Fab Labs in Italy: Collective Goods in the Sharing Economy

UNIVERSITÀ DEGLI STUDI DI TORINO

FabLabs in Italy: collective goods in the *sharing economy*[1]

by Cecilia Manzo and Francesco Ramella

1. Regarding Makers and FabLabs

FabLabs (Fabrication Laboratories) are artisanal workshops, open to the public, offering tools and services for digital manufacturing – in other words, the transformation of data into objects and viceversa. While rapidly expanding on a global scale, these laboratories have as yet been little studied. Google Scholar, for example, reports the existence of only 52 publications devoted specifically to this topic, and these have mostly appeared in the last five years.[2] Only a small minority are scientific in nature. None of them – as far as we are aware – deal with the subject in terms of local development. The purpose of this article, therefore, is to explore the FabLab from this particular perspective, with two objectives in mind. The first is descriptive: we intend to reconstruct the geography and the characteristics of these laboratories in Italy. We want to understand where, when and how they came into being, as well as what they do and what ties they have with the territory in which they operate. The second goal is more expository: we intend to provide some hypotheses regarding the reasons for, and modalities of, their proliferation.

FabLabs are one of the manifestations of the so-called "maker movement". But who are these makers? They might be called the new craftsmen of the digital era. Many of them are hobbyists and amateurs: Werner Sombart would have classified them as "Sunday inventors". Others, however, are proto-entrepreneurs who use their creative and professional skills to launch new products and activities. These, Sombart would have defined as "weekday inventors" or "inventors of

---

[1] This article is the result of the joint work of the two authors and the assumptions and arguments developed are the result of their shared, accrued reflections. That being said, sections 1, 2 and 3 were written by Francesco Ramella and sections 4, 5 and 6 by Cecilia Manzo. The latter has also collected data on Italian FabLabs and carried out interviews with their founder-coordinators. The authors would like to thank Renzo Carriero, Davide Donatiello, Ivana Pais and Maurizio Pisati for their helpful suggestions during the writing of the text.

[2] This consultation took place at the end of July 2015, making use of key title words (Fab Lab; Fabrication Laboratories etc.).

anything" [3] (Sombart 1916).

Makers are often young people with a passion for "personal fabrication": they combine DIY with the use of digital technologies, thus giving rise to new economic phenomena. In some cases, these are activities that are not primarily motivated by reasons of acquisitiveness and are not aimed at producing goods for the market: they follow a different logic, based on cooperation, the dissemination and sharing of knowledge and the application of open source principles to the manufacture of material objects.

In other cases, these are activities that do not exclude commercial purposes, generating productive and entrepreneurial phenomena that collocate them partly in the context of the sharing economy and partly in that of the market economy. These new activities invest both in production and distribution areas. In terms of the former category, one can consider those companies that arose in connection with the maker movement, dealing for example with the production of new 3D equipment, or digital artisan products or services specialising in rapid prototyping. Regarding distribution, one can mention the marketplace created for the distribution of new personal artisanal products, both digital and otherwise, as well as specialised publications (such as *Make* magazine) and trade shows (Maker Faires).

Maker companies are clearly generational in nature and differ from traditional artisanal companies by making the most of the opportunities offered by new electronic and information technologies at various stages in the life cycle of the product: the creative process (through open innovation and online communities); project financing (through crowd-funding platforms); product design and scanning of (through CAD programs and 3D scanners); prototype construction and small series of products (through 3D printers, laser cutters and online production services); and sales (via e-commerce).[4]

[3] As we will see, this latter category was used by Neil Gershenfeld to give a name to his MIT course, which led to the origins of the FabLabs.

[4] For a more detailed reconstruction of the "maker phenomenon", see: AaVv 2014; Aliverti 2014; Anderson 2012; Gauntlett 2011; Gershenfeld 2011, 2012; Hatch 2014; Menichinell and Ranellucci 2014.

The rapid proliferation of FabLabs in many countries over the past decade must be understood against this background. These laboratories work with the typical mechanisms of the sharing economy: they provide a space with tools and equipment for digital manufacturing, making them available to individual users, small businesses and schools. There are three main objectives: a) training; b) the promotion of digital fabrication; c) the development of open-innovation.

In addition, they operate by linking local resources to global networks. On the one hand, in fact, their configuration is that of a *local place*: a physical location used for tutoring, teaching, and implementing creative solutions, with groups of individuals interacting in a specific local context. On the other hand, they are also a *global place*, guaranteeing access to an international community of laboratories and groups of individuals with shared practices and attitudes. In other words, they mobilise local resources, while at the same time making use of a repertoire of practices and resources available on a global scale.

For these reasons, FabLabs can be considered as "local collective goods" (LCG) capable of generating external economies useful for development. [5] They have, however, operational modalities and generative mechanisms somewhat different from traditional LCG, as explored in the literature on local development and mostly associated with the activities of public institutions (authorities) or interest organisations (associations). The study of these collective goods in the sharing economy is particularly interesting in a context such as the Italian one, characterised as it is by a strong artisanal vocation and the widespread presence of small and medium-sized businesses. It can

[5] In the literature on local development, LCG are thought of as "generators of external economies" that operate on a local scale. They create advantages for a local area's companies (especially SMEs) both because they lower production costs and because they increase innovative capacity (Crouch et al., 2001; Crouch et al., 2004; Trigilia 2005). These external economies can be tangible and intangible. The former include local infrastructure and services; the latter include cognitive and normative resources, such as tacit and contextualised knowledge, conventions, norms of reciprocity and local social capital (Le Galès and Voelzkow 2001, p. 3). Businesses – especially small ones – are not able to produce these competitive advantages by themselves: such advantages are instead generated and provided within the local production system as typical public or club goods.

help to focus on the contribution they can make to the diffusion of digital fabrication and open-innovation in manufacturing sectors.

As is well-known, the Italian innovation system is a rather weak one (European Commission 2015). And so it is rather surprising to find Italy ranked third in the world in terms of the number of FabLabs (behind the United States and France). Why then, in a country that is so fragile where innovation performance is concerned, have, in just a few years, as many as 56 FabLabs sprung up, all members of the international Fab Foundation network? [6] Why are these laboratories located primarily in the country's central and northern regions, and especially in the areas that make up what is known as the "Third Italy"? Does there exist a link – as this information would seem to suggest – with the widespread pattern of industrialisation present in Italy, based on small and medium-sized manufacturing enterprises?

To find an answer to these questions – and thus solve the "Italian puzzle" – we carried out a two-level survey, the first being macro and meso in nature. After discussing the distinctive characteristics of the FabLab (section 2), we made a geographical analysis involving different territorial zones (section 3). The intent was to see if an ecological analysis would provide some sort of interpretative path regarding the "contextual factors" that influence this phenomenon.[7] The second, micro, level is territorially more circumscribed. To reconstruct the "agency factors" that drive this kind of development, we gathered information on all the Italian FabLab websites and conducted twenty semi-structured interviews with some of their founders/coordinators (section 4). There was a twofold purpose here: a) to reconstruct the generating mechanisms in order to test the interpretations suggested by the ecological analysis; b) to analyse the type of activities and services provided in order to understand if and in

[6] The Fab Foundation –we shall go into more detail about this later on – is a non-profit organisation and part of the FabLab program at MIT's Center for Bits and Atoms. The Fab Foundation website – from which we obtained the list of laboratories – shows 57 Italian FabLabs (the same number as in France). On the list, however, one of them occurs twice under different names.

[7] By contextual factors, we refer to the socio-economic and institutional features of specific territories, which also include cultural and regulatory aspects. For the distinction between contextual and agency factors, see Burroni and Trigilia (2011).

what way they can be considered as LCG that promote new ways of arriving at entrepreneurship and innovation.

2. New local collective goods for development

FabLabs represent a subcategory of *makerspace*, which in part also includes activities pursued in *hackerspace* and *coworking environments*. They also have certain distinctive features, however: 1) a strong specialisation in digital technologies for rapid prototyping [8]; 2) the sharing of certain guiding principles; 3) the membership of an international network of laboratories that employ the same procedures and equipment.[9]

As we have already mentioned, they are small laboratories open to the public, with digital manufacturing equipment and services, and possessing two main aspects: a) on the one hand they are a *technical platform* for innovation, aimed at stimulating local entrepreneurship; b) and on the other they are a *social platform* for innovation, designed to stimulate learning, creativity and peer to peer collaboration.

To be accepted into the international network, they must comply with four essential requirements (although there are no formal checks): 1) Public access to the laboratory must be guaranteed, either free or based on an exchange of services, for at least part of the week. 2) They must subscribe to the principles of the Fab Charter. For our present purposes, the final two are perhaps the most important: these

[8] Compared to traditional methods, new digital manufacturing technologies enable faster and cheaper prototyping of industrial and artisanal products.

[9] Given the relative newness of the phenomena, it is worth specifyifying what we mean by these terms. *Coworking* refers to a working environment shared by people who perform independent activities (self-employed, freelance etc.) and who are interested not only in dividing up the cost of renting an office but also in combatting the isolation connected to these professional activities, creating opportunities for interaction and synergy with others working in the same space. *Hackerspace* involves centres that enable people with common interests, often related to software programming and information technologies, to meet in a physical location, to discuss and co-operate on individual or group projects, the orientation being one of "open innovation". *Makerspace*, meanwhile, comprises centres and workshops for DIY artisanal activities, equipped with tools, equipment (digital or otherwise) and training programs that are made available to the public to create and design. These workshops may be set up by schools, universities, associations, private individuals and companies, both for educational and amateur purposes and for commercial reasons. On the differences between FabLabs and the above places, see Cavalcanti (2013) and Make in Italy (2015).

establish the lawfulness of the commercial exploitation of the projects developed in the FabLab and also the sharing of certain of the benefits that derive therefrom.[10] 3) They must adopt the tools and processes common to all FabLabs pertaining to the worldwide network.[11] 4) Finally, they must actively participate in this network, collaborating with other FabLabs and taking part in some of its most important events: video-conferences, annual meetings and Fab Academy courses.[12]

This international network was founded by MIT professor Neil Gershenfeld, who opened the "Center for Bits and Atoms" (CBA) in 2001. The name of the centre clearly illustrates the idea that inspired the FabLabs: the setting up of places where information technology meets productive activity – where, in other words, new objects are created using digital design interacting with machines that operate on physical materials. In short, then, laboratories where bits interact with atoms.

The FabLab project builds on the success with MIT students of an experimental course launched by Gershenfeld in 1998, "MAS 863: How to Make (Almost) Anything", the intention of which was to bring together personal and digital fabrication, individual creativity and group collaboration. With support from the National Foundation, which had financed the CBA, a program was later launched to extend these experiences beyond MIT walls. The first FabLab was thus established in 2003 in Boston's South End Technology Center and this was followed by others in India, Costa Rica and Norway. The basic equipment for each of these centres had an initial value of about

[10] The Fab Charter can be downloaded (in 12 different languages) from this site: http://www.fabfoundation.org/fab-labs/the-fab-charter/.

[11] All FabLabs contain a number of machines and programs (open source and freeware) to create and realise physical objects. Some equipment, such as 3D printers, use so-called "additive technologies" (printing layer on layer to build prototypes and objects of all kinds), while others employ "subtractive technologies" (eliminating parts of material) such as CNC milling machines, laser cutters and cutting plotters. Then there are other tools for the input phase, such as 3D scanners and various software for 3D graphics. And finally there is the famous Arduino board, a cult object for makers all over the world: the open source platform for electronic prototyping created in Italy by Massimo Banzi in the context of the activities of the Ivrea Interaction Design Institute. A detailed list of the equipment that should be found in each of the participating laboratories in the Fab Foundation can be found at this address: http://fab.cba.mit.edu/about/fab/inv.html.

[12] The Fab Academy is an advanced training program dealing with digital fabrication.

$20,000. [13] Over the following years, these experiences were replicated in many other countries around the world and so in 2009 the Fab Foundation was established to support and facilitate the creation of an international network.

The diffusion of these labs should be seen in the context of the technological and organisational changes taking place in the manufacturing sector, which have given rise to talk of a "third industrial revolution" (The Economist, 2012; Anderson 2012). A new production scenario, in other words, based on the digitisation/ automation of fabrication, on online trade and on strategies of open innovation, both market-oriented and otherwise. (Benkler 2003; Chesbrough 2006; Ramella 2016).

These changes appear to delineate a "new combination" of productive factors – to use Schumpeterian terminology – which brings together digital manufacturing, customisation of production and consumption, and global markets, setting the stage for a large-scale revival of artisanal-industrial activity. This is accompanied, moreover, by the diffusion of new forms of auto-entrepreneurship that exploit the so-called "long tail" economies, creating *mass markets for niche products* (Anderson, 2012; 2006). In other words, these new entrepreneurs – thanks to the Internet – intercept the demand coming from markets distributed on a global scale for products that, at a local level, would not find adequate demand.

The new digital production technologies do not offer the benefits of "economies of scale" and are not to be thought of as an alternative to the production models that are based on these. However, they are very efficient for small series production: they make it possible to vary the goods without a significant change in unit costs based on the volume of production. They therefore offer enormous potential for product-driven customisation, which in many cases makes use of the direct collaboration of the "evolved user". The latter can form real online communities of a temporary kind, helping to develop "open hardware" projects launched by the entrepreneur/maker.[14]

---

[13] The birth of the FabLab project – with its first concrete realisations – is recounted in detail in Gershenfeld (2011; 2012).

[14] Companies that follow a business approach based on open hardware make the files of their product design public, while holding on to the properties of names and logos. As

In short, maker-businesses adopt a production strategy based on quality, creativity and product customisation – the products are then sold online through specialised marketplaces (such as Etsy and others).[15] Sometimes they produce these goods directly and at other times they make use of online service companies that specialise in digital manufacturing (the best known examples being Ponoko and Shapeways).[16]

Despite the emphasis in the academic literature, which emphasises the "revolutionary" aspect of these phenomena, they are not actually new in an absolute sense. They look, rather, like the radicalisation of a model – well known to the social sciences – which emerged in the post-Fordism era: that of "flexible specialization" (Piore and Sabel 1984; Bagnasco and Sabel 1995; Trigilia 2002). In fact, the new digital technology, the spread of Internet and of open innovation, rather than introduce elements of discontinuity in this model, if anything represent a possible upgrade: one that is especially interesting for a country like Italy with its strong artisanal and manufacturing traditions.[17]

Set against this background, therefore, it is difficult not to consider FabLabs as potential local collective goods (LCG) for development. The majority of FabLabs, in fact, are collocated in an intermediate position between centres (pro-market) that sell digital production services professionally (such as TechShop), and those inspired by a counter-cultural type of logic (anti-market) based on open source and peer-to-peer collaboration (such as various examples

---

Anderson effectively puts it, these companies "*give away the bits and sell the atoms*" (2012, p. 107). A good example of this is his own company, 3D Robotics, which deals with the "open share" production of drones; or the Italian Arduino, which produces commercial versions of the famous board.

[15] Etsy is an e-commerce website – like Amazon and E-bay – but which specialises in the sale of artisanal and vintage items. The site, founded in 2005, in 2014 involved approximately 1.4 million sellers and 30 million buyers, reaching a sales volume of 1.9 billion dollars with a stock value estimated at 1.8 billion dollars (Picker 2015).

[16] Ponoko and Shapeways are two companies that offer – via the Internet and on a commercial basis – digital fabrication services. They serve as support agencies and intermediaries between the makers who design objects on digital files and the workshops that are able to manufacture them (using 3D printers, CNC machines etc.).

[17] On the future importance of creativity and artisanal kinds of production, see Micelli (2011) and Sennet (2008).

of the first hackerspace).[18]

As we have seen, one of the FabLabs' guiding principles is also the development of local communities through the dissemination of entrepreneurship. They can, therefore, with their multiple activities, play a part both in terms of social and economic innovation: on the one hand offering new solutions to the needs of local communities (European Commission 2013a) and on the other strengthening their capacity to use – for economic goals – their own "resources and abilities that are hidden, scattered, or badly utilized" (Hirschman, 1958, page 5).

It is a case, therefore, of LCG for development, but of a particular kind, in terms of the activities that take place and the generative mechanisms. Regarding the former, FabLabs belong to that set of diverse phenomena that make up the sharing economy. They create systems of horizontal relations based on "temporary access" to production tools and services that are often private. In addition, they are based on logics of action that are partly similar to those of open source communities, production networks and peer to peer exchange (Benkler 2004; Benkler and Nissembaum 2006; Botsman and Rogers 2011; European Commission 2013b; Schor 2014; Pais and Provasi 2015).

To deploy some of the categories proposed by Benkler (2004) for the sharing economy, FabLabs: a) are based on forms of "onerous collaboration" that allow the decentralised production of goods and services not founded on "command and authority"; b) make machines available that are configured as "sharable goods" (rivalrous private goods that can be shared because they are equipped with unutilised over-capacity). That said, however, there are also differences with respect to the phenomena studied by Benkler, who mainly referred reference to the large online community composed of "unknowns" that collaborate on the production of open source software (FLOSS: Free/Libre Open Source Software).

FabLabs, in fact, demonstrate the presence of a relational architecture that closely resembles the "small world" networks (Watts

[18] TechShop is a chain of commercial laboratories, widespread in the United States, which provides its subscribers with digital fabrication courses and tools and a specialised staff to assist them in the design and prototyping of their projects.

and Strogats 1998; Watts 2004; Ramella 2016). Relations coexist rooted both in *global networks*, between large, distant, partly unknown groups of people (weak ties) and in *local networks*, between small, close-knit groups of people who are in frequent contact with one another (strong ties). In addition, the governance structure of the global network shows a particular kind of physiognomy: decentralisation and horizontal relations of collaboration *between* and *within* the FabLabs are coupled with a centralised coordination – albeit very loosely linked – exercised by the Fab Foundation.

Emphasis should also be placed on the originality of the generative mechanisms of these LCG, especially compared to the "classic" examples analysed in studies on local development. Drawing on the literature on innovation, we could say that we are dealing with a "private-collective" kind of model, according to which individuals, or small groups of people, invest their resources and expertise to produce a public good (Von Hippel and Von Krogh 2003). A model, then, that is different both from that based on "private investment", which produces goods for the market, and from that of "collective action", which produces public or club goods. In the latter case, public institutions – based on the principle of authority – or interest organisations – based on an associative logic – are present to solve the problem of incentives that hinder collaboration on the production of a collective good.

As far as FabLabs are concerned, to judge from our interviews with the founders, what enables them to overcome the obstacles to collective action is a mix of elements, which varies from case to case: a) incentives of identity (participation brings with it identification with a community of reference); b) intrinsic motivation (interest in new technologies, pro-social attitudes etc.). c) extrinsic motivations (professional and reputational interests, etc.);[19] d) interpersonal ties (with the motivational and monitoring mechanisms typical of small groups).

[19] The distinction between these two types of motivation was introduced by social psychologist Teresa Amabile [1983; 1996]. *Extrinsic motivation* is linked to the achievement of some goal or external benefit other than that arising from the activity itself. In contrast, *intrinsic motivation* relates to the interests and specific rewards deriving from the performance of a given task.

In academic literature on FabLabs, the idea often emerges that these phenomena are the almost inevitable result of the "technological revolution" that is taking place. In reality, however, this is not actually the case. FabLabs do not spring up just anywhere, and when they do it is rarely in the same way. As we shall see, both "contextual factors" and "agency factors" have fostered their rapid expansion on a global and local scale.

3. The geography of FabLabs

The last 5 years have seen a tenfold increase in FabLabs around the world. There are 548 at present, spread throughout 78 different countries. Only in half of these countries (40), however, are there more than one, while in just 14 do we find more than a dozen. It is a territorially-concentrated phenomenon, in other words, which predominantly, but not exclusively, involves developed countries, particularly those in the West (Table 1). There are 260 in the EU and 94 in the US: with about 12% of the world's population, these two areas encompass about two-thirds of the FabLabs worldwide .[20]

---------- *Inserire qui Tab. 1* ----------

Analysis of ecological data reveals some interesting features. The first is that although there is no correlation between the number of FabLabs present in a country and that of its inhabitants, there is, however, a clear link revealed with the volume of urban population and levels of economic development. Considering the intensity of the phenomenon – the number of FabLabs per million inhabitants – there is a connection with the employment rate of the population (*r* 0.27 sig. 0.033), the number of researchers (*r* 0.30 sig. 0.036) and Internet servers (*r* 0.48 sig. 0.000) in relation to population.

What this data tells us is that the phenomenon is an urban one, mainly concentrated in the most advanced Western economies, which

[20] With a stronger relative incidence in the EU than in the US: in the former, there are 5.1 FabLabs for every 10 million inhabitants, while in the latter there are only 3.

is affected by the diffusion of new information technologies.[21] It also suggests a linear relationship with a country's scientific technological advancement: the more resources invested in research and in new communications infrastructure, the greater the FabLab presence.

Shifting attention to the European context, however, this relationship appears much more complex. The data collected annually as part of the Innovation Union Scoreboard (IUS) – to evaluate the quality of the National Innovation Systems (NIS) of the member states – makes it possible to assess this relationship in greater detail, in an area which encompasses almost half of the world's FabLabs.[22] In addition to rate of urban population (r 0.35 sig. 0.05) and per capita GDP (r 0.56 sig. 0,001), the analyses conducted using the diffusion of FabLabs in relation to population confirm the existence of statistically significant relationships with many of the IUS indicators concerning research, technological infrastructure, innovation and advanced training.

A logistic regression, however, makes it possible to greatly simplify the explanatory model and evaluate the relative importance of the NIS and economic development.[23] For the sake of analytical parsimony, we at first used the *Summary Innovation Index 2014* as an independent variable: this index summarises the innovation performance of a number of different countries and possesses a good

[21] A binomial logistic regression conducted on 202 countries shows that the chance that a country has at least one FabLab can be predicted with good reliability by combining only two variables: volume of urban population and diffusion of Internet use. This simple model can correctly classify 79% of the countries surveyed, as opposed to the 62.9% we are able to attribute without considering these two variables – that is, based on a model with only one intercept (see Appendix Table 4). Internet diffusion amongst the population is highly correlated with per capita GDP (r 0.71 sig. 0.000) and thus summarises two pieces of information: one relating to a country's level of economic development, the other to the advancement of technological infrastructure.

[22] In addition to the 28 EU member states data is collected for 6 other countries: Macedonia, Iceland, Norway, Serbia, Switzerland and Turkey.

[23] We conducted a binomial logistic anlysis of all the 34 countries for which data is available. Given the small sample size, this analysis is to be understood as purely exploratory and serves to suggest a rather speculative line of reasoning. The incidence of FabLabs in the population was employed as the dependent variable, creating two classes according to the median value. While the lower class contains the countries that have no FabLabs at all, or at least a very small number (an average of 0.4 FLs per 10 million inhabitants), the upper class includes the countries with the highest number (7.7 FLs per 10 million inhabitants).

level of forecasting with respect to the diffusion of FabLabs throughout Europe. We then tested a second model, using per capita GDP instead. In the light of the results, the latter emerges as a more effective predictor than the previous indicator.[24] It should also be kept in mind that a control analysis conducted with both variables shows that, once the per capita GDP is considered, the innovation index loses all autonomous predictive capacity .[25]

Meanwhile, subdividing European countries based on IUS ranking, it can be noticed that the peak of FabLab diffusion is located in the group of countries known as innovation *Followers* rather than in that of innovation *Leaders* (Table 2). Amongst the latter, in fact, FabLab incidence is rather low.[26]

---------- *Inserire qui Tab. 2* ----------

These analyses highlight the fact that the relationship between FabLab diffusion and NIS quality is anything but linear. While large countries such as Britain and Germany have a lower number of FabLabs than might be expected considering their position in the European rankings, France and Italy (Fig. 1), on the other hand, tend to stand out. But the latter country especially, given its rather backward location in the European NIS ranking, is the real "outlier" here. [27] Why, therefore, are FabLabs so widespread in Italy?

---------- *Inserire qui Fig. 1* ----------

[24] This single-variable model makes it possible to correctly classify 82.4% of cases, as opposed to the 52.9% that we are able to assign by default (with the one-intercept model). Taking into account per capita GDP, in other words, we can with good reliability predict whether or not a country possesses a large number of FabLabs (see Appendix Table 5). An analysis conducted with two variables – adding other indicators to per capita GDP (the percentage of urban population, or diffusion of Internet access in areas with medium to low urbanisation) – while increasing predictive power still leaves per capita GDP as the only statistically significant variable. In order not to complicate the analyses we therefore preferred to consider the model with just a single variable.

[25] The two variables are in fact highly correlated: *r* 0.78 sig. 0.000.

[26] There are four European innovation leaders: Sweden, Denmark, Finland and Germany.

[27] It ranks 16th in fact amongst European countries in terms of the quality of national innovation system, but 7th in terms of FabLab diffusion (and is the first in the world amongst countries with more than 20 million inhabitants).

Considering the generational connotation and artisanal vocation of this phenomenon, the first two hypotheses that can be advanced regard the high rate of youth unemployment and the consistency of manufacturing traditions and small businesses in Italy.[28] The first hypothesis, however, does not seem to be supported by the geographical distribution of Fab Labs (Table 3), given that these are concentrated more heavily in the Centre-North (where unemployment is lower) and that – at a provincial level (NUTS 3) – no correlation appears in relation to unemployment rates (whether total, youth or intellectual). Moreover, the qualitative interviews show no overwhelming presence amongst the founders of people in search of employment.

The geography of the phenomenon does, however, provide some additional support for the second hypothesis: FabLabs are highly present in regions of the Third Italy, where the model of flexible specialisation based on industrial districts is historically most widely diffuse (Pyke, Becattini and Sengenberger 1990). The geographical location of FabLabs, in fact, seems to be more in line with the percentage distribution of manufacturing firms than with that of the population (Table 3).

---------- *Inserire qui Tab. 3* ----------

Overall, even in the Italian case, where we have conducted a more disaggregated territorial analysis, ecological data confirms the results seen above with reference to the global context: Fab Labs, in other words, are a phenomenon linked to economic development and urban population. In addition, however, two other factors emerge: the importance of high levels of education and a fragmented production structure, with a strong presence of manufacturing micro-enterprises. A multivariate analysis, in fact, highlights how these four variables are able, in three quarters of cases, to clearly predict the presence or

[28] Italy, in fact, has a youth unemployment rate (15-24 years) that is almost twice the European average: 42.7% vs 22.2. It is also the second manufacturing economy in Europe behind Germany. Compared to the latter, however, it has a much higher proportion of people employed in small firms (up to 50 employees): 55% vs 22.5%.

absence in each province of at least one Fab Lab.[29] Then, for exploratory purposes, adding another two variables to the model, describing the provision of social capital and the degree of mobilisation in civil society on the issues of civil rights and the environment, predictive ability is strengthened even further, reaching 78% in terms of correctly assigned provinces.[30]

These results suggest an interpretive key to the "Italian puzzle"[31] that jointly includes the "human capital surplus" and "deficit of collective goods" in the country. The diffusion of FabLabs has been fostered by two types of territorial context: on the one hand, the great metropolitan centres, and, on the other, small and medium-sized cities with a manufacturing development of small business. In these areas, the presence of high levels of education and resources for participation and of social capital in civil society seem to have facilitated a grassroots mobilisation – a generational matrix [32] – aimed at producing collective goods for development and innovation: this being due to the under-supply in Italy of such goods both in the public and in private/market spheres, brought about by a shortfall of investment in research and advanced training .[33]

To reinforce this conjectural reasoning, we can use Innovation Leader European countries as a comparison. Why, in these contexts, is the number of FabLabs so low? The hypothesis that we can formulate –

[29] Again we conducted a binomial logistic regression considering the 110 Italian provinces, the aim being to explain what variables are able to "predict" the presence or absence of at least one FabLab in every province. Taking into account volume of population, value added per capita, percentage of population with a university degree and percentage of micro-manufacturing enterprises (up to 9 employees) it was possible to correctly assign 74.5% of the Italian provinces, in contrast to 62.7% using the model with just one intercept (see Appendix Table 6).

[30] The first added variable shows the percentage of people who claim to trust others and the second that of the people who have, over the last year, taken part in a meeting of an ecological, civil rights or peace association. These latter results, however, need to be interpreted with extreme caution, since the Istat data on which they are based are available only at the regional level and were therefore attributed evenly to all provinces of the same region.

[31] In other words, the strong diffusion of FabLabs within the context of a weak national innovation system.

[32] As we will see, the vast majority of the founders are between 30 and 40 years of age.

[33] Italy is the second lowest country in Europe in terms of the incidence of university spending as a percentage of the GDP. As for per capita expenditure on R & D, set against an EU average of 100, Italy spends 54 in the business sector (Innovation Leader countries 253), 76 in the university sector (Leader countries 257), 77 in the government sector (Leader countries 131).

one which must be checked through a comparative international survey – is that, in more advanced NIS, the public and private education and research system offers many of the goods and services provided by FabLabs, thus rendering the grassroots creation of the latter less necessary.[34]

In the Italian context, however, the provision of infrastructure and services related to new digital technology is very weak.[35] This "supply vacuum" has thus created a structure of opportunity favourable to the mobilisation of civil society for the provision of these collective goods. As we will see more clearly in the next section, it should also be added that in Italy, in comparison with other countries, the FabLab phenomenon started late, to then explode in conjunction with the international economic crisis. It took on a more markedly "voluntarist" character, involving the mobilisation of small groups of citizens.[36] This, therefore, is where "contextual factors" and "agency factors" meet up.

As comes out from the interviews with FabLab founders/coordinators, the proliferation of this phenomenon in the most difficult period of the economic crisis was partly intensified by the hope – through the creation of a laboratory or by participating in its training courses – of finding a way out from states of partial occupation. Even though they often do not represent a self-sufficient, professional alternative, these laboratories make it possible to develop skills, collaborative networks and reputational resources that, compared to other professional activities and autoentrepreneurial paths, are synergistic and functional.

---

[34] There are none in Sweden, only one in Finland, and 29 in Germany, but with a lower incidence relative to the European average (3.6 FabLabs every 10 million inhabitants vs. 4.4). The only exception is Denmark, which with 10.6 FLs ranks above the European average. This figure, however, is strongly amplified by the small size of the country (5.6 million inhabitants with 6 FLs).

[35] To provide just one proxy-indicator of this deficit, it is worth remembering that Italy is fourth last in the ranking of European countries according to the values of the "Digital Economy and Society Index". This index was developed by the European Commission in order to assess the quality of ICT infrastructure and diffusion of digitisation in the economy and society of member states (https://ec.europa.eu/digital-agenda/en/desi#_ftn1.).

[36] In other contexts, however, the initial spread of FabLabs was supported mainly by public and private organizations, such as universities, schools, research centres and innovation agencies etc. (Troxler 2010, p. 7).

In other words, the rapid diffusion of FabLabs in Italy seems to be a phenomenon linked to the *"surplus of human capital"* rather than to unemployment in the strict sense, and with a double connotation. First, in the sense of an over-capacity of labour resources and technical and professional skills that are not fully utilised in the formal economy (especially in a time of crisis).[37] Second – to paraphrase one of the meanings derived from the Latin etymology of the word – in the sense of overcoming conventional boundaries, in the exploration of new modalities of innovation and of the creation of social and economic value.

It would be reductive, in fact, to adduce the motivations of those involved in the foundation of a FabLab to exclusively instrumental reasons, aimed at a quest for professional benefits. As we have already mentioned in the previous section, what social psychologists call "intrinsic motivation" also plays an important role – the search, that is, for personal meaning and gratification connected to the performance of certain activities. In the same way – paraphrasing the categories of Alessandro Pizzorno (1993, p. 175) – an "identifying activity" is also present: i.e., the search for social identity defined by the commitment to the values and practices of a community of reference. In the FabLab network, in fact, a kind of *technical community* is created, in the sense of a group of individuals (both near and far) with an intense interest in the learning, development and dissemination of the knowledge and values of digital fabrication. At a local level, this often means a limited, fairly well-integrated, group of individuals, featuring stable and frequent relations, which tends to develop common interests and projects and a sense of belonging to a community with a global scale of extension: the maker community. [38]

[37] It is a matter of the availability of technical and professional skills and time that are in excess in relation to the use made of them by the official labour market and in the "main" professional positions of these figures. There are various reasons for this: because employed work does not allow them to fully exploit their technological interests and their entrepreneurial spirit; because forms of precarious, part-time or freelance professional work leave time available for other activities.

[38] These small groups recall some of the logic highlighted by the literature on "communities of practice" in organisations, which emphasised how group activities and the development of shared identity – based on common working practices – facilitate innovation (Lave and Wenger 1991; Wenger 1998; Brown and Duguid 1991; 2001).

In conclusion, the macro analysis based on ecological data suggests an interpretative path to explain the "Italian puzzle" that – as we shall see in the next section – also appears to be compatible with the micro analysis. We could summarise things in this way: the deficit of collective goods for digital manufacturing present in a country with such a strong manufacturing vocation as Italy has created a structure of opportunity conducive to the voluntaristic mobilisation of citizens aimed at creating FabLabs. The latter, however, do not come into being everywhere with the same intensity: their geographical diffusion has been fostered by specific: 1) contextual factors (the most highly developed areas, metropolitan cities and provinces with a strong presence of SMEs) and 2) agency factors (people with high levels of education and a passion for technology, with civic inclinations and a "surplus" of time and expertise).

4. Italian FabLabs

The empirical research carried out on Italian FabLabs both provides support for this hypothesis and also makes it possible to draw an initial picture of the phenomenon. The data presented refers to all the laboratories recognised by the Fab Foundation, listed on the Italian section of the website (www.fablab.io/labs).[39] The first part of the analysis is based on data derived from the mapping of their websites and specialist blogs and aims to reconstruct some of the FabLabs' distinctive features (when they began, what they do, who their founders are, what equipment they are provided with, what activities are carried out, internal organisation, opening hours, etc.).

The second part of the analysis is qualitative and is based on semi-structured interviews with a representative sample of the founders-

[39] The first list of FabLabs present round the world was compiled in 2012 by the Center for Bits and Atoms. To get on the list, it was necessary to send an e-mail with the details of the laboratory. Initially there were 128 FabLabs, plus 27 "Planned FabLabs" (on the point of opening). Shortly after this, the management of the FabLab world map passed to the Fab Foundation, which developed the fablabs.io platform. With the new platform, the access mechanism to the list also changed and at present new laboratories are expected to fill out a form within the platform. Their name is then added to the map and, once online, the effective existence of the laboratory must be confirmed by at least one another FabLab already on the list (and usually geographically close) and from the administrators of the site.

coordinators of laboratories (20 in total, including two coordinators and non-founders) distributed over the entire peninsula (8 in the Third Italy, 8 in the North-West, and 4 in the South).[40] The objective is to reconstruct the generative mechanisms of the FabLabs and to analyse the type of activities and services offered, in order to understand if and how they can be considered LCG capable of generating external economies, both tangible and intangible, useful for development.

The 56 Italian laboratories are spread over 43 provinces and 17 regions and – as we have seen (Table 3) – are concentrated in the more highly developed areas of the country: in the regions of the Third Italy and North West (Fig. 2). At a municipal level, there is a strong presence in urban areas: 42 laboratories are in medium-sized to large cities (Milan and Rome being the cities with the highest concentration) and the remaining 14 in medium-sized to small municipalities.

---------- *inserire qui Fig. 2* ----------

The short history of the Italian FabLab is characterised by two important stages: a first stage which could be called *embryonic* and a second called *explosion*. The diffusion process, as shown in Figure 3, was very quick, with the "explosion" in the first half of 2014. This was followed by a period of downscaling over the next two months.[41] In addition, the data collected identifies a *consolidation phase*: this saw the original laboratories going through a "settling down" stage as well as a proliferation of new laboratories, although in this case the phenomenon was less spontaneous and more driven by active policies.[42]

---

[40] The Third Italy: Cascina, Contea, Florence, Padua, Parma, Pesaro, Verona, Tolentino. North-West: Biella, Borgomanero, Turin, Genoa, Imperia, Milan (with 2 FabLabs), Varese. South: Cava dè Tirreni, Palermo, Catania, Sassari.

[41] The cumulative distribution of the foundation's data assumes the classic S shape: the typical logistic curve of the phenomena of innovation diffusion (Rogers 2003; Ramella 2016, p. 54).

[42] Over the last year, in fact, the first steps have been taken towards promoting FabLabs and supporting maker activity by regional and local authorities (Veneto Region, the City of Milan, Sardinia) and some private foundations (Fondazione Nord-Est, Innovazione Digitale, Adriano Olivetti and Mike Bongiorno).

---------- *inserire qui Fig. 3* ----------

There were, in the years preceding the explosion phase, two major events involving the digital fabrication and maker world. The first took place in Turin in 2011, when, as part of the "Future Station" show, "FabLab Italia" was created – a temporary digital fabrication laboratory.[43] The theme of digital fabrication found fertile terrain in the city and, a few months after the exhibition closed, the first Italian laboratory, the "Fab Lab Torino", was founded in former industrial buildings which housed the coworking *Toolbox* and *Officine Arduino*. The second major event occurred in 2013, when Rome hosted the first *Maker Faire*, *the European edition*,[44] an exhibition connected to *Make* magazine, a point of reference for the Maker community.

If the spread of Italian FabLabs was very fast, it was still late taking off compared to the rest of Europe: the European *embryonic phase* occurred in 2008 (four years before the "Fab Lab Torino"), when two laboratories were opened in Barcelona and Amsterdam that are still a reference point for the global network.

Ultimately, we can only observe that the phenomenon in Italy, and also partly in Europe (as is the case in Spain and France) developed at a time when youth unemployment was growing and in which new forms of auto-entrepreneurship were starting up.[45] From the information obtained through interviews, as the economic crisis worsened, an increasing number of people seemed to turn to FabLabs to "create" a job through the development of new skills. The founders, in fact, confirm the presence amongst members of the unemployed,

---

[43] The exhibition was created as part of the initiatives related to the celebration of the 150th anniversary of the unification of Italy and intended to represent the future of work in Italy, through multimedia languages, advanced technology and a selection of projects, prototypes and products created by public and private research institutions or individual inventors.

[44] An event totally dedicated to FabLabs and makers. The growth of interest in the topic is shown by the data regarding the number of participants, which rose from 35,000 in 2013 to 90,000 in 2015.

[45] In the second quarter of 2015, the innovative startup total reached 4,497 units. Companies which included at least one young person in their shareholding structure numbered 1,724, 40.6% of all startups, compared with a ratio of 13.8% taking into account corporations with the presence of young people [Source: Business Register, INPS]. Freelancers/self-employed (in Italy, workers with VAT numbers) that started up activities in 2014 numbered 574,298 (+ 8.5% compared to 2013), 39% of which were under 35 [source: MEF – Ministry of Economy and Finance].

whether young people seeking their first job or people trying to find their way back into the labour market.

> Nobody attending a FabLab, however, is really unemployed, because everyone is able to create a job for themselves in an afternoon. The principle is that, if you know how to do "almost anything", somehow you have the means to deal with a problem and come up with a solution. Maybe an artisanal one, not a professional one. But that's just another one of our strengths [*Interview 4, Third Italy, Founder and coordinator*].

To better understand the spread of the phenomenon, it is necessary to look more closely at the most important figures in the laboratories and observe the trajectory of their careers. The founders,[46] in most cases, are men (11% being women) and are between 30 and 40 years of age (the average age being 35). A certain homogeneity is also noticeable in terms of education: 40% have a degree in engineering, 39% in architecture, 9% in the social sciences, 9% have a technical diploma and 3% have a degree in chemistry.[47] It is not uncommon for a founder to have worked overseas – either when at university or soon after – where they have come to know and use the tools of digital fabrication. The analysis makes it possible to identify three distinct types of founder: the *sharing-entrepreneur*, the *designer* and the *patchworker*.

The first group, that of *sharing economy entrepreneurs*, occupies 7 of our case studies (3 in the Third Italy, 2 in the East, 2 in the South). For the sharing-entrepreneur, opening the laboratory is all about their passion to lead the way. Before opening the FabLab they have had other professional experiences related to information technology, electronics and design, but these have not completely satisfied their "know-how" and need for professional independence. After getting to know the world of the FabLab, therefore, they decide to become a part of it by opening a laboratory in the place where they live, interrupting

[46] The average age was calculated using the year of birth of one founder for each FabLab, not the whole group of founders. The total number of cases on which data is available is 37.

[47] The figure regarding sex is calculated on 56 cases (universal), with 37 cases for education.

their previous career and deciding to invest their resources in terms of time and – in part – money in the FabLab. The sharing-entrepreneur is a figure who accepts the challenge thrown down by the MIT, fully endorses the principles of the Fab Charter, and believes in an economic model based on the values of sharing and self-production. The laboratory is seen as a kind of library, a place open to all, where freedom of access, common interests and experimentation come together to trigger a mechanism of contamination between skills and ongoing informal training. The sharing-entrepreneur believes that the Fab Lab, thanks to its particular features and potential, can become a real research and development laboratory external to companies.

The second group, the *designers*, occupy 8 case studies (4 in the Northwest, 2 in the Third Italy, 2 in the South): they are mostly architects and engineers. Here too the matter is one of technical and professional "overcapacity" being directed towards digital manufacturing. The FabLab represents an evolution of one part of the designer's professionalism: not a "new" starting point, as in the previous case, but something in line with the general continuity of their work. It is not a private investment made exclusively to bring growth to their own studio: "collective" and pro-social objectives also exist, since the space is open to everyone. And it does not, moreover, represent a secondary activity in relation to their usual work: on the contrary, the two activities are strongly integrated, and in some cases it is the laboratory that tends to predominate.

The third group, the *patchworkers*, occupies five of our case studies (3 in the Third Italy and 2 in the North-West) and involves founders for whom the laboratory has become a (patch-like) "piece" of their professionalism. All have one or more jobs (in the case of freelancers or consultants) and, having always been passionate about electronics and new technologies, they decide to make a professional investment in a FabLab. This does not mean that they are ready to leave their profession in order to devote themselves entirely to the laboratory, but the latter becomes a piece of the "patchwork" that makes up their professionalism. In these cases, the hours are influenced by the availability of free time of the founder and the other partners: they are usually open in the late afternoon and/or evening and at weekends. Amongst patchworkers, their main job (or jobs), while skilled and in

line with their studies, does not satisfy (or does so only partially) their "know-how" in the field of technology. This technical and professional overcapacity is thus channelled into the FabLab during their free time. It should be emphasised, however, that their approach is never an amateur one: these spaces, like the others, offer sufficient training and equipment to develop projects.

> I have always been interested in electronics, mechanics... making things. So the moment the idea of the FabLab came out, which was exactly the answer to all my needs, the choice was quite automatic. You make things, you make them at home... instead, you make them here, giving a hand to someone. I don't have to say, "I'm not going out tonight because I have this thing I have to do," I can say, "I'm going out tonight because I have this thing I have to do." [*Interview 4, North West, founder and coordinator*].

A transversal reading of the various profiles reveals that the reasons why founders open a digital laboratory seem to go beyond problems related to the uncertainty of the labour market. The most frequently given reasons concern a passion for technology, the need (determined by their absence) to create places where it is possible to experiment, to design and carry out research, combined with the desire to spread the culture of digital fabrication. What comes out clearly from the interviews is the fact that the greatest sense of fulfillment derives from having a place where people with similar interests and skills (sometimes complementary) can meet up and create projects together.

> One of the things that pushed me to open a FabLab was the desire to discover new technologies. Another, more important, thing was sharing something with other people in a way that went beyond just a social thing. Working together with people helps you to grow and learn new skills. The FabLab is a laboratory, a workshop, where you meet up with people whose skills are different from yours, you chat, you sit at a table and exchange information. Then there is the practical side… after the talk, you are all involved in a project together, you are not alone [*Interview 3, North West, founder and coordinator*].

Another fundamental aspect of FabLabs is of course the members/users, those who take out a membership card or who otherwise benefit from the tools and services that are on offer. The average number of registered users stands at 66 per laboratory (Fondazione Make in Italy, 2014). The founders we interviewed state that a FabLab is assiduously frequented, over a week, by about 10 people.[48] Those who approach the laboratory often do so out of curiosity or because they are familiar with the world of digital fabrication. There is no real "typical user". FabLabs are frequented by students, by people looking for a first job and by hobbyists, and at the same time they are open to private companies, institutions and professional associations.

Here we can see the three "guiding spirits" of the laboratory. The first is to offer a shared workspace equipped with tools that are difficult to purchase individually. The second is to provide the services of a research and development laboratory for prototyping products. The third is that of education, which often takes place through informal exchanges amongst members, or between founders and members, or through organised courses and workshops. It is only necessary to go to one of their websites to see the numerous training events that are proposed. FabLabs are also increasingly involved in creating projects with schools (especially middle-schools and high schools) in order to facilitate the acquisition of digital skills amongst students.[49]

What about the physical structure of a laboratory? Considering the premises themselves, FabLabs are based: a) in industrial buildings or warehouses (a phenomenon linked to the reuse of abandoned spaces); b) in private areas adjacent to other activities (architectural firms,

[48] The figure refers to people who attend the laboratory and are actively involved with the equipment and with design and prototyping, and does not include events such as workshops, open days, etc. The latter attract a high number of people, but not all the people who participate in these events regularly attend the laboratory.

[49] One of the objectives of FabLabs is that of education and so various projects have been begun designed to bring the FabLab into schools. With the "The Good School" plan ("*La Buona Scuola*") The Ministry of Education (MIUR) recognizes the role of the FabLab as an environment for acquiring digital skills. In 2014, the *Fondazione Nord Est* initiated the "FabLab at school" project with the aim of bringing a laboratory into each school to promote manufacturing innovation in the North East. The project started on an experimental basis in certain polytechnic institutes in Veneto, Friuli Venezia Giulia and Trentino Alto Adige [source: http://www.fablabascuola.it/].

companies, associations); c) in business incubators; d) or in totally independent locations (public or private property). Almost all the laboratories benefit from these spaces free of charge. Of the 56 Italians FabLabs, 73% are located in private spaces and 27% in public spaces.[50] Only 10% of those using private spaces pay rent, while the rest of the laboratories have their premises on the basis of a free loan. It is not uncommon for FabLab workplaces to be incorporated within, or adjacent to, other activities related to the world of design or social innovation such as: coworking (9%), graphic design firms (9%), technology parks or business incubators (20%) and small companies (6%).

---------- *inserire qui Fig. 4* ----------

Although the 3D printer is the symbol instrument of such places, it is far from the only piece of equipment to be used there. Each laboratory contains the integration of various types of machinery and tools for the design and construction of prototypes. Survey results show a wide variety of possibilities: in Italy these range from laboratories with a 3D printer and little else to fully-equipped laboratories (as suggested by the Fab Foundation). A "typical laboratory" tends to be equipped with: a 3D printer, a laser cutter, a vinyl cutter, CNC milling, an Arduino kit and a bank of electronics; as well as tools for designing and scanning products (three-dimensional graphics programs, 3D scanners,) and more "traditional" tools (amongst those mentioned during interviews were: cutter, press, drill press, carpentry tools etc.).

If the Fab Charter does not impose any constraints on "minimum equipment" tools, it does, in contrast, place a clear obligation on "free access for individuals and organised access to courses". Access and opening hours are regulated differently in each FabLab. The average number of opening days for the 56 laboratories is 4.3 per week. [51] In addition, several laboratories organise an Open Day dedicated to those

[50] The 27% of laboratories which benefit from a premises provided by a public body is geographically distributed as follows: 13% located in the Third Italy, another 11% in the North West and only 4% in the South.

[51] 49% of laboratories are open only in the afternoon, 46% are open all day (or close only at lunch), the remaining 5% have no set time or are open only by appointment.

curious to know something about digital fabrication and which aims to raise awareness of the laboratory in the local area.

Access to the laboratory, in terms of making use of the structure, is granted by paying a year or half-year membership, while the use of equipment is provided on an hourly rate or credit system. In some cases, access to the equipment and the association is totally free.

> The basic system used is that of credit. The moment you become a member, you are provided with a certain amount of credit that can be "spent" on using the equipment. The only way you can gain more credit is to do something for the FabLab – run a course, for example, so that you're making your skills available: I won't pay you for your teaching but I will repay you in credit [...] What we try to do is have a community of members who are active on the basis of the time available. [*Interview 5, the Third Italy, Founder and coordinator*]

The issue of sustainability is linked in part to what has been said so far regarding access mechanisms to the laboratories and in part to training courses. In fact, out of 20 interviewees, 15 state that the sustainability of the FabLab is partially (and in some cases totally) guaranteed by course enrollments and/or membership. One last point on the more organisational aspect of the laboratories regards operational management, which ensures the general functioning of the facility. Management activities are carried out by the founders and the most active partners in a voluntary, informal way. None of the founders or members receive a salary, but six laboratories have paid staff (one or two people at most) through contractual arrangements that provide for collaboration on projects (in most cases, this is a matter of self-employed people with VAT numbers).

This "voluntaristic" aspect of management is also the manifestation of a strong sense of community. Within the laboratories are, in fact, small groups of people who have developed a strong identification with the "mission" of spreading the maker culture. From what the founders say, there often emerges a sense of duty that results in a kind of civic voluntarism aimed at the teaching, dissemination and development of digital fabrication.

While, therefore, the almost complete lack of paid staff emphasises the "passion" of the members, it also, on the other hand, highlights, the fragility of this phenomenon in Italy, something which is additionally indicated by the relatively low costs for the creation of a laboratory. The data collected by the *Fondazione Make in Italy* [52] in 2014 shows that on average about 10 thousand euros was spent to open a FabLab, a figure much lower than those proposed by MIT. [53] From this, certain particular features of the Italian FabLab stand out: 1) operating costs remain low thanks to the free use of space; 2) at startup, the tools acquired are often not particularly expensive and the equipment is not complete; 3) management of the facility is guaranteed by personnel performing this role voluntarily.

The initial investment is mainly based on personal capital and it is not uncommon for the founders to have purchased (or, in the case of 3D printers, built by themselves) several machines before deciding to open the FabLab: while 43 founders made use of personal capital, the remaining 13 benefited from public or private funds that allowed them to cover the costs of start-up and management. It is interesting to note that the public tenders which made the opening of FabLabs possible came from measures that were not specifically aimed at digital labs, but which were designed to support innovative activities or youth entrepreneurship.

There is one final observation to be made on the FabLab networks that are springing up in some areas of the Third Italy and the South to develop joint projects and integrate the skills and equipment of the parties involved. These networks are partly inspired by the design of the Barcelona FabLab, which aims to create an integrated system, with the establishment of at least one laboratory in each district of the city. As for Italy, the first initiative was begun in Emilia Romagna (Mak-ER), with a network aimed at integrating laboratories and digital artisans

---

[52] The Italian FabLab and Makers Foundation Make cdb in Italy was created in 2014 by Massimo Banzi, Carlo De Benedetti, and Riccardo Luna. In 2015 the foundation carried out a census of digital fabrication labs in Italy (*Censimento dei laboratori di fabbricazione digitale in Italia*): this data is open source and can be downloaded from the site http://www.makeinitaly.foundation.it.

[53] According to the list of instruments given by MIT, it has been calculated that to realise a "state of the art" FabLab the cost is about 227,000 US dollars (list costs updated August 21, 2015) to which must then be added management expenses.

within the region. [54] The second network, at present under development, is promoted by the Veneto Region and aims to create and/or support 20 FabLabs. [55] Another regional network regards Tuscany, where the "Fab Toscana" project aims to create a laboratory in each province, as well as integrate existing ones. Unlike the previous two examples, in this case the initiative has (at the moment) not received the backing of public institutions, but was launched on the basis of a project written and presented by the Cascina FabLab during Fab11.[56] Amongst initiatives still in the planning stages, it is worth mentioning the networks promoted by *Sardegna Ricerche* (a body for research and technological development in the Sardinia region) and by the Pesaro-Urbino region, launched by the Pesaro FabLab in collaboration with the Province.

5. Is there an "Italian way" for FabLabs?

As we mentioned in section 3, FabLabs neither start everywhere nor in the same way. But above all they do not perform the same functions in every context. For the perspective chosen in this article, which considers them as public goods for local development, it is useful therefore to focus on the kind of laboratory present in Italy, on the one hand highlighting their aggregational capacity and on the other their relations with the area in which they are based. [57] To this end, we have developed a FabLab typology (Figure 5) resulting from the intersection of two aspects: 1) *the capacity to create a local community* (Aggregation); 2) *the ties with the local area* (Territory).

---

[54] Mak-ER (the Digital Factory Network in Emilia-Romagna) is promoted and coordinated by the FabLab in Reggio Emilia and MakeInBo and operates thanks to the operational support of ASTER (a consortium including the Emilia-Romagna Region, universities, CNR, ENEA and Unioncamere which is committed to the promotion of innovation in the regional production system in partnership with business associations). The Mak-ER association, founded in 2014, presents itself as a network of people and places devoted to digital fabrication (for further information, see the website http://www.mak-er.it/)

[55] The Veneto Region – through the use of the FAS National Fund – has allocated 2 million euros to support the development of 20 FabLabs in its territory.

[56] An international conference of all the FabLabs worldwide, organised by the Fab Foundation.

[57] At the present moment, however, it is not yet possible to adequately measure the socio-economic impact.

The capacity to create a local community refers to the fact that FabLabs, in addition to being a place for digital manufacturing, also have an "almost associative" function: they are a reference and aggregational point for people that share the same interests. To register this first aspect, we used two indicators. 1. The laboratory's *degree of openness* (access times, costs and registration procedures, use of equipment, and the presence of Open Days). 2. The presence within the FabLab of a *cohesive group of people*, characterised by the stability and frequency of relations, which tends to develop common interests and projects.

Ties to the local area, on the other hand, refers to the ability of the FabLab to involve local actors and the productive vocations of the region in which they operate. In other words, we have tried to assess how FabLabs are able to activate territorial relationships that can both affect their internal growth and have an impact on local development. To register this second aspect, we used three indicators. 1. *The ability to activate the demand* for services by citizens, schools and businesses. 2. *The ability to establish formal and informal collaboration* with public and private actors (e.g. local authorities, professional associations, banks, foundations, etc.). 3. *Design capacity*: the ability to carry out projects with local actors (craftsmen, entrepreneurs, government agencies, etc.) and/or with parties outside the local area (outside the region and/or beyond national boundaries).

The attribution of points on each of the indicators of the two aspects has made it possible to position the 20 FabLabs studied on a Cartesian graph, in which the abscissa axis represents the *capacity for aggregation* and the ordinate axis represents *ties to the local area.*[58] As shown in Figure 3, three point clouds emerge that represent distinct types of laboratory: the first has a strong bias towards *aggregation*; the second towards the *local area*; the third, finally, maintains a balance between both aspects. [59]

[58] Points were assigned for each indicator ranging from 1 (poor) to 5 (high), on the basis of the qualitative data collected by the field survey. The points are shown in Table 7 in the appendix.

[59] The FabLabs are indicated by different acronyms according to the regional macro-area where they are located: the Third Italy (TI-1, TI-2, TI-3, TI-4, TI-5, TI-6, TI-7, TI-8), North-West (NW-1, NW-2, NW-3, NW-4, NW-5, NW-6, NW-7, NW-8), the South (S-1, S-2, S-3, S-4).

---------- *inserire qui Fig. 5* ----------

The FabLabs in the first group have a more "internal" *aggregation* function, one less involved in creating "external" ties.[60] It is made up of 3 laboratories in the North West, 1 in the South and 1 in the Third Italy. These laboratories are spaces run by private bodies, their premises provided as a free loan by a public entity or local association. Access is free, as is the use of equipment. Attendance at the laboratory is stable, with a group of people going 2 or 3 times a week (or sometimes every day) and assisting the founder in the management of the FabLab. The projects carried out there depend on the specific passions and common interests of the members. This first group includes many of the founders that we have defined as *patchworkers*. Collaborations with companies or schools are not sporadic, but training takes place informally and is fairly unstructured: it is often one of the members who explains the use of equipment to new users. The main strength of these FabLabs is their ability to operate as a place of aggregation, with a function that is more associative than productive.

At the other extreme of the graph can be found the group with a significant *territorial vocation.*[61] It is made up of 3 FabLabs in the North West, 2 in the Third Italy and 2 in the South. The laboratories, in this case, are more likely to be market-orientated and attuned to the productive specificities of the context in which they operate. Most of the *designer* founders are in this group. Training activity is extensive and is directed both towards private individuals and to businesses. Activities involving schools are conducted in a structured manner by the two examples in the South, less so by the others. The FabLabs in the North West, thanks also to a stronger presence in urban areas, feature a number of collaborations with university students or teachers. Laboratories are located next to other activities (design firms or local companies) that provide the premises through a free loan. Design work and prototyping are very important aspects and often the result of collaborations with private companies. Strong ties to the local area are also defined by the ability to activate demand from

[60] More than 3 "aggregation" points, fewer than 3 "territory" points.
[61] Fewer than 3 "aggregation" points, more than 3 "territory" points.

businesses. The FabLabs in this second group, therefore, attempt to act as research and development laboratories, experimenting with innovative techniques and practices that can be applied to the sectoral specialisations present in the area.

> We've started the first approaches for the development of the production sectors in the area. The first concerns laser incisions and the use of 3D printing. We ran a course to explain to employers how the sector can become more technological and that this has advantages [*Interview 2, the Third Italy, Founder and coordinator*].

> Over the last two years we've started to propose ourselves to companies as prototypers. A lot of businesses don't have the skills required to complete the prototyping process. It's very difficult to explain to businesses what we do. The strategy that we are following is to present them with a result, a finished product [*Interview 8, Third Italy, Founder and coordinator*].

The third group, finally, succeeds in mixing the *capacity to create a local community* (Aggregation) with *ties to the local area* (Territory).[62] It is made up of 5 FabLabs in the Third Italy and 2 in the North West and the founders are mostly those that we have defined as *sharing-entrepreneurs*. On the one hand, these laboratories represent a reference point for the community of people interested in digital fabrication. On the other hand, they are capable of activating virtuous relationships with the surrounding area. Internal training is frequent and structured, and designed for both children and adults. Activities in schools are well developed, notwithstanding the many bureaucratic and organisational difficulties. These FabLabs, therefore, are spaces that are able to interact with their local context, mobilising resources and generating social and economic innovation.

Before concluding, one point is particularly worth emphasising: the concentration of FabLabs to the right of the graph shows that Italian labs have been able to orientate themselves towards local productive

[62] More than 3 points for both "aggregation" and "territory".

activities, developing partnerships with businesses and creating a series of services and activities with ties to the productive vocations of the local area. Good examples of this are provided by the FabLabs specialised in the fields of design and medical technology (in the North West), as well as the FabLabs with ties to local manufacturing production (in the Third Italy and, to a lesser extent, in the South).

This area of the graph also shows a greater presence of FabLabs located in the Third Italy. These regions – which are characterised by a model of flexible specialisation – are therefore those: a) with a greater number of FabLabs; b) with FabLabs that demonstrate a greater ability to establish ties with the local area. Laboratories in the North West, however, show, relatively speaking, a more pro-market orientation, with a strong propensity to develop commercial projects and prototypes, often in collaboration with companies. In the South, finally, there is a greater presence of FabLabs that are very active in the field of training activities aimed at schools, this probably being due to the wider availability of public funds for integrated didactics.

6. Conclusions

In the preceding pages, we have outlined the conceptual, spatial and temporal coordinates that lead us to consider FabLabs as local collective goods for development created within the context of the sharing economy. The ecological analysis provides the first indications of the contextual factors that have fostered the diffusion of these laboratories on a global scale. It is, therefore, an urban phenomenon, mainly concentrated in countries that are more economically and technologically highly developed. A consideration of the European context, however, reveals a more complex relationship. FabLabs, in fact, turn out to be less common in certain large economies that feature a high rate of innovation. Italy presents itself as a particularly interesting case here, showing a surprising development of FabLab activity notwithstanding the fact that official indicators describe the country's economy as less innovative. To explain this "puzzle", we therefore proposed an interpretative key that jointly refers to the "human capital surplus" and "deficit of collective goods" in this country.

Internally, however, the Italian case proves to be rather heterogeneous. FabLabs have proliferated mainly (though not exclusively) in the richer regions, in large metropolitan centres and in small and medium-sized cities with widespread development of small business (especially in the Third Italy). Contextual and agency factors help to explain the reasons for this kind of localisation. On the one hand, FabLabs find it easier to establish themselves in the most advanced and dynamic areas (economically and/or culturally) of the country, in the context of a development model with a strong manufacturing vocation that is suffering from a deficit of collective goods for digital manufacturing, both in the public and private spheres of the market. On the other hand, the presence in these local contexts of high levels of education, of resources of participation and of social capital, has facilitated a "voluntaristic mobilisation" of citizens interested in producing these collective goods.

Following on from the *embryonic* and *explosion phases*, the FabLab diffusion process seems now to be moving in the direction of a *consolidation phase*, this time led by active regional and municipal policies. Unlike the first laboratories with ties to MIT, which came into being with the backing of solid institutional bodies, the creation of the Italian FabLab has so far been based on a "private-collective" model, with small groups of people investing their resources and expertise to produce a public good. These "founders" – albeit demonstrating a variety of profiles (*sharing-entrepreneur*, *designer*, *patchworker*) – are united by a high level of human capital, passion, curiosity and interest in this particular world, to the point where they feel the need to create a place where they can share their knowledge and skills. All of these factors – combined with identification with a community of reference (the maker community and Fab Foundation) that operates on a global scale – have generated a model of diffusion that is voluntaristic in nature, and this represents both the strength and fragility of the "Italian way".

In Italy, moreover, these small, artisanal, digital laboratories have also performed a function of *social innovation through brokerage* (Burt 2005), creating "collaborative public spaces" for people interested in digital fabrication (Lester and Piore 2004). These collaborations are not locally confined: some provincial and regional

networks are starting to emerge, especially in areas of the Third Italy and South. FabLabs have made it possible, therefore, to resolve a situation of *network failure* (Schrank and Whitford 2011) due to the lack of appropriate incentives and resources provided by the market, public authorities and organisations of interest.

In conclusion, in the light of what has been said above, Italian FabLabs seem to constitute real "local collective goods" for development. Although not yet fully established, their *capacity for aggregation* and ability to *create ties with their local area* shows that they have already been able to attune themselves to the specific needs of their local communities.

Appendix

---------- *inserire qui Tab. 4* ----------
---------- *inserire qui Tab. 5* ----------
---------- *inserire qui Tab. 6* ----------
---------- *inserire qui Tab. 7* ----------

Bibliography

AaVv (2014), *Maker A-Z*, Milano: Altreconomia edizioni.

Aliverti, P. (2014), *Stampa 3D, Stazione futuro. Con una storia italiana di successo. Sharebot*, Milano: Hoepli

Anderson, C. (2006), *The Long Tail*, New York: Hyperion.

Anderson, C. (2012), *Makers. The New Industrial Revolution*, New York: Crown Business [trad. It. *Makers. Il ritorno dei produttori,* Milano, Rizzoli Etas, 2013].

Bagnasco, A., Sabel, C. (eds) (1995) *Small Firms in Europe*, London: Pinter.

Benkler, Y. (2003), Freedom in the Commons: Towards a Political Economy of Information, in *Duke Law Journal*, vol. 52, no. 6, pp. 1245-1276.

Benkler, Y. (2004), Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production, in *The Yale Law Journal*, vol. 114, no. 2, pp. 273-358.

Benkler, Y., Nissembaum, H. (2006), Commons-based Peer Production and Virtue, in *The Journal of Political Philosophy,* vol. 14, no. 4, pp. 394–419

Botsman, R., Rogers, R. (2011), What's Mine Is Yours: The Rise of Collaborative Consumption, New York: HarperCollins.

Brown, J. S., Duguid, P. (1991), Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation, in *Organization Science*, vol. 2, no. 1, pp. 40-57.

Brown, J. S., Duguid, P. (2001), Knowledge and Organization: A Social-Practice Perspective, in *Organization Science*, vol. 12, no. 2 , pp. 198-213.

Burroni, L., Trigilia, C. (a cura di) (2011), *Le città dell'innovazione. Dove e perchè cresce l'alta tecnologia in Italia*, Bologna: Il Mulino.

Burt, R.S. (2005), *Brokerage and Closure*, Oxford: Oxford University Press.

Cavalcanti, G. (2013), Is It a Hackerspace, Makerspace, TechShop, or FabLab?, in "Make", 22 maggio, http://makezine.com/2013/05/22/the-difference-between-hackerspaces-makerspaces-techshops-and-fablabs/(consultato 28 luglio 2015).

Chesbrough, H.W. (2006), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston: Harvard Business School Press.

Crouch, C., Le Galès, P., Trigilia, C., Voelzkow, H. (2001), *Local Production Systems in Europe. Rise or Demise?*, Oxford: Oxford University Press.

Crouch, C., Le Galès, P., Trigilia, C., Voelzkow, H. (2004), *Changing Governance of Local Economies. Responses of European Local Production Systems*, Oxford: Oxford University Press.

European Commission (2013a), *Social Innovation Research in the European Union*, Luxembourg: Publications Office of the European Union.

European Commission (2013b), *The Sharing Economy. Accessibility Based Business Models for Peer-to-Peer Markets,* Business Innovation Observatory.

European Commission (2015), *Innovation Union Scoreboard 2015*, Belgium, available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm

Gauntlett, D. (2011), *Making is Connecting. The Social Meaning of Creativity from DIY and Knitting to You Tube and Web 2.0*,

Cambridge: Polity Press [trad. it. *La società dei Makers. La creatività dal fai da te al Web 2.0*, Venezia, Marsilio editori, 2013]
Gershenfeld, N. (2011), *Fab: the Coming Revolution on Your Desktop-From Personal Computers to Personal Fabrication*, New York: Basic Book.
Gershenfeld, N. (2012), How to Make Almost Anything, in *Foreign Affairs*, vol. 91, n. 6, pp. 43-57.
Hatch, M. (2014), *The Maker Movement Manifesto*, New York: McGraw Hill Education.
Hirschman, A.O. (1958), *A Strategy of Economic Development*, New Haven, CT: Yale University Press.
Lave, J., Wenger, E. (1991), *Situated Learning: Legitimate Peripheral Participation*, New York: Cambridge University Press.
Le Galès, P. , Voelzkow, H. (2001), Introduction: The Governance of Local Eco- nomies, in C. Crouch, P. Le Galès, C. Trigilia and H. Voelzkow (eds), *Local Pro- duction Systems in Europe. Rise or Demise?* Oxford: Oxford University Press, pp. 1–24.
Lester, R.K., Piore, M.J. (2004), *Innovation. The Missing Dimension*, Cambridge: Harvard University Press.
Make in Italy (2015), FabLab, Makerspace, Hackerspace, TechShop: quattro tipi di laboratori, http://www.makeinitaly.foundation/fablab-makerspace-hackerspace-techshop-limportanza-delle-definizioni/ (consultato 28 luglio 2015).
Menichinell, M., Ranellucci, A. (2014), *Censimento dei laboratori di fabbricazione digitale in Italia*, report fondazione Make in Italy.
Micelli, S. (2011), *Futuro artigiano,* Venezia: Marsilio Editori.
Pais, I., Provasi, G. (2015), *Sharing economy*: un passo avanti verso una 'risocializzazione' dell'economia?, in *Stato e Mercato*, n. 3, pp.
Piore, M.J., Sabel, C.F. (1984) *The Second Industrial Divide: Possibilities for Prosperity*, New York: Basic Books.
Pizzorno, A. (1993), *Le radici della politica assoluta e altri saggi*, Milano: Feltrinelli.
Picker, L., (2015), Etsy Seeks Up to $1.78 Billion Value as Artisan Site Readies IPO, in *BloomberBusiness*, 31 Marzo, http://www.bloomberg.com/news/articles/2015-03-31/etsy-seeks-up-to-1-78-billion-value-as-artisan-site-readies-ipo; (consultato il 21-9-2015).
Pyke, F., Becattini, G., Sengenberger, W. (eds) (1990) *Industrial Districts and Inter-Firm Co-operation in Italy*, Geneva: International Labour Organization.

Ramella, F. (2016), *The Sociology of Economic Innovation*, London: Routledge.
Rogers, E.M. (2003), *Diffusion of Innovations*, V ed., New York: The Free Press.
Sennet, R. (2008), *The Craftsman*, New Haven, CT: Yale University Press.
Schor, J. (2014), *Debating the Sharing Economy*, Great Transition Initiative, http://www.greattransition.org/publication/debating-the-sharing-economy.
Schrank, A., Whitford, J. (2011), The Anatomy of Network Failure, in *Sociological Theory,* vol. 29, no. 3, pp. 151-177.
Sombart, W. (1916), *Der Moderne Kapitalismus*, Berlino: Duncker & Humblot [trad. it. *Il capitalism moderno,* Torino, Utet, 1967].
The Economist (2012), *Manufacturing and Innovation*, Special Report, 21st of April.
Trigilia, C. (2002) *Economic Sociology: State, Market, and Society in Modern Capitalism*, Oxford: Blackwell.
Trigilia, C. (2005), *Sviluppo locale. Un progetto per l'Italia*, Roma-Bari: Laterza.
Troxler, P. (2010), Commons-based Peer-Production of Physical Goods. Is there Room for a Hybrid Innovation Ecology?**,** http://ssrn.com/abstract=1692617.
Von Hippel, E., Von Krogh, G. (2003), Open Source Software and the "Private-Collective" Model: Issues for Organization Science, in *Organization Science*, vol. 14, n. 2, pp. 209–223.
Walter-Herrmann, J., Büching, C. (eds) (2013), *FabLab of Machines, Makers and Inventors*, Bielefeld: Verlag.
Watts, D.J. (2004), *Six Degrees. The Science of a Connected Age*, London: Vintage Books.
Watts, D.J., Strogatz, S.H. (1998), Collective Dynamics of "Small World" Networks, in *Nature*, vol. 393, no. 4 June, pp. 440-442.
Wenger, E. (1998), *Communities of Practice. Learning, Meaning and Identity*, Cambridge: Cambridge University Press.