Engaged by Design: The Role of Emerging Collaborative Infrastructures for Social Development. Roma Makers as A Case Study

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Abstract: We are living in a moment of radical change. The environmental and economic crisis have been undermining the strength of democratic societies, causing, mainly in western communities, a widespread sense of alienation and insecurity. By the way, new social structures are emerging from bottom-up initiatives, as a response to the lack of good political practices. These actions often reveal themselves as strong creative think tanks; they play a key role in the decision-making process concerning commons and contribute to the definition of the community identity, by acting as connectors between both social and environmental factors. Founded in 2012 by a group of young people from different backgrounds, Roma Makers has been the first fab lab in Rome, Italy, and in the last four years, it has grown in terms of network and community. Started from scratch, with limited economic resources and during a peak of the Italian economic and political crisis, Roma Makers has been able to build a bridge between citizens and authorities, using the global innovation network as a mean to join different urban realities. With the direction of four public labs widespread among the Lazio Region, several mini-labs in public schools, the collaboration with trade associations, universities and high educational centers, together with the organisation of several technological events, Roma Makers has built an active infrastructure of knowledge focused on the empowerment of citizens in technological innovation and digital manufacturing. The infrastructure operates at different levels of society and creates a connection between professionals, students, hobbyists, urban associations, companies and institutions so that they can meet and share projects and ideas. This new layer of knowledge is expanding from a very local scale (the neighbourhood of Garbatella in Rome) to the Lazio Region area, and it allows local economies to be developed by giving access to innovative and advanced manufacturing machines and processes. In this system, a new role of design is emerging and changing the linear relationship client/designer/user with collaborative networks that generate an open knowledge repository, in which everyone is included and can contribute by finding the most suitable field to share one’s skills. The knowledge ecosystem fosters the encounter between local know-how and innovation, creating new
markets and encouraging new economies. In 2015 Roma Makers has expanded by becoming an incubator for two start-ups that connect the infrastructure with two important economic sectors: design firms and arts, introducing digital manufacturing tools and networked design into the industry process. This scenario leads to a new concept of participatory design as a tool for an active engagement of individuals in the development of their communities. The current paper will analyse how the new collaborative design and production processes emerging from the Roma Makers Infrastructure is contributing to building a sustainable and inclusive social ecosystem. The research will highlight the peculiar urban context in which it develops and focuses on how a self-generating network of knowledge based on a peer-to-peer system can be a key agent to enhance civic engagement for urban development.

**Keywords:** Emerging processes, Community development, Peer-to-peer systems, Technological innovation, Civic engagement

1. Introduction

1.1 The maker movement, fab labs and the democratisation of innovation

The influence of technology in our lives today is perhaps the greatest it has ever been. During the second part of the XX century, technology innovation have been accelerating, above all in the field of ICT, and the advent of Internet and smart mobiles changed massively the way we relate both as individuals, by virtually deleting geographical boundaries, and to knowledge, by opening access to data and information. A new approach to technology is developing a new way for people to perceive, use and interact with tech innovation and production: the spreading of the maker movement and fab labs is giving access to everyone to advanced manufacturing technologies and projects, creating both digital and physical networks, while maintaining a distributed and decentralized structure. The maker movement defines “the increasing number of people employing do-it-yourself (DIY) and do-it-with-others (DIWO) techniques and processes to develop unique technology products” (Techopedia.com, 2016) and it officially started with the launch of MAKE Magazine, a review for makers and hobbyists focused on technological innovation and DIY. In 2006 the maker movement took a more defined shape to the world with the first Maker Faire in the Bay Area, which was attended by more than 20000 visitors. The event has been replicated all over the world and registered a growing success in less than 10 years.
Fab labs started in 2001 as a research project of the MIT’s Center for Bits and Atoms, and for the first time a research center opened its doors to give access to advanced digital fabrication tools to everyone. Fab Labs differ from the maker movement both from its definition and its structure. First of all, a Fab Lab is a place: it is a laboratory open to the general public, where one can find advanced technological machines for digital manufacturing. Then, Fab Labs are a network: all labs are connected to the others and they share knowledge, projects and best practices. The Fab Lab Network is an infrastructure for people to share their knowledge and creativity, while exploring and exchanging experiences and projects. As they share the same fabrication technologies and the same software, the great power of the Fab Lab Network is that it allows people to replicate projects and products in every lab of the network. It is currently the biggest organized infrastructure on digital manufacturing process and research in the world: the official database of fab labs, the platform fablabs.io, counts at the moment of writing the current paper, 1120 registered fab labs all over the globe. The main goal of the network is the dissemination of knowledge resulting from innovative research as well as from engaging the general public to be actively involved in the technological innovation process. This is the so-called “democratisation of innovation”, which roots in the open source philosophy and scales it to the whole technological world, giving access to information, data and tools for advanced manufacturing to everyone. Like in software development, the distribution of information is generating not only a more rapid and efficient product development, but it is above all changing the process of innovation, passing from a linear process to a distributed one in which people from different background cooperate and share their skills to improve the project they are involved into.
1.2 Italy: the second European Fab Country

In Italy, the Fab Lab revolution started later than other countries. The very first Italian Fab Lab is the Fab Lab Italia founded by Massimo Banzi and coordinated by Enrico Bassi in 2011 in Torino, and it was active from March to November of the same year (Menichinelli, 2016). The first permanent fab lab in Italy is Fab Lab Torino (still active), built inside Officine Arduino and officially opened to the public on February 17th, 2012. From 2012 to 2016, the Fab Labs phenomenon in Italy has grown exponentially, all over the country, and turning Italy the second European country with the highest number of fab labs (the first one is France). The explication of that success relies in the traditional Italian economic background. Despite the global appreciation of the “Made in Italy”, Italy has never been able to turn its industry into a global business (The Economist, 2016), in part because of its deeply-rooted small-firms-based economic system. The Fab Lab model is a structure that fits perfectly in the Italian economic pattern: the Fab Lab Network foster creativity by combining information and data from everywhere and merging it with local resources, the distributed manufacturing model allows labs to be part of global businesses while maintaining a small/medium size of the plant, and the high customization allowed by digital fabrication can define a new modern shape for the Italian craft tradition by improving old techniques with digital tools.
2. Context

2.1 Roma Makers: from a small group to an urban infrastructure

Despite almost a decade trapped in a sort of immobility concerning urban development, Rome has played a key role in the dissemination of the maker movement and fab labs in Italy. In March 2012, the event “World Wide Rome – The Makers Edition” (WWR) registered participants from all the country, and it was the trigger for Roman tech community to develop the idea of opening the first Fab Lab in Rome. At the very beginning, the story of the first Roman fab lab is the birth of a community: after the WWR, the social group Fablab Roma was created and a community of tech enthusiasts, professionals, students, journalists and citizens started to organize regular meetings and discuss about the possibility to open the first Fab Lab in Rome. In late 2012, the group Roma Makers began to contribute to the dissemination of the Fab Lab culture by organizing small talks, the “Pop Up Makers”, where projects of the Fab Lab Network were presented to the public. The role of the Pop Ups has been a key to establish a first connection with the social context, understand the urban tissue and build a basic social and cultural infrastructure to engage people in the project. In September 2013, Roma Makers officially opened its first laboratory. Structured as a non-profit association, the very first founder group was composed by four young professionals from different backgrounds: Stefano Varano (president), biologist and electronics expert, Alessandro Zampieri (secretary), designer, Leonardo Zaccone (treasurer), musician and teacher, Silvio Tassinari (counselor), designer. The lab was self-funded, and thanks to a good communication strategy and a good response from the community, Roma Makers had the opportunity to double its space and in the summer 2014 moved to a bigger structure, which is still the current lab. From 2013 to 2015 the activity of Roma Makers has been focused on creating a favorable ecosystem in which technological innovation is used as a main connector for citizens to be actively involved in the community. The members of Roma Makers have grown sensibly, and the opening party before the Maker Faire Rome 2014 was attended by the entire Roman maker community and from notorious international personalities of the maker and fab world. In this period, the main activity of the community focuses on fostering and promoting projects on different levels, from self-made machines, to educational programs and international collaboration: Falla 3D, designed by Silvio Tassinari and Giacomo Falaschi (Fab Lab Contea) is an open self-assembled and self-programmed 3D printer that can be entirely made in a fab lab, the Minimakers program on technological education for children, and the participation to the networked design project Fab Lab Amazon, launched by Fab Lab Peru and involved more that 15 fab labs all around the world. From 2014 to 2016 Roma Makers has grown both as a community and labs: starting with the collaboration for the opening and management of the five laboratories of Fab Lab Lazio, followed by the creation of a series of mini fab labs in primary and high schools, and finally the foundation of two start-ups offering service through digital manufacturing, Roma Makers has turned from a fab lab in the center of Roma into Fab Lab Roma, an urban network of collaborative fab labs disseminated among the metropolitan and regional area.
2.2 Involving institutions: the public fab labs of Regione Lazio

In 2015 Roma Makers won the position for the management of the brand new public fab labs opened inside the Lazio Region incubators in different cities of the region: Rome, Viterbo and Bracciano, and later, Latina and Rieti. The interest and the engagement of the public institutions has been the first step to launch a territorial platform to disseminate technological knowledge and reach a larger audience, above all among professionals and public administrators. The public response has been successful from the beginning, and the Fab Lab Lazio community had registered more than 3000 users in two years. Being a core tool inside the institution BIC Lazio, the public incubator for start-ups, the Fab Lab Lazio has been the very first experience directly connected to the business world. It has shown to be the perfect tool for new start-ups to test their products and prototypes, while the entire infrastructure offers a group of mentors and support both for technical skills and business strategies. As part of the project “STAART UP – Creazione di FabLab regionali per imprese operanti nel campo culturale, creativo e delle arti figurative”, Fab Lab Lazio is a distributed infrastructure in which, according to the territorial resources, every lab is focused on a specific area of research:

- FabLab Roma Casilino, focused on creative industry;
- FabLab Bracciano, focused on tech agriculture and food;
- FabLab Viterbo, focused on cultural and historical heritage;
- FabLab Latina, focused on science;
- FabLab Rieti, focused on electronics, energy efficiency and sustainability.

2.3 Educating for the future: mini labs in public schools

The “Minimakers” education program has been one of the main activities of Roma Makers from the beginning. It started with a series of small workshops for children to get them closer to technology and let them play and learn by making small toys and gadgets. The workshops included robot design, electronics, coding, 3d modeling and small 3d printed objects. Minimakers program had a great success among families, that engaged themselves to promote it in schools. The collaboration educative structures leaded to the opening of Fab Lab Faraday Ostia in 2014, followed in 2015 by the Fab Lab Rosmini. Both fab labs are set up into the school building, in which students can experiment...
with new processes for learning, designing, thinking and making. In both these experiences, the presence of a fab lab inside an educational institution had a double effect: the education of student based on a learning-by-doing, open and sharing principles, and the changing of the educational practice by teachers, who recognize in this new approach a great potential for generating a more stimulating learning environment. The spread of fab labs among Italy let the governments pay more attention to the necessity for digital education to be integrated into the educational system. Taking learning-by-doing as fundamental for a better education, the Ministero dell’Istruzione, Università e Ricerca (MIUR) launched a funding program for schools to set up their own fab labs. Several schools of Rome answered to the call and established a partnership with Roma Makers, both for co-designing the laboratories and the definition of educational programs and activities. The co-creation of the “Atelier Creativi” (as MIUR documents refer to fab labs in schools) has been not only a work of advisory and assistance, but above all a complete experience of co-design in which different stakeholders (civic leaders, teachers, families and makers) took active part at various level: from the interior design of the laboratory, to the definition of the activities, to the management of the space both during the school time and after it. In 2016 Fab Lab Roma counts with four active fab labs in schools, and the spreading of digital education generated a new demand for digital educators, making the numbers of employed of the network grow from 10 (2015) to 19 (2016). Simultaneously Roma Makers set up a specialized training for educators to work in fab labs. One of the most important aspect of the school fab labs is the double relationship they have with the territory: while during the school time they are reserved for students and teachers, after school time they are open to the neighbors to develop projects and learn about digital fabrication processes.
2.4 An answer to crisis: new economic opportunities

A controversial question about fab labs is whether they are able or not to generate business. According to The Fab Foundation reports, several projects came out from the Fab Lab Network and are currently active businesses. Concerning Roma Makers, the development of the network has opened a path for new markets to grow. To reach its own sustainability, Roma Makers team focused on the usability of machines and software for several projects, both concerning product design and technological empowerment. Along with different educational courses and events for professionals, students and amateurs, Roma Makers is also a supporter and adviser for external start-ups and craftsmen to develop their products and test their ideas. In the very beginning, the team of Roma Makers, in collaboration with Fab Lab Contea, developed its own 3d printer, Falla 3D, which is an open project promoted through an “educational maker experience”: instead of buying the entire machine or the pieces and just assembling it, the Falla 3D could be acquired by following a training on building and modeling one’s own 3d printer. This leads to a new business model in which the
users are involved in the process of making while buying their product, becoming active agents in the production system and learning how to customize their product by themselves. Fostering participatory design process and merging it into its economic activity, in 2016 Roma Makers has become an incubator for start-ups related to digital fabrication and technological empowerment. The business branch of Fab Lab Roma follows basically two types of economic demand:

- The role digital manufacturing can play with industry and craftsmanship;
- The request for high skilled trainers, fab lab managers and digital artists.

FabFactory is the design start-up that has its operational headquarter inside the principal fab lab in Garbatella. Funded by two founder members of Roma Makers association, FabFactory is a bridge connecting the “fab design process” with industry, by developing solutions for designers, craftsmen and entrepreneurs to improve their projects. FabFactory offers a variety of service with a specialized team for prototyping and customized products for medium and small companies, while offering also a small high customizable range of products designed by its own team. The mission of FabFactory is to promote collaborative design processes based on networked system among companies to foster innovation by users for users.

Spazio Chirale is an innovative start-up which explores the implications the introduction of digital manufacturing processes and practices have into the educational system and the artistic production. Placed nearby the Fab Lab Garbatella, Spazio Chirale is an “open gallery of process”, that means that the space, instead of offering an exposition of finished artworks, shows the “making” of the art product, by displaying working machines and promoting workshops and activities in which participants and artists create their work. This is a brand new concept of interactive exposition in which users are involved in the creation of the exposition itself instead of just interacting with the final artistic production.

Figure 5. The Economic Development of Roma Makers/Fab Lab Roma. Data source by Roma Makers archives
3. The infrastructure of knowledge

3.1 A self-generating model

What makes Roma Makers unique in its structure is its self-generating model of growth. The entire Fab Lab Network can be described as a spontaneous phenomenon, but not all fab labs are born from scratch and without any help. The Fab Foundation is the official institution that helps new fab labs to start and defines the basic standards and the goals a lab has to subscribe to be considered a Fab Lab. Looking at the development of the Fab Lab Roma Network, Roma Makers took the experience of The Fab Foundation and scaled it to the city, becoming a unique case of self-generating network of Fab Lab in Italy. This is particularly true if compared to the Fab Lab Network of Milan, which counts with the presence of several successful fab labs and makerspaces distributed among its area, and, even though they are part of the global network, locally, every lab runs its local business and the collaboration with others is restricted to specific projects. Besides Fab Lab Roma, Italy has two previous experience of local organized Fab Lab Network: MakER, the web of Emilia Romagna Region, and Fab Lab Toscana. Both operate at a regional scale, and their main goals is to coordinate some administrative and business strategies following a distributed model for an economic growth. Roma Makers share the same values, but the main difference with these two realities is determined by the way they grow: while both MakER and Fab Lab Toscana are networks in which every lab in the region is invited to join, Fab Lab Roma Network is the answer to a local demand, offering an advisory service to citizens institutions to open and run a fab lab. This was the key for the community to grow sensibly in the last four years, and the main factor of a new dynamic economic market based digital fabrication, which involves private and public actors working together and sharing resources and knowledge.

3.2 The scale of the infrastructure: a new layer in the city

With the opening of many fab labs and mini fab labs distributed among the metropolitan area, Fab Lab Roma Network is assuming the configuration of a new layer of the city. The different labs offer a multilevel service that answers to a variety of social needs from different segments of the society,
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from the young age to elders, and creates an inclusive and interdisciplinary infrastructure of knowledge, in which citizens can share experiences and experimenting new practices with advanced technological tools. In several cases, such as the Roma Makers, FabLabaro, Spazio Chirale and Fab Lab Primavalle, the laboratories have turned into urban hubs for citizens to meet, share and discuss about the community concerns, problems and common goals and needs. The dissemination among the entire urban area allows every lab to define best practices and activities according to its very local resources and offering a way to find innovative social practices and policies for generating commons and enhancing local economies. Every fab lab, according to the global Fab Charter, defines its identity from the interaction with its environment and the contribute of its users, that at the same time identify themselves as members of the fab lab community. The technological empowerment is the main connector for individuals to feel as a part of a global community, while maintaining their own local identity. In the Roman case, the inclusiveness represented by having access to a physical place almost in every part of the city has a strong impact in terms of civic engagement. Rome, despite its huge dimension and its important role as a European capital, shows a lack of organized planning and of an efficient urban mobility system, that have caused a marginalization of the outskirts of the city, generating a sense of alienation and a detachment of that fringes of the society from the urban life. The accessibility to the urban fab lab network gives back the sense of being a part of an urban community, by connecting all different nodes of the city and including all individuals from every social class. Moreover, the presence of urban hubs is repairing the existing crack between citizens and public institutions, offering a new vision and space to encounter and work together to find innovative paths for urban and social development.

3.3 From user to actor: the change of the paradigm in design process

The Fab Lab Roma Network and the Roma Makers experience generate a shift in the paradigm of design by moving the attention from the product to the process. The power of the fab lab approach is to empower people from being “users” to become “actors”. Learning how the design process works does not mean to become necessarily a master in every technology that one can find in fab lab, but its practical approach is a trigger for a new perception and generates awareness behind the making of products. The connection between the digital information and fabrication of objects is released in form of data among the network and become a source for others to customize and contribute to the project, generating an innovative approach to manufacturing and tinkering similarly to the Open Source Community in software development. This leads to a dynamic design process that switches from the concept of user-centered design to user-centered innovation (Hippel, 2005), in which the active contribution of people helps and fosters innovative processes and products to better answer to the needs of a specific audience. Beyond the production itself, the technological empowerment and the active role played by all the persons involved in a project contribute to create a more aware society, in which a creative use of media and technology foster creativity and a design thinking approach in the everyday life, for a more sustainable living. In an ever-more technological and connected world, where social media, software and high tech devices play a fundamental role in defining our relationships as individuals and our relationship with the environment, being aware of the logic behind the technological innovation process and understanding the impact of technology in our social structure will be an essential skill for an active citizenship in the next future.
4. Conclusion

4.1 Building a sustainable and inclusive ecosystem for a new growth

Even though the Global Fab Lab Network is growing faster, it is not yet very clear how it relates to the industrial system and whether it is really leading an “industrial revolution”. In our case study, we can observe that the great impact generated by the Fab Lab Roma Network and the Roma Makers community relies in its role as a connection between different social agents: the network itself can be defined as a bridge among governments, civic leaders and citizens offering a general approach and solutions to various social issues such as education, local economies and technological development. By the analysis of the structure of the network and its rules, we can deduce that this new networked approach overtakes some critical dualisms of our economic system. As a part of a global network, Roma Makers overtakes the duality between local and global, letting people feel as members of a global society while developing solutions in keeping with their local resources and maintaining their own identity as a local community. The second observation is represented by the strong connection between the digital and the physical world, that generates a non-linear design process in which the concept and the manufacturing processes are strictly bounded from the beginning, and the product is a “work in progress” that can be improved and customized depending on personal needs. Last but not least, one of the more interesting effects the Fab Lab Roma Network has is the connection it creates between the traditional process and innovation. A good example can be found in the renewed rise of craftsmanship, a very strong economic sector in Italy. Improving traditional techniques through the introduction of digital manufacturing tools, the Fab approach establishes a new dialogue between tradition and innovation, by redefining the human-machine interaction into a more complementary relationship that overtakes the old antagonism of the two processes, and enables an evolution of the traditional know-how into a new modern business model for small-medium production. In such a difficult moment for the Italian economic scenario, an active network of small laboratories connected to a global one and that cooperate in redefining a new contemporary “Made in Italy” could represent a valid starting point for a new growth of the country.

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**Acknowledgements:** This paper is the result of the work combined of the core community that everyday gives all its efforts to make Fab Lab Roma grow. A special thank goes to Stefano Capezzone, for helping and fostering the research, and to the core of Roma Makers for sharing their experience and giving us information and support.