

## Chapter 5

# Fab Labs and Makerspaces for Learning and Innovation: The Case of Arhte Program in Brazil

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### **ABSTRACT**

*A collaborative space for stimulating innovation is a place of learning through the exchange and sharing of knowledge and experience among its members. At the same time, it allows one to leverage innovation using technological resources available in the space, stimulating the creativity of its participants and enabling the development of products and solutions based on personal projects from ideation, or the construction supported on knowledge developed by other elements together, collaboratively, enhancing the final result. These spaces have several designations and typologies, like makerspaces, hackerspaces, techshops, and fab labs. In this chapter, the authors focus on a model, widely tested and in use in several places of the world, the fab lab. The possibility of implementing a fab lab, or fabrication laboratory, or fabulous laboratory, which is a laboratory of digital fabrication, serving as a prototyping platform of physical objects, with broad educational, social, and economic advantages will be analyzed and described.*

### **BACKGROUND AND LITERATURE REVIEW**

Created in 2001 in the Massachusetts Institute of Technology (MIT) Center for Bits and Atoms (CBA), directed by Neil Gershenfeld, linked to the famous MIT Media Lab, the first Fab Lab was funded by the National Science Foundation (NSF) from the United States of America (USA), and begins based on the success of the course taught by Gershenfeld himself titled “How to Make Almost Anything” (Gershenfeld, 2012).

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## ***Fab Labs and Makerspaces for Learning and Innovation***

Eychenne and Neves mention that these Fab Labs are the “educational component of awareness to digital and personal fabrication, democratizing the conception of techniques and technologies and not just the consumption” (2013, p.10).

With the motto “Learn, Make, Share”, these spaces aim to empower its members for the realization of sustainable solutions, local and community-based, using open source tools and equipment’s whenever possible (open software, open hardware, open design, open learning), to allow all the possibility of creating low cost products which meet the need for one, one hundred, or a thousand people, with the ability to very quickly show the viability of these ideas through the acceptance by the community, leveraging improvements that will make these solutions evolve collaboratively (Greenberg, 2008).

To quickly realize the viability of the solution, the machines and tools existing in the space will allow developing a prototype that, if it’s not feasible, will lead to the search for new solutions (We Fab, n.d.).

Fail early, fail cheap... fail always..., continuing to learn and evolve so that entrepreneurship is encouraged and emulated by others (Instructables, 2010).

In these collaborative spaces the participation of all community members is nurtured, promoting equality of race and gender, benefiting from cross-knowledge, shared by every culture and subculture, which will enrich the result.

Students are encouraged to be producers of knowledge and not mere passive recipients (Student as Producer, n.d.).

Teachers, researchers and students, young and more experienced, men and women of all races and creeds, small business owners, inventors and entrepreneurs, members of the local community, all in a horizontal relationship, without titles or awards, just competence and mutual respect, working and learning from each other in a common space.

Fab Labs build bridges between the engineers and fabrication of high-tech products, and other actors usually more averse to technical and manual manufacturing.

The purpose is to enhance the entry of women in more technical fields and Engineering, but also to attract students and professionals of Arts and Humanities, Design and Architecture, allowing them to materialize their ideas based on available and affordable technology, supporting creative inventions and aesthetic processes that will enrich the research and development results (R&D).

The typology of academic Fab Lab, created in universities or research centers, aims to develop a culture of learning by doing, giving students, teachers, independent inventors and entrepreneurs the opportunity to learn by doing, creating a multidisciplinary space open to the outside to receive different insights and inputs (MIT, n.d.).

In such cases, funding depends on the university or research center where they are installed, as well as the purchase of equipment and materials necessary for their operation, having its educational aspect assured by teachers and Postdoctoral Fellows (Eychenne & Neves, 2013, p.18) that support the management and maintenance of the space and its dynamics (Fab Foundation, n.d.).

Working in a network, like the Internet supporting them, there are currently 1.123 Fab Labs worldwide, being 40 in Brazil (Fab Labs, n.d.), facilitating the sharing of information and knowledge, connecting people and organizations and, thus, enabling the collaborative innovation (Hatch, 2013; Troxler, 2014).

These spaces aim to develop access to knowledge of science and engineering, democratizing the practice of using the technic on the proposed projects (Blikstein, 2014), providing training courses to the community on the use of the equipment available in the space, allowing the use of machines to carry out participant’s own projects or to participate in collaborative projects of the Fab Lab network (Walter-Herrmann & Büching, (Eds.), 2014).

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