COMSATS University FAB LAB Lahore

Co-funded by the Erasmus+ Programme of the European Union

Fabrication Laboratory

COMSATS University Lahore Campus

An outcome of the TAKEUP Project **Inaugurated: 3rd Nov 2023**

What is a Fab Lab (or Makers Lab)

A place to think, to create, to learn, to mentor, to invent: a place for learning and innovation. Fab Labs provide access to the environment, the skills, the materials and the advanced technology to allow anyone anywhere to make (almost) anything.

Purpose/Objective of FabLab

To provide a well-equipped place and environment where entrepreneurs, innovators, designers and researchers can transform their imagination into physical reality by using technologies and machines.

The TAKEUP Project

Global paradigm for evolution of universities includes promotion of entrepreneurial culture among students, academic staff, and researchers. The development of Entrepreneurial Universities is the goal of TAKEUP, which is a joint project of a consortium of two European and four Pakistani universities. The TAKE-UP Project was conceived and initiated in February 2019 by University of Saarland (Germany) in collaboration with Universities in Pakistan and Europe. The project was approved by European Union (EU) in January 2020 with funding of one Million Euros under Erasmus+ Program of Capacity Building in Higher Education. The project spans three years and has been divided into ten work-packages.

The work packages are aimed to enable four partner Pakistani Universities to start transforming into innovative entrepreneurial universities by promoting a culture of entrepreneurship through training of the faculty/staff and motivating students and researchers to become entrepreneurs. Cornerstone of TAKE-UP is the establishment of Fab Labs at Pakistani universities as physical spaces and equipment for innovation and prototyping. It also involves the initiation of specially designed courses on prototyping and entrepreneurship for students, faculty, and researchers.

TAKEUP Project and Entrepreneurship

Higher Education Institutions in Pakistan have been struggling to provide future entrepreneurs with adequate facilities and equipment to convert their innovative ideas into a prototype. Especially after the motivation phase where ideas have been developed, it is necessary for these young entrepreneurs to be guided through visualization and rapid prototyping to keep them invested in their ideas and see these come to light. In addition, many business ideas demand that there is a prototype available to better understand what inventors are trying to accomplish. For some IT-related ideas, these prototypes can be related to first mock-ups of “apps” but could also be related to a demonstrator (using Arduino boards and Raspberry Pis). For other ideas it might be necessary to develop 3D prototypes like a machine, a tool, a gadget, a digital device, a robot, or a drone. Fab Labs are the perfect solution to these needs and are also very useful to adding value to the coaching process. The establishment of Fab Lab at CUI (Lahore) is in line with the vision of the Pakistan Higher Education Commission to promote entrepreneurial culture in Pakistani academia.

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The Concept and background of FabLab

The concept of a Fab Lab emerged from "Center for Bits and Atoms" of the MIT University in the year 2000. The goal was to provide access to the tools, knowledge and the financial means to educate, innovate and invent using technology and digital fabrication to allow anyone to make (almost) anything, and thereby create opportunities to improve lives and livelihoods around the world. First FabLab was established in 2001 by Professor Neil Gershenfeld of MIT.

Fab Labs are considered an excellent and relatively newer addition in academia that can be used to encourage hands-on learning and problem-solving skills among the students. These are excellent platforms for the development of new products and technologies, and support entrepreneurship and innovation. The practical-based learning environment in the FabLab promotes networking, collaboration, interdisciplinary learning and provides access to advanced technologies. The Fabrication Lab is not just a room filled with machines; it represents a doorway to a future where imagination knows no bounds and where ideas evolve into reality, making a way forward for innovation and creativity among entrepreneurs.

Since 2001, more than 2500 Fab Labs in 125 countries have been established that are registered with FabLab Association and FabLab Network (https://www.fablabs.io). These are being maintained by Centre for Bits and Atoms of MIT under the supervision of Professor Neil Gershenfeld.

Fab Lab in 4 minutes

A short 4-minute video is available at the following link that gives a quick and crispy overview of the history and future prospect of the Fab Labs. https://ng.cba.mit.edu/show/video/16.08.fablabs.mp4

The COMSATS University FabLab, Lahore

The FabLab equipment are housed in a temporary space in the A-Block of the Lahore campus. It will be shifted to the Incubation Centre after it is constructed. All the equipment and their operating software have been installed and are ready to use. The operating manuals and the protocols for individual equipment and for the over operation of the FabLab are available in the Lab. Users are required to follow the instructions and protocols.

Major Equipment In FabLab

1. Laser Cutter and Engraver
2. Cutting Plotter
3. Grinding Machine
4. Bench Drill Machine
5. 3D Scanners (Small and Room)
6. Electronic Circuit Designing Tool
7. Compressor
8. 3D Printers (Expected to be included in Dec 2023)
9. A variety of fabrication tools, like handheld drill machines, screw drivers, wrenches, dust cleaners, oscilloscope, magnifier and safety gadgets etc.

Open For All

The FabLab facility is a place for creativity and innovation, hence it is open for all. However, considering the infrastructural, spatial and human resource's limitations, and for the time being, only the students or faculty members of CUI Lahore campus who have an innovative idea/design to work on are allowed to use the FabLab. Supervision of students by a faculty member is preferred but not mandatory. Users will be required to reserve any specific equipment for a specified slot at least one day prior to use.

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Limitations

1. Not a substitute of a traditional Teaching Laboratory
2. Not a substitute of a traditional Works/Engineering Section
3. Not for routine repair of equipment /devices/machines, etc.
4. Not for mass production of any item for commercial use
5. Equipment/Tools are not for use outside the FabLab
6. All activities in FabLab are to be recorded/documented
7. Legal framework (To be developed under Incubation Centre)

Way Forward and Opportunities

1. Involve students in FabLab projects.
2. Encourage students to formulate Product-oriented FYPs.
3. Registration with International Fab Lab Association and FabLab Network of MIT
4. Plan to participate in the Annual FabLab Conference organized by Fab Foundation. (Next Conference-FAB24: Mexico August 4-11, 2024.
5. Encourage students and faculty to register in Fab Lab Courses offered by Fab Labs around the world.
6. Develop Fab Courses for learners at CUI in consultation and International Fab Lab Association
7. Provision of regular budget and human resources for sustainable operation.
8. Add more equipment including desktop CNC machine.

Major Facilities Available

Trotec Q400 Laser cutter (laser engraver)

For engraving and cutting: Wood, Plastic, Leather
Cutting Thickness: 2-4 mm

Secabo S120 II

Vinyl Cutting plotter

For precise digitally controlled cutting of vinyl and laminated sheets, papers, and stickers

Matterport Pro2 + tripod

3D scanner (for rooms)
Use for creating virtual 3D models and schematics of physical spaces, as well as edit and share the output models using the Matterport App and cloud service.

The software allows to create walkthroughs, tours, schematic maps, and professional-quality 2D still capture output.

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Matter and Form V2 3D

Desktop 3D scanner for small objects, for onward printing on 3D printers. Powered by MFStudio software. Compatible with STL, OBJ, DAE formats

Circuit Designing Setup

1. Soldering station (TOOLCRAFT ST-100D)
2. Hot air soldering station (TOOLCRAFT LSH-880)
3. Solder fume extractor (TOOLCRAFT ZD-153A)
4. Laboratory power supply (VOLTCRAFT DPPS-32-20)
5. Digital oscilloscope (VOLTCRAFT DSO1204E)
6. Digital Multimeter (Fluke 115, AMProbe AM-510-EUR)

Metabo BS 175

Combination belt sander
Sturdy machine for sophisticated sharpening, grinding and deburring task and for finishing wood, plastic and metal surfaces.

Bench drill PBD 40

Precise drilling with good workspace illumination with integrated laser and an LED. Digital display for precise adjustment and drilling rows of holes.

Maximum Drilling Diameter
In Steel/Wood: 13 mm/40 mm.
Drilling Stroke: 90 mm

Prusa (i3 MK3S+) (Prusa SL1S + CW1S BUNDLE)

3D printers to produces high-quality 3D Models with even more detail than the original

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How MIT's fab labs scaled around the world

Now a global community of builders of all skill levels and backgrounds, the fab lab network grew from a single maker facility at MIT.

Zach Winn | MIT News Office

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What do a student tinkerer in Bhutan, a design professional in Nairobi, and an artist in Brazil have in common? They're part of a global community of makers benefiting from the fab lab network, which provides the space, equipment, and training to make (almost) anything.

Today the fab lab network includes more than 2,500 centers across 125 countries, including places as remote as northern Norway and as populated as the city centers of Cairo and Barcelona. Each lab provides community access to equipment such as laser cutters, computer-controlled milling machines, and 3D printers, along with training to use the equipment.

Some fab labs emphasize themes like sustainability or bridging community divides, while others focus on strengthening the local workforce or empowering students to become activists. But the similarities between fab labs may strike visitors more than the differences. And although advanced fabrication equipment is the labs' most visible feature, people most often talk about the common energy they feel when surrounded by creators pursuing their passions.

MIT Professor Neil Gershenfeld, who is also director of MIT's Center for Bits and Atoms (CBA), created the first fab lab with the late Mel King, a legendary civil rights activist and former MIT adjunct professor who saw the fab lab's potential to empower communities. From there, the expansion into a wider network was driven by grassroots interest from far-flung communities around the globe.

Fab Lab becomes Fab Network

Gershenfeld and his colleagues launched CBA in 2001 to study the boundary between computer science and physical science, and with National Science Foundation (NSF) support they created a digital fabrication research facility with equipment to make objects of any size, from the scale of atoms to buildings. But it would take a lifetime of existing courses at MIT to learn to use all of the machines, so they began teaching a new course, MAS.863 (How To Make (almost) Anything). The course has been one of the most popular at MIT since its inception.Inspired by that response, in 2003 Gershenfeld met with King to explore an outreach project for the NSF. Following his retirement from MIT, King, who passed away in March, had created the South End Technology Center (SETC) to expand access to technology in Boston communities, and he saw the lab as a powerful way to further that mission.

"Neil said, 'Hey Mel, you should bring your kids over to my lab,' and Mel said, 'You should bring your lab over to my kids,'" says Megan Smith '86, SM '88, former White House chief technology officer and a member of the MIT Corporation, who has visited fab labs around the country.

MIT Professor Neil Gershenfeld, the founder of FabLab is also director of MIT's Center for Bits and Atoms (CBA)

King became a mentor for Gershenfeld. "We went to see Mel, and he instantly leapt from providing access to technology to the means to create technology," Gershenfeld recalls, noting that King had also pioneered community television, community computing, and community Internet. "It was the obvious next step in the evolution for him. We didn't have to convince him of anything or explain how it fit."

Gershenfeld and his colleagues worked with King to create at SETC a community-scale version of their lab at MIT, offering equipment, software, and training. It was an instant success. "What really drove the success of the SETC lab — and all the fab labs — is the passion to create," Gershenfeld says. "There's a passion to make from bright, inventive people, who often are refugees from very rigid schools or companies who are attracted. They get pulled in for the capabilities but stay for the culture."

As SETC's fab lab took off, the Ghanaian community in Boston surprised Gershenfeld's team by asking them to help make one in Ghana. After that, a contingent from South Africa wanted one. Then northern Norway. Then rural India.

"We did about 10 fab labs where we'd open one and then someone else would want one," Gershenfeld says. "Once we got up to about 10 we saw it was beginning to scale globally. Later we noticed the number of fab labs was doubling roughly every two years, just like Moore's Law for chips, and we realized something much larger was happening."

In 2009, members of the fab lab network started the nonprofit Fab Foundation to facilitate the growth of more labs. Its leaders still credit King for helping them see the potential for expansion. "Mel's tech center was bringing kids into this world where they could be productive, build wealth, and be seen as the innovative spirits that they are," says Fab Foundation CEO Sherry Lassiter, who has worked with Gershenfeld since 2001. "He taught us how you bring communities together."

Fab Network goes global

As the fab lab network has expanded, it has systematized its support programs. The classes and training the labs offer has blossomed into the Fab Academy, a hands-on global version of the MIT class. Meetings among fab lab organizers grew into the Fab Summit, an annual event that brings makers together to share learnings and best practices. MIT last hosted the summit in 2015. This year's event is in Bhutan, then it will return to MIT in 2026 after going to Mexico and the Czech Republic.

"In one sense, it's the most diverse event I know of: You have people from every ethnicity, every income level, etc.," Gershenfeld says. "But in another sense, it's similar people in all of those different packages: bright, inventive change agents."

At a Fab Summit in Barcelona in 2013, the mayor made the bold commitment for the city to produce everything it consumes within 40 years. That commitment sparked the Fab City Initiative, through which similar commitments have been made by 49 cities and regions, including Boston, Cambridge, and Somerville.The initiative is an example of the high aspirations of the fab lab network, which seeks not just to support makers but to change the way societies make.

"Our systems of production and consumption are incrementally producing social conflicts and environmental devastation, but what if we can create a shortcut by bringing production back to the city?" asks Tomas Diez, the executive director of the Fab City Initiative who helped set up the first fab lab in Barcelona. "It won't happen in one day. We have to work within the current system to transform it. But it's going to create new business opportunities and a new economy based on a reorganization of our resources."

Accelerating potential

Inclusivity is another common thread among Fab Labs. In fact, many people compare fab labs to libraries because they are available to be used to create whatever individuals decide.

There are countless stories of fab labs changing people's direction in life. One such person is Jens Dyvik, who did an internship at a fab lab in Amsterdam that inspired him to spend two years touring fab labs around the world, staying for two or three weeks at each lab and volunteering in any ways he could. When Dyvik returned, he started a fab lab in Olso, Norway.

"I got super interested in open hardware and in the potential of what Neil describes as distributing ideas globally and fabricating locally," Dyvik says. "I wanted to see if I could contribute to make that reality."

Gershenfeld says that fab labs are now transitioning from providing access to tools to making the tools themselves. To help facilitate that transition, CBA is helping communities create what he calls super fab labs with more advanced capabilities that can make the components that go into those machines. The first of these was in the south of India, in Kerala, followed by one in Bhutan.

"Some people have basically locally cloned elements of our fab lab," Dyvik says. "We helped them with training, and it wasn't so much the money that was saved as the learning along the way."

Gershenfeld believes machines making machines is the next step for improving access to the means of production. He says King had a lot to do with that idea. "The step after fab labs is you don't buy the tool and then go to the fab lab to use it, you go to the fab lab to make it, so that the tools themselves can spread democratically and virally," Gershenfeld says. "Technology was Mel's focus later in life. He grabbed onto this idea of not just making something, but making something with the means to make itself."

Back at CBA, researchers are working on realizing King's vision with assemblers and then self-assemblers, coming attractions for the future of fab labs. But the spread of fab labs shows that it's not necessary to wait on those results to transform society today.

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