THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

How the Fablabs Community Can Help the Italian Industry

Francesco Ruberto
Ph.D. Candidate, Department of Economics and Management of Technology (DREAMT),
University of Pavia, Italy

Abstract:
The aim of this study is to explore the relationships between Innovation infrastructures, Fablabs and the Italian industrial sector and how people outside of Silicon Valley and main center of innovations create technology innovation in practice and why they should use Fablabs tools for accelerating those processes. The number of entrepreneurs in Italy using Fablab services is exploding. However, while entrepreneurs in the main centers of innovation, such as Silicon Valley, have crucial social, cultural, economic, and material resources to build high-impact companies, these resources are often not present in moderate innovators countries. This research analyzes how Fablabs can facilitate the innovation activities of the Italian industries, reviewing the case of Fablabs who experience success in providing services to companies. To obtain useful data that match the research objectives, this study use a Focus group interview method. The questions are open-ended, which means that during the interviews, the actual questions may change according to the responses of the interviewees. The findings will contribute to understanding the role that Fablabs play for the Italian industry, explaining how digital fabrication technologies can help Italian companies to be more competitive.

Keywords: *Fablab, Italian industry, Digital Fabrication, Silicon Valley.*

1. Introduction

Entrepreneurs' aspiration in Italy are fed by vivid stories of Silicon Valley companies and startups. They read about innovative startups in blog such as TechCrunch. However, there is an unstated backdrop for these Silicon Valley success stories. Entrepreneurs in Silicon Valley rely on the many resources available to them, including personal social networks, technical and entrepreneurship communities, technology innovation events, and venture capital financing (Saxenian, 1996). However, in view of the current economic conditions and the rather uncertain outlook, it is likely that in most southern (Italy) and eastern European countries, most strongly affected by the crisis growth in business R&D expenditure will be quite sluggish in the foreseeable future. Following the dramatic rise in firm failures during the crisis, the renewal of industry and the corresponding reallocation of resources have yet to make significant progress toward enhancing overall economic performance (OECD, 2012). This lack of resources makes technology innovation in southern and eastern European countries very difficult.

Thus, it is evident that entrepreneurs in southern European countries face a double challenge in realizing their aspirations: they must design and market innovative products, and they must create and utilize "innovation infrastructures" that support their practice. Innovation infrastructures are defined as a set of stable and dependable social, cultural, technical, informational, economic, and material resources that afford systematic, effective, and efficient innovation. These infrastructures aid entrepreneurs in learning new innovation practices. Entrepreneurs leverage these infrastructures to connect with mentors, clients, and investors. They also use them to find potential cofounders, employees, and business partners. This definition is based on Star and Ruhleder's (1996) work on infrastructures. In their work, infrastructures are resources that undergird the shared practices of a certain group. Infrastructures must persist beyond a single event, standardizing practices across time and space (Star & Ruhleder, 1996). Thus, innovation infrastructures must give continuity and stability to innovation practices, so entrepreneurs can rely on these practices to innovate systematically.

The case presented in this study shows that while migration to and from centers of innovation will continue to be a fundamental force to create industries in new locations, those entrepreneurs who decide to stay in their home country now have a greater chance to succeed at creating products and companies with global potential if they start to use new innovation infrastructure, such as Fablabs. Fablabs are digital fabrication laboratories , set up to inspire people and entrepreneurs to turn their ideas into new products and prototypes by giving them access to a range of advanced digital manufacturing technology.

This study aims to explore the relationships between Innovation infrastructures, Fablabs and the Italian industrial sector and how people outside of Silicon Valley and main center of innovations create technology innovation in practice and why they should use Fablabs tools for accelerating those processes. To this end, in this study was conducted an explanatory, multiply-case, following a focus group protocols when selecting participants for this study in order to explain causal relationships between Fablabs and the Italian Industry and to develop theory regarding this new field of research. In detail, the key objectives of this study include:

1. To interpret the meanings of two key concepts—innovation infrastructures, Fablabs and how can improve the innovation process in the Italian industry ;
2. To take the Italian Fablabs community as the case study, to examine their major problems, the major strategies and practices of innovation and company development, and to identify the visions in future;
3. To explain the underlying impetuses driving the rise of Fablabs in Italy, and to evaluate the major contributions of Fablabs as innovation infrastructure for the Italian Industry;
4. To analyze the spatial characteristics, the formation process, the expertise and services offered by Fablabs in Italy, a case study of Italian Fablabs community is conducted, and to discuss their impact to Italian Industry.

2. Theoretical Concepts

2.1. The lag in Innovation in Italy

The lag in innovation in Italy vis-à-vis the other main industrial countries is one of the effects of the fragmentation of the production system into many small firms that have trouble bearing the high cost of R&D and taking the related risks. Such other causes as shortages in human capital for management and R&D and excessive labour flexibility, undermining the incentive to invest in training, also play a role. Lack of financial sources is a further hurdle; equity, more suitable than debt for financing innovation, is less common than in other countries. Public incentives for firms have had modest results. To enhance the capacity for innovation some actions should be taken to help firms grow, adopt a more managerial approach, and increase their equity. It is important to support the venture capital market, which is less developed than in other countries. The design and management of public funding for innovation need improvement (Bugamelli et al., 2012). The European Commission – Directorate General Regional Policy stated that "in 2005, Italy's innovation performance was in 12th position out of the 25 EU Member States. Its main strength is the public funding of innovation; its main weaknesses are the lack of venture capital, the low level of cooperation between firms and the low level of business RTD. In addition, there is a predominance of SMEs (98% have less than 20 employees) specializing in low and medium technology sectors." (Directorate-General Regional Policy, Innovation in the National Strategic Reference Frameworks, 2006, p.2). In the National Strategic Framework (NSF) 2007-2013, the poor innovation capacity of the private and public sectors is identified as the principal source of competitive lag in the country. The systemic weakness of Italy is linked to the modest amount of private research conducted even in very large firms, the insufficient capacity to institute relationship mechanisms between the latter and SMEs, the limited aptitude of SMEs to dialogue with the research supply system, the inadequate level of training of entrepreneurs and the poor involvement of workers in the innovation process both in businesses and in the public administration (Coletti, 2007). Indicators of innovative output such as patents filed at the European Patent Office (EPO) confirm the Italian delay in innovation (Lotti & Schivardi, 2005). Of the total number of patents filed at the EPO in 2001 Italy had a share (7.8%) is significantly lower than one of the main European countries. The relationship between the number of patents and population puts Italy in the group of countries with a low propensity to patent (which also includes Belgium, Greece, Ireland, Portugal, United Kingdom) set against Austria, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Sweden.

2.2. Fablabs

A Fablab is a technical prototyping platform for innovation and invention, providing stimulus for local entrepreneurship. A Fablab is also a platform for learning and innovation: a place to play, to create, to learn, to mentor, and to invent. To be a Fablab means connecting to a global community of learners, educators, technologists, researchers, makers and innovators, a knowledge sharing network that spans 30 countries and 24 time zones. Because all Fablabs share common tools and processes, the program is building a global network, a distributed laboratory for research and invention (Fablab chart, 2007). A Fablab is a fully kitted fabrication workshop which gives everyone in the community, from small children through to entrepreneurs and businesses, the capability to turn their ideas and concepts into reality (Neil Gershenfeld, 2005). A Fablab is a community inventors' workshop offering digital fabrication on a personal scale, in which new products can be built by both businesses and individuals. In addition, Fablabs hosts learning events that support entrepreneurs to learn new innovation practices from Silicon Valley, Boston MIT and main center of innovation. At the beginning of 2014, the international Fablab network consisted of 474 Fablabs in 71countries, made possible by hundreds of staff members (paid and volunteers). This phenomenon is caused by the continued cost reduction of the machines, the growth of open source software and hardware (Troxler & Wolf, 2010, Troxler, 2013), and because the cost of a part or component "is based on the machine's time, not shape or variety of parts, so there is no surcharge for complexity or difference" (SHoP, 2012, 251).

2.3. Focus Groups

Focus group research involves an organized group interview that allows the researcher to obtain several perspectives on the same topic in a relatively small amount of time (Patton, 1990). Powell et al (1996) defines a focus group as "A group of individuals selected and assembled by researchers to discuss and comment on, from personal experience, the topic that is the subject of the research". Focus groups are generally comprised of a homogenous group, with regard to specific characteristics, of six to ten people (Powell & Single, 1996; Patton, 1990). Focus group research has both benefits and limitations to be considered by the researcher. The benefits of focus groups to the researcher include the opportunity to conduct multiple interviews at the same time as well as to gain the insight and data produced by the interaction between participants. Limitations to be considered are the difficulty in keeping participants focused on the topic, ensuring that all group members have the opportunity to provide input, and outcomes which cannot be easily predetermined (Gibbs, 1997). Patton (1990) concludes that focus group interviews are indeed interviews and therefore require the same quality

controls as a one-on-one interview. Conducting a focus group interview requires the researcher to carefully plan for a structured approach in five areas: (a) preparing for the session, (b) developing the questions, (c) planning the session, (d) facilitating the session, and (e) ending the session (McNamara, 1999). Finally, the researcher closes the session by reviewing the occurrences of the meeting, thanking the participants for attending, and adjourning the meeting (McNamara, 1999).

3. Research Objectives

Four specific questions guided this study: (1) How effective have Fablabs been in attracting, diffuse knowledge, give access to technology and fasten time-to-market to companies?, (2) Have companies which use Fablabs services stopped making prototypes in their home locations or are they referring to external companies and preferring Fablabs prototyping services?, (3) How effective and important Fablabs can be for Italian companies?, and (4) Do the physical infrastructures and human resources inside Fablabs (buildings, layout, facilities) help facilitate collaboration and accelerate idea generation and innovation?

4. Research Methods

4.1. Setting Participants

This study was conducted taking in consideration several Fablabs in all Italy. In this study was selected a purposeful sampling method in conjunction with criterion and stratified sampling to select study participants. Purposeful sampling is a logical and powerful sampling method that allows for relatively small samples to be selected purposefully. Purposefully means the selection of information-rich cases that are subjected to in-depth study (Patton, 1990). Patton noted that information-rich cases are cases where the researcher "…can learn a great deal about issues of central importance to the purpose of the research". The researcher included criterion sampling as the method to select a purposeful sample of information-rich cases. Patton (1990) found that utilizing more than one sampling method, or mixed method, would further contribute to sample reliability. Criterion sampling is a quality assurance approach that allows the researcher to study cases that meet certain predetermined criterion of importance. The study participants were divided in three focus groups.

First, study participants must have been employees of Fablabs and must have served in an administrative capacity at some time. Second, the managers/directors were separated into groups based on their position, level of administration, and their tasks. From this group were selected the members of the two managerial focus groups using stratified random sampling. Third, the four administrative personnel who work with Fablabs managers were selected to participate.

The sample for focus group one (N = 6) was drawn from a population of 52 Fablabs in Italy by taking in consideration just the main manager/director of the lab. Each of the managers was assigned a number between 1 and 6. Once, selected the sixth participant who agreed to participate, the sample of six participants for focus group one were obtained. The sample for focus group two (N = 6) was always drawn from a population of 52 Fablabs with more than 200 Assistants Fablab Managers. However, the assistant Fablabs Managers were selected within the six original Fabalabs who accepted to take part in the study. Each of the assistants Fablab Managers was assigned a number between 1 and 6. In this way, was obtained the sample of six for focus group two. Focus group three was comprised of the complete population of administrative Fablabs personnel (N = 6). The six administrative Fablabs personnel were selected based on their job and task within their Fablab and especially if they executed jobs for companies.

Case Study Focus Group Participants
Fablabs Managers
Assistant Fablab Managers
Administrative Personnel and other workforce

Figure 1: Criterion Sample Selection Matrix
Source: Author (2015)

4.2. Focus Groups Questions

Open-Ended Interview Questions (Focus Groups)

1. Do you think that Fablabs in Italy has been effective in diffusing new knowledge tocompanies? If yes, how? If no, why?
2. What benefit in terms of R&D and manufacturing time and costs did the Fablab provide for Italian companies?
3. What do you see as the strengths of your prototyping service?
4. Do you feel that Fablab's services offer and quality has refined the sector of prototyping services? Do you think the traditional actors of this market are losing business?
5. 99% of Italian companies are of a small size, which implies many difficulties in competing with the big actors in the domestic and foreign market. Do you think the Fablabs can help Italian companies in competing in the business market? If yes, how? If no, why?
6. Do you think the synergy between Fablabs and companies has a strong potential to tighten the web for innovation and strengthen the local economy in the underdeveloped area?
7. How successful do you feel your Fablab has been in providing companies with a high quality human resources and infrastructures?
8. Do you feel your Fablab environment can incentivize the sharing of knowledge amongst users and being an instrument of networking?

9. Do you think the use of the fabrication tools will result in more disruptive innovations or eccentric creativity?

4.3. Data Analysis

Data analysis in a qualitative case study consists of a detailed description of the case and the setting (Creswell, 1998) in conjunction with a structured approach at analyzing results. In this study was used the constant comparative method of data collection to identify general themes first followed by a detailed discussion of the most salient themes. The constant comparative method is a detailed organizational data analysis process where the researcher follows a prescribed format. This format, endorsed by Maykut and Morehouse (1994), includes: (a) reading and coding each data piece carefully, (b) organizing each data piece into categories, (c) comparing each new data piece to existing categories to determine whether the new data fit an existing category or falls into a new category, (d) looking for emerging themes within each category, and (e) repeating the process for finding the most salient themes. Patton (1990) refers to this type of analysis as inductive. Inductive analysis allows categories "…to emerge from patterns found in the case under study". In this study was used the constant comparative analysis with the focus group interviews, document reviews, and observations. Data collected from each focus group was first organized by group. Within each group, was looked for categories to emerge that help determine if really Fablabs in Italy can play a critical role for Italian companies. Next, in the study were compared the categories from each focus group to identify recurring themes that help illustrate the level of preparedness of academy program graduates. These themes were then compared to find the most salient themes affecting principal preparation. Data collected from document reviews and observations were used to supplement the focus group interviews. Specifically, in the study was reviewed each of the documents and observations to determine where they fit into the emerging themes found in the focus groups.

5. Findings

5.1. Finding 1

A core component of Fablabs community is the idea of sharing knowledge. Generally, Fablabs rely on community members and their human resources acting as mentors and sharing their knowledge in particular fields to other community members. For instance, individuals who have skills in electronics or programming are tapped into teaching hands-on workshops to entrepreneurs and other people of the local community. Fablabs seek to encourage in their local environment innovation, collaboration and learning, enabling more companies to cultivate an interest in the several digital fabrication fields. Fablabs develop creative ways to encourage local entrepreneurs to actively learn, create, innovate and share knowledge. As one Fablab Manager notes, "Instead of trying to interest companies in science as received knowledge, it's possible to equip them to do science, giving them both the knowledge and the tools to discover it."

Secondly, the existence of an Italian Fablabs community makes it easier for entrepreneurs to exploit knowledge-based business ideas, thus lowering the barriers that inhibit direct commercial application and increasing the possibility of competition in foreign markets. Furthermore, Italian companies can benefit from their proximity to Fablabs, due to the fact that numerous Fablabs are clustered in a relatively small area, especially if they operate in the same sector (or in closely connected sectors).

5.2. Finding 2

An insured feature of Fablabs is to significantly speed time-to-market. By combining the several Fablab technologies (3D printers, laser cutters, milling machines etc.) prototypes can be created in few hours or in case of complex one just in some days. One Fablab Manager said, "With this new disruptive technologies and process, users can now go directly from machine to molding, expediting the time it takes to go to market."

In the old days, before the coming of Fablabs and maker spaces on the scene, time-to-market was clearly a lengthy cycle in any industry because getting a product from concept stage to being available for purchase took time. Product development often had a difficult time making it out of the engineering department, based on such variables as initial approval, testing phases, budgeting, staffing allocations, manufacturing, shipping etc. But today, that's all different. Thanks to an innovative process known as 3D rapid prototyping, time-to-market can be greatly reduced. And the strange thing is: the technology is nothing new. It has been around for nearly three decades. Known as "additive manufacturing," 3D printing is used to fabricate models, prototypes and parts out of resin material. However, these technologies for small companies are still expensive but through Fablabs they can accede to these new technologies and speed the time-to-market for their products.

5.3. Finding 3

Fablabs usually have the most advanced 3D printers and digital fabrication tools and most of the time these 3D printers can print in over one-hundred different materials. The possibilities with this emerging technology are mind-boggling, from printed prosthetic limbs to printer replication. Some of the world's largest companies such as Coca-Cola, Nokia and eBay are all currently utilizing 3D printing technologies. The possibilities of 3D printing are captivating, but it does not come without costs. For this reason, Fablabs are fundamental for offering 3D printing technology to small companies at a low cost. Fablabs make the costs for this technology to go down and drive more demand for 3D printer services. Although small companies have been struggling with innovating 3D printers, the concept of 3D printing is logical and easy to understand.

5.4. Finding 4

For small businesses that make things and for entrepreneurs who dream of doing the same, the greatest challenge is almost always the cost of technology for turning an idea into a tangible product. Often, the chore of even creating a prototype is so daunting, great ideas are simply left on the table. This problem is very common amongst Italian companies due to the fact that 99% of them are of small and medium sizes. That common obstacle is exactly why Fablab technology is a potential game changer for small Italian companies. While manufacturing was once a big money, big business proposition, digital fabrication technologies can put the power of prototyping and one-off manufacturing into the hands of local entrepreneurs. With one machine and a digital design, in Fablabs companies can build a three-dimensional object of virtually anything right on the spot. The advent of affordability is one of the most surprising things about Fablabs, besides what they can do is that the technology isn't actually new; it's just newly affordable. Fablabs services are now relatively inexpensive for companies and they can expand capability for small companies that will be only limited by the imagination of their owners. The opportunity to harness this technology gives entrepreneurs who are creative and innovative a method of bringing their ideas to life that is entirely unprecedented.

5.5. Finding 5

Fablabs could actually be most useful in some of the world's most undeveloped and impoverished places. Fablabs are now running everywhere in the world from South Boston, Ghana, Costa Rica, India, Norway to South Africa. In underdeveloped areas there are people in demand and companies with compelling technologies problems that they're desperate to solve. These places are very different from each other, and people and companies have unique problems. Some areas of South of Italy have the same problems of some rural areas in India and so in some ways, entrepreneurs remarkably face similar issues. Small companies in underdeveloped areas lack technologies and qualified human resources so they have this tremendous sense of opportunity for technology. Fablabs deliver high-tech tools and fabrication laboratories aim to help developing small companies communities find innovative solutions to local needs.

5.6. Finding 6

Fablabs can provide Italian companies very qualified human resources. Fablabs are part of a new model of organization experimenting with people's willingness to volunteer their time and relinquish traditional property rights over some portion of the fruits of their labor. This does not mean that standard forms of compensation are becoming obsolete. Particularly among extremely highly skilled individuals, however, additional forms of motivation, such as the chance to work on personally meaningful projects, and the opportunity to display ingenuity in the company of respected peers, are proving capable of accomplishing more than was traditionally thought possible. Indeed, it is these use the whole range of human motivations to harness talent and a diverse motivations that make the Fablab network a growing force in solving global problems and provide services for companies.

5.7. Finding 7

Fablabs are organized in a global network of local labs, enabling invention by providing access to tools for rapid digital fabrication. Fablabs have the most regulated requirements and the closest connection to the universities and research centers. This renders the global Fablab network a very suitable platform for technology transfer options and STEM entrepreneurship and for regulated digital fabrication performed in a sustainable way. In fact, Fablabs can open new niches for sustainable innovation in society and allow companies to find new partners all around the world. The goal of any Fablab in Italy should be to help Italian companies in collaborating each other in order to share best practices that allow for the creation of programs and networks.

6. Conclusions

The purpose of this study was to analyze the case of Fablabs community helping the Italian industry in the process of innovation and growth. This case is representative of how entrepreneurs engage in Fablab digital fabrication technologies which allow to make almost anything and optimizing time and production cost. In fact, the number of entrepreneurs in Italy using Fablab services is exploding. A qualitative case study design was selected to gather data through focus group interviews, document reviews, and an observation of a current academy session. Focus group interviews included assistant principals and principals (N = 18), purposefully selected to include an equal number of Fablabs Managers, Assistant Fablab Managers and Administrative Personnel and other workforce.

Nonetheless, the results of this study confirmed my intuition that companies that utilize Fablabs services obtain better results in terms of business results than companies that do not utilize Fablabs services. This conclusion is based not only on the data herein but also through my research and interactions with Fablabs Managers, assistants and stuff during the study. From the onset of this study, Fablabs Managers, Assistant Fablab Managers and Administrative Personnel in their responses did not distinguish themselves in a marked manner. As a moderator of focus groups, it was evident and well appreciated that all participants engage in high quality dialogue centered on the question. The several responses rarely deviated amongst the different focus groups, and showed very good knowledge on the issue. Fablabs personnel, themselves, were aware of the small demarcation from their peers who were Managers or assistants. Clearly, Fablab personnel learned from experience and unfortunately, in some instances, from their mistakes when left to their own devices. When interviewed, Fablabs Managers and assistants, on the other hand, showed an in-depth knowledge of each issue and merely enhanced responses by bundling Fablab knowledge with personal experiences. In addition, Fablabs Managers and assistants answered questions in a detailed and succinct manner. The data from this study leads to conclude that companies who use Fablabs services are better prepared, have more business opportunities, are more confident in competing in the market, are more knowledgeable and gain access to new technologies compared to companies who do not use Fablabs services.

7. References

i. Bugamelli, M., Cannari, L., Lotti, F. & Magri, S. (2012). The innovation gap of Italy's production system: Roots and possible solutions. Bank of Italy, occasional paper, no. 121.
ii. Coletti, R. (2007). Italy and Innovation: Organizational Structure and Public Policies.
iii. Creswell, J. W. (1998). Qualitative inquiry and research design: Choosing among five traditions. Thousand Oaks, CA: Sage.
iv. European Trend Chart on Innovation (2006). EC, Directorate-General Enterprise, Annual Innovation Policy Trends and Appraisal Report Italy.
v. Fab Charter (2007). The Fab Charter. Available online at http://fab.cba.mit.edu/about/charter/.
vi. Gershenfeld, N. A. (2005). Fab: The Coming Revolution on Your Desktop--from Personal Computers to Personal Fabrication. Basic Books.
vii. Gershenfeld, N. A. (2012). How to Make Almost Anything. foreign affairs.
viii. Gibbs, A. (1997). Focus groups. Social Research Update, 19, 1-7.
ix. Lotti, F. & Schivardi, F. (2005). Cross Country Differences in Patent Propensity: a Firm-Level Investigation. Giornale degli Economisti e Annali di Economia, vol. 64, n. 4, pp. 469-502.
x. Maykut, P. & Morehouse, R. (1994). Beginning qualitative research: a philosophical and practical guide. Washington, DC: Falmer Press.
xi. McNamara, C. (1999). Basics of conducting focus groups. Retrieved July 18, 2006, from http://www.managementhelp.org/evaluatn/focusgrp.html.
xii. OECD (2012). OECD Science, Technology and Industry Outlook 2012, OECD Publishing. http://dx.doi.org/10.1787/sti_outlook-2012-en.
xiii. Patton, M. (1990). Qualitative evaluation and research methods. (2nd ed.)Newbury Park, CA: Sage.
xiv. Powell, R.A. &Single, H.M. (1996). Focus groups. International Journal of Quality in Health Care 8 (5): 499-504.
xv. Powell, R.A., Single, H.M. & Lloyd, K.R. (1996). Focus groups in mental health research: enhancing the validity of user and provider questionnaires', International Journal of Social Psychology 42 (3): 193-206.
xvi. Saxenian, A. (1996). Regional Advantage: Culture and Competition in Silicon Valley and Route 28. Harvard University Press.
xvii. SHoP (2012). SHoP: Out of Practice. New York: Monacelli Press.
xviii. Star, S. L., & Ruhleder, K. (1996). Steps toward an ecology of infrastructure: Design and access for large information spaces. Information Systems Research, 7(1), 111–134.
xix. Troxler, P. & Wolf, P. (2010). Bending the Rules: The Fab Lab Innovation Ecology. Zurich:11 International CINet Conference.
xx. Troxler, P. (2013). Making the 3rd Industrial Revolution. The Struggle for PolycentricStructures and a New Peer Production Commons in the Fab Lab Community. In J. Walter-Herrmann & C. Büching (Eds.). Fab Labs: Of Machines, Makers and Inventors. Bielefeld:Transcript Publishers.