SPE-177181-MS

Fablab Creating a Culture of Innovation in Ecuador

Fernando Bocchicchio, and Manuel Paz, Schlumberger del Ecuador

This paper was prepared for presentation at the SPE Latin American and Caribbean Petroleum Engineering Conference held in Quito, Ecuador, 18–20 November 2015.

Abstract

As part of the Social and Corporate Responsibility actions of the oilfield services company the first fabrication laboratory (Fab Lab) was created. This scientific-technological program was born from an alliance between the public company, Yachay, and the oilfield services company, and it is a clear indication that they share a passion for learning and science to create opportunities for all youth.

The methodology applies is based on informal learning and the theories of creative thinking. The Fab Lab first appeared in 2000 in the Center for Bits and Atoms (CBA) of the Massachusetts Institute of Technology (MIT). Essentially, it is a laboratory where other laboratories are created. It allows for building machines that are capable of **″building almost anything″**. In Ecuador it involves providing this powerful technological tool and sharing infrastructure, machinery, technology and software with people interested in innovation. This Fab Lab is a space for experimentation within the production fields.

To build the Fab Lab in Ecuador the efforts of MIT (Massachusetts Institute of Technology), the public company, Yachay, and Schlumberger del Ecuador S.A. have come together, and thus there is a wide range of objectives, projects and business models and local planning. The aim is to provide digital development enthusiasts. Practical applications include solar and hydraulic turbines, which help to resolve social problems, including health, agriculture and textiles.

On January 15, during the most important Science event in Ecuador, ″INNOPOLIS,″ within the business venture and innovation framework of 2015 in Ciudad Yachay, the FABLAB was presented with a broad agenda of activities for the general public to learn about the latest innovative tendencies around the world, as well as the scientific projects undertaken in Ecuador.

This system looks to have an impact on the socioeconomic structure of the Ecuadorian society, geared toward a culture of innovation, with creative and proactive individuals, with talents that efficiently contribute to resolving public needs, thereby helping with the transformation of the production matrix in the country.

Introduction

The Fab Lab concept appears at the beginning of the 2000s at the Center for Bits and Atoms (CBA) of the Massachusetts Institute of Technology (MIT) whose director at that time was Neil Gershenfeld. It was born from a collaboration within the Media Lab of MIT, between the Grassroots Invention Group and the

CBA, whose research focuses on the relationship between the content of the information and its physical representation and empowerment of communities through a technological base. Under the developmental framework of its research, the CBA receives funding from the National Science Foundation (NSF) to buy machines that can ″build almost everything.″ The Fab lab was born as a way to justify such financing, ″doing what was done at MIT, instead of just talking about it″. In 2002, the first Fab labs in India, Costa Rica, Norway, Boston and Ghana emerge, being local-scale production units.

In 1998, Neil Gershenfeld proposes a course called How To Make (almost) Anything, in which he explains how to handle each machine that makes up a Fab Lab. This class is still being held. In 2004, he performed another course, How To Make Something That Makes (almost) Anything, more oriented to personal fabrication, in which he addresses the concepts of digital manufacturing and open hardware, although the widest part of the course is dedicated to machines and technical aspects. Since 2009, within the model of this course, the Fab Academy offers a distance-learning program that allows for completing and going deeper into the educational resources available in local Fab Labs and technically certifying the people that have achieved them.

Statement of Theory and Definitions

As defined by the Fab Foundation, a Fab lab is defined as follows:

Mission: FabLab is a global network of local labs, enabling invention by providing access for individuals to tools for digital fabrication.

Access: You can use the FabLab to make almost anything (that doesn't hurt anyone); you must learn to do it yourself, and you must share use of the lab with others.

Education: Training in the FabLab is based on doing projects and learning from your peers; you're expected to contribute to documentation and instruction.

Responsibility: users are responsible for:

Safety: Knowing how to work without hurting people or machines

Cleaning up: Leaving the lab cleaner than you found it

Operations: Assisting with maintaining, repairing, and reporting on tools, supplies, and incidents.

Secrecy: Designs and processes developed in a FabLab must remain available for individual use although intellectual property can be protected however you choose.

Business: Commercial activities can be incubated in the FabLab but they must not conflict with open access, they should grow beyond rather than within the lab, and they are expected to benefit the inventors, labs, and networks that contribute to their success.

Description and Application of Equipment and Processes

In the project that the oilfield services company is developing in Ecuador, there are 459 items including computers, supplies, peripherals, consumables and other items needed for the creation of the first fabrication laboratory in Ecuador.

On a general level, the machines usually included in the Fab Lab are:

A computer-controlled laser cutter to assemble 3D structures from 2D parts.

A milling machine for making medium-sized pieces for furniture and houses.

A vinyl cutter to make flexible circuits and antennas.

A precision milling machine for making three-dimensional molds.

Programming tools for low cost-processors.

A RepRap type rapid-prototyping machine.

A 3D printer that can reproduce small-scale 3D figures from a computer file.

Presentation of Data and Results

The main objective that the oilfield services company seeks is to favor creativity, providing students, entrepreneurs, researchers and manufactures with the basic digital tools so that they can develop their projects and apply them in a real way and find solutions to the needs presented.

Fab Labs are spaces of experimentation in the production field that are integrated into local contexts where they are located. In the case of the first fabrication laboratory of Ecuador, it is a joint project between the Public Company, YACHAY, and the oilfield services company. Therefore, there is a wide range of objectives, projects and business models and local planning according to each Fab Lab. Some are explicitly targeted towards artists and cross the digital fabrication experiences and environments of the hacker-spaces, whereas others aim at solving social and health problems; some are funded publicly, while others seek business models that will sustain them. The projects that have been developed in Fab Labs include solar and hydraulic turbines, computers and wireless data networks (thin client), analytical instruments for agriculture and health, custom homes, rapid prototyping machines, and many others.

Conclusions

Prior to the creation of the fabrication laboratory, the oilfield services company along with the public company, Yachay, delivered comprehensive training with the modality of the SEED Academy with 68 teachers from the Urcuqui Educational Unit, where they were trained on different topics related to Science, Technology, Engineering and Mathematics, as well as on basic programming with scratch software and management of basic robotic-principles, and handling Gogo board cards and Makey Makey.

Nowadays it is estimated that there are 59 official Fab Labs around the world. In Ecuador, the Fabrication Laboratory will be opened in November this year.

Digital fabrication labs open the door to personal manufacturing and individualized production. Therefore, they lead to a relocation of production to average or individual level. Additionally, they displace the object of the transaction, as the scarcity of capacity for building the physical object disappears, giving way to design and/or additional services. The Additional Services such transport, customs. . . can also be affected. As for the social aspect, they can easily empower people on the production techniques and be able to solve real problems in their daily life or simply produce something that does not exist or that they just want to produce.

Acknowledgments

Thanks to all students, teachers and the national government of Ecuador for the opportunity to allow the oilfield services company to modestly contribute to the improvement of education in Ecuador.

Nomenclature

MIT	Massachusetts Institute of Technology
LWD	Learning While Doing
STEM	Science, Technology, Engineering y Mathematics
SEED	Schlumberger Excellence in Educational and Development
Fab Lab	Fabrication Laboratory

References

About the Fab lab concept history: Neil Gershenfeld on Fab Labs, *Ted talk,* February 2006, http://www.ted.com/talks/neil_gershenfeld_on_fab_labs.html

Back to top Gershenfeld, Niel, Fab, the coming revolution on your desktop - from personal computers to personal fabrication, Basic Books, New York, 2005

http://fab.cba.mit.edu/classes/MIT/863.08/

http://www.fabfoundation.org /
www.planetseed.com
https://scratch.mit.edu/
http://www.gogoboard.org/
https://www.media.mit.edu/