

FabLabs as local business incubators on the example of Krakow

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Abstract: Entrepreneurship is an important element of the modern market economy. The characteristic features that describe modern entrepreneurship are expansiveness and innovation. Expansiveness defines the willingness to catch up with the best and setting ambitious goals. Innovation means a constant search for novelties and constant improvement. The functioning of modern places such as FabLabs fits in with the characteristic features of modern entrepreneurship. The scientific goal of this publication is to present the FabLabs institutions as innovative organizations that catalyze entrepreneurship on a local scale. The article presents a detailed analysis of the Krakow community of the FabLabs. The research methods used in the article are: analysis of existing data and telephone interview. The article was created using compact book materials, magazines, as well as netographic information and telephone contacts with representatives of Krakow's FabLabs. The article describes the concept of FabLabs, its roots and development in the world and in Poland. The functioning and role of the FabLabs as local entrepreneurship centres in Poland were discussed. The activities of the FabLabs in Krakow were thoroughly analyzed. The thesis put forward in the publication is that FabLabs play an important role in supporting local entrepreneurship. The research results positively verify the thesis. Based on the collected data and the information obtained, it is clear that the functioning of the FabLabs in the city of Krakow significantly favours local development of entrepreneurial attitudes.

Keywords: expansiveness, innovation, creativity, society, local systems

1. Introduction

Entrepreneurship is now a lever of the modern economy. It enables constant development and achieving a competitive advantage. Expansiveness and innovation are characteristic adjectives that describe contemporary entrepreneurship.

Among the many places for the development of entrepreneurship, FabLabs deserve attention in the form of publications. These relatively new places for the development of ideas in Poland are becoming more and more popular.

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The scientific aim of the article is to present the FabLabs institutions as innovative organizations that catalyze entrepreneurship in local systems. The publication devotes special attention to the Krakow community of FabLabs.

The research methods used in the article are: analysis of existing data and telephone interview in the form of open questions. The publication was created thanks to the use of a compact book monograph, magazines, as well as netographic information and telephone contacts with managers, founders and employees of the Krakow FabLabs.

The thesis put forward in the publication is that FabLabs play an important role in supporting local entrepreneurship.

Based on the results of the research, it is clear that the functioning of FabLabs in the city of Krakow significantly fosters the development of entrepreneurial attitudes, fosters the creation of innovation, while playing a pro-social role.

2. The concept and development of FabLabs in the world

The term FabLab (also Fab Lab, Fab lab) comes from Fabrication Laboratory and means a type of workshop or a small laboratory that allows willing people to implement their own ideas, passions or projects. Sometimes a FabLab is defined as a small workshop that offers digital modelling and manufacturing capabilities (Gershenfeld, 2005).

The concept of FabLab is synonymous with such concepts as:

- Makerspace;
- Hackerspace (Haklab) (<https://hackerspaces.org>, 2020).

FabLabs are publicly available institutions that offer at least some of their services or workshops for free. Each FabLab must contain, inter alia, a 3D printer, an electronics zone with available microcontrollers, a carpentry shop or a CNC plotter. The scope of the equipment is precisely defined by FabFoundation (<http://www.fabfoundation.org>, 2020).

Makerspace can be defined as a physical space equipped with work tools. Unlike the FabLabs, there are no rules that define how large a space is and what specific tools must be in it (<http://wojciechkarz.pl/makerspace/>, 2020).

Hackerspace is a grassroots form of Makerspace, usually focused on programming and electronics. Like Makerspaces, Hackerspaces usually live off contributions and have little formal rules. They often host parties, focusing on building a community of hackers and electronics to create new projects together (<https://startup.pfr.pl/pl/aktualnosci/makerspace-co-jest/>, 2020).

The world's first FabLab was established in 2001 in the USA. Its founder was Professor Neil Gershenfeld, director of the Center for Bits and Atoms at Media Lab, scientifically associated with the Massachusetts Institute of Technology (MIT) in Cambridge, USA (Markoff, 2011). As a physicist, computer scientist and DIY enthusiast, he initiated the creation of the first FabLab in the world. In 2001, Gershenfeld came to the conclusion that the world is full of people with different ideas, but who lack a place to work and implement ideas in practice. According to Gershenfeld, people who want to create something or improve an already functioning product should be given a chance (Mikhak et al., 2002).

The first FabLab was the result of a collaboration between the Grassroots Invention Group and the Media Lab Center for Bits and Atoms at the Massachusetts Institute of Technology (MIT) under a grant from the National Science Foundation in Washington. The key objective of establishing the first FabLab was an attempt to examine the degree of the ability to implement the possessed information and knowledge in practice and the suitability of high technology for the needs of local communities. The pioneering FabLab, in contrast to the majority of those currently operating, was a typical university unit (Fab Central—Fab Lab—IaaC. Archived from the original on 10 February 2014).

Another FabLab was created on the Asian continent. The Indian Institute of Education (Vigyan Ashram) with capital backing from the National Science Foundation created the first FabLab outside the US in India in 2002 (<http://vigyanashram.com/Default.aspx>, 2020).

Until 2008, the number of FabLabs remained low (Osunoyomi et al., 2016). In the following years, the idea of FabLabs began to spread rapidly around the world. Studios began to appear on almost every continent. In 2009, at the initiative of Gershenfeld and as part of MIT, the FabFundation was established. The Foundation coordinates the opening and operation of FabLabs around the globe. The organization has also developed its own logo (Figure 1) and specific guidelines for the necessary FabLab equipment that is necessary to use this name (<http://www.fabfoundation.org/index.php/about-fab-foundation/index.html> 2020).



Figure 1. Logo of the FabLabs

Source: https://en.wikipedia.org/wiki/Fab_lab, 2020.

Contributing to the expansion of the FabLabs around the world is the fact that the foundation does not charge any license fees from its followers. Moreover, it does not impose any additional restrictions as to the conditions of functioning on a given market. The project logo can also be used at no cost. According to the Małopolska Regional Development Agency (MAAR) estimates, more than 1000 FabLabs currently operate on the markets of 100 countries (<https://www.marr.pl/news/fablab-malopolska-wkrotce-w-krakowie/>, 2020). Most of them, however, no longer have much in common with university units. The locations of FabLabs in the world in 2018 are shown in Figure 2.



Figure 2. Map of the FabLabs around the world

Source: <https://www.dobreprogramy.pl/cyryllo/FabLab-miec-swoje-miejsce-na-hobby,86498.html>, 2020.

The data in Figure 2 clearly show the dominance of the location of the FabLabs in Western Europe as well as in the USA.

FabLabs allows realize passions, interests or dreams. Thanks to their help, it is possible to produce many interesting products or inventions. An important aspect of the FabLabs' activity is mutual assistance, cooperation between members and supporting creativity. FabLabs also focus on group work, which triggers synergistic effects (Gershenfeld, 2005).

The FabLabs' offer is addressed to wide social groups, including in particular young people who do not have their own technical background, workplace, tools, and the necessary technical knowledge. This mainly applies to young city dwellers, schoolchildren and students who have limited financial resources (Tokushima, 2016).

FabLabs, thanks to their equipment, give the opportunity to implement their passions in practice without falling into costs. They operate in an open hardware environment and take the digital revolution to a new level, for example with self-replicating 3D printers. As workshops for creative work, FabLabs usually have:

- computers;
- devices for digital production and fabrication (3D printers, 3D scanners, CNC machine tools, plotters) thanks to which it is possible to create virtually any object or device;
- cutters for sheet metal processing: laser cutter, plasma cutter, water jet cutter, knife cutter;
- carpentry tools;
- design stations, both assembly and testing (Verbelen et al., 2013).

FabLabs care about safety and compliance with health and safety rules. Each person who wants to use the collected equipment must undergo appropriate workplace and health and safety training. What’s more, beginner DIY enthusiasts can count on the support and advice of trainers. In addition to access to devices, each FabLab user has the opportunity to establish contacts with other people, share knowledge and ideas. Moreover, on the premises of the FabLabs, workshops and practical classes by people prepared for this are conducted. As part of the lablabs, there are also associations of DIY enthusiasts, modellers, architects, artists and engineers (Walter-Herrmann and Bueching, 2013).

3. The beginnings and development of the FabLabs in Poland

The FabLab market in Poland is under development. Compared to the USA or Germany, FabLabs, Makerspaces and Hackerspaces appeared in Poland relatively late, just a few years ago. The location of FabLabs, Makerspaces and Hackerspaces in Poland at the end of 2017 is shown in Figure 3.



Figure 3. Location of FabLabs, Makerspaces and Hackerspaces in Poland in September 2017

Source: <https://www.dobreprogramy.pl/cyryllo/FabLab-miec-swoje-miejsce-na-hobby,86498.html>, 2020.

The data in Figure 3 shows that FabLabs and its related Makerspaces and Hackerspaces are unevenly distributed. At the end of 2017, there were 21 active FabLabs in Poland. Most of them operated in the Greater Poland Voivodeship (5) and Silesian Voivodeship (4). Including the Makerspaces and Hackerspaces, which often later turn into FabLabs, the regions with the

highest saturation should include the Masovian and Lower Silesian voivodeships. In total, out of 16 regions in Poland, 11 can boast of having active FabLabs in their area. The fewest FabLabs, Makerspaces and Hackerspaces are located in the eastern part of Poland, i.e. in the least developed and least enterprising regions of the country.

The first FabLabs in Poland appeared in large urban centres. Gdynia, Lodz, Poznań, Krakow and Warsaw are among the cities that can be considered pioneers of FabLabs, Makerspaces and Hackerspaces in Poland. The list of the first FabLabs in Poland is presented in Table 1.

Table 1. The first FabLabs in Poland

Name	Town	Date of establishing
FabLab Lodz	Lodz	2013
FabLab Tri-City	Gdynia	2013
FabLab Lublin	Lublin	2013
Wytwórnia (Plant)	Krakow	2013
FabLab Kielce	Kielce	2013
Zakład (Plant) Makerspace	Poznań	2014
FabLab Poznań	Poznań	2014
Hackerspace Kraków	Krakow	2014
FabLab	Bielsko-Biała	2014
Off Marina	Szczecin	2014
FabLab24	Bielsko-Biała	2014
Fab Lab Twarda powered by Orange	Warsaw	2017
FabLab Gdansk powered by Orange	Gdańsk	2017

Source: Author's own elaboration.

One of the first Polish FabLabs was FabLab Lodz, opened in 2013. FabLab Tri-City is also one of the pioneers in this field. The oldest are FabLabs in Lublin and Kielce, too. In Poland, the presence of the FabLabs is not only the domain of large cities. The presence of the studio can be noted in smaller towns such as Wisła, Września, Sokołowsko, Niechanowo. In this respect, the Greater Poland Voivodeship is in the lead (<http://fab-lab.pl/>, 2018).

Polish FabLabs are often made in unusual places. Krakow's Wytwórnia (Plant) operates in the last remaining building of the former Telpod factory in the industrial district of Zabłocie (<https://wytworniakrakow.pl/>, 2020). Szczecin's Off Marina was established on the site of a nineteenth-century restaurant enriched with concert halls and a theatre, transformed into a furniture factory after the war (<http://off-marina.pl/>, 2020). In turn, the Poznań Makerspace Plant is located in the premises of the former graphic factory in the Jeźyce district (<http://zaklad.org/>, 2018).

Polish FabLabs often produce unique and innovative items, e.g. in Off Marina individually ordered guitars, in FabLab Małopolska accessories for Star Wars Armada or patchwork products. FabLab Lublin can boast of building houses using the straw bale method, ecological energy generators or compost toilets, and FabLab Krakow—weather stations with air purity sensors.

Polish FabLabs are not a monolith. Some of them focus on developing traditional professions based on the use of new technologies, while others are only based on electronics, IT or high technologies.

Polish FabLabs function as social nonprofit organizations. Most often they have the status of an association or foundation. In most cases, they are started by a group of enthusiasts, students. Some are created with the support of external entities, such as FabLab24 (<http://www.fablab24.pl> 2020). Most of them operate independently, in some cases as school organizations. Such an example is FabLab Wisła Czarne (<http://fablab.wisla.pl/> 2020).

4. Krakow's FabLabs as local business incubators

The Krakow's FabLabs market is one of the most dynamic in Poland. The first Hackerspace in Krakow, later transformed into FabLab, was established in 2012. In the following years, more studios began to appear. In 2020, there were four FabLabs in Krakow. The characteristics of the Krakow's FabLabs are presented in Table 2.

Table 2. FabLabs in Krakow in 2020

Name	Date of establishing	Number of members	Specialization
Hackerspace Kraków	2012 (2014)	30	Modern technologies, electronics, IT
Wytwórnia (Plant)	2013	50	Creative workshop, handicraft
FabLab Krakow	2017	15	Modern technologies, electronics, IT
FabLab Małopolska	2018	10	Modern technologies, electronics

Source: Author's own elaboration.

The first three FabLabs were created thanks to the initiative and financial resources invested by young people interested in creating a creative space. These people then involved other volunteers in the activities. On the other hand, the newest Krakow's FabLab was created on the initiative and with the support of a non-governmental organization and the Marshal's Office.

The first FabLab in Krakow, which from the very beginning met the requirements set by the FabFundation, inaugurated its activity on 11 May 2013. On the initiative of two students, Kajetan Jaształ and Maciej Chart-Olasiński, FabLab was launched under the name Wytwórnia (Plant) at 9 Ślusarska Street in Krakow's Zabłocie district. At the beginning, the studio operated as a sole proprietorship. However, from 2016 it obtained the status of an association (<https://wytworniakrakow.pl/>, 2020).

The business premises were renovated and equipped thanks to the efforts and financial resources of the founders and a group of supporters. Currently, it has about 350 square metres of usable space, divided into such parts as:

- Fine picking zone;
- Carpentry workshop;
- Zone of embracing and organization;
- Heavy works zone;
- Quiet work zone;

- Chillout zone;
- Co-work;
- Ideationroom;
- Photo darkroom.

The facility was designed as a studio, workshop and prototyping room. The main profile of the activity of the discussed FabLab are traditional professions and activities such as tailoring, renovation of old furniture, making musical instruments, carpentry and screen printing. The facility, which was initially intended to be a meeting place for a narrow group of friends, began to expand its group of members over time. Currently, their number can be estimated at about 50 people.

The label is financed through monthly fees charged to its members. Their amount varies depending on the status and frequency of appearances in FabLab. As part of a coworking workshop, monthly fees range from 80 PLN to 350 PLN, and in the case of a coworking office, from 250 PLN to 450 PLN. In addition, the additional financial support comes from voluntary donations from donors from various sources. For some time, the Wytwórnia (Plant) was also living off fees for renting rooms for various types of training or events.

According to Katarzyna Dulińska-Bohonko, the person responsible for marketing and PR at the Wytwórnia (Plant), the profile of its supporters is varied. The members of the label are students, working people, as well as entrepreneurs, designers and freelancers. Each member undergoes mandatory health and safety training or on-the-job training necessary to work with a given device.

Some people treat activity in FabLab as a typical hobby or a way of spending free time. The results of their work often become the furnishings of their homes. However, for some members of the discussed studio, the products of their work constitute the basic or additional source of income.

Some of the members of the Wytwórnia (Plant) are also involved in coaching activities. Trainers represent various fields and disciplines of knowledge and craftsmanship. During regular training, they help and support new members. They also organize trainings and shows for external entities.

Among the most visible activities of the organization in question in stimulating local entrepreneurship, it was necessary to conduct a free creative workshop in November 2018 called “Discover the designer in yourself”. The workshops were intended for all eager and broad age groups. The activities covered 11 thematic areas, including ceramics, portrait photography, book illustrations and sieve-sewing. In addition, the Studio can boast of organizing a number of other events. These were, among others workshops on building 3D printers organized by Materialination, programming workshops: WebMuses and OpenProgramming, Christmas decorations factory, MediaLabs, as well as numerous film evenings, joint breakfasts and design sessions.

In 2012, Hackerspace Kraków started its activity. In 2014, it was renamed FabLab. The organization was established by two students: Maria Skrzypek and Mirosław Woźniak. Hackerspace Kraków has been operating as a foundation since 2014 and is located at 5 Zacisze Street in the very centre of the city (<https://hackerspace-krk.pl/>, 2020).

Hackerspace Kraków gathers mainly lovers of small electronics, modern 3D technologies and programming microcontrollers. According to Jakub Kramarz, a board member of the Hackerspace Kraków Foundation, its members are students, high school students, retirees, pensioners, as well as families with children. Financing the activities of the FabLab in question is carried out through membership fees, which amount to 50 PLN per month and donations. The organization specializes in conducting courses, presentations and workshops.

The most important achievements of the Hackerspace Kraków Foundation in stimulating local entrepreneurship include the annual organization of amateur radio courses enabling the acquisition of amateur radio licenses. These are the only courses of this type in the region. In addition, the cyclical Nighthacks that integrate young people to work on joint projects deserve attention.

On 11 October 2017 Robert Gryń, the owner of the Krakow-based Codewise company, decided to open his FabLab (<https://innpoland.pl/147267,fab-lab-krakow-inicjatywa-roberta-gryna-o-ktorej-nikt-nie-slyszal>, 2020). FabLab Krakow is located at 8 Czysa Street in Krakow and functions as an association. The studio, in addition to 3D printers, provides the possibility of using a laser cutter, CNC milling machine, prototyping electronic devices or using sewing machines. FabLab Krakow offers also workshops on ceramics, vegan felting, the production of natural cosmetics, small electronics, screen printing, creating moss pictures and a wordpress course. According to Przemysław Baranowski, the guardian of FabLab Krakow, working at FabLab Krakow gives the opportunity to experiment on your product and correct its mistakes. One of the designers, while working at FabLab Krakow, created original shoes with a wooden sole—Skleyaki. They use the technology of alternating cutting in wooden alder plywood. The author of the idea won them in the Young Design 2018 competition (https://www.iwp.com.pl/young_design, 2020).

The offer of FabLab Krakow is addressed to a wide range of interested people, regardless of age, gender or profession. The free thematic workshops for people with disabilities are worth mentioning. The organization applies preferential fees to students. The cost of monthly access without any time limits at FabLab Krakow is 150 PLN (100 PLN for students). The price includes access to all devices without exception, basic materials and the ability to store your unfinished projects. There is also a single entry fee of 30 PLN (20 PLN for students). Every Thursday from 4:00 pm to 9:00 pm FabLab Krakow offers free tours (<https://fablab-krakow.pl> 2020).

On 17 October 2018, at the initiative of the Małopolska Regional Development Agency represented by Jakub Hołysz and the Marshal's Office, the youngest FabLab in Krakow was established (<https://www.marr.pl/> 2020). FabLab Małopolska was located at 65A Królewska Street. The organization in question offers access to 6 laboratories:

- tailoring;
- modelling;
- design;
- electronics;
- 3D printing;
- product photography.

The youngest FabLab in Krakow is currently in the embryonic stage. Its launch and financing currently comes mainly from subsidies from Małopolska Regional Development Agency and membership fees in the amount of 80 PLN introduced from January 2019 (<https://www.fablabmalopolska.pl/>, 2020).

According to Malwina Wójcik, the coordinator of FabLab Małopolska, FabLab's members are mainly students of various faculties, especially arts. There are also people representing the older generation of FabLab's enthusiasts, as well as families with children. For seniors, a visit to FabLabs is a return to childhood memories related to attending classes in modeling shops.

FabLab Małopolska supports local entrepreneurship by organizing a number of free events. On the one hand, these are trainings, courses, meetings addressed to various groups of recipients (mainly students, young entrepreneurs, families with children). FabLab organizes contests in which you can win subscriptions that give you the opportunity to work individually in this creative space. Particularly noteworthy is the rich offer of thematic family (family) or children's workshops.

The organization of projects supporting young business is one of the most important achievements of the organization in question. The businessmaker project teaches the basics of business and running your own business. On the other hand, the innomaker project introduces the principles of design thinking—designing and commercializing everyday products. Some of the manufactured products are sold, which constitutes income for their creators, and some become a permanent element of the organization.

Despite the fact that there are several FabLabs in Krakow, there is no competition among them. It can rather be said about creative inspiration and exchange of mutual experiences.

The future of FabLabs in the Małopolska Voivodeship is promising. It is planned to open more studios, located not only in Krakow, but also in smaller towns of the region. In addition, it is also planned to launch a mobile FabLab, located in a truck, which would reach remote corners of the region (<http://innowacyjnystart.pl/index.php/miejsca-i-spoleczności/152-fab-lab-malopolska>, 2020).

5. Summary

The activity of FabLabs, as well as related Makerspaces or Hackerspaces in Poland and in the world, is difficult to overestimate. Enabling young people, and not only, access to space, equipment or technology provides a simple way to shape creativity and stimulate innovation. Many people have their own ideas, but it is not possible to implement them in practice. The idea of FabLabs meets these types of problems and acts as local business incubators.

In the case of countries such as Poland, the activity of the FabLabs is particularly valuable. For years, Poland has been one of the last places in Europe in terms of the level of innovation. Many ideas are unlikely to be implemented due to the lack of technical or financial resources of the creators. The spread of places of creativity seems to be a valuable remedy for improving the disadvantage.

Due to the growing interest in the FabLabs' offer in Poland, their further development can be expected. It would be especially valuable to develop FabLabs in small towns and villages, where access to modern technology is the most limited.

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FabLabs jako lokalne inkubatory przedsiębiorczości na przykładzie Krakowa

Abstrakt: Przedsiębiorczość stanowi istotny element współczesnej gospodarki rynkowej. Charakterystycznymi cechami opisującymi nowoczesną przedsiębiorczość są ekspansywność oraz innowacyjność. Ekspansywność określa chęć dorównania najlepszym i stawianie sobie ambitnych celów. Innowacyjność zaś to ciągłe poszukiwanie nowinek i nieustanne udoskonalanie. Funkcjonowanie nowoczesnych miejsc takich jak FabLaby wpisuje się w charakterystykę współczesnej przedsiębiorczości. Celem naukowym niniejszej publikacji jest przedstawienie instytucji FabLabów jako społecznych i jednocześnie innowacyjnych organizacji katalizujących przedsiębiorczość w obszarach miejskich. W artykule poddano szczegółowej analizie krakowskie środowisko FabLabów. Metody badawcze zastosowane w artykule to: krytyka piśmiennicza, analiza danych zastanych i wywiad telefoniczny. Artykuł powstał dzięki wykorzystaniu

zwartych materiałów książkowych, czasopism, jak również informacji netograficznych i kontaktów osobistych z przedstawicielami krakowskich FabLabów. W artykule dokonano charakterystyki pojęcia FabLab, jego korzeni oraz rozwoju na świecie i w Polsce. Omówiono funkcjonowanie i rolę FabLabów jako ośrodków przedsiębiorczości na terenie Polski. Dogłębnej analizie poddano działalność FabLabów na terenie Krakowa. Teza, jaką postawiono w publikacji, to stwierdzenie, że FabLaby odgrywają istotną rolę społeczno-innowacyjną w kreowaniu zachowań przedsiębiorczych. Wyniki badań pozytywnie weryfikują postawioną tezę. Na podstawie zgromadzonych danych i uzyskanych informacji wynika jasno, że funkcjonowanie FabLabów na obszarze Krakowa w istotny sposób sprzyja rozwojowi postaw przedsiębiorczych oraz kreowaniu innowacyjności, przy realizowanej jednocześnie funkcji prospołecznej.

Słowa kluczowe: ekspansywność, innowacyjność, kreatywność, społeczeństwo, układy lokalne