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Building Responsible Innovation Ecosystem, a new approach for inter-organizational cooperation

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Joël Ntsondé, PhD Student, Mines ParisTech, PSL Research University, Centre de Gestion Scientifique (CGS), UMR CNRS i3 9217, 60 Boulevard Saint-Michel 75006 Paris, France, joel.ntsonde@mines-paristech.fr

Franck Aggeri, Professor, Mines ParisTech, PSL Research University Centre de Gestion Scientifique (CGS), UMR CNRS i3 9217, 60 Boulevard Saint-Michel 75006 Paris, France, franck.aggeri@mines-paristech.fr

Abstract

In order to develop more sustainable projects and deal with the current global environmental crisis, an increasing number of actors are willing to set up models of circular economy and need to develop cooperative approaches to handle the complexity inherent to these models. However, in management literature, the field of collective strategies and inter-organizational cooperation is relatively emerging and still need to be expanded, especially regarding sustainable development issues. So the underlying question we address in this paper is to determine which processes socio-economic actors rely on to build up these collective strategies and inter-organizational cooperation. Empirically, our research focuses on food waste reduction initiatives, using a qualitative method to study several projects which aimed

at applying models of circular economy to the food production and distribution chain in Paris Region in France. This research led us to identify a new form of collective action that we outline by introducing the concept of responsible innovation ecosystem. This concept can be used in management to understand how heterogeneous actors can cooperate to develop innovative and sustainable projects.

Key words: innovation ecosystem, inter-organizational cooperation, responsible innovation, collective innovation, circular economy, food waste, heterogeneous actors

Introduction

During the last century, global material consumption has already increased eight-fold and is still expected to triple by 2050. Different works have showed that this continuous rise cannot be sustained anymore by our planet (Kok et al., 2013) and generates growing negative externalities in terms of global warming, pollution, waste generation and resources scarcity. As a matter of fact, our global growth is rooted in a model which is disconnected from our physical constraints because it does not take into account its impacts on human, social and natural capital (EMF, 2012). As indicated by Brown and Ulgiati (2011), so far, we have focused mainly on the economic sphere and have neglected the “*environmental and social dimensions of sustainability*”.

For a couple of years, the concept of circular economy has drawn considerable attention from different actors in society: politicians, journalists and academics. There is no standard definition for circular economy but most of scholars who worked on this concept agree on several aspects (Beulque et al., 2016): circular economy is a model of economic development which differs from the linear model that is currently dominant. The linear model

consists in extracting raw materials, producing goods, consuming them and eventually throwing them whereas the circular model proposes methods like recycling, reuse or eco-design to disconnect economic growth from natural resources consumption (EMF, 2012). In this context, Ellen MacArthur Foundation assessed that circular economy could not only stimulate our economies, creating jobs and fostering innovation, but that it could also contribute to tackle the environmental crisis. Indeed it could allow us to reduce our CO₂ emissions by 48% by 2030 and to reduce our consumption of raw materials by 32% by 2030 (EMF, 2012). Similarly, Ellen MacArthur Foundation reckons that circular economy could reduce urban bulk, air and water pollution, and regenerate polluted lands (EMF, 2012).

Circular economy appears to be an interesting notion to contribute to the development of sustainable projects and deal equitably with the physical capacity of our planet (Ghisellini et al. 2015). However, the linear model of production and consumption, which is deeply rooted in organizations' processes and routines, has been reinforced by continuous technological progress and drives companies towards competitive and individualistic strategies incompatible with the requirements of circular economy.

Circular economy requires collective action

Recent works have stressed the different obstacles actors have to overcome in circular business development: systemic interdependencies between actors to value limited resources, strong technological, organizational or marketing uncertainties, lack of skills and knowledge, collective organizations that are lacking, etc. (Micheaux & Aggeri, 2016, Lewandowski, 2016). Indeed, designing a model of circular economy implies to set up a system in which actors will explore how to collaborate with others in order to share resources, materials and infrastructure. In such a system, some actors will use the waste produced by other actors as raw materials, setting up interdependency relationships between them (Kok et al., 2013). This

system will also require dialogue between stakeholders to address governance issues, set mutual visions, join forces to face challenges and acquire good mutual understanding (Kok et al., 2013). Setting up such a system requires trust and long term vision, which is difficult to obtain in an unstable and fast changing environment.

Actually, when companies decide to commit into circular economy, they face several issues such as price volatility of raw materials, opportunistic behaviors, and lack of infrastructure. For example, some research works have been carried out on electronic and automotive sectors, and showed that private actors trying to set up, on their own, systems of circular economy, often fail in building the collective approach required to develop circular models and would welcome some support from public authorities (Shi et al., 2012, Ghisellini et al. 2015, Micheaux & Aggeri, 2016). Some scholars have identified a set of mechanisms which stress the difficulties experienced by companies in setting up circular models by themselves (Micheaux & Aggeri, 2016, Ghisellini et al. 2015, Desrochers, 2004; Van Beers et al., 2007; Veiga and Magrini, 2009):

- Difficulties to gather all the necessary skills to handle a whole chain of waste repurposing or manage all the different kinds of waste produced
- High investment costs required to build the infrastructure and facilities to handle the amount of waste produced
- Raw material prices volatility which undermines a long term perspective and threaten the willingness to secure steady investments
- The resistance of different actors within organizations such as purchasing departments who focus mainly on costs and competition criteria in the selection of providers
- Lack of support from top managers on these projects

- Lack of skills and competencies
- Difficulties to share the value created between different partners when their number is increasing in circular loops
- Lack of standards and adapted regulations to create an environment favorable to the development of circular models

Therefore, empirical experiments carried out by private actors show that it is very unlikely for them to develop sustained models of circular economy by themselves because they often stumble over markets and competition mechanisms which are not favorable towards collective action and long term strategies. In other words, the collective strategies required in circular economy cannot emerge spontaneously from market-based incentives and individual initiatives (Micheaux & Aggeri, 2016). It appears that, in order to achieve a system of circular economy, a set of heterogeneous actors has to develop new strategies by developing new forms of collective action.

There is a gap in the literature regarding the new forms of collective action existing in circular economy

So far, many researchers have been focusing on individual and competitive strategies and have not provided many tools or methods that can help socio-economic actors to define common strategies and make collective decisions at the inter-organizational level. For instance, Porter's works on shared value provides guidelines to conduct a strategy from a firm's perspective, but does not explain how socio-economic actors can deploy collective strategies based on cooperative approaches (Porter & Kramer, 2011). Besides, even if some management scholars have been particularly interested in analyzing how socio-economic actors can cooperate in certain cases, they mostly focused on clarifying mechanisms related to coordination, assuming that cohesion (risk sharing and common purpose) is implicit because

relationships, aspirations and preferences are stable (Segrestin, 2006). Astley and Fombrun (1983) were the first scholars in management to coin the term collective strategies. They proposed a comprehensive model of inter-organizational cooperation. However, this model corresponds to a deterministic and contingent approach which emphasizes the role of the external environment and does not clarify which mechanisms are deployed by actors to design their own collective strategies (Poirel, 2015), indeed, “*although problems of interorganizational interdependence have grown at a very rapid rate, mechanisms for dealing with it have not*” (Astley & Fombrun, 1983).

In the 90s, Moore (1993, 1996) has introduced the concept of business ecosystems to describe the new forms of collective action which were occurring in cross-sectoral settings that could not be explained within markets or hierarchies paradigms. This concept enables to clarify the new dynamics of inter-organizational cooperation that have emerged in a context of increasing uncertainty and instability of the economic environment and of growing international competition that companies have to handle (Beulque & Aggeri, 2014). This concept has been reused later by other researchers to describe some specific kinds of collective action shaped by open innovation and coopetition dynamics. These researchers proposed the concept of innovation ecosystem for these forms of collective action (Iansiti and Levien, 2004, Ben Letaifa and Rabeau, 2012, Froehlicher and Barès, 2014) that focus on fostering innovation of products and services.

This concept of innovation ecosystem provides us with an interesting way of understanding the dynamics of collective action between heterogeneous actors that are occurring in the circular economy but does not clarify which socio-economic mechanisms actors rely on to build up these ecosystems. Besides, the concept of innovation ecosystem does not address some of the specific issues which reside in the core of circular models, namely, responsibility and systemic approach. In particular, the question of responsibility is

key in circular economy because circular models are not always more profitable than linear ones, especially in the short term.

How to take into account the issue of responsible innovation?

Even if circular economy often requires technological, organizational or social innovation, there are also other aspects that are important and need to be present in every initiative or project which aim at developing circular models. Circular economy is conveying values and goals dedicated to shaping a better society, which would be more sustainable from the environmental point of view. These values and goals refer to the underlying question of responsibility that socio-economic actors should include into their innovation processes, if they decide to apply models of circular economy. This question has been especially well explained by the philosopher Hans Jonas (1979). Actually, Jonas reconsidered the modernity assumptions, and emphasized the “responsibility” of men, who have acquired a tremendous technological power towards nature. Jonas explains that men have to define an ethic to assess the risk of technological progress and avoid mankind disappearance.

In other words, socio-economic actors should not focus only on innovation but need also to take “responsibility” for their action, namely, the social and environmental impacts of their innovation processes, and find a way to integrate them into their conception, production and distribution processes. This is precisely what circular economy can be useful for, providing socio-economic actors with tools to develop responsible and innovative projects. The question of responsibility is also pretty significant because it can explain the will which drives actors to succeed in their initiatives. Indeed, private and public actors, who commit to projects of circular economy, experience a strong desire to have a positive impact on society from a social and environmental point of view. Thus, responsible innovation is at the core of the cohesion mechanisms which operate in circular economy systems.

Food waste reduction initiatives offer relevant cases to analyze these new forms of collective action

In order to study the new forms of collective action and inter-organizational cooperation that are developing, especially in the field of sustainable development and circular economy, we chose to study the problem of food waste in Paris Region. Over the past years, due to environmental issues and economic crisis, food waste has become a major issue in rich countries. For example, in France, a national agency dedicated to food matters assessed that roughly 3.5 millions of people are food insecure (CNA, 2013). In the same time, the French ministry of agriculture estimated that French people waste 20 kg of food per person and per year. These facts have made people realize that it is really important and even urgent to apply circular economy models to the whole chain of food production and distribution.

As a result, many different actors, either public or private, chose to get involved in food waste reduction, engaging a real dynamic of collective action and innovation. So, in this paper, the questions we ask are: *how can we analyze the new forms of collective action occurring in the field of food waste repurposing and by which mechanisms these heterogeneous actors are building this dynamic of collective action and innovation?*

In this paper, we will first present the concepts coming from our literature review and that will be used further to study and analyze the projects of food waste reduction. Then, we will explain the methodology we followed to select our cases, conduct our interviews and analyze our data. Finally, we will present the results that came out of our study and discuss what can be their theoretical and practical implications.

Literature review

For a couple of years, some scholars have been increasingly interested in studying and analyzing how companies tried to develop collective strategies at an inter-organizational level. In order to do so, they introduced concepts such as business ecosystems and innovation ecosystems which are interesting to understand dynamics of collective action but do not take into account the singularity of circular economy models which encompass dynamics of responsible innovation. In this literature review, we will go through the concepts of business ecosystems, innovation ecosystems and responsible innovation that will be useful to understand how the dynamics of collective action occurring in circular economy can be analyzed from a theoretical point of view.

Business Ecosystems

Since the 90s, a more systemic and holistic approach has been developed to understand how and in which way, firms could cooperate to reach a common purpose. This approach led to the birth of the concept of “Business Ecosystem” to describe new forms of interactions that can materialize between actors of different natures and from various sectors. This concept has been first introduced by Moore (1993) in his paper published in Harvard Business Review “*Predators and prey: a new ecology of competition*”. This paper aimed at proposing an analogy with biology to describe competitive and cooperative attitudes that could occur between socio-economic actors. Then, Moore (1996) defined a business ecosystem as: “*an economic community supported by a foundation of interacting organizations and individuals—the organisms of the business world. The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders*”.

More recently, Torrès-Blay (2000), defined a business ecosystem as: “*a heterogeneous coalition of firms coming from different sectors and forming a strategic community of interests or values structured as a network with a leader who manages to impose or to share his commercial vision or his technological standard*”. Some scholars remarked that firms belonging to a same business ecosystem share a common objective: increase customer value for their products and services (Fréry et al., 2012). Finally, Iansiti and Levien (2004) noticed three key success factors for these ecosystems: productivity, adaptability to uncertainty, and ability to identify niche markets for new coming firms.

Innovation Ecosystems

Over the past few years, a new form of business ecosystem has been theorized by management researchers: innovation ecosystems. Iansiti and Levien (2004) consider that if the main goal of a business ecosystem is to spread a new innovation, then it can be defined as an innovation ecosystem. Some researchers chose the point of view of research and innovation to describe the characteristics of an innovation ecosystem. They claimed that an innovation ecosystem is composed by the involved actors, their interactions and the public policies set up to enhance research and innovation (SNRI, 2009). Sharing this idea, Jackson (2011), explained that an innovation ecosystem is built with complex relationships between actors and entities which aim at developing innovation and technological development. However, he widened the definition of what a member of such an ecosystem is, including also material (equipment, premises) and human resources (students, employees, scholars...).

Besides, several researchers described also to what extent an innovation ecosystem can stimulate the development of a dynamic of collective innovation relying on open innovation processes and distributed knowledge networks (Froehlicher & Barès, 2014). Others indicated that the members of an innovation ecosystem aim to gather and form a community because

they develop a sense of belonging (Amin, Cohendet, 2005). Several reasons have been claimed by scholars to explain the birth of these innovation ecosystems. For some scholars, this is the reduction of innovation lifecycles, the increase of R&D costs and the scarcity of resources that bring firms to knock down the walls and engage in dynamics of cooperation and collaboration (Gassmann & Enkel, 2004; Chesbrough, 2006).

Others expressed that the transition from traditional to open innovation processes is due to exogenous factors such as international competition, deregulation and new technologies (Prahalad & Ramaswamy, 2003). However, Ben Letaifa and Rabeau (2012) explained that this is actually the phenomenon of industrial convergence which contributed to the spawning of innovation ecosystems which are the reflection of coepetitive (simultaneously competitive and cooperative) and open dynamics that shape those forms of collective action. Most of these works have contributed to clarify the open innovation and coepetition mechanisms existing in innovation ecosystems once they are settled, but they don't explore the question of the coordination and cohesion mechanisms used by socio-economic actors to build up these ecosystems. Besides, the literature in management does not provide us with many answers with regards to the obstacles that actors have to handle and the different roles which emerge in the building process of these innovation ecosystems.

Responsible Innovation

In order to set up models of circular economy, socio-economic actors try to build innovation ecosystems relying on inter-organizational cooperation mechanisms. In these ecosystems dedicated to foster the development of circular models, the question of responsibility has to be addressed because it contributes to shape the dynamic of collective action which drives their building process. Before exploring the relationship existing between innovation ecosystems and responsibility in the case of circular economy, we need first to

precise the concept of responsible innovation and highlight the approaches that have been used by management researchers to analyze it.

Many scholars consider that the question of responsible innovation has been first raised by Hans Jonas (1979) who emphasized the huge responsibility towards nature that mankind has acquired thanks to technological progress. More recently, the EU commission worked also on this concept of responsible innovation and proposed the following definition (René von Schomberg, 2011): *“Responsible innovation is a transparent and interactive process by which social actors, researchers and innovators collaborate for the ethical acceptability, the durability and the societal relevance of innovation – allowing this way the inclusion of the process of sciences and technologies within society”*. As of Ingham (2011), he proposed this definition for responsible innovation: *“the voluntary and proactive integration of social and environmental aspects in strategies, behaviors and processes that produce new and enhanced solutions by the development and use of resources which create societal (economic, social and environmental) value”*.

These definitions are interesting because they encompass the three main dimensions of sustainable development, meaning the economic, social and environmental ones. However, they do not take into account the significance of stakeholders. They stand for a classical vision which forgets the collective and inter-organizational dimensions which exist in responsible innovation projects. Little research work has been carried out to highlight how collective action can shape responsible innovation processes. The notion of « innovation field » for sustainable development introduced by Aggeri (2011) allows us to conceptualize the collective design work which is often required to develop responsible innovations.

In his model, Aggeri proposes a vision of responsible innovation which enables to *“materialize and legitimate collective projects which renew common goods, boost the*

generation of later distributed innovations, reconfigure, polarize and assemble past and future innovations in new frameworks of collective action". This co-design process actually relies on two simultaneous activities: "scriptwriting" and "scenography". On one hand, the "scriptwriting" of an innovation field *"starts from a problematic situation, assembles a series of concepts and of pieces of speech which make sense and enable to make a link between a critic related to a problematic and a promise for the future"*, and on the other hand, the "scenography" relies on *"the set up of public scenes, collective experimentations using tools and platforms which will emphasize this new scriptwriting and serve as support for new collective explorations"*. This model allows us to include both responsible and collective dimensions existing in innovation processes, offering a theoretical framework to describe the different forms of collective action aiming at developing responsible innovation projects.

From the theoretical concepts mentioned above, we will now analyze the socio-economic mechanisms that operate at the core of the dynamics of collective and responsible innovation which shape the building process of circular economy systems. In the next parts of this paper, we will precise how the relationship existing between the concept of innovation ecosystems and the concept of responsible innovation can be used to analyze the specific mechanisms of inter-organizational cooperation and collective action that private and public actors set up and use to design and materialize efficient and effective circular models.

Methodology

Given that the objective of our research was to understand how heterogeneous actors try to collaborate to create economic, social and environmental value, we decided to choose a sector involving heterogeneous actors (private and public), and fostering responsible innovation projects. As a result, we focused on the food waste reduction field because we saw

a real collective dynamic undertaking in this field and several actors trying to build collectively responsible innovation projects.

Data Collection

Our research included roughly twelve initiatives and projects occurring in Paris region in France, selected because of their organizational characteristics: they were projects involving private and public actors trying to carry out collectively responsible innovation projects to reduce food waste. Given that the food waste reduction field is still pretty young, the most innovative private actors we met were entrepreneurs who launched their business less than four or five years ago. Larger companies like supermarkets were mostly followers and were acting in the background.

We collected our empirical data from April to June 2016 through semi-directive interviews with CEOs, project leaders or public policy makers. In order to conduct our interviews, we prepared a list of roughly 20 questions about their main activities, their vision and actions regarding circular economy, their cooperation with other actors, relationships between public and private actors and the different challenges they were facing in their responsible innovation projects. Most of the interviews have been recorded and transcribed, and for the rest of them we took notes. We also used reports and presentations provided by the different actors or published by institutions such as FAO (Food and Agriculture Organization), Ellen MacArthur Foundation, The French ministry of ecology and the French national agency for sustainable development (see table 1).

	Private actors	Public actors
Interviews average duration : 1h15	Start-ups and SMEs (Phénix, Cœur de couleur, Re-belle, Freegan Pony, Travail et vie)	Local Authorities (Paris, ORSA, Val-de-Marne) Clusters (Materiaupole, Paris Region Entreprises)
Positions	5 CEOs 1 Head of innovation 1 Head of strategic projects 1 Consultant	1 Deputy of social innovation and circular economy 3 Project managers
Documentation	Corporate presentations Business reports Institutional reports	Report based on the workshops organized by the Paris city council on circular economy Institutional reports Workshops minutes of ORSA

Table 1 : Data collection sources / source : author

Data Analysis

In order to analyze the collected data, first we carried out several readings, and then we noticed three themes which came out of our material. Thereafter we carried out a vertical analysis of each interview in order to identify key themes, and then we realized a cross-interviews analysis to detect themes which were redundant from an interview to another. Roughly ten themes came out of this double analysis. Some of the themes we used in our analysis have also been identified during our literature review. Thanks to these themes, we coded the whole data collected during our interviews, using the multi-thematic coding method (Ayache, Dumez, 2011). The table 2 presents the different codes we used in our analysis with an example of verbatim for each code.

Thematic codes	origin of the code	Exemples of verbatim
Space and area	Interviews	"There are a lot of resources on the area which have to be reused"
Clusters	Literature review	"Our job is to meet companies which present us their projects, particularly innovation projects, and we give us feedback, advice, networking and financing"
Types of actors	Methodology	"In our association, there is no difference between public and private actors. Everybody works together to develop the area"
Develop of a new sector	Interviews	"A momentum is needed to foster the development of these new activities"
Vision of circular economy	Literature review	"As far as I'm concerned, circular economy is a general concept which includes many tools which allow us to design a more positive business model"
Create and share value	Interviews	"Supermarkets need to work with us because they can't manage their food waste anymore, and they can't manage it by themselves. It would be too costly for them to set up the logistic chain"
Cooperation and partnerships	Literature review	"We have to work together, each one bringing his skills. It matters because when we make a change, if we command it, things always go wrong because people won't understand it"
Platform	Interviews	"A platform alone doesn't work, people are needed to do the logistic job"
Legal issues	Interviews	"On the other hand, the leverage on waste savings could increase because of legal hardening of waste recycling"
CSR Strategy	Interviews	"Supermarkets are ready to finance this kind of initiative because of costs, legislation, image and sometimes for personal values"
Innovation and Experimentation	Interviews	"The goal is to bring new ideas, not necessarily innovations but that could be processes, ways of doing which could be interesting"

Table 2 : Codes and verbatim / source : author

In this paper, we have chosen to present five out of the twelve initiatives we encountered, chosen because they were the most relevant regarding our research objectives, as a matter of fact, they managed to initiate a collective and responsible dynamic to develop their projects.

Results

Food waste provides an interesting case to analyze the way socio-economic actors create collective and responsible innovation dynamics. Actually, the problem of food waste raises complex issues regarding our system of food production and consumption because it is not only a problem of dysfunction; it is rather inherent to this mass production system. Mourad (2012) explains that since food recycling can be time and labor consuming, it can be more profitable for food wholesalers and retailers to get involved into mass production without paying attention to waste. Mourad adds also that food producers are constrained by strict esthetic criteria (color, size...) established by wholesalers, so they have to get rid of large amount of fruit and vegetables that do not meet these esthetic requirements. Besides, hygiene rules are so strict that supermarkets are afraid of legal issues if they donate food to associations. As a result, due to these strong business logics and strict legal rules, both industrial actors and consumers have incorporated social norms and habits that foster food waste and let a large amount of this surplus unexploited.

A set of distributed and responsible innovation shaping a dynamic of collective action

Actually, the food waste generated by the linear production and distribution system represents a huge potential that can be used to make profit and have a positive impact from a social and environmental point of view. As a result, several innovative and collective projects led by entrepreneurs or public actors are currently initiating and developing a dynamic of collective and responsible innovation. Regarding Paris region, we have chosen to focus on five initiatives which are listed in the table 3 below.

Project Leader	Actors involved in the project	Ongoing actions
Phenix	wholesalers, Cœur de couleur, entrepreneurs...	Identifying entrepreneurs engaged in food waste reduction and set up partnership with them
Cœur de couleur	University, Local authority of « Hauts-de-Seine », Phenix, supermarkets, printers, cosmetics producers	Setting up an ecosystem of circular economy with Phenix and other actors
Re-belle	Actors involved in food waste repurposing sector	Setting up a common vision of food waste repurposing Setting up a partnership with a supermarket
Paris city council	Actors involved in food waste reduction	Requesting for proposals to reduce food waste Identifying actors involved in food waste repurposing
ORSA council of development	Public and private socio-economic actors	Leading workshops on circular economy

Table 3: Innovation projects to reduce food waste / source: author

Collective and responsible projects aiming at reducing food waste in Paris region:

- Phenix's project :

Phenix can be considered like a major player of food waste repurposing in Paris Region and is especially effective in taking advantage of the huge potential generated by the waste coming from the food mass production and consumption system. The simplest way to present Phenix is to define it as an interconnection hub between supermarkets on one side and associations, charities (edible food) and zoos (non-edible) on the other side. Actually, Phenix is able to collect and donate 7.5 tons of food per day in France. In terms of business model, Phenix gets profit from two different channels:

1. One third of its profits come from a commission took off the savings made by the supermarkets in their waste management budget. Actually, Phenix allows

supermarkets to reduce two or three-fold the budget they dedicate to manage food waste.

2. Two-third come from another commission that Phenix takes off the tax deduction obtained by the supermarkets when they donate their food surplus to Phenix (due to a French law granting 60% of tax deduction for a company which makes a donation to a non-profit organization).

Currently, Phenix's project consists in extending his network and developing partnerships with other entrepreneurs, such as Coeur de couleur, who transform food waste into standards and manufactured products like fruit jams, cosmetic products or beverages. Phenix reckons that in a few months, the associations they are working with will not be able to absorb the whole volume of food they collect because it is still growing. Therefore, they have started to search and identify potential partners who could have developed innovative ways of processing food waste and who would be interested in getting the food waste collected by Phenix to transform it into commercial products. Phenix is currently led by two entrepreneurs and has been created two years ago.

- Coeur de couleur's project

A couple of months ago, the local authority of "Hauts-de-Seine", a French local public actor, initiated a call for applications to promote the economic development of his territory. In order to respond to this call, Coeur de couleur, a small company, is setting up a collective project including Phenix, a local university, supermarkets and other companies (see table 3). Actually Phenix and Coeur are complementary because while Phenix possesses logistics and transport assets, Coeur de couleur can bring his expertise in food waste processing downstream. The objective of this collective project is to propose a

model of circular economy to reduce food waste at a local level and create jobs in the area of “Hauts-de-Seine”.

Actually, the process defined is that Phenix collects food waste in the restaurant of the university and then distributes the edible part to associations and provides Coeur de Couleur with the non edible part, so that Coeur de couleur transforms it in pigments. Finally, Coeur de couleur will sell its pigments to printers and cosmetic producers who will then sell their products to supermarkets to close the loop. The leader of this project, Cœur de couleur, is a small family business which has been created in February 2013. During the first three years, her founder focused mainly on carrying out research and development activities and on defining her social and environmental vision. Now, she has registered several patents and proposes a method to extract pigments from food waste and sell them for cosmetic or textile applications.

- Re-Belle’s project

Re-belle’s main activity is to produce jams with fruits collected in supermarkets because they have not been sold. Currently, Re-belle’s project consists in setting up a coalition gathering new entrepreneurs, who have launched businesses or projects to reduce food waste, especially those who transform food waste in commercial products. The objective of this initiative is to define collectively a new vision for this new activity which consists in transforming food waste into commercial products. This initiative aims also at promoting the activities carried out by these new entrepreneurs and lobby public actors to get an institutional and legal environment more favorable. Re-belle has been launched by an entrepreneur in 2014 in order to initiate activities to reduce food waste. Re-belle produces roughly 400 jars of jam per week and provides them to groceries in Paris.

This business is pretty young and the founder of Re-belle got an agreement with the company Baluchon, which sells meals to enterprises. Baluchon accepted to employ the founder of Re-belle in order to let her test her model before launching her own company. Moreover, Baluchon accepted also to share part of its infrastructure with Re-belle, meaning its kitchen and some of its employees. We can notice that Rebelle and Phenix have both been involved in the general estates of circular economy, a big series of workshops with over a hundred participants from Paris region dedicated to promote circular economy and organized in 2015 by Paris city council.

- Paris City council's initiative

. In the beginning of 2016, Paris City council launched a call for applications to select projects trying to reduce food waste and finance the selected projects. Paris administration would like also to support entrepreneurs like Phenix, Coeur de Couleur and Re-belle who engaged to repurpose food waste. However they have to follow the directives of Brussels commission and respect fair competition between actors, which implies not providing public subsidies to private companies. So Paris city council is interested in providing infrastructure to these actors in order to help them grow, collect and treat higher volume of food waste. In order to do so, they launched a study to identify the requirements and needs of such a project. The objective would be to set up several transformation units in Paris which could be used by entrepreneurs to get volume, sort food waste and transform it. The Paris city council has been the first local authority in France who decided to dedicate a specific resource to manage circular economy. In Paris, there is a strong political will to build a more sustainable environment. Paris city council organized the general estates of circular economy in which Phenix, Rebelle were involved. Several workshops have been scheduled on different themes and enabled to issue a report with 65 recommendations to foster the development of circular economy in Paris Region.

- ORSA council of development's project

ORSA stands for “Orly Rungis Seine Amont”, it is a small area in the south of Paris which includes several cities. Currently, there is an urbanism project which has been launched by the state to develop this area. In order to do so, ORSA council of development, which is an instance of participative democracy, decided to initiate several large meetings with many different actors located in the area (companies, associations, administration...) in order to get them involved in this urbanism project. After a couple of meetings, the participants of these meetings identified two themes to guide the development of this urbanism projects: sustainable agriculture and circular economy. Therefore, the council of development created two workshops dedicated to these themes. Regarding the workshop on circular economy, participants conducted a set of interviews which allowed them to identify and classify some actors of circular economy. Now, they are pursuing workshops to share ideas and define a strategy which will foster the development of local projects and experimentations which aim at reducing and repurposing food waste. Phenix has been involved in the workshops of ORSA thanks to the general estates of circular economy of Paris and their common collaboration with Rungis international market.

Analysis of the processes structuring the innovative and collective projects aiming at reducing food waste

Setting up an effective project to collect, transform and repurpose food waste requires investments and financing to develop infrastructure for logistics, production and transport. From the entrepreneurs' side, the equation is pretty complicated because most of them are less than four years old and small, they lack a huge amount of capital available. As a result, all these actors are trying to initiate collective action in order to deal with several issues and obstacles that we will analyze now:

What issues and obstacles these collective projects are dealing with?

This dynamic of collective and responsible innovation which is structuring this new field of food waste repurposing have to face many issues and obstacles: actors are heterogeneous, small, have different time scales and are confronted to incumbent players' strategies, opposite business logics reinforced by the linear production model or a legal framework which is not always favorable (hygiene norms) :

- **Heterogeneous actors:** actors committed to food waste repurposing have different activities and production methods. For instance some will transform fruit and vegetables; other will transform oils and other non edible food. Then and they will produce a large diversity of products: fruit juices, wines, cosmetic products, mushrooms, jams. Due to this diversity of activities and products, it is complicated for the actor to set up mutual infrastructure for all of them.
- **Small actors:** private actors involved in these projects are mostly entrepreneurs who do not have enough capital to finance the investments required for production, transport and logistics.
- **Different time scales:** There is a significant difference in terms of time scale between private and public actors in the decision making processes. Private actors give priority to short term decisions whereas public ones will define their actions in a long term perspective. Actually, entrepreneurs have to deal with operational issues and can not necessarily afford to wait for public actors to set up time consuming workshops.
- **Incumbent players' strategies:** Supermarkets are not always eager to cooperate with entrepreneurs and public actors involved in food waste recycling and repurposing. For instance, they are reluctant to provide quantitative data regarding the amount of food waste they generate because they are often afraid of disclosing their business models.

- **Business logics from the linear model:** Given that the linear system foster mass production and consumption, it is sometimes more profitable for big players (supermarkets, wholesalers) to discard food waste than to recycle and repurpose it.
- **Legal framework:** Hygiene's rules are strict and contribute to increase the amount of food waste because most of the food which exceeds consumption time limits is edible. Moreover, supermarkets refuse sometimes to donate food waste because they are afraid of legal issues if someone gets sick

How do these collective projects manage coordination and foster cohesion?

In order to lead the different initiatives they launched, actors of the food waste repurposing field have to set up several kinds of coordination mechanisms. Phenix chose to dedicate a full resource to lead its project, they hired a strategic project manager who is responsible of identifying and setting partnerships with entrepreneurs who can repurpose food waste. From his side, Paris city council has decided to launch calls for applications in order to coordinate the actions of the different entrepreneurs and associations involved in the food waste recycling. ORSA's council of development is using a participative approach through meetings and workshops with many different actors of its local area.

In addition to coordination aspects, public and private actors are also trying to build on cohesion mechanisms to strengthen their collective action. This cohesion relies on the principle of responsibility which is shared by the actors and is composed of two main dimensions that we outlined from the analysis we carried out on the data collected from the interviews: mutual trust and shared values. With regards to mutual trust, one of the entrepreneurs stated for instance that: *"this type of project cannot be achieved without trust. This is also for this reason that we need to gather we people who share our way of thinking"*. Thanks to this mutual trust, the participants involved in a same project are not afraid of

sharing information; choose to respect others' opinions and commit in a long term relationship with their partners.

This trust is all the more important that the different participants of a project are inter-dependent. The second aspect of the principle of responsibility is the common vision, objectives and values that are shared by the participants. All the actors of the different projects share the same desire to set up circular models in the food production and distribution system. All of them aim at applying the concept of circular economy and diffusing this concept over the whole society.

Distributed initiatives that are building their inter-dependencies

The five initiatives presented above are involved in a process of collective and responsible innovation which can be analyzed with the model of Franck Aggeri (2011) that we introduced in the literature review. Actually the concepts of “scriptwriting” and “scenography” allow us to clarify the mechanisms through which, the private and public actors we met during our study are building a new field of innovation structured by distributed initiatives. Thanks to the interviews conducted, we unveiled items indicating that a cognitive process, similar to the concept of “scriptwriting”, is occurring among these actors to build a common system of shared values, representations and languages around the concept of “circular economy”. All the actors we met claimed their belonging to the field of “circular economy” and stated that they were in accordance with the values existing in the concept of circular economy. Most of these actors use also the metaphor of “the loop” as a simple way to apprehend the logic of circularity which resides in the core of circular economy. Besides, the cognitive process occurring materializes also through other items such as the language and terminology used by the actors. For instance, most of them are struggling to replace the

terminology of “waste” by “surplus” in order to diffuse a more positive image of their activities.

On the other hand, we observe also that all the initiatives we studied can be considered like distributed initiatives contributing to the structuring of the new innovation field of food waste repurposing and corresponding to what Aggeri (2011) defined as: “*innovation possibilities, unknown at first, which do not result from the materialization of a pre-established plan rather from a succession of situated experiences sharing common principles*”. Indeed, the projects led by Phenix, Coeur de couleur, Re-belle, Paris city council or ORSA’s council of development have specific characteristics and use different approaches to initiate a dynamic of collective action in favor of circular economy, but they do not necessarily obey to a master plan established in advance by a higher authority. Nevertheless, in spite of being distributed and spontaneous, these initiatives are linked and inter-dependent. Phenix is involved in Coeur de couleur’s project and aim to provide collect and logistics services to Coeur de couleur within the project launched by the public authority of “les Hauts-de-Seine”. Paris city council is linked with Phenix and Re-belle as it plans to include them in its project to set up local production units of food repurposing in Paris. Finally, Phenix and ORSA’s council of development are linked through the wholesale market of Rungis in which they are both involved. All these distributed and interdependent initiatives can be considered as being part of what we define as a responsible innovation ecosystem.

New forms of collective action: responsible innovation ecosystems

Our research work led us to introduce a new concept: responsible innovation ecosystem. This concept allows us to understand the nature of the network which structures the initiatives that actors, involved in food waste repurposing, are trying to develop through collective projects.

	Innovation ecosystems	Responsible innovation ecosystems
Heterogenous actors	It includes heterogeneous actors of different status : companies, associations, administrations...	It includes heterogeneous actors of different status : companies, associations, administrations...
Cross sectoral initiatives	Members of the ecosystem come from different sectors: public administration, industry, services	Members of the ecosystem come from different sectors: public administration, industry, services
Leadership	The leadership is firmo-centric with a leader who manages to impose his vision to the ecosystem	The leadership is distributed with several initiatives managed by private or public actors
Inter-organizational interactions	Inside an innovation ecosystem, inter-organizational interactions are shaped by a cooperative logic, meaning simultaneously competitive and cooperative	Inter-organizational interactions are shaped by cooperative but also cognitive or institutional mechanisms
Common objective	The common objective is to develop and spread innovations of products or services	The common objective is to get a positive impact on society from the social and environmental points of view
Innovation Process	Innovation ecosystem rests upon a dynamic of open innovation building new networks of distributive knowledge and competences	Innovative and collective initiatives contribute to structure a dynamic of open but also responsible innovation

Table 4: Comparison between innovation ecosystems and responsible innovation ecosystems / source: author

From the table above, we can notice that both innovation and responsible innovation ecosystems includes heterogeneous actors involved in cross-sectoral initiatives. However, they differ for the other items:

- **Leadership:** In the field of food waste repurposing, there is no one leader who is imposing his vision like it happens in classical innovation ecosystems. Instead, we

can observe that the responsible innovation ecosystem is composed with several distributed initiatives which have been launched by private or public actors.

- **Inter-organizational interactions:** The cooperative logic is present in both types of ecosystems, however, regarding the responsible innovation ecosystem, we have identified other types of inter-organizational mechanisms: cognitive and institutional processes which are used by the actors to structure their collective action. Regarding the cognitive processes, actors are willing to set a common vision and shared values to strengthen their cohesion, for instance, one of the entrepreneurs explained that, speaking of other entrepreneurs involved in food waste repurposing: *“In terms of philosophy, way of doing, I think that it is interesting that we collaborate, that we think together to our vision, to what it should be in the long term because it can have a great impact on food waste and this is what we are looking for”*. As for institutional process, they are rather used by public actors through call for applications or formal meetings and workshops.
- **Common objective:** the ecosystem which is emerging in Paris aims at promoting a society which is more positive from the social and environmental point of view. This responsible innovation ecosystem is oriented towards a more positive vision of society which is able to deal with the social and environmental challenges it is facing. For example, one of the entrepreneurs has expressed the following thoughts: *“the idea is to share our knowledge to get a loop which is as efficient as possible, with the objective of developing the area. To enact the economic development of the area and create jobs”*. On the contrary, in a classical innovation ecosystem, the common objective is mostly to promote and diffuse innovation of products and services.

- **Innovation process:** On top of the open innovation mechanism which also exists in innovation ecosystems, there is also a mechanism of responsible innovation inside responsible innovation ecosystems. This mechanism of responsible innovation materializes by the integration of social and environmental aspects in the decision processes of the different actors. For example, Coeur de couleur took into account its potential impact on the environment while choosing a location to install its production unit.

Designing and building a responsible innovation ecosystem

We have shown previously that the food waste repurposing field in Paris is a responsible innovation ecosystem composed of several collective initiatives which are distributed and inter-dependent. We have also indicated that the private and public actors involved in this ecosystem are contributing to the development of this ecosystem by developing inter-organizational relationships shaped by cooperative, cognitive and institutional mechanisms. However, as this ecosystem is still emerging, from the data we collected during our research, we managed to outline the processes which can be used to co-design a responsible innovation ecosystem. Given that such an ecosystem is mainly composed of distributed initiatives, it is not possible to carry out the co-design process with a pre-established plan; instead, it is necessary to guide the structuring of a collective process which will allow the different actors to explore different options and manage effectively their inter-organizational relationships.

Process operated to define players and roles within an ecosystem

Designing and building a responsible innovation ecosystem relies on a process of collective action oriented towards the emergence of different players and roles which will contribute to the development of the ecosystem (see table below).

Roles	Actions	Impact
Aggregators	Act as an interconnection hub between a large number of members of the ecosystem by exchanging information, services with them	Foster the building of inter-dependancies between several collective projects and increases the potentiel of collective innovation
Lobbyists	Focus on building a common vision shared by the ecosystem members and promote this vision inside and outside of the ecosystem	Improve the internal cohesion and the legitimacy of the ecosystem by cognitive mechanisms : builing and diffusing common objectives oriented towards a positive vision of society from social and environmental points of view
Supporters	Provide the ecosystem with financing and infrastructure to support the development of the ecosystem	Accelerate the development of the ecosystem and strenghten its durability through institutional tools (call for applications, workshops, legal framework..)
Linkers	Interface between cross-sectoral members of the ecosystem (public administration, entrepreneurs, large companies, NGO...)	Facilitate cross-sectoral inter-organizational interactions in the ecosystem using simultaneously cognitive and institutional mechanisms

Table 5: Roles operating within a responsible innovation ecosystem / source : author

In order to build a responsible innovation ecosystem, several roles have to emerge through collective actions (see table 5): Aggregators, Lobbyists, Supporters and Linkers. Aggregators are really important for growing the ecosystem because they can interconnect a lot of different collective projects and initiatives. Thanks to aggregators, the responsible innovation ecosystem can grow faster. With regards to the food waste repurposing field, a good example of aggregator is Phenix.

Besides, Supporters are also significant for the growth of the ecosystem as they can provide financing and infrastructure which are indispensable for increasing the volume of activities managed by the actors of the ecosystem. As a general rule, the roles of supporters are held by public actors because they are the ones ready to invest resources to develop their own local area thanks to the development of a local responsible innovation ecosystem. The linkers have the ability to facilitate cross-sectoral cooperations which are necessary to facilitate the inter-organizational relationships between public and private actors who have different cultures, methods and perceptions. Eventually, the lobbyists are important to reinforce the cohesion of the actors around shared values and vision; and to construct the legitimacy of the responsible innovation ecosystem.

Process operated to set up governance principles framing the ecosystem

Another process operating in the design and building of a responsible innovation ecosystem is the definition of principles that actors are following to build their inter-organizational relationships within the ecosystem (see list below). From the data collected, we identified six principles that actors rely on when they build these inter-organizational relationships. By following the principles enlisted below, actors can build continuously and effectively their inter-organizational relationships and develop the responsible innovation ecosystem they are involved in. Let us now clarify what these principles consist in and how they can help actors in the co-design of their responsible innovation ecosystem:

- Principle 1: Involve heterogeneous and cross-sectors actors to address the complexity of the dynamic of collective and responsible innovation which is required to build up the ecosystem

As we have noticed previously, when socio-economic actors are committed into the building process of a responsible innovation ecosystem, they have to face several complex issues in terms of process, organization, innovation, financing and so on. Therefore in order to foster

the growth of the ecosystem, it is interesting and relevant to involve heterogeneous actors who will bring complementary skills from other sectors.

- Principle 2: Launch projects (even small ones) involving cross-sectoral actors which will help them to build mutual trust and to learn how to manage inter-organizational relationships

If there are heterogeneous and cross-sectoral actors within the ecosystem, it is important to foster the development of projects which will foster the cooperation between all these different kinds of actors. As these actors have different issues and organizations, it is important to create spaces for them to meet and work together in order to learn how to work together and to trust each other. For this reason, it is important to launch some projects which will include a minimum of diversity within their members. These projects will serve as supports to build on bridges between these heterogeneous and cross-sectoral actors.

- Principle 3: Each actor has to clarify and share its business model to facilitate the co-design of a collective shared value

One of the challenges that socio-economic actors have to manage while designing a responsible innovation ecosystem is the design of business models that will allow each actor to share the common value created within the ecosystem. Each actor clarifies and shares its business model with the others so that everyone will apprehend in a better way how one can share the common value.

- Principle 4: Gather a large number of actors to share investment required to finance infrastructure needed for developing and growing the ecosystem

Our research indicates that when a responsible innovation ecosystem is emerging, it is first composed of distributed initiatives without necessarily a pre-established plan, which means that many of these initiatives will be managed by small actors (entrepreneurs, associations...). On the other hand, a responsible innovation ecosystem will need investments and

infrastructure (transport, energy, facilities...) for its own development. As a consequence, the best way to foster the growth of the ecosystem is to gather as many as actors as possible and make them co-finance in the infrastructure required.

- Principle 5: Co-design a common vision and set of values which will allow gathering the actors of the ecosystem and promoting the ecosystem

One of the characteristics of a responsible innovation ecosystem is that it aims at generating a positive impact on Society. On the other hand, it is generally composed of heterogeneous and cross-sectoral actors who have different methods and cultures and have to initiate a dynamic of collective action to develop their ecosystem. As a result, co-designing a common vision and set of values represents an excellent solution to strengthen the cohesion between the different actors. Besides, the actors will be able to rely on this common vision to promote their ecosystem and eventually contribute to shape a environment more favorable for their own development.

- Principle 6: Use a set of institutional settings (workshops, call for applications...) to guide the collective dynamic towards a common objective and ensure the durability of the ecosystem

As we have mentioned it previously, responsible innovation ecosystems are developing through distributed initiatives shaping a dynamic of collective and responsible innovation. Nevertheless this dynamic needs to be managed and supported; otherwise it can fail. In other words, institutional settings are required in order to support the collective and responsible dynamic which shapes a responsible innovation ecosystem. This is usually what public actors try to promote by creating institutional environments favorable to innovation. They usually try to build an institutional infrastructure by means of different instruments: workshops, general estates, laws and calls for applications. These settings are important to maintain the dynamic of collective and responsible innovation in a long term within the ecosystem.

Discussion

This research allowed us to go deeper into the concept of innovation ecosystems, highlighting specific kinds of ecosystems which are focused on sustainable development objectives and can be led by heterogeneous and cross-sectoral actors. We defined the concept of responsible innovation ecosystem that is particularly useful to understand these new forms of collective action that are pretty efficient in the emerging field of food waste repurposing in setting up a dynamic of collective and responsible innovation. Our results contribute to increase our knowledge regarding the notion of business ecosystems introduced once by Moore (1993, 1996) and show how this concept can be relevant to study and outline interesting and new forms of collective action. The notions of business and innovation ecosystem are relatively new and still need to be investigated in depth to determine all the elements they rest upon.

The notion of business or innovation ecosystem is interesting because it oversteps the classical dichotomy existing, in the literature, between markets and hierarchies. For a long time, researchers in management have been considering that cooperation between actors could be achieved either by markets regulating offer and demand or by organizations setting up rules for its members. Now, it appears that other forms of cooperation exist, with different kinds of actors cooperating to achieve a common objective. Here, regarding the case of food waste repurposing, we emphasized that responsible innovation ecosystems don't emerge spontaneously from the market but are co-designed and built by actors through a dynamic of collective and responsible action relying on different mechanisms and processes that we outlined. As a matter of fact, in an ecosystem which is composed of distributed initiatives, socio-economic actors have to rely on processes through which they can set roles and

principles that will help them to build it. Thus, from our research, we enlisted four roles and six principles that are shaping the co-design process of a responsible innovation ecosystem.

In terms of practical implications, our results provide a concept which can be used to analyze collective dynamics in projects of sustainable development. Especially if we look at what occurs in the field of circular economy, collective action is required to develop efficient circular systems. Given that in the literature of management, few works have indicated how innovation ecosystems emerge and are built by socio-economic actors, our concept of responsible innovation ecosystem proposes a framework with roles and principles that can serve as a baseline to understand out how organizations can build up new and effective forms of collective action that aim at increasing simultaneously their economic, social and environmental values.

Still from a practical point of view, our findings raise also the question of how public authorities could foster the development of these responsible innovation ecosystems through policies, institutional and legal framework or any other tool of collective action. Traditional methods and tools that are currently available for public actors do not fit to new forms of collective actions such as responsible innovation ecosystems. Financing R&D or proposing subsidies does not guarantee the development of a responsible innovation ecosystem.

First of all, public actors need to review their evaluation processes and tools to make sure that they are able to assess social and environmental aspects of an innovation project. Then, they need to understand the logic and processes that shape innovation in these ecosystems, so that it will be possible to encourage the different actors and help them to take care of their collective dynamic of innovation. Regarding responsible innovation ecosystems in particular, public actors need to acquire new skills to develop new sectors such as food waste repurposing, which gather heterogeneous actors and aim at bringing to the surface more

sustainable economic systems. From this point of view, our research provides valuable clue regarding how public actors can guide the development of a responsible innovation ecosystem. As a matter of fact, the four roles and six principles that came out of our study can be used by public actors in order to upgrade their policies in order to foster and improve the growth, effectiveness and durability of these ecosystems.

Conclusion

During our research, we chose to focus on the emerging field of food waste repurposing in order to observe, describe and analyze the dynamic of collective and responsible innovation that is created by some actors involved in this sector. We have selected five out of the existing initiatives and it led us to introduce the new concept of responsible innovation ecosystem which allowed us to outline the mechanisms shaping the dynamic of collective action observed in the emerging field of food waste repurposing. Responsible innovation ecosystems involve heterogeneous actors, are shaped by open innovation processes and aim at developing projects that bring not only economic, but also social and environmental values to their stakeholders.

Furthermore, we identified the processes that are operated by socio-economic actors to build up a responsible innovation ecosystem. This led us to define four roles and six principles that are required in order to co-design these responsible innovation ecosystems. Other researches still need to be conducted in order to apply this new concept of responsible innovation ecosystem to other case studies. The case of food waste repurposing, which has been studied in this paper, is pretty young and still growing, so it would be interesting to study other sectors which are bigger and more stable (energy, real estate...).

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