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Boosting co-creation practices in makespaces to support the design of more empowering and circular food systems at a neighbourhood scale

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Abstract

The Fab Lab network is newly engaged in several projects that involve the idea of rethinking sustainability, re-localizing manufacturing and promoting a collaborative learning culture. Fab Labs, as makespaces, are now perceived as key spaces for actively developing practical knowledge and create interactions with local stakeholders toward a more sustainable and redistributed manufacturing. In this respect, makespaces are encouraged to redefine its relationship with the local ecosystem by exploring questions such as: What are the effective interactions with local communities? How to build local interventions for enabling more emerging futures?

The paper aims at exploring what could be the role of co-creation in local context actions and what could be the community services developed in collaboration with makespaces for supporting the transition towards more circular cities. The results are based on an ongoing action-research at Fab Lab Barcelona called “El Barri Circular”, which is designed in the frame of the EU-SISCODE project ¹as a 18th month co-creation process about circular practices in the neighbourhood of Poblenou. This pilot has been engaging local stakeholders to create synergies in the specific context of food. The pilot used a set of design and co-creation methodologies to support a transition towards re-valuing surplus food and bio-waste at the neighbourhood scale.

Over the project, *El Barri Circular* has collaborated with local km0 restaurants, cooperatives, local associations, urban gardens, and makers’ community and engaged more specifically with three circular community projects connected to the food value chain: food waste redistribution, bio-waste-based material development and collective composting. Four interdependent types of community services for circular systems were imagined, and will now be co-produced and tested at the neighbourhood level: a set of learning and co-designed activities to support the local design and production of dedicated tools, a logistical service for food waste collection-processing and community engagement and an environmental monitoring system that measures the flow of materials, energy and resources in the local food system.

The project outputs will be discussed within broader networks and feed a collective handbook that will contribute to envision the design of new circular practices in makespaces and thus, shape new forms of learning in local areas.

Keywords: Fab Labs, Co-creation, Community Engagement, Sustainable Education, Eco-design

¹ <https://siscodeproject.eu/>

1. Introduction

Makespaces as enabling spaces for local circular transformations

Circularity is one core value present in the manifesto of the Fab City network (Diez, 2018). The key guiding principles of Fab City are aligned with the primary directives of the Circular Economy Action Plan by contributing to the reduction of municipal waste and packaging by 2030 (Diez, 2017). Barcelona is one of the pioneers of the Fab City network. In July 2014, the city hosted the Fab10 annual conference in which Fab City Global Initiative was officially launched. In this occasion, the Barcelona City Council committed to the goal of producing locally half of everything consumed in the city by 2054. This initiative proposes a model for cities to be resilient, productive and self-sufficient in order to respond to the current societal challenges. It also aims at recovering the knowledge and the capacity to make things and empower citizens to become the leading agents of their own destiny.

At a local scale, Fab City initiative boost the use of community production spaces as hubs to connect citizens with existing products and services that foster new sustainable practices in consumption and production. According to Stewart and Tooze's definition (Stewart and Tooze, 2018), 'makerspace' can be used as a catch-all term for an open access community fabrication workshop regrouping Fab Labs, Hackerspaces, (Re)Makespaces and other facilities with a suite of fabrication tools and technologies openly accessible for use by a community.

Meeting local needs through local inventiveness, these spaces have a great potential to foster synergies between different actors in a territory using open source and redistributed fabrication. Dewberry et al. (2017) asserts that a form of redistributed manufacturing composed of new, localised structures of design and manufacturing, could enable large reductions in resource consumption by limiting waste in a supply chain, and through addressing the flows of resources at critical times in the lifecycle of products.

The maker network has been growing empowering people and offering enabling opportunities through digital social innovation strategies. By developing research programs, maker communities are helping to create blueprints for a new generation of prototypes that are tailored to local circumstances. Following the idea of bringing opportunities for people to develop innovative solutions, the present study describes the combination of two methodologies to foster eco-innovative practices enabling citizens to develop skills and knowledge for territorial circular transformations.

Responsible Research Innovation and co-creation practices to support local community transformations

Responsible research and innovation (RRI) and co-creation have been considered as potential approaches to engage citizens and different levels of decision making authorities in collaborative processes. Responsible research and innovation (RRI) is a concept that has recently gained currency, particularly in Europe. According to the European Commission (2014), RRI means that societal actors work together during the whole research and innovation process in order to better align both the process and its outcomes, with the values, needs and expectations of European society. Von Schomberg (2013) defines RRI as a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products.

Recently RRI literature have introduced the perspective of co-creation, with the aim to associate these two areas of knowledge and cross potential connections between them. Co-creation methodologies, when applied in RRI,

have the potential to efficiently engage citizens and civil society organizations, bringing on board the widest diversity of actors normally excluded from making decisions, on matters of science and innovation. Co-creation is defined as the participation of end-users in the process of innovation (von Hippel, 1987), in which knowledge and solutions are co-produced by different actors working in synergy, in an inclusive process for civil society and citizens (Regeer & Bunders, 2009).

Adapting the use of co-creation in RRI as a bottom-up approach to address local solutions, Fab Lab Barcelona has been developing a pilot within SISCODE EU project applying co-design tools to find a common language among different participants. SISCODE is an H2020-EU funded project aimed at stimulating the use of co-creation methodologies in policy design, using bottom-up design-driven methodologies to pollinate Responsible Research and Innovation (RRI), and Science Technology and Innovation (STI) Policies. The project looks for new ways to reach the gap between grassroots, citizen initiatives and policy design when facing societal challenges. The assumption is that “Labs” (Fab Labs, Living Labs, and Science Galleries) could play an important role in creating bridges and activating the desired societal changes. 10 pilots are being conducted in 10 different EU places through the implementation of co-creation journeys that last around 18 months. In these experiments, each lab aims to tackle a specific societal challenge, (meaningful for the context in which the lab is located but at the same time transversal and relevant at a wider scale) and engage with it a set of stakeholders in a co-creation process from the stage of co-design where stakeholders are analysing the context, reframing the problem and envision alternatives, to that of co-production of prototypes within an iterative process. (Real et al., 2019; Rizzo et al., 2018)

El Barri Circular: from co-creation to the emergence of a new synergistic system for local food cycles

The Fab Lab Barcelona’s pilot has been exploring how co-creation and RRI can be approached to locally develop solutions to improve the circularity of surplus food and bio-waste at a neighbourhood scale. The main challenge started by exploring the following question: **How to endeavour a circular economy in the neighbourhood by co-producing projects that connect local resources and territorial needs?**

“El Barri Circular”, which means “the circular neighbourhood”, by mixing Spanish and Catalan languages, has been engaging local stakeholders at different levels to create synergies between existing initiatives related to the food system. The pilot aims to stimulate the use of co-creation methodologies, through an active learning process, to support a transition towards re-valuing surplus food and bio-waste at the neighbourhood scale.

After six months of exploration and learning, the core network of stakeholders has designed a “synergistic system for local food cycles. The system is acting at the neighbourhood level in collaboration with local stakeholders, and include ongoing food waste generators in the co-development of three circular community projects proposing food waste redistribution, bio-waste-based material development and collective composting activities. To activate and enhance the community empowerment and circular knowledge capacity building, three types of community services have been imagined. These include: a logistical service for food waste collection and community engagement, a set of learning practices to support the local design and production of dedicated tools, and an environmental plan that measures the flow of materials, energy and resources in the local food system. The system model will be developed and tested in Poblenou, the maker district of Barcelona in further steps.

This case study presents the “El Barri Circular” journey as an example of how to use co-creation and RRI into the innovation process to locally develop solutions to improve the circularity of a territory. The paper will first

describe the co-creation process and then give an overview and discuss the emerging synergistic system for supporting the development of local food cycles.

2. Method: The co-creation process

Co-creation combined with Responsible Research Innovation was adopted for this study to develop deeper understanding of community engagement and its role in finding solutions to address local issues regarding surplus food and bio-waste. The research strategy is based on a specific neighbourhood, known as the maker and creative area of Barcelona, the district of Poblenou. Fab City Global Initiative has already started a first exploration in this territory, in which a prototype of a productive and scalable city has been tested. The initial idea aimed to contribute to the city's reindustrialisation through activities, services and projects that promote interaction between local communities and citizen initiatives. Following the same principles of people-centred, inclusive and locally productive approaches, *El Barri Circular* has been applying participatory design and learning by doing experiences to co-create and empower citizens as drivers for change.

The experimentation was based on a methodology divided into 4 phases (Real, 2019; Rizzo, 2018) in which social innovation was fostered through the use of co-creation to combat local challenges: 1. Analysing the context, 2. Reframing the problem, 3. Envision alternatives, 4. Selecting the idea. The main stakeholders involved in this process were represented by local markets and km0 restaurants, cooperatives, local association's urban gardens, composting initiatives, projects with food redistribution, makers and material designers.

- The first phase consisted of 'analysing the context' by having a better understanding of the existing instruments for circular economy, identifying the policies about food cycles at the different local scales and analysing the dynamism of Poblenou neighbourhood and Barcelona. For this phase, the Fab Lab's team participated in 5 policy making events, 35 informal interviews with 50 local actors in order to identify the ongoing policies and resources that are participating in the local circular transition. Moreover, an effort has been done to develop a consistent mapping of current initiatives related to circular economy. The mapping phase focused on spreading awareness about ongoing activities and projects developed at Fab Lab Barcelona that are related to co-creation activities and empowerment of citizens through sustainable and regenerative cities.
- The second phase consisted of 'reframing the problem' through a shaping of the set of data collected to better structure the future interventions with local stakeholders. A first co-creation workshop named "Synergy Soup" was proposed (called "Sopa de Sinergias) destined to a core group of local stakeholders identified through the different interviews, events and participative observations. The event aimed at identifying synergies among the actors by matching local resources with local needs from each stakeholder. The workshop was built upon existing systemic design methodologies regrouping industrial symbiosis identification tools (Van Capelleveen et al., 2018; Makinen, 2018), resource mapping, input-output system modelling (Bistagnino et al, 2010; Barbero et al.; 2017). It was composed by four activities: (1) a presentation of the context and key aspects of circular design; (2) an icebreaker where participants were engaged in the preparation of the soup presenting themselves, picking some pre-cut vegetables and commenting their subjectivity by associating shape, colour to their emotion and personal inspirations. (3) Then, they were divided in three subgroups and were asked to first identify local needs and resources at individual, organisational and neighbourhood level and second to create projects that are matching identified resources and needs. They were playing on cardboards with three types of cards to fill (needs, resources, and projects) and advertisement paper collected and reused to be cut into lines to help them build and show the different connexions. Finally each group made a restitution while note-taking and soup distribution were offered by

the two facilitators. The workshop permits to identify 58 needs, 36 resources and 31 ideas of projects were generated by participants. It allowed getting to know each other and start creating shared value and a sense of community. After this event, the team developed and proposed a new plan of co-creation activities to guarantee an effective engagement and collaboration of the local community through an action learning process. The communication plan was redefined according to the target identified. An identity for the pilot was created and named “*El Barri Circular #Poblenou, episod: Food, waste and local crafts.*” Social media channels and personal invitations have permitted to maintain the engagement of the core group of stakeholders while opening the challenge more broadly to the community.

- The third phase which consists in “envisioning alternatives”, was composed of five events during one month, in which the participants of *El Barri Circular* were actively involved to foster ideation and participate to learning experiences. The first event was a community ideation workshop which took place at an historic community place, “El Ateneu de la Flor de Maig”² where 5 pre-identified projects were challenged in groups through three short activities: First, participants used a customised version of the 6W tools to define the ideal solution of each concept and cross the different visions; Secondly, the facilitators created a new specific onion diagram that can be described as a back casting-value opportunity mapping challenging “how” to reach the solution, and identifying needs and opportunities in terms of materials, tools, resources and skills, and other project dimensions. After this problem definition activity, each group was asked to design idea cards adapted from the n to describe from 1 to 3 concepts framing diverse actions that could redefine and facilitate the development of the project. Finally a restitution of each group were realised. The community ideation workshop was followed by two learning by doing experiences, which were proposed and co-organised with local participants to raise knowledge and answer the need to “make things together”. The Fab Textiles³ ran a workshop for realising biomaterials and bio-composites from local waste collected in restaurants. Three techniques were explored by the participants: 3D extrusion, bioplastic sheets and bowls mold design. The second experience was facilitated by MACUS Cooperative⁴, based on digital fabrication tools and machine design. The fourth event was composed by a session of co-design and scenario building, together with three stakeholders. The workshop was proposed during a local event about circular economy which took place in Palo Alto Foundation⁵, another historical place of Poblenou. The workshop aims at understanding better the impact of food waste valorisation processes and designing new scenarios for local valorisation and supports. It was divided in three steps starting by the presentation and exhibition of three different initiatives using bio waste and food surplus. Then, each process was screened onto table where people, in groups used specific stickers for identifying the environmental impact at different stages of the process. This was inspired by simplified eco-designed tools such as LIDs eco-design wheel (Brezet et al., (1997)) or Material, Energy, Toxicity (MET) matrix (Gertsakis, 1997). The last part consisted in creating emotional narratives so to support new visions and services in the neighbourhoods to envision local logistic, educational services and new bank-time systems. Specific co-creation tools (Personas and moodboards) were given to participants to support them in scenario design. Finally, a last event was organised - the “convivial agora” in collaboration with the 40 students of the summer school of Degrowth⁶ to go beyond environmental issues and discussing about the conviviality of the emerging projects. The event was designed with one context and theoretical presentation, one co-creation workshop and one larger public debate. The co-creation workshop has been

² <https://ateneuflordemaig.wordpress.com/> (Accessed on 28/08/2019)

³ <https://fabtextiles.org/> (Accessed on 28/08/2019)

⁴ <https://www.facebook.com/M4CUS/> (Accessed on 28/08/2019)

⁵ <https://paloalto.barcelona/taller-barri-circular> (Accessed on 28/08/2019)

⁶ <https://summerschool.degrowth.org/> (Accessed on 28/08/2019)

designed within the inspirational frame of the design tools for conviviality (Lizarralde and Tyl, 2017; Real et al., 2018; Vetter, 2017).

Through all these events, the internal team in collaboration with external stakeholders defined and refined a synergistic model for supporting local food waste transformation in the neighbourhood. The model is described below.

3. Results and Discussion: Toward a new synergistic system for local food waste transformation

The model is aimed at synthesizing the vision shared within the first three phases of the project to support circular food transformations at a neighbourhood scale. By identifying and co-designing with the local stakeholders as well as observing and raising knowledge about the food cycles, four community services have been identified, will be designed and experimented in further steps.

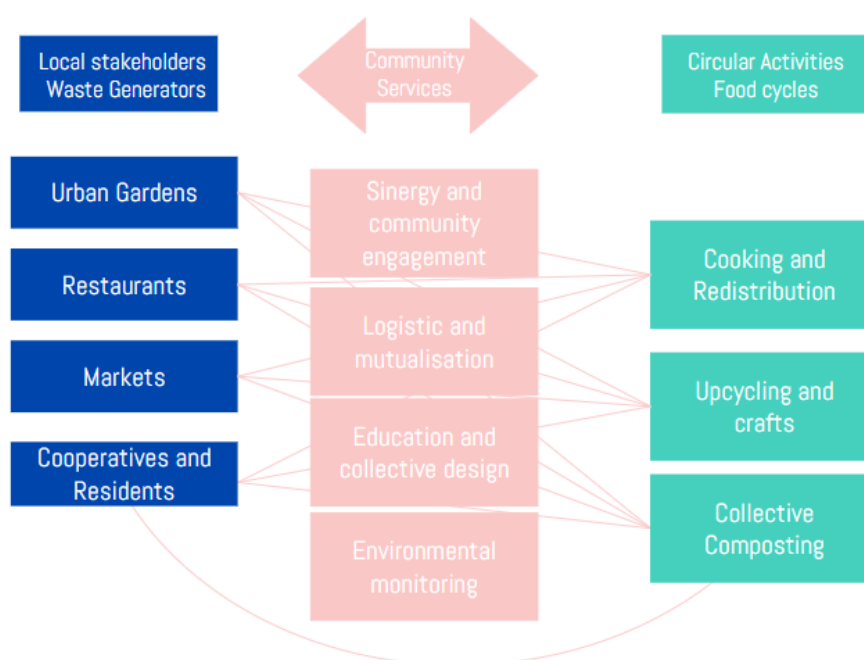


Figure 1. Synergistic system for local food waste transformation

Four type of stakeholders have been categorised as potential enactors of circular food shifts in the neighbourhood of Poblenou: (1) Urban Gardens as mixed and heterogeneous places where people are reconnecting with nature, experiments techniques, organise events for both creating social bonds and raise knowledge and discussions about environmental and health issues; (2) restaurants and (3) markets in the dynamic of building sustainable alternatives (with km 0 and slow food networks), (4) food cooperatives, particularly active in Barcelona and Catalonia (Espelt, 2013) where part of local residents are building self-organised groups that connects local producers and consumers with a short loop and historical Catalan cooperativism principles. Seeing as well generator of waste and actors of changes, these stakeholders are weaving an important amount of the local food waste.

Three **circular activities** have been selected, simplified from the food waste hierarchy (Papargyropoulou, 2014) and adapted for the specificities of the neighbourhood scale (Poblenou in that case).

- First, the activity of *cooking and redistributing food surplus* has been found through diverse practices: internally into families or communities, through sharing applications or within social organisations. One specific initiative caught up our attention as a promising social initiatives. The “Bacuinetes from

BarcelonaActua⁷ is a collective of grandmothers and local people (often in social difficulties) who collect and cook once a week the food surplus collected in local shops and distribute them in a collective meals organised for people in needs each week. Social associations from the city and neighbourhoods are supporting the initiative by connecting people and providers as well as booking a kitchen place each week.

- Another activity concerns *the design of materials and products based on food waste* with craft and innovative production techniques. This activity is generally under-explored at such a small scale. However, an opportunity has been identified with the strong presence of artisans and makers locally and the wish to tend to enhance the autonomy of citizens by allowing them to be aware of how things are made, to design products and to have access to the means of production. The Fab Textiles and others makers are yet experimenting in material innovations from food waste and look after new modes of production more distributed. Within the first workshop, several techniques have been tested to create biomaterials and bio composites from coffee, orange, yucca peels as well as eggs and mussels shells.
- The third circular activity is the *experimentation of effective compost techniques at individual, building and neighbourhood scale*. Several possibilities have been already provided by the city like municipal organic waste collection point, the distribution of collective compost bins in building. Another technique, the worm compost system is being experimented in a local urban garden, using waste from residents, local restaurants and markets with a semi-industrial worm composting to create compost distributed for local gardens and others uses to turn green the local area.

To maintain, support and scale up this grassroots initiatives at the neighbourhood level, four types of **community services** have been imagined from the emerging needs of local stakeholders i.e. *services for community building, logistic, making education and environmental monitoring*.

- First, stakeholders identified a necessity for re-connecting people, informing them as well as opening or promoting existing spaces and events for encouraging *community synergy building*. The service will be built upon collaborations with the stakeholders to access to the diversity of places present in the neighbourhood that could be private or public, to communicate about and participate in local events, to create new moments for synergy emergence, where co-creation tools can be shared and used in an open way.
- Another need is about *logistics* questioning how to integrate in the actual system and habits of stakeholders the possibility for them to be active in the local food waste transformations. The logistic system consists of collecting waste in restaurants and markets, processing them and finally re-distributing meals, products and composts. This requires a preparation phase for organising people and tasks while providing necessary tools to make it possible. Three actions are proposed before launching the service:
 - Designing a shared soft mobility device (a cargo-bike) that permits to transport bio-wastes, products and materials from one point to another.
 - Gathering bio-waste providers (restaurants and markets) around a series of meetings aimed to discover and discuss material innovation possibilities, to best select the type of waste, the disposal devices and storage of resources and finally to agree on a schedule.

⁷ <http://www.barcelonactua.org/ca/proyecto-exito-BACuinetes> (Accessed on 28/08/2019)

- Devices or organisational mechanisms could be developed to gather the list of community tasks to be done and connect them to local stakeholders, making them accessible through micro-volunteering platforms or other forms of collaborations that ensure and diversify their effective engagement.
- Local stakeholders want experiences to learn by doing, so to improve their internal capacity and go beyond cognitive gaps and individual learning limits. Educational services are composed by a set of learning and co-designed activities that support the local design and co-production of dedicated tools needed to feed local food waste transformations. In the case of cooking, material innovation or composting, specific workshops could be realised in cooperation with the local expertise, from practicing bio-material recipes from existing database, to the design of new ideas via co-creation tools, to building moulds with digital fabrication tools. Collective co-development could be organised like the realisation of a cargo-bike system that is made with self-helped bike workshop.
- The last service is about *environmental monitoring* and suppose the exploration on how to measure the flow of material, energy and resources for the emerging local food system. An essential step towards achieving a relevant model of circularity at the neighbourhood scale is gaining a better understanding of the evolution of the environmental impacts from the existing to the new emerging multi-loop systems. First measures from material analysis flow can be done at the prototype level and scenario of upscaling could be then debated in collaboration with other studies and emergent work from other scales.

4. Conclusions

The case-study shows that co-creation methodologies have permitted to engage local stakeholders, support them to adopt new practices and co-design a contextual set of services for encouraging local food waste at the neighbourhood level. It highlights the complexity of local transformations and underlies the hypothesis that makespaces can participate in supporting the design and development of local circular ecosystems, thanks to an activist mindset, a knowledge-making culture and global connexions. In the project *El Barri Circular*, the makespace was piloting the co-creation process connecting local initiatives in a global societal challenge.

An important and emergent aspect for such initiative remains the stakeholder engagement process and respective design activities that supported it. Indeed, the evolution of the process and its results in this case was highly dependent of the synergies established with local stakeholders combined with the tools and methods shared within the EU SISCODE project. Starting with an understanding of the actual ecosystem was crucial to strengthen connection between actors and promote collaboratively actions, supporting existing initiatives. From the identification of stakeholders and initiatives, the immersive visits to the synergy mapping and ideation workshops, the stakeholder engagement process, was like the divergence and convergence phases of design processes, enlarging and consolidating the active network. Through discussions and events, the initial concepts have been transformed, the emerging model has gained in legitimacy.

The synergistic model for local food waste transformations is proposing to co-produce with local stakeholders services for community building, logistic, making education and environmental monitoring to optimise how food waste are redistributed and transformed in meals, materials, products and compost. A new playground is now being developed to make the proposal tangible, and define more precisely what could be the role of makespaces in the system and how to revisit the interactions between the quintuple helix of stakeholders, meaning public bodies, the civil society, residents, economic actors and academics. According to the specific context, answers could be different from makespace-led initiatives, public-led actions to self-organized ecosystems in neighbourhoods.

The project outputs will be discussed within broader networks and feed a collective handbook that will contribute to envision the design of new circular practices in makespaces and thus, shape new forms of learning in local areas. There is an interest to adapt such processes in other sectors or even to let it open to transversal applications. This weak signals will be also reinforced by replicating it in other neighbourhoods considering the specificities of the context (cultural, political, economic, and demographic), as well as creating connexions with other scales, specifically at the city and regional levels. Those interactions can help to avoid new forms of disconnexions, distances and dispersions between people in territories.

Creating new forms of values for territories through co-creation is a constant engagement for reaching RRI values. It consists of making more efforts towards inclusion, transparency and openness while adopting new postures to be aware of the potential barriers and conflicts behind system development, and looking for overcoming emergent frustrations that can create more convivial and sustainable environments. Encouraging local stakeholders to learn about design, as well as revisiting the deep roots, principles and practices of design for transforming territories is compulsory to build effective systemic changes toward circularity.

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