

HOW IS THIS IDEA DIFFERENT FROM WHAT YOUR ORGANIZATION (OR OTHER ORGANIZATIONS) IS ALREADY DOING?

- 1) We're building the world's first digital fabrication lab (Fab Lab) in a refugee camp, with the support of Prof. Neil Gershenfeld, who founded the Fab Lab concept at MIT, and the leadership of the Fab Foundation and Fab Lab Barcelona. While 3D printers are important, it is critical to have a full suite of digital manufacturing tools like CNC routers, laser cutters, milling machines and vinyl cutters. In combination with conventional power tools, refugees will be able to rapidly prototype nearly any solution. We have already shared our security strategy with the Royal Hashemite Court, to ensure the lab is not used in ways that threaten security in the camp. For instance, we are already using a Raspberry Pi with an attached camera and wifi dongle, and some embedded Python code, to provide a live stream on the internet of what is being printed on one of our 3D printers. We can also remotely control the printer, and the whole set up costs less than \$100.
- 2) Our lab will be an Open Innovation Center, connecting refugees with the resources of global open-source communities.
 - a. Establishing the lab as an MIT-affiliated Fab Lab will immediately connect it with 450 other Fab Labs around the world. A Fab Lab is a technical prototyping platform for innovation and invention, sharing common tools and processes with a global network of learners, educators, technologists, researchers, makers and innovators gathered around digital fabrication and computation research. Fab Labs provide a platform from which a community's technical challenges can be shared with this international network, which can help problem solve and design solutions with and for the community. We have already tapped into this international network with great success. One of our team members is a mechanical / interactive designer based at Fab Lab Barcelona, and she led the development of the prosthetic hand for the Yemeni amputee we helped. As a Jordanian, she is now developing a new design for 3D printed hands that we believe will be more culturally suitable in the Middle East. Furthermore, our Director of R&D and Training is a Fab Academy graduate. He has done a phenomenal job on the ground, and we were able to find and recruit him through the powerful Fab Lab network.
 - b. We have also leveraged the work of the rapidly growing e-NABLE community, a network of over 5,000 individuals across the world who develop and share open-source 3D printed prosthetics. We have connected the great work of this community with the needs and context of the tens of thousands of amputees injured in the conflicts raging across the Middle East.
 - c. In addition, we are collaborating with the immensely skilled community of Ultimaker, the leading open-source consumer 3D printer company. After developing the initial prototype of the open-source ultrasonic echolocation device for the blind, we have since been able to hand over R&D to an ingenious innovator within the Ultimaker community based at the University of Virginia. He has brought a whole new level of expertise to our R&D efforts on this device and has given us the leverage to focus on other R&D projects.

- d. Finally we are in early discussions with the management of OSVehicle, an open-source vehicle organization, to design a low-cost vehicle with and for refugees in the camp. We'd be able to manufacture the vehicle within our facility and share the designs globally for others to modify/replicate.
 - e. There are many other open-source communities we intend to connect with our lab, including Instructables, Arduino, Open Source Ecology, Open Source Hardware Association, Soft Robotics Toolkit and more.
- 3) Our facility will provide co-working space that facilitates informal knowledge exchange / skill exchange. As one refugee told us during our focus group discussions, "When people are working together they can help and teach each other." There is a strong interest in sharing skills. During one of the focus group discussions, a tailor remarked, "Suppose next to me in the lab is someone who is not very skilled. But by working on machines next to each other, we can both learn from each other. I can teach him how to use a machine, and he will learn by observation." We are very focused on embedding the lab within the social context of the local community and ensuring they feel ownership of the facility. This will promote social cohesion, reduce operating risk and enhance collaboration both within the local community and with contributors from around the world.
- 4) We have an omnibus approach, designed to help as many people as we can in as many ways as we can.
- a. Vocational Training & Entrepreneurship - A Fab Lab epitomizes hands-on, informal training. The Syrian people are known to be extremely good with their hands, and more than 3,000 shops have sprung up in Za'atari -- many providing services such as carpentry, tailoring, blacksmithing, electronics repair, etc. We are providing tools and training that improve their ability to earn a living, and *substantially* reducing the risk of work-related injuries. The equipment used by refugees in the camp today are often makeshift tools that are very dangerous to operate, like circular saws connected to tables and converted into table saws. The need for more and better tools was heavily emphasized by focus group participants, one of whom said, "There are many tools in the camp. But these are primitive. We started from scratch here. It is all handmade primitive tools that refugees made to manage their needs and daily lives. Now the camp is developing, and we can make more tools as we need in the facility."
 - b. Education & Teaching Approaches – Our lab will have a day care center providing informal education through experiential learning. A Fab Lab provides students with the tools to create real, practical and fun products that advance their learning of cutting edge technology and positions them for future employment. Students who, for many reasons, cannot or will not participate in the formal education system have an opportunity to operate a 3D printer, make do-it-yourself robots and create wearable electronic circuits – and in so doing, learn coding, 3D modeling, electronics etc.
 - c. Psychological Treatment & Overcoming Trauma – The technology in our facility will allow community members to create interactive art for psychological treatment. For example, a Jordanian mechanical designer on our team built a robotic camera connected to a virtual reality device. The camera was placed on one woman and the virtual reality device on another woman confined to a wheelchair. Through a choreographed dance, the woman in the wheelchair could experience what it's like to dance. More broadly, the tools in our facility can be used to make many forms of art, such as digital embroidery, sculptured furniture and laser-engraved etchings.
 - d. Service Provision – Our facility will be an inclusive community center, serving even the most vulnerable segments of the population. Those who are too poor to afford even basic products and services provided by the shops in the camp can obtain free

services (such as repairs, sewing, etc.) in our lab in exchange for volunteering at the facility.

- e. Learning Spaces/Transforming School Environments – An award-winning humanitarian architect has created the plans for our facility (a glimpse is provided in the attached photos). The building will be modular, making it easy to expand over time. It will be built with local materials, to reduce costs and to support the local economy, and it will be non-permanent (i.e., easy to disassemble and remove). Most importantly, it will be an *inspiring space* with sculptured walls and ample room for community members to meet and exchange ideas. Beyond the physical structure of the building, the space will engage the community with a gallery of art and products made by refugees, including 3D-printed objects and small educational robots.
- 5) Our approach to helping refugees is heavily focused on building local ownership within the host community and generating as much benefit to Jordan as possible. The lead implementing partner in the MENA region for the ROW consortium is 3Dmena Social Innovation, a Jordanian non-profit organization. We seek to attenuate the immediate effects of conflict while driving long-term economic development, productivity growth, venture creation and employment generation in Jordan, particularly for youth. We have presented our work to His Majesty King Abdullah II and Her Majesty Queen Rania on Jordanian national television, and we are supporting King Abdullah's initiatives to launch two Fab Labs in Amman. The first is a medical innovation Fab Lab, focused on prosthetics innovation and improved rehabilitative care, with the Royal Medical Services. The second is a Fab Lab in the King Hussein Business Park, focused on creating jobs and startups in advanced technology fields like 3D printing, robotics, the internet of things and virtual/augmented reality. Finally, we are supporting a consortium led by a Jordanian vocational training institute to build Fab Labs in Irbid and Mafraq, two cities in North Jordan that are heavily burdened by the refugee crisis.
- 6) Our long-term vision is to create a Google X for the humanitarian sector: a network of makerspaces in conflict zones in which refugees and open-source communities co-create the impossible (more on this in the response to Amplify questions).