab.

Program goals

4. **Program goals** (objectives over the next few years within a specific program area)

Overall purpose

The first phase of our project allowed us to achieve our short term vision, which was to prototype open source medical devices. For this second phase, our main goal is to follow-up activities conducted during the first phase of the project, by showing the evidence of the quality of Open source medical devices we built.

Specific objectives (SO)

- **SO-1:** consolidate the documentation produced in phase I and share;
- **SO-2:** perform some basics and important medical analysis and tests in a pilot medical laboratory in rural setting;
- **SO-3:** prepare the process to successfully meet the compliance requested to scale up local manufacturing of open source medical devices;

Projection of activities

5. **Projection of activities** that will be carried out in support of the goals mentioned in 4. This needn't be too detailed, as long as we have enough information to understand how you intend to attain your program goals.

SO-1 Activities

- document the building steps of the open-source medical devices developed in this project ;
- share the documentation with open licences in such a way that people can freely replicate, adapt or improve the model and the design across the world;
- produce Open Educational Resources (OER).

SO-2 Activities

- using open source medical equipment we built, equip a medical laboratory in rural setting;
- perform medical analysis and tests with DIY equipment we built;
- conduct a comparative study between the DIY equipment, with the commercialized one.

SO-3 Activities

- identify all the local standards and norms requested for the scaling up of promising open source medical devices amongst those we built.
- Perform an evaluation process to successfully implement ISO 13485 certification for developed equipment;

Learning

6. **Learning** (description of how your organization plans to track the progress and impact of your work, and feed this back into your organizational learning)

The progress and impact of our work will be measured through :

- the number of visits and downloads of our educational material and others documents related to the project;
- The accuracy of the results obtained from open-source equipment, compared to those from commercial equipment;
- the level of acceptance and adoption of DIY equipements by practitioners, local authorities and policymakers;
- the number of relevant ISO certifications obtained.

Sustainability

7. **Sustainability** (description of how this work will be supported in the future both financially and programmatically)

The Mboalab open-source medical devices project was launched with initial funding from the Open Society Foundations. However, it is important to mention that this project will not end if the support from the Open Society Foundations stops; because it is sustainable. Indeed, our experience at the Mboalab taught us that, once we have a good prototype working well, people and institutions will get interested. Without any doubt, we will have the same success with the open-source medical devices generated through this project. But for the moment we need an additional grant from the Open Society Foundations; that is why we are applying for this follow-up grant. To show evidence the Open source medical devices we built are of good quality and can meet all the compliances to be scaled up. Like that, we can put in place a social business model to produce more cheap and high quality equipment for medical labs in Cameroon; while keeping the margin lower as possible (just what needed to pay salaries and consumables).

Financial history

If easily accessible, please attach the last two to three years of available budgets for your organization. If this is too cumbersome or difficult to collate, please

discuss your organization's financial history over the last three years. Has your organization budget grown, remained static or decreased – and why?

Other donors

Please provide a list of organizations (funders, industry groups, governments, and others) that support the work of your organization. If your organization is unable to disclose this information, please describe the reason(s) why.

We are the first local biomanufacturing and research unit to be founded in Cameroon and thus far we have been supported by:

- The Shuttleworth Foundation;
- University of Cambridge;
- Beneficial Bio Ltd;
- The UK Global Challenges Research Fund (GCRF),
- Open Society Foundations,
- The Volkswagen Stiftung
- The French organisation, Universcience.
- The Mozilla Foundation

Program-level budget summary

In line with our intention to provide greater flexibility, please submit a budget summary rather than a fully detailed budget. This budget summary should provide an indicative summary of organizational expenses within a specific program area. These expenses may include personnel costs and overhead administrative costs, programmatic costs (meetings, travel, etc.), equipment and other capital purchases, administrative costs (telephone, internet, etc.), etc.
Please note: While there is no fixed limit on OSF contributions to a grantee's overhead costs, there is a recommended cap of no more than a twenty percent contribution to an organization's overhead or administrative costs.
The budget summary should outline the total cost of each category. It is not necessary to list each salary cost, simply state the entire amount for personnel costs. Please submit the proposal budget in a separate document (in Excel), as per the attached template.

Tax determination letter

Please include a copy of your organization's tax determination letter if your organization is based in the United States.

Supplementary documents

Please include a copy of the following documents pertaining to your organization (if available):

1. Annual report
2. Strategy documents (i.e. business plan, five year strategic plan, capacity building plan)
3. Audited financial reports

4. CVs of personnel in leadership roles

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[1] https://wikifactory.com/+biolabkh/incubator

[2] https://openbioeconomy.org/news/developing-a-locally-manufacturable-typhoid-diagnostic-in-cameroon-new-project-for-2020/?fbclid=IwAR3jdMcWhOxAuIpfJKSpz7P-dXamXipAicSr2x_R21ada78lkLaky1kfgBE

[3] https://www.ceb.cam.ac.uk/news/open-enzymes-making-biotechnology-globally-accessible

[4] https://www.mboalab.africa/biotech-internship-program/

[5] https://openhardware.metajnl.com/

[6] https://wikifactory.com/+biolabkh/incubator