

## **FabLab – experimentation and demonstration of innovation with impact on the footwear industry**

### **ABSTRACT**

The article focuses on the development and implementation of the Factory Laboratory concept in Portugal, a place for experimentation and demonstration of new production processes and new technologies (such as 3D printing, robotisation and others), which allows companies to study solutions in a simulated environment before investing. This concept allows the transfer of knowledge to SMEs through experimentation, reducing the obstacles to the implementation of technologically innovative or disruptive solutions in these companies.

### **MANUSCRIPT**

The digital transition of industrial processes and industry in general, whether it is the reduction of paper data recording or the automation of processes and operations, inevitably leads to an increase in the number of specialists in these areas.

However, most businesses, especially small and medium-sized enterprises (SMEs), are not prepared for this new reality and need external support. The FabLabs, Digital Manufacturing Laboratory (FABrication LABoratory), are collaborative spaces focused on innovation and knowledge exchange, spaces that seek to promote new technological skills, search for solutions to specific problems and also demonstration of new technologies (3D printing, automation and applied robotics, Internet of Things, circular economy and others).

In addition to technical capabilities, FabLabs also foster skills such as design thinking and creativity, resource management, strategic planning, teamwork, and networking. These spaces facilitate complementary interdisciplinarity, bringing together teams composed of technicians and researchers from different technological areas.

Thus, the community and companies have the opportunity to explore technological solutions in a simulated environment using existing resources in FabLabs or even study other possibilities in a phase prior to investment and its implementation. In particular, this collaboration brings significant value to the companies, allowing them to stand out in a very competitive sector such as footwear and leather goods.

The first FabLab, created in 2001 and funded by the National Science Foundation (NSF) of the United States of America, originated in an intervention by the founder Gershenfeld entitled "How to do (almost) anything" [1]. The success of the idea was so significant that the concept of FabLab quickly spread throughout the world. There are currently approximately 2,000 FabLabs in more than 149 countries, and they can be grouped into three main lines [2]: academic as is the case of universities or schools with a focus on students; the public aspect, generally supported by public funds, free access and managed by local communities; and the third aspect dedicated to the industrial sector, the professionals of Fablabs, whose objective is to support companies in a certain sector or

sectors where the collaboration of different players is fundamental, often applying the concept of innovation in collaboration of triple or *quadruple helix collaboration*.

Collaborative innovation is the key to the success of any industry process that seeks to develop creative and competitive products and services. In this way, FabLabs enable the bridge between skilled employees, manufacturers of high-tech products, end users and others who are often more reluctant to process and digitise manufacturing, thus improving the capabilities of all stakeholders [3, 4].

In 2020, the COVID-19 pandemic situation highlighted the importance of FabLabs that made a great contribution through the production of PPE and accessories/adapters such as visors, adjustments for face masks, door openers, breathing connectors among many other items [5].

There are almost no FabLabs dedicated to the footwear and leather industries. However, there are some spaces for innovation, demonstration and technological training, without being classified as a FabLab per se. The CTC in France is an example, which presents a "platform" for footwear and leather goods [6]. In addition, some general-purpose FabLabs promote activities related to footwear and prototyping materials, such as the Barcelona FabLab [7] and the Leon FabLab [8].



*Figure 1: Left: 3D printed shoe made at the FabLab in Barcelona. Right: Biomaterials developed at the FabLab in León.1*

In Portugal, the Footwear Technology Centre installed its first FabLab in 2018, a space for experiential learning, innovation, demonstration, prototyping and acceleration of new ideas, called Shoe FabLab [9]. This space is dedicated to a professional network of footwear and leather goods producers, small businesses and artisans. It is also often used for workshops and thematic weeks dedicated to industry professionals or high school and university students. This FabLab is equipped with CAD systems dedicated to 2D and 3D modelling of footwear, cutting tools and sewing machines, as well as shoe assembly and finishing equipment.

More recently, the Shoe FabLab has expanded to include a second and third space dedicated to digital technologies such as 3D printing, robotics, automation solutions and

the Internet of Things (IoT), the production and recycling of materials for 3D printing, laser engraving and cutting, digital printing, simulation software and digital twins, among others (ref10), thus becoming the CTCP FabLab. There is also content in video format for technological awareness and educational resources where newly developed technologies of interest to the sector are presented, as well as to address their potentialities and limitations. For more effective collaboration, a strategic questionnaire has been developed for industry players to understand which technologies would be of interest to companies to experiment with and receive more information, focusing on digital marketing, 3D printing, IoT, augmented and virtual reality, automation and robotics, and the digitisation of production and management processes.

Globally, a FabLab offers industry, in particular, the footwear and leather goods industries an opportunity for companies to use digital technologies to influence the production process for sustainable design and adapt to the changing environment of markets and innovative practices.





*Figure 2: CTCP FabLab.2*

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