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1.A. CIRCULAR ECONOMY CONCEPTUALIZATION AND CRITICAL APPROACHES

1.A.1. The Circular Economy at a crossroad: Technocratic Eco - Modernism or Convivial Technology for Social Revolution?

Mario Pansera, Andrea Genovese

Abstract

In the last decade, the concept of 'Circular Economy' (CE) has gained prominence in the political and corporate discourse around the world. According to its proponents, CE represents a new paradigm that will push the frontiers of environmental sustainability by transforming the relationships between ecological systems and economic activities. In this paper we discuss how this idea is problematic for a number of physical, economic and political reasons, claiming that the biggest shortcoming of the CE discourse is represented by it's a political framing. We call for opening up a debate to deconstruct the increasingly hegemonic discourse of CE based on a technocratic approach and reconstruct it by embedding normative and political dimensions. Finally, we propose a countervailing discourse of CE based on the idea of convivial technology.

1.Introduction

"Today a lack of realism no longer consists in advocating greater well-being through the inversion of growth and the subversion of the prevailing way of life. Lack of realism consists in imagining that economic growth can still bring about increased human welfare, and indeed that it is still physically possible." André Gorz (1980)

"What continues to strike me, is that the 'environmental issue' necessarily means such different things to different people, that in aggregate it encompasses quite literally everything there is."David Harvey (1993)

In the last decade, 'Circular Economy' (CE) has surged as a prominent concept in the political and corporate discourse around the world. The notion, which, thanks to its immediacy, can be easily communicated and employed to coin slogans and mottos, is the most probable candidate to replace the outdated 'sustainable development' imaginary that dominated the post-Brundtland era.Although its origin can be located in a specific academic tradition (i.e. the one linked to the Industrial Ecology field of study), CE has become an 'umbrella term' -i.e. an empty buzzwordthat can shelter different meanings (Rip & Voß, 2013)-whose flexibility and haziness is a potential battle ground for competing ideological agendas (Homrich, Galvão, Abadia, & Carvalho, 2018; Korhonen, Nuur, Feldmann, & Birkie, 2018). In the views of its promoters, CE represents a new paradigm that will push the frontiers of environmental sustainability by transforming the relationships between ecological systems and economic activities (Ghisellini, Cialani, & Ulgiati, 2016). This is supposed to happen through a shift in the design of socioeconomic metabolism from a linear model based on 'extraction-production-consumption' towards a circular model in which waste, by-products and end-of-life products are ideally totally reused, recycled or remanufactured (Genovese, Figueroa, & Koh, 2017). CE proponents are not just concerned with the reduction of the use of the environment as a sink for residuals or with the delay of cradle-to-grave material flows (as a simplistic view of sustainable supply chain management strategies may suggest), but rather with a thorough rethinking of production methods, which also involves a reduction of resource use and the implementation of advanced planning

approaches (Genovese et al.,2017). For their capacity to mobilise different and complementary imaginaries (i.e. the technical, the environmental and the commercial/economic) CE principles represent the new political frontier to the achievement of environmental sustainability (Winanset al., 2017).

In this paper, as postulated by Korhonen et al. (2018a, 2018b), we argue that, although presented in a neutral, apolitical fashion, the CE agenda represents a highly contested political project. By recognising the existence of alternative and competing CE narratives, we recognise that, in its currently hegemonic formulation, CE is very much aligned to a technocratic, eco-modernist agenda. The dominant discourse of CE, indeed, essentially draws on a refurbished new version of 'circular' market-oriented capitalism that look at industrial wastes and environmental degradation not as 'system failures' but as opportunity to relaunch a new season of -this time sustainable and possibly 'green' -economic growth (European Commission, 2017). We discuss how this idea is problematic for a number of physical, economic and political reasons and then focus on what in our view is the biggest shortcoming of the CE discourse: its apolitical framing. We call for opening up a debate (Stirling, 2008) to deconstruct the increasingly hegemonic discourse of CE based on a technocratic approach and reconstruct it by embedding normative and political dimensions. Finally, we propose a countervailing discourse of CE based on the idea of convivial technology (Illich, 1973) that not only would enable an environmentally sustainable society but also a social transformation towards a more just and classless society. The paper is organised as follows: first we discuss the intrinsic contradictions of market capitalism that contributed to the emergence of the CE paradigm; second, we suggest that CE present all the features of an 'eco-modernist' project; third,we argue that in its present form proposed by the European institutions the CE paradigm is apolitically framed;we then have a look at the alternative CE framing provided by the Chinese government;finally we conclude with a call to repoliticise the concept.

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1.A.2.The circular economy, its fundamental cycle, its tensions

Benjamin Fragny, Cathy Zadra-Veil

Kenneth Boulding already portrayed the earth as a closed system characterized not by linear interrelations between the economy and the environment but by circular relations (Boulding, 1966). Pearce and Turner (1990) have shown the particularly holistic nature of the environmental economics, which, as an approach to the functioning of the economy, should lead to the implementation of a circular economy on a global scale. This approach to the circular economy aims to raise awareness of the interrelationships between the economic system and the natural system (Pearce and Turner, 1990). Faced with socio-environmental issues related to the depletion of non-renewable resources and pollutions, public and private persons are now focusing on the circular economy as a potential solution. However, the concept is not yet well defined and each gives its own definition (Kirchherr et al, 2017). Furthermore its conceptualization often consists only in a modified representation of the linear economy taking into account recycling at the end of the process (European Commission, 2014). Some authors have highlighted the importance of the organization of the company as well as the barriers to be crossed by it on a micro scale to set up the circular economy (Ritzén, Ölundh Sandström, 2017). Others have highlighted the limits and challenges that the circular economy will have to overcome on a macro scale (Korhonen et al., 2018). Current practical approaches to the circular economy are of major interest in attempting to expand waste management strategies to address both waste limitation issues -necessary to maintain the natural system's absorptive capacity -and depletion of resources. Some approaches go further than the mostly considered triptych (refuse, reduce, recycle) (Kirchherr et al, 2017). Thus, Reike et al (2018) consider up to 9 strategies (9R) related to the circular economy. Our question focuses in particular on the tensions that must be taken into account by the multiple stakeholders in the field of construction, in order to implement a circular economy.

Our methodology is based on the collection of primary and secondary data from several actors (Cycle up, Icade, NoE, Circolab, Camposphère, Democles, Matabase...) in the real estate sector and more specifically construction.

It allows us to identify the tensions of a circular economy system that could call into question the primary circularity (waste-collection-reuse). Indeed, the circular economy cannot be implemented by a single actor, regardless of the territory where its activities are located. The territory consists of a set of actors, locally available materials, rules. We consider here that some elements usually integrated in the cycle of the circular economy do not actually belong to the cycle but constitute constraints, tensions which must be treated by the actors. Indeed, we hypothesize that the circular economy is based on a fundamental circular production cycle and tensions (Figure 1). The fundamental cycle consists of the steps of design, construction, use and recycling, which integrate the 9R. The materials, distribution and pickup / collection are tensions that constrain the implementation of the circular economy cycle. These are conditions of effectiveness related to the success of a virtuous circular economy. This brings us to a proposal to modify the cycle traditionally accepted in the circular economy and to innovative proposals regarding the construction process in the circular economy.

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1.A.3. To the roots of the circular economy: the collapse theory

Sophie Boutillier

Mots clés : innovation, ressource, effondrement, technologie, croissance

Question de recherche: La question d'un équilibre entre ressources et besoins est un sujet qui préoccupe les économistes depuis plusieurs siècles, bien avant la révolution industrielle(Boutillier, 2003). Depuis le 19esiècle, différentes phases d'évolution peuvent être distinguées sur la prise en compte de cette question. Nous distinguerons trois périodes:1/ de la fin du 18eà la fin du 19esiècle, cette période est marquée par des points de vue partagés entre les économistes qui s'interrogent les moyens à mettre en œuvre pour créer de la richesse, tout en questionnant la pérennité de ce phénomène. 2/ Le début du 20esiècle (en dépit des deux guerres mondiales) se caractérise par l'idéologie du progrès technique et industriel, comme solution de tous les maux économiques et sociaux. 3/La fin du 20esiècle voit en revanche(outre la question de l'épuisement des ressources fossiles, la multiplication des risques technologiques et le changement climatique)apparaitre un nouveau danger, celui de l'effondrement généré par des facteurs environnementaux qui se combinent avec des facteurs économique, sociaux et politiques. Ce vocable a été popularisé par Diamond (2005).

Les économistes classiques, en premier lieu Smith, pensaient avoir découvert le secret de «la richesse des nations»(1776) en montrant les avantages de la division du travail dans l'entreprise et de la division internationale du travail (les deux étant étroitement liées). Cette analyse était fondamentalement révolutionnaire, car les économistes avaient pendant plusieurs siècles raisonnés dans une économie de rareté avec des ressources en énergie réduite (humaine, animale, vent, eau notamment), avec des rendements médiocres, qui semblait indépassable. L'invention de la machine à vapeur puis sa diffusion à partir du 19esiècle donna l'illusion que la création de richesse pouvait être sans limites. Mais cette créativité technologique ne fut pas sans danger (Fressoz, 201;Jarrige, Le Roux, 2017). Aussi cette conception du développement économique fut-elle abondamment critiquée dès le 19esiècle, Malthus (1798) ayant alerté sur le risque d'un déséquilibre entre ressources et population. Le biologiste Lamark (1820) doutait également à la même époque de la pérennité de la civilisation

industrielle. Quant à Engels dans «La dialectique de la nature»(1883), explique en substance que les ressources naturelles ne sont pas sans limite. Quelques années plus tard, Jevons (1865) publie son étude sur les risques de pénurie de charbon en Angleterre. Cependant, la croissance économique de l'après-seconde guerre mondiale avait fait naitre l'illusion que la croissance économique pouvait être sans limite, jusqu'à la publication du rapport du Club de Rome, « Halte à la croissance » (1972), peu de temps avant que n'éclate la première crise pétrolière. Au début des années 1980, la question de l'emploi et du chômage semble prendre le devant par rapport à l'épuisement possible des ressources naturelles et de la fragilité de la civilisation industrielle, jusqu'à la publication de l'ouvrage d'U. Beck sur « La société du risque» (1986).

2La théorie de l'effondrement ou de la collapsologie (Servigne, Stevens, 2015) a été développée au début du 21esiècle. L'une de ses originalités est qu'elle est pluridisciplinaire (économie, sociologie, psychologie, physique, chimique, science politique, …), mettant en évidence les relations systémiques qui lient les différentes composantes de la société. En effet, paradoxalement plus une société se développe, plus elle devient fragile, car elle se complexifie et a besoin de plus en plus d'énergie et de ressources. C'est un cercle vicieux car après avoir épuisé l'énergie bon marché, elle perd sa capacité à résoudre les problèmes économiques et sociaux auxquels elle est confrontée (Tainter, 2013). L'objectif de ce projet de communication est de présenter les raisonnements et les arguments sur lesquels s'appuient les auteurs qui développent cette théorie. Si le mot «collapsologie» aurait été inventé par Servigne et Stevens avec une certaine autodérision, la question de l'effondrement des civilisations n'est pas nouvelle. Depuis l'antiquité, nombre de penseurs s'y sont intéressés (en dehors des références aux mythes et religions). Ce que la théorie de l'effondrement a introduit est d'une part une prise de recul par rapport au mode de production industriel, d'autre part une ré-interrogation de l'histoire des civilisations en mettant l'accent sur les causes écologiques (cf. nouvelles théories sur l'effondrement de l'Empire romain d'Occident). Ces deux orientations convergent vers d'une part une prise de conscience des populations, et la multiplication d'initiatives individuelles ou dans le cadre associatif, d'autre part par l'élaboration de politiques publiques visant à privilégier des énergies renouvelables et à proposer un autre modèle industriel, respectueux de l'homme et de l'environnement. La multiplication depuis quelques années des appels, en faveur d'un New Deal vert, vont en ce sens (Klein, 2019). En d'autres termes, existe-il un monde post-collapsologie?

La méthodologie de cette présentation se base sur une revue de la littérature (systémique) de la théorie de la collapsologie/effondrement pour présenter les principaux chercheurs (certains d'entre eux ont d'ores et déjà été évoqués dans le paragraphe ci-dessus) qui participent au développement de ce courant de pensée.

Principaux résultats

L'objectif est d'identifier : -Les concepts développés,-Le raisonnement développé,-Les relations systémiques qui lient les différentes composantes des systèmes économiques et productifs,-La nature des dangers identifiés:écologique, économique, social, politique,-Les solutions envisageables en termes de politique publique.

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1.B. GLOBAL VALUE CHAINS, CIRCULAR ECONOMY AND INTERNATIONAL ISSUES

1.B.1. The environmental dimension of intra - EU trade: new disparities revealed

Hugo Campos, Oscar Rodil

Abstract

The world's population is increasingly aware of environmental problems and the need to adopt changes leading to a more sustainable way of life. In response to this need, governments have implemented a variety of measures to address environmental issues. In fact, the European Union(EU)is promoting the so-called circular economy (CE) strategy with the aim of minimising the generation of waste and making the best use of the available resources.

Since 2015, various CE measures have been proposed and implemented. However, none of them mentions the impact of international trade on the environment despite the importance of trade, especially the intra-EU trade.

Concerning international economy, the role of global value chains (GVCs) is particularly relevant as a way of organising fragmented production processes not only in different processes, but also in different countries. In general, regarding regional blocs, intra-regional trade is usually much more intense than the extra-regional (De Marchi, Di Maria & Micelli, 2013; Gereffi, 2014; Achabou, Dekhili & Hamdoun, 2017). Participation in GVC also generates innovation processes due to the need of being competitive in international markets. One of the possible innovation paths related to GVC is called environmental upgrading, which is defined as any improvement applied by a firm that reduces the amount of emissions generated and energy consumption (Khattak & Pinto, 2018).

Therefore, it is necessary to include the effects of trade on the environment in policies oriented to the promotion of the CE. This would allow a better assessment of these programmes and the consideration of measures to reduce the impact of trade on the environment. In this sense, the input-output (IO) methodology is useful for analyzing the environmental impact of trade (Miller & Blair, 2009). Some studies using this method find relevant differences in emission intensity (measured by emissions per output) between European countries (Bhattacharyya & Matsumura, 2010).

The aim of this paper is to analyse the evolution of disparities concerning the environmental impact of the intra-EU trade by using an IO approach. In this respect, the main research question is whether the EU integration process has accentuated the disparities in terms of trade-related emissions between the EU countries.

In order to address this question, an analysis of intra-EU trade is carried out using IO methodology with environmental extension for the years 2000, 2005 and 2015. The choice of the year 2005 is justified by the fact that most Eastern European countries joined the EU since2004onwards.

The statistical information used comes from Eora26database, a multiregional IO model that includes 186 countries and 26 homogeneous sectors for all of them (Lenzen et al., 2012; Lenzen et al., 2013). In addition, TiVA (Trade in Value Added) database (OECD) will be used to address specific trade issues in terms of value added.

The main results point outthe following tendencies. Firstly, the EU average emission intensity decreases over the sample years. Secondly, after the integration of several Eastern European countries

in 2004, the disparities in the average emission intensity increased for some sectors of these countries. Thirdly, the findings indicate that, following the integration of Eastern European countries, disparities in emission intensity not only increased, but also were higher than disparities in exports intensity (ratio of exports in US dollars by country and sector and total output by country and sector), which were constant during the sample years.

The initial disparities increase could be explained by the need to improve companies' competitiveness in newly integrated countries in order to compete in the common European market. Although in 2015 some sectors belonging to Easter European countries still had the highest emission intensity related to exports, the disparities with respect to the EU average intensity were smaller than in previous years. This evolution in intensity reflects the environmental improvement processes that took place in these economies.

Keywords: inter-EU trade, circular economy, environmental upgrading, global value chains

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1.B.2. The United States- South Korea Free Trade Agreement: Economic Effects and Institutional Innovations

Luchen Cai, Santos M. Ruesga, Antonio Vázquez Barquero

The KORUS FTA is a bilateral agreement that regulates economic relations between the United States and South Korea. Its economic impact on member countries is bigger than traditional agreements, since the level of product market opening reaches 99.8%. This reflects the characteristics of the high standard of the United States trade agreement in terms of intellectual property, competition policy, investments, and trade in services, labor and environmental standards. On the other hand, as the first country in Northeast Asia to sign an FTA with the United States, the economic effects of the KORUS FTA also play an important role in the countries of East Asia.

The objective of the research is to achieve an economic study on South Korea that allows knowing the economic evolution of Korea in the short term of the free trade agreement between the US and Korea: the motivation of the FTA, the effects on exports and imports, as well as productive competitiveness and innovations and employment outcomes.

In order to reach these objectives, the research method was using the statistical information of the UN Comtrade Database, the evolution of bilateral trade, employment data, indices of productive competitiveness2 and the gravity model of trade. In addition, the argument is reinforced by using important publications and related theories, which allows showing the economic and trade institutions, structural connections and norms, as well as the motivation of the KORUS FTA.

The research result shows that KORUS FTA plays an important role in improving competitive advantages, increasing international trade and economic growth in Korea, although there are differences between expected and achieved results due to the slow recovery of international trade after the financial crisis in 2007. Specifically, it shows that KORUS FTA has positive effects on trade and productive competitiveness and innovations between the two countries, especially on exports from South Korea. South Korea's exports are achieved a significant increase with an average annual growth rate of 3.4%. Meanwhile, KORUS FTA has increased Korea's comparative advantage in relatively weak productive activities in the United States market, giving these activities an opportunity to stimulate their competitiveness and expand market share. However, the effect of KORUS FTA on South Korea's employment is not significant. We estimate that South Korea's net exports to the United States have created 37,000 jobs in Korea by KORUS FTA. Nevertheless, there are negative production and employment effects in the agricultural sector, for example, in the production of fruits and vegetables.

At the same time, it would be important to mention the effect of technological innovations. Most production activities will be automatized with technologies known today. The combination of robotics and artificial intelligence, software and algorithms, increasing computing capacity and machine learning, is already displacing people from their jobs, sometimes to new ones or, directly, to unemployment. This substitution is being especially visible in Korea's productive activities, due to the incorporation of large-scale robots. Specifically, in subsectors such as the automobile or electronics, it coexists with the decline in the participation of the economies, and with the geographical relocation of some subsectors. In the field of services, it is more difficult to replace humans with machines, but displacements are also beginning in some more routine, less complex tasks. All this requires inclusive policies to overcome the process of replacing workers with machines.

Finally, the economic effect of KORUS FTA has different trends over time in both countries; the effects of openness and productive competitiveness are complex and dynamic. Because the KORUS FTA has been in force for a few years, the research focuses on a relatively short period, so its long-term economic effect remains as a highlight topic to investigate. In this regard, it would be important to make a comparative study of the economic effect with respect to the other Korean free trade agreements, such as the FTA between Korea and the European Union and he FTA between Korea and

China, particularly on their improvement capacity of technological innovation and employment generation.

Keywords: KORUS FTA; Economic Effects; South Korea; Innovations and Institutions

1.B.3. Debilidades y fortalezas del sistema de innovación en paraguay: nuevas estrategias y políticas para su dinamización

Selva Olmedo Barchello

Palabras clave: innovación, componentes, actores, políticas públicas, sistemas

El objetivo de investigación consiste en analizar los factores que condicionan el desarrollo y la innovación en el Paraguay, haciéndose énfasis en el sistema de innovación nacional, la capacidad innovadora y la articulación entre los diferentes elementos del sistema con el fin de elaborar propuestas para su dinamización.

La metodología de investigación a ser aplicada será de enfoque sistémico-estructural, combinando el análisis cualitativo y cuantitativo. Para la revisión del estado del arte, la misma se enmarcará en un diseño documental-bibliográfico. Se recurrirán a fuentes secundarias con la utilización de base de datos de las Encuestas de Innovación Empresarial del Paraguay 2013 y 2016. El estudio detallado en base a microdatos de esta encuesta constituirá la materia prima de base para el estudio empírico. Así mismo se estudiarán diferentes variables de empleo, gasto, inversión, financiamiento, vinculación, ventas entre otros. Para su complementación cualitativa se realizaron entrevistas a empresarios de diversos rubros innovadores en Paraguay.

Los resultados esperados pretenden explicar los aspectos que debilitan el conjunto y hace que se configure una actividad poco proclive. El diagnóstico realizado dará luces para comprender a fondo los problemas de estructuración y subestructuración, las políticas, estrategias, que se han hecho en este campo, políticas de i +D, innovación, capacitación y formación de recursos humanos, especialización, tamaño de empresa, banca de inversión, capital riesgo, entre otros. Para luego identificar el sector o los sectores con dinámica innovadora, políticas de acompañamiento, movilización recursos financieros, las lecciones aprendidas para finalmente concluir en la reflexión de medidas de políticas públicas para un buen funcionamiento del sistema.

Se observó en el primer análisis realizado sobre Paraguay, que en el mismo no se observan aspectos de un estado innovador, como comprador de tecnología como usuario. Paraguay no dispone de incentivos fiscales a la I+D+i. Si bien, se identifican aspectos en los que el país se encuentra en la etapa de creación de bases con el objetivo de propiciar actividades de I+D+i, como ser, una mayor inversión en la digitalización en sus procesos y acciones. El tejido empresarial paraguayo se caracteriza por la predominancia de las micro y pequeñas empresas, entre las actividades de innovación, la más destacada fue la adquisición de maquinarias y equipos, siendo los sectores de productos alimenticios,

farmacéutico y productos químicos los de mayor inversión. Entre los principales obstáculos se encuentran los insuficientes incentivos en cuanto a políticas públicas, escasez de personal calificado y dificultades de acceso o costo excesivo del financiamiento.

Entre los principales resultados obtenidos de las entrevistas realizadas a empresarios paraguayos, se destacan tres aspectos que obstaculizan las actividades de innovación dentro de sus respectivas empresas; deficiencia en las políticas públicas, falta de mano de obra capacitada, financiamiento y estructura de mercado pequeño. Se observó que la estructura organizacional de cada empresa juega un papel importante en las decisiones de I+D+i, ya que la mayoría se constituyen en empresas familiares. Entre las principales características del empresario paraguayo se encuentran; su aversión al riesgo y a los cambios, lo que determina su predisposición a innovar. Aspectos relacionados a la sostenibilidad como política de empresa, es incipiente incluso en las de gran tamaño.

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2.A. EU POLICY FOR CIRCULAR ECONOMY

2.A.1. New regional laws for circular economy in Spain

René Javier Santamaría Arinas, Ignacio Barriobero Martínez, David San Martín Segura, Lucía Muñoz Benito

KEYWORDS: Sustainable development – Circular economy – Environmental law – Innovative regulation – State's basic laws – Additional regional laws for environmental protection

ABSTRACT: Under the presidency of Jean-Claude Juncker, in 2015 the European Commission adopted the EU Action Plan for the Circular Economy (SANTAMARÍA ARINAS, 2018). Four years later, the implementation of the plan has been finished by a Working Document prepared by the European Commission Staff [SWD(2019) 90 final]. It is a self-complacent working document that must be clarified both in an economic (LLORENTE-GONZÁLEZ y VENCE, 2019) and in a juridical sense (NOGUEIRA LÓPEZ, 2019; SANTAMARÍA ARINAS, 2019a). However, in this document it is said that "the circular economy is now an irreversible, global mega trend". According to this affirmation, several "new challenges" are pointed out, that will have to be faced by the new European Commission, chaired by Ursula Von der Leyen for a few weeks now.

It must be noted that the actions proposed by the Plan does not only concern the European institutions, but also the Member States to some extent. Thus, waiting for the approval of new commitments, it seems appropriate to evaluate the set of statutes and regulations adopted during this time.

In Spain such period has been characterized by a high political instability, that could explain the lack of initiatives by Spanish central state's institutions (PUENTES COCIÑA, 2018). However, some Autonomous Regions have taken the lead in that subject, adopting circular economy criteria in several Statutes on climate change and/or waste management. It is the case, in chronological order, of Cataluña, Navarra, Andalucía and Islas Baleares. But it is also the case of Castilla-La Mancha, that has been the first Region to adopt a specific Statute on circular economy (Ley 7/2019, de 29 de noviembre, de economía circular de Castilla-La Mancha).

The Statutes adopted by Cataluña and Navarra have already been the subject of academic papers (DE LA VARGA PASTOR, 2018; RUIZ DE APODACA, 2019), but there is currently no study that addresses whole set of statutes with juridical methodology. This paper tries to fill the gap by offering a critical and a compared analysis of the five Statutes. The objective is to assess the extent to which they incorporate truly innovative intervention techniques, beyond programmatic statements.

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2.A.2. Is circular economy compatible with strong market rules and competition law?

Alba Nogueira

Keywords. Environmental Law, Circular Economy, Market rules, Better regulation, Competition Law, Enablers and barriers.

Since the birth of environmental concern, its impact on economic development has been a constant. The so-called "most relevant paradigm changes" in the EU Law and policies in recent times recapture that debate. On the one hand, the ambitious impulse of liberalization and administrative simplification, especially after the approval of the "Bolkestein Directive"; on the other, its compatibility with the novel Circular Economy (CE) Strategy that seeks to curb environmental collapse. The Circular Economy Strategy was meant to produce a "complete systemic change ... not only in technologies, but also in organization, society, financing methods and policies". CE requires strong public planning and support. A comprehensive view of circular economy calls to go beyond waste and recycling and focus on design, production and consumption. The dynamics of multi-level, public-private and between companies' collaboration, that are necessary for circular economy, can collide with elements clearly prevalent in the current legal order, such as liberalization for the constitution of a European internal market, Competition law or market unit.

The need to study how to fit an ambitious formulation of the circular economy with market and economic rules, scarcely open to environmental or social nuances, together with the central role that innovation should play, can offer a favorable ground for regulatory experimentation. Environmental law can continue to act as a "testing laboratory" for legal principles and techniques, as it did in the past.

This paper will explore how public intervention to boost circular economy, designing out waste and pollution, keeping products and materials in use and regenerating natural systems can find legal obstacles derived from competition law and economic freedoms.

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2.A.3. The first EU circular economy legislative package: more waste law with little legal innovation

Beltrán Puentes

KEYWORDS: circular economy, innovation, waste law

ABSTRACT:

1. **Research object**

The research object of this paper is the Circular Economy Legislative Package of European Parliament and Council of 30 May 2018, integrated by:

- Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste.
- Directive (EU) 2018/849 of the European Parliament and of the Council of 30 May 2018 amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and

accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment.

- Directive (EU) 2018/850 of the European Parliament and of the Council of 30 May 2018 amending Directive 1999/31/EC on the landfill of waste.
- Directive (UE) 2018/852, of the European Parliament and of the Council of 30 May 2018 amending Directive 94/62/EC packaging and packaging waste.

2. Research question

Through the legal analysis of these four directives, we will try to answer the following research questions:

- Firstly, I wonder whether the changes introduced by these four directives represent a real innovation in European waste law. I want to consider whether the package introduces new legal principles or new relevant rules, or whether, on the contrary, the reform is limited to promoting better implementation and greater compliance with the principles that have been in force in waste legislation for decades.
- The second question is whether this was the necessary reform to implement the circular economy strategy or whether it should have taken place in areas other than waste (product design, regulations on products and materials, public procurement, etc.). In other words, I wonder whether this reform is necessary and ambitious enough to boost the innovative solutions that are needed by the circular economy transition.

3. Methodology

The methodology used in this work is purely legal and is based on the analytical and comparative study of the directives under investigation. It analyses, on the one hand, the changes introduced by the European Parliament and the Council in European waste law and, at the same time, compares the innovations finally introduced with respect to the approaches of the previous directives and the European Commission's reform proposals.

4. Results

The main reforms introduced by the May 2018 legislative package are the following ones:

- Definitions alignment: new or clearer concepts.
- Measures to boost the waste hierarchy:
- Use of economic incentives and other measures.
- Establishment of minimum measures in the field of prevention.
- Reinforcement of separate collection.
- Promotion of operations to prepare for the reuse and recycling of waste.
- Measures to encourage the use of secondary raw materials.

- Measures to promote the use of by-products in industrial symbiosis.
- Reinforcement of extended producer responsibility.
- Modification of the system for calculating the achievement of objectives.
- Modification of the content of management plans and waste prevention programmes.
- Increased reporting and monitoring obligations.
- New powers for the Commission.

5. **Conclusions**

- The challenge remains on the effective compliance with existing principles.
- Insufficient impetus in preparation for reuse.
- The relevance of some specific waste streams compared to the irrelevance of others.
- Limited scope and ambition of the reforms.

6. **References**

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2.A.4. Sectoral cross-cutting policy recommendations for the revised EU CE Action Plan (version 2.0)

Jeff Dodick, Yamit Naftali, Dan Kauffman

Key Words: circular economy, *R2π* project, policy packaging, cross-cutting policy, organizing themes, Ecodesign, EPR, Ecolabelling

Purpose and Research Questions

This presentation discuses the process of designing a *Circular Economy Policy Package* that will enable the transition of EU businesses and government organizations towards systemic circularity throughout their value chain, in order to promote a resource efficient economy and society. A policy package is a combination of policy instruments (**PIs**) designed to address one or more policy objectives, in order to improve their effectiveness, while minimizing unintended effects and facilitating the interventions' legitimacy and feasibility in order to increase efficiency. To facilitate the adoption of Circular Economy Business Models (**CEBMs**) in the EU, a policy packaging approach was used, whereby different **PIs** are combined to yield synergetic effects, while concurrently addressing potential contradictions.

Based on this goal the *R2π Policy* team asked: What cross-sectoral CE policies should be recommended to the EU in order to improve its CE action plan (**EUCEAP**) to better promote CE practices?

Methodology

In order to recommend a coherent set of policies to the EU, the R2π policy team first developed policy packages for six material / product sectors[1] in which the widespread implementation of **CEBMs** had been analysed; these included: Construction, Electronics, Food, Plastics, Textiles and Water.

In the first stage all the PIs that are likely to advance the CE in a specific sector were identified. In the next stage, the potential contribution of each PI and its likely implementation "cost" were assessed, in order to identify the most effective PIs; those PIs with the highest potential to both advance circular economy objectives and those PIs whose implementation does not incur excessive cost were retained as part of the initial PI group. Additionally, the potential implementation barriers faced by each of the PIs in the package were identified; concurrently, the stakeholders involved in the decision-making and implementation stages of the PIs were also identified. To this end, both stakeholders who benefit, or do not benefit from each PI were identified. On this basis the sectoral *Basic Package* was formed.

In the next stage, the *R2Pi* team identified the relation types among the PIs while considering the negative, unintended effects by using a causal mapping method, in which relations among PIs were indicated. Thus, the pre-conditions for implementing the most promising, "low hanging fruits" among policies were identified, as well as instruments that may facilitate the CE if enacted with these primary PIs (and thus have synergetic relations with the primary PIs). On this basis, the *Basic Package* was modified into the *Effective package*, which accounts for the likelihood of reaching CE objectives in the most effective way. To this end, several PIs were revised and new policies were included in the sectoral packages.

After completing the *Effective Package* for each sector, commonalities among policies were identified in order to ascertain the key instruments that would facilitate the widespread implementation of the CE. This resulted in **11** cross-sectoral PIs emerging and that R2π is recommending to the revised **EUCEAP**. These 11 PIs were, classified, subsequently among **five** organizing themes found in the environmental policy literature (See: Karp & Gaulding (1995) and their citations; Perman, Ma, McGilvray & Commmon, (2003); and the European Environment Agency website[2]):

1. **Command and Control**: Regulations, permits, enforcement and fines and ownership issues.
2. **Encourage-Voluntary**: Communication, participation and education, nudges and labels.
3. **Integration**: Ensuring environmental goals are cross cutting in non-environmental spheres, as well as across value chains.
4. **Invest**: Investment in infrastructure, institutions, information, assessment, research (via government resources).
5. **Market-based**: Fiscal incentives, grants and fiscal disincentives, charges, tradable permits, deposit refund schemes.

Results

The 11 cross-cutting policies listed below are divided into two groups: (i) new policy additions and (ii) policy extensions. Each policy is also classified according to one of the five organizing themes.

(i) The following **three** new policy additions were recommended by *R2π* to the EU:

1. Create education campaigns aimed at the public and at professionals, raising the awareness of circular economy issues. (Encourage-Voluntary)
2. Integrate CE education programs in existing curriculum at different stages of studies. (Encourage Voluntary)
3. Lower purchase tax or provide subsidies to encourage producers to use recycled materials and reuse /repair products (instead of using virgin raw material to create new products). (Market-based)

The following **eight** policy extensions (based on the current **EUCEAP**) were recommended by *R2π*:

1. Extend *Ecodesign Directive* requirements and increase Extended Producer Responsibility on a wider variety of products. (Command and Control)
2. Make public procurement of CE products a preference. (Command and Control)
3. Create mandated standardisation levels to improve the circular nature of materials and products. (Command and Control)
4. Enforce mandatory waste disposal regulations. (Command and Control)
5. Encourage responsible consumption based on circular economy principles through appropriate labelling. (Encourage-Voluntary)
6. Set specific objectives and targets to ensure reduction of waste (Integration)
7. Design programs for government investment in R&D for circular economy solutions. (Investment)
8. Create platforms for sharing information and promote collaborations to prevent waste of resources and retain the value of these resources in the economy as long as possible. (Investment)

Finally, also demonstrate how our recommendations provide additional value to the current EUCEAP and how they might be implemented within the framework of the upcoming, revised EUCEAP.

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2.B. INNOVATION

2.B.1. Impacto microeconómico das políticas de innovación no sector do medio ambiente: Avaliación da execución do Programa FEDER-Innterconecta do Fondo Tecnolóxico 2007-2013 en Galicia

Diego Sande

Cal é o impacto das políticas de innovación rexionais no sector do medio ambiente en Galicia? É diferente segundo os sectores das empresas?

Os actuais desafíos que o sistema capitalista enfronta están a crear unha conciencia crecente en relación á dirección das políticas de innovación e sobre os efectos que estas causan na sociedade (Pereira & Vence, 2016). A diferenza das innovacións xenéricas, as innovacións ambientais teñen unha identidade particular, xa que constitúen instrumentos cos que facer fronte aos problemas ambientais.

Ao longo do tempo ten habido diferentes definicións para a innovación medioambiental. Gran parte destas fan referencia á utilización dos procesos, produtos e formas administrativas ou de xestión coa fin de reducir o impacto medioambiental (Kemp y Arundel, 1998; Rennings, 2000; Rennings y Zwick, 2003; Comisión Europea, 2008). Para Amores, Martín, Navas & Delgado (2011), as innovacións ambientais consisten no desenvolvemento, aplicación ou introdución de novas ideas, comportamentos, produtos, procesos, procedementos e/ou sistemas organizativos que contribúen á redución do impacto medioambiental e que ademais posibilitan cambios nas normas socioculturais estruturas institucionais. Como sinala a OCDE (2010), se ben non existe un total consenso sobre a extensión do concepto, acéptase xeralmente o feito de que as innovacións ambientais diferéncianse do resto en que: 1) Resultan en reducións do impacto medioambiental, 2) O seu alcance vai máis aló dos límites da organización innovadora, incluíndo fenómenos sociais que posibilitan mudanzas nas estruturas institucionais e na normativa existente.

Cunha gran diversidade de enfoques, a maior parte de achegas que tratan de medir a innovación medioambiental comezan a darse a finais da década dos noventa, sendo posiblemente os traballos máis destacados os realizados na década 2000-2010, o que dá conta da novidade da materia, e o seu interese, especialmente tendo en conta a relación existente entre competitividade e ecoinnovación (Alvarez, Fernández & Romera, 2014).

Como Comunidade Autónoma Obxectivo Converxencia da Unión Europea, Galicia foi beneficiaria del Fondo Tecnolóxico 2007-2013, que mobilizou un volume importante de recursos. De entre as diferentes liñas de actuación deseñadas, centramos a análise nas dúas primeiras convocatorias galegas do programa *FEDER-Innterconecta* implementadas ata 2015 e pertencentes a este "*Programa Operativo por e para el beneficio da I+D+i empresarial*". A análise proposta trata de identificar a repercusión da participación neste programa para as empresas que realizan innovación medioambiental a partir dos principais indicadores dispoñibles (proxectos, fondos percibidos, redes de colaboración, investimento en investigación e en desenvolvemento, evolución do gasto en I+D, etc.). Este impacto amósase desigual en función do campo tecnolóxico dos proxectos e tamén por tipo de indicadores, o que afecta tamén ás empresas que innovan en medio ambiente. Os resultados

obtidos permitirán, tamén, extraer recomendacións para a implementación futura das políticas de innovación medioambiental no tecido empresarial galego.

En canto á metodoloxía empregada, ao centrar a análise nos indicadores de innovación das empresas, o estudo adquire un carácter microeconómico e empírico. Tanto a análise temporal e de interrelación de datos, como os exercicios de análise e síntese con carácter tanto cualitativo como cuantitativo, permitirán alcanzar o obxectivo de medición do impacto para os proxectos de innovación de carácter medioambiental.

A compoñente empírica do traballo parte do cruzamento de datos cuantitativos obtidos de múltiples fontes: estatísticas de I+D do contexto do Instituto Galego de Estatística (IGE) do Instituto Español de Estadística (INE), e de Eurostat, datos Consellería de Facenda da Xunta de Galicia, do Ministerio de Hacienda e da Administración Europea; datos sobre empresas participantes facilitados por CDTI e, por último, datos aportados por ARDÁN sobre indicadores de resultados económico-financeiros das empresas.

Palabras clave

Políticas de I+D+i, innovación medio ambiente, Fondo Tecnolóxico, impacto eco-innovación en empresas, desenvolvemento rexional.

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2.B.2. Specificities of environmental innovation dynamics in service firms. The French case

MERLIN-BROGNIART Céline, NADEL Simon

Keywords : environmental innovation ; services ; French case

The ability to innovate is an essential component of business survival. The tertiarization of the economy has contributed to changes in business innovation strategies, which seek to develop more flexible organizations able to respond to rapid changes in our societies. On the other hand, the links between manufacturing and services have strengthened over time, so that innovations are spreading across sectors.

In addition, more and more companies are choosing environmental innovation to renew their innovation dynamic. Environmental innovation (EI) is generally defined as the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organisation (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resources use (including energy use) compared to relevant alternatives (Kemp, Pearson, 2007). Formerly limited to eco-industries and therefore to technological innovations, this definition has evolved to take into account non-technological innovations, more appropriate to the types of innovations in service activities.

Limited research has been done on the issue of EI in services. Indeed, the work analyzing EI has so far, with few exceptions (Cainelli, Mazzanti, 2013, Desmarchelier et al., 2013, Djellal, Gallouj, 2015), mainly focused on industrial activities. In this paper, we aim to identify the specificities of environmental innovation in French service activities.

From a theoretical perspective combining the literature on the economics of services and works from economics of innovation, we aim to study the determinants of environmental innovation in service activities. More specifically, we will analyze the respective role of investment in knowledge, through investment in training and R & D; the characteristics of the firm, as well as the role of sources of information and cooperation for innovation in environmental matters. We are also interested in the regulatory dimension and its influence on the environmental performance of service activities.

• Methodology

This analysis on the characteristics that are conducive to the development of eco-innovations is tested using individual data on innovation. An econometric model is built using the “Community Innovation Survey 2008” (CIS 2008) that is representative of all French service activities. This survey gives information on firm’s innovation behavior, on the adoption of different kinds of innovation and on the number of eco-innovations developed by firms, during the period 2006-2008.

A zero inflated negative binomial model is developed to highlight the determinants of environmental intensity in service activities.

• Expected results

The first results show that environmental innovations in services are integrated into both technological and non-technological innovations.

The specificities of EIs in service activities in relation to manufacturing firms concern environmental benefits. Environmental innovation in service activities are associated with peculiarities in firm size and sources of information and cooperation that carry EI services activities compared to industrial firms. Also, even though the implementation of R&D in service activities has no impact on the development of a unique EI, it has an effect on the intensity of environmental innovation. Conversely, regulation has an impact on the implementation of EI, but does not affect intensity of environmental innovation in service activities.

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2.B.3. El papel de la eco-innovación en el cambio hacia una economía circular: una aproximación empírica del perfil de las empresas eco - innovadoras españolas

Karen Hinojosa, Ángeles Pereira

Resumen

En el marco del debate actual sobre la insostenibilidad del modelo económico de producción y consumo lineal, la economía circular surge como un paradigma alternativo que busca transformaciones industriales regenerativas orientadas a lograr una producción y consumo sostenibles (Korhonen, Nuur, Feldmann, & Birkie, 2018). En su aceptación más extendida, la economía circular es definida como un sistema industrial restaurador o regenerativo por intención y diseño que tiene como objetivo mantener la utilidad y el valor de los productos, componentes y materiales durante el máximo tiempo posible (EMF, 2013). El eco-diseño y la eco-innovación han sido reconocidos como instrumentos clave para la puesta en práctica de la economía circular (de Jesus, Antunes, Santos, & Mendonça, 2016; Vence & Pereira, 2019). Esta comunicación tiene por objetivo ofrecer una aproximación empírica del perfil de las empresas eco-innovadoras españolas, así como analizar la relación entre el diseño y la eco-innovación. Se trata de un trabajo inicial que forma parte de un proyecto más amplio orientado a determinar la relación entre eco-innovación y economía circular.

El diseño es central ya que puede afectar a distintos procesos durante el ciclo de vida del producto / servicio. Al actuar al inicio de la cadena de valor, puede determinar la durabilidad de los productos, laselección de recursos y componentes menos dañinos y prever su sustitución, actualización, reutilización, restauración, remanufactura y reciclaje de alta calidad; además de contribuir con ciclos de materiales más limpios (EEA, 2016). La eco-innovación consiste en "la introducción de cualquier producto, proceso, cambio organizacional o solución de marketing nuevo o significativamente mejorado que reduzca el uso de recursos naturales y disminuya la liberación de sustancias nocivas a lo largo de todo el ciclo de vida" (EIO, 2011, p. 9). La eco-innovación impulsa el cambio de los modelos de negocio actuales contribuyendo con el rediseño de productos y servicios, la reconfiguración de las cadenas de valor, la transformación en la forma en que interactúan los ciudadanos con los productos (propiedad, arrendamiento, uso compartido, etc.) y el desarrollo de mejoras en los sistemas para la distribución de valor (ciudades sostenibles, movilidad ecológica, sistemas de energía inteligentes, etc.) (EIO, 2014). Por tanto, tiene potencial para favorecer el cambio sistémico hacia modelos de negocio,

producción y pautas de consumo más sostenibles, en línea con la economía circular(de Jesús et al, 2016).

A partir de los datos relativos a 4.518 empresas del panel español de innovación tecnológica PITEC (2014-2016), en esta investigación se comparan las características de empresas eco-innovadoras y no eco-innovadoras, mediante el análisis de correlaciones. Las empresas eco-innovadoras son aquellas que han realizado innovación en los últimos dos años y que han tenido como objetivos relevantes:menores materiales por unidad producida, menos energía por unidad producida, menor impacto ambiental y cumplimiento de los requisitos normativos medioambientales, de salud o seguridad.

Los resultados obtenidos muestran que, en promedio, las empresas españolas que realizan algún tipo de eco-innovación son de tamaño mediano y con un volumen de negocio elevado. El alcance de su mercado geográfico es nacional e internacional, y se concentran principalmente en el sector de manufactura y servicios. Los tipos de innovación más dominantes son las de producto y de organización. En términos generales, el principal input de las empresas eco-innovadoras es el gasto en I+D, seguido del gasto en actividades realizadas para la introducción de innovaciones en el mercado y el gasto en formación. En cambio, no se evidencia una relación importante entre el gasto en diseño y el desarrollo de una eco-innovación. Por otro lado, se identificó que los factores facilitadores de la eco-innovación son de origen interno: empleados y departamentos y de origen externo asociados a clientes, competidores, proveedores y stakeholders. Las principales barreras que obstaculizan a las empresas eco-innovadoras son la falta de fondos yde acceso a fuentes financieras, así como los elevados costes de inversión. El contraste de Chi-cuadrado permite concluir que existe asociación estadísticamente significativa entre ser empresa eco-innovadora y cada una de las variables de estudio. Con respecto al análisis V de Cramer se muestra que para todas las variables es estadísticamente significativa, con un grado de relación moderado o débil.

Palabras clave

Economía circular, eco-innovación, empresas españolas, barreras, inputs

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2.B.4. Putting Responsible Research and innovation (RRI) in practice: the case of the WooBAdh project

Sara Bello, Sara. González, Gumersindo Feijoo, Maria Teresa Moreira

Keywords: Responsible Research and Innovation, ethics, circular economy, waste valorization.

Intensive research is currently underway to successfully convert lignocellulosic biomass into profitable products, paving the way for a sustainable bioeconomy. The circular economy approach in the field of bioproducts considers the valorization of residual fractions as a platform for high added value products.

In this research context, the WooBAdh project aims to produce bioadhesives with tailored functionalized lignins and tannins derived from wood or other vegetable sources with the objective of replacing formaldehyde in wood adhesives. Enzymatic oxidation will allow to functionalize the selected fractions for further polymerization expecting an overall reduction of volatile organic compound (VOCs) emissions.

In issues of bio-based circular economy, where synthetic biology and metabolic engineering are relevant areas addressed, the results of the project may suppose a predicament in the steps towards a sustainable bioeconomy in line with Europe's 2030 goals. Therefore, it is not only interesting to address innovative processes from a techno-economic and environmental point of view, but it is also necessary to take a further step considering the values, needs and expectations of society as main objectives. This will be done through the application of the Responsible Research and Innovation (RRI) methodology. This approach has recently been integrated into EU research projects and its practical application is still under development. However, what is clear so far is that the implementation of the RRI must involve all partners considering and applying its key dimensions: i) governance, ii) public participation, iii) gender equality, iv) science education, v) open access and vi) ethics. The main conditions for the implementation of the RRI are anticipation, reflexivity, inclusion and responsiveness, all in a transparent, interactive and proactive manner (Figure 1).

Implementation will first be carried out by providing RRI guidelines to the scientists in the consortium on the main strategic topics mentioned above. This ensures that all research activities are carried out in accordance with the RRI guidelines. The monitoring of project results against RRI will be based on defined qualitative or quantitative indicators. In this respect, the European Commission has taken the first steps by proposing some indicators to analyze performance in each of the key dimensions of RRI.

In terms of governance, possible indicators are the development of actions focused on the promotion of RRI at national and EU level and the investment in RRI activities within the project. In terms of public participation, indicators could be media coverage, impact of research in terms of social media/web info, as well as participation of scientists/stakeholders in communication activities and dissemination of results at all levels of education. Gender equality will be monitored as the percentage of partner institutions that include a gender equality plan, document specific actions aimed at changing aspects of their organizational culture that reinforce gender bias, or provide training/support to researchers regarding the analysis of gender dimensions. For science education, possible monitoring indicators are the inclusion of a training initiative or other educational resource in the project or the funds allocated to training or other educational resource in the project. In terms of open access/open science, one indicator could be the number of documents published in open access during the project. Finally, for ethics

monitoring, one possible indicator is the number of documents generated during the project related to research integrity policies and measures.

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3.A. INDICATORS AND TOOLS FOR CIRCULAR ECONOMY

3.A.1. Sectoral and productive structure of the circular economy in the European Union

Leandro Llorente, Xavier Vence

KEYWORDS

Circular economy / sectoral structure / employment / wages / productivity / capital

ABSTRACT

The socio-economic implications of the paradigm shift towards a circular economy (CE) are currently scarcely explored. The most widely disseminated literature on the subject is focused on its effect on economic prosperity, while its relationship with sustainable development in terms of inter- and intra-generational equity remains a secondary issue. (Hobson 2016; Kirchherr et al. 2017; Murray et al. 2017). This is partly due to the greater attention devoted to the promotion of CE in the field of business and to the analysis of its technical dimensions, in relation to the rather small amount of critical studies from the social sciences. (Gregson et al. 2015; Korhonen et al. 2018). The impact in socio-economic terms is presumed to be positive beyond the existence of empirical evidence, based on the assumption that the shift towards CE is a "win-win" process. (Hobson 2016).

In the case of the European Union, the studies addressing the issue focus mainly on the estimation of growth in GDP and job creation potentially resulting from an increase in the participation of economic sectors dedicated to the preservation of value (recycling, repair and reuse) (Wijkman and Skanberg 2015; Morgan and Mitchell 2015; Jensen-Cormier, Steph; Smith, Robert; Vaughan 2018; Cambridge Econometrics et al. 2018). However, the manifest qualitative differences between these economic activities suggest disparate socio-economic impacts. At the same time, analyses tend to neglect other fundamental issues related to social welfare, such as the effects on income distribution and working conditions. (Llorente-González and Vence 2019).

In this sense, this paper aims to make an empirical contribution to the study of the socio-economic implications of the transition to CE. In order to do so, we will inquire about the sectoral structure and the particular economic characteristics of the activities considered to be linked to CE. For this purpose, the available information was collected on the number of firms, total value of production, added value, gross operating surplus, total billing, remunerations, gross investment in tangible goods and persons employed with and without salary, in 2016, from the 24 productive branches that make up the recycling, repair and reuse sectors in the European Union. The 24 activities were then classified into homogeneous groups according to two proxy variables reflecting capital intensity and labour productivity. Finally, the relative participation and the main economic characteristics of each group were analysed.

The results confirm that the group of activities considered to be linked to the CE have a relatively low presence within the European economies. More than half of the employment and firms in these sectors are concentrated in repair and maintenance activities with wages, productivity and investment per worker levels significantly below the average of the European economy, involving mostly small establishments and micro-entrepreneurs with a very high incidence of unpaid work. The results evidence, in the first place, the marginal status and the lower value assigned by the market to the activities dedicated to the conservation of resources, thus emphasizing the need for active intervention. Secondly, they call for reflection on the choice of economic indicators, in order to reliably

capture the complexity of the socio-economic impact of a potential expansion of the economic sectors related to CE as they are currently structured.

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3.A.2. Integrating the circular economy paradigm into the global environmental sustainability: a framework of absolute environmental indicators

Brais Suárez - Eiroa, Emilio Fernández, Gonzalo Méndez – Martínez

Keywords: circular economy; indicators; sustainable development; production perspective; socio-ecological system.

Abstract

Since the sixties, there is a growing concern regarding the anthropogenic impact on the environment. Nevertheless, global environmental pressures have been increased considerably, and now it is common to hear policy-makers and general society talk about the ecological crisis and the climate emergency. Nowadays there is a scientific consensus about the need for defining the safe operating space (SOS) for human activities within the planet due to the existence of tipping points in our planetary system (Steffen *et al.*, 2015). The planetary boundaries (PBs) framework addresses this question by estimating nine planetary limits that define the SOS. The SOS should be understood under the global socio-ecological system (SES) perspective due to the fact that global interconnections and cross-scale feedbacks connect human activities from any part of the world with environmental impacts in other Earth regions (Liu *et al.* 2007). Therefore, the different social actors should be aware of their own responsibility for the global concerns, and this include individuals, enterprises and governments.

The final reason of the ecological crisis is the way humanity produce and consume, which is resulting in a demand of ecosystem services exceeding supply. Circular economy (CE) can be define as a production-consumption system that enable decoupling the economic development from the environmental impacts (Korhonen *et al.*, 2019). Nonetheless, increasing circularity and efficiency does not mean environmental sustainability has been achieved due to the fact that relative indicators mislead important information about the real environmental impacts (Suárez-Eiroa *et al.*, 2019).

Taking all of the above into consideration, CE should be integrated under the sustainable development paradigm and the SES perspective, global responsibilities should be distributed to the different social actors and absolute indicators should be used to measure the environmental performance of the CE.

The aim of this work is to transfer the PBs to the different productive sectors and companies of any country in order to enable measurement of the final performance of a CE system. From this perspective, circularity can be used as a proxy of environmental benefits, but the final performance of the CE system needs to be measured by absolute environmental indicators.

Current methodologies to transfer PBs to companies and sectors mislead important information, such as temporal responsibility of accumulated impacts or the responsibility of the region they belong (Ryberg *et al.*, 2018). The proposed methodology of this work intends to fill this gap. Countries can be considered the starting point to transfer PBs to lower scales due to national governments have direct competences with the rest of social actors within the country. National boundaries are calculated from the consumption perspective. Subsequently, national boundaries are calculated from the production perspective. Outcomes are disaggregated by productive sector based on their contribution to the national footprint from the production perspective. Sectoral boundaries are later disaggregated by companies based on their contribution to the sectoral GVA. Furthermore, boundaries can be also transferred to industrial parks by adding the boundaries of the companies that lie within the park.

The methodology has been applied in four case studies: 200 sectors in Spain, three companies of the same sector, a subsector of an Autonomous Community, and an industrial park. Moreover, nine environmental categories are covered. The results enable the discussion of the limitations and practical applications of the methodology, as well as the usefulness of these environmental indicators to measure the final performance of a CE system.

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3.A.3. The role of ports in industrial ecology and circular economy: construction of a dashboard of indicators

Blandine Laperche, Sonia Veyssiere, Le S.T.K., J. Gruwez, G.Cotonnec

Famous experiments of industrial ecology often take place in port regions (see for example the case of Kalundborg in Denmark (Ehrenfeld, Gertler, 1997) and Dunkerque in France, Gallaud, Laperche; 2016; Kasmi et al., 2017). However, the analysis of the specific role played by ports in the development of industrial ecology or more largely in circular economy experiments has not been made extensively so far.

Circular economy and industrial ecology can constitute specific levers for the development of industrial-port regions in looking for differentiating strategies to gain advantages in competition, and such areas may be well adapted to industrial ecology and circular economy experiments (Mat et al., 2015; Cerceau et al.2014; Ezzat, 2016; Beyer, Lacoste, 2017 ; Strale, 2017 ; Amenta, De Martino, 2018 ; Carpenter et al., 2018; Karimpour et al, 2019)

Being sites of trade and transformation of fossil fuels, they are (especially industrial ports) thus at the forefront of industrial change efforts aimed at reducing greenhouse gas emissions and at diversifying the energy supply. Given such importance of industrial ports, sustainability has become a strategic axis for their development (Acciaro et al., 2014). Some studies have focused on modelling ports metabolism, in order to optimize exchanges of flow, in a circular economy prospective (Strale, 2017).

Being Ports are places of production, transformation and exchange of energy (renewable, fossil), materials (steel, excavated earth and sediment), and manufactured goods. They are characterized by a diversity of activity (steel production, metalworking, petrochemistry and chemistry) and an industrial structure where large industrial facilities and subcontracting small and medium-sized businesses are crowded together, industrial/port areas lend themselves to the creation of industrial symbioses constructed from substitution and mutualization flows. These flows may encourage synergies within and between sectors and generate agglomeration effects favorable to the diversification of activities based on “related variety” (Kamsi, 2018, Kasmi, 2020). Moreover, ports can also facilitate the circulation and repurposing of flows of materials and energy at the international level, when waste and by-products are overflowing in one place and deficient in another one. However, these dynamics necessitate the raising awareness of the place that port areas could occupy in a circular economy strategy and specific actions from port authorities (Cerceau et al., 2014; Hollen et al. 2015).

In this paper, our aim is to highlight the role of ports (as spatial planners, developers of economic activities, managers of flows) in Industrial ecology and Circular economy by proposing a dashboard of indicators for analyzing, evaluating and monitoring this implication. This dashboard will include either traditional indicators associated with industrial ecology/circular economy (economic, social and environmental impacts) or more specific indicators relating to the effectiveness of port activities in industrial ecology projects. The latter could relate to the contribution of "port resources": land, services (including governance), flows to the development of industrial symbiosis, etc. Therefore, our approach aims at complementing other sets of indicators that are developed to analyze in port cities, but relying on traditional indicators of impact (Gravagnuolo et al.2019). The dashboard indicators are constructed on the basis of a literature review about the most relevant indicators (from Ademe in France, from the European Union, the MacArthur Foundation and as selected set of academic works), in parallel with the co-creation of ad hoc indicators intended to highlight the port authority's contribution to the development of industrial symbioses.

Applied to the case of Dunkerque France, this dashboard can be used by the port’s authority as a territorial marketing tool, as well as a governance tool and will disseminate the good practices. It will also serve as a comparison framework to analyze the contribution of other industrial ports in circular economy experiments. This presentation will be based on the first results of this research program, supported by the Grand Port Maritime of Dunkerque.

Key words: Ports, industrial economy, circular economy, indicators

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3.A.4. Towards a methodology to define and adopt production systems lifetime extension strategies

Andrea Barni, Silvia Menato, Alessandro Fontana, Marzio Sorlini

1. **INTRODUCTION AND OBJECTIVES**

The transition towards a circular economy in the industrial sector is part of the future European Agenda for a more sustainable economy, confirmed by the recent release of the 2018 Circular Economy Action Plan[1]. Increased interest on the theme by all industrial stakeholders (companies, policy makers and sectorial associations) is unveiled by case studies to demonstrate benefits from

applying to industrial production circular approaches, such as long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling, and upcycling, all closing the loops and saving resources and wastes.

This is particularly true for those manufacturing and processing industries that use complex manufacturing machinery, often made of expensive and critical components whose conditions need to be systematically monitored to avoid unplanned production downtime and to reduce operational expenses. On one side company's tolerance for long periods of downtime is low, thus solid maintenance plans are necessary, on the other side highly skilled technicians are needed for maintenance and repairing of such equipment (Mehmeti, 2018). Main common problems leading to the downtime period are an initial not correct calibration of the machine during the installation phase, due to not complete understanding of the operator's manual, the occurring of overload of machines, leading to system failure, and scarce maintenance. These problems can be reduced by properly training the operators, conducting frequently inspections and maintenance and keeping the machines clean, but there is a turning point when the company decide to replace the entire equipment instead of extending its life, usually linked to costs and the profitability of the actions to be performed (Erkoyuncu, 2017). The replacement decision is conditioned by: the data availability on the status of the components to be maintained, repaired or substituted; the availability of technologies to perform efficiently in-site inspections of critical components and equipment functionalities; the adoption of life cycle thinking to support analyses and decisions on industrial equipment life time; potential pros and cons deriving from replacing parts with new or used technologies: availability of latest technology, guarantee of quality and safety, reduction of maintenance costs, increased capacity; the possibility to certify repairs and substitutions.

In sake of this, (still few) manufacturers today offer a set of equipment management services to prevent failures and support customers by offloading maintenance tasks, or provide leasing plans to their customer, benefitting from the service product system business model and properly managing the maintenance of components extending equipment lifespan (European Union, 2017).

Such actions of components repairing, substituting and extending machines life time through maintenance programs, can be traced back to the circular economy approaches as possible way of closing the loops (Webster, 2017). Nevertheless, these actions are still not adopted in a systematic way:

- in most cases, maintenance plans are not "optimized" on the basis of the actual status of components;

- substitution of components is generally not preventive but corrective;

- sensors and technologies for in-site inspections have still not been installed in most cases, hindering predictive decisions on the actions to be taken.

Objective of the study is to understand in a systematic way which are the elements that can support or affect the adoption of circular economy-oriented assets management strategies, and deriving a methodology to guide end users in the understanding of the best-suited approaches to maximise manufacturing systems lifetime.

2. **METHODOLOGY**

Refurbishment and remanufacturing are able to restore the required reliability of a system at a lower cost than installing a new system, and to recovery value at the end of a system lifetime in order to extend its original lifespan. Both these practices meet the circular economy strategies to keep in use

and in the loop materials and products, but the most efficient way of implementing one of these depends by the stakeholders belonging to the system value-chain, the existing processes to be renewed, and by the available data on the actual status of components. The lifetime extension of existing systems can be achieved by acting at sourcing level (with the upcycle of dismissed products), at manufacturing stage (refurbishment or remanufacturing), in the distribution phase (the possibility to re-sell or share the product), and in the use phase (maintenance services). A strategy is needed to define the right phase to act, the stakeholders involved and, the materials, components and processes to "improve".

Within the context of the European project RECLAIM, a Strategy Definition Canvas has been developed to guide the characterization of the lifetime-extension strategies identified both from literature and directly from the field as the current industrial practices. The canvas is constituted by fields covering the aspects to be considered in order to characterize lifetime extension strategies: approach (resale, servitisation, preventive maintenance, …), involved lifecycle phases (redesign, manufacturing, distribution, use), involved stakeholders (suppliers, service providers, customers, …), stakeholders' contribution (customer share machine data), enabling technologies (sharing platform, new recycling technologies, …), End of Life management (e.g.: reuse 70%, recycle 30%), circular business model adopted (lifetime extension, circular supplies, …).

3. RESULTS AND CONCLUSION

The developed canvas has been validated in the woodworking large production line of a Swiss company, supporting the development of a set of what-if scenarios for machinery refurbishment and upgrade options in the analysed plant. The results allowed to define a digital retrofitting plan supporting the re-introduction in the production site of a dismissed machine by leveraging on: i) integration of a distributed sensor network supporting monitoring of product quality and identification of the causes of deviation; ii) development of a dedicated digital twin of existing machinery on the company shop floor supporting the identification of incumbent failures and machine breaks; iii) adoption of a simulation model supporting the rescheduling of production batches according with optimized manufacturing capabilities. Benefits in terms of level of extension of existing machinery lifetime, capacity upgrade to monitor existing processes to optimise machinery use and increase production flexibility, are still under evaluation.

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3.A.5. “Zerø”: strategic tool for corporate circularity

Miguel Varela, Iago Elizechea

Abstract:

Presentation of ZERØ, a digital platform developed by Teimas Desenvolvemento S.L. (Spain), a technology-based company, pioneer in creating and deploying business solutions and strategic tools specifically designed for sustainability and circular economy. Founded in 2008, Teimas relies on an solid experience and expertise in the development of technology and innovation for public and private entities in the recycling and circular economy field. ZERØ undertakes the challenge of helping to drive a greater circularity in corporations.It optimises and automates corporate processes for resources and waste management, transforming operational data into key business indicators in order to improve the circularity strategy of companies.

Key words: circular economy, software platform, corporate circularity, resources and waste management.

1. Introduction: Waste management in the European Union (EU)

The Circular Economy (CE) is a new economic paradigm presented as an alternative to the current lineal model of production and consumption, with the potential to solve environmental challenges, while opening up business opportunities and economic growth.

In recent years the CE model has become a priority in the policies of the EU. In this context, the EU has developed an extensive environmental regulatory framework that increasingly affects the transparency and traceability of industrial waste management. These regulations establish a system of “Extended Producer Responsibility” [1] that obliges the producer to maintain responsibility for the waste until it final treatment.

In order to comply with the waste management obligations, companies have to adopt operational processes that involve the generation of certain indicators, as well as the preparation and custody of documents to support the traceability of these processes.

In this regard, innovation becomes the key element to achieve the transition to a CE: waste producing companies need to equip themselves with adequate information systems in order to efficiently and cost-effectively support the waste management process in accordance with legal regulations. In addition, it is estimated that compliance with waste legislation can have a high impact on the gross added value of the companies.

2. Zerø: Circular economy platform

ZERØ, developed by Teimas Desenvolvemento S.L.[2], arrives as a solution for sustainability management. It isavailable as SaaS, as well as a license sale that can be installed on other servers. With regards to SaaS, once ZERØ has been configured according to the characteristics of the client, it is hosted on Teimas servers in the cloud, and a support service is provided to the company.

2.1. Implementation

The implementation of ZERØ in a company involves: consultancy and functional analysis (capturing waste data in order to configure the tool); development and setup (elaboration of a functional system, adapted to the needs of the company, including the integration with other company's systems on demand); launch of ZERØ helpdesk for the preventive, reactive and legal maintenance of the solution; and, optionally: adaptations, customizations,integrations or developments for the company.

Moreover, either Teimas or its associated partners will be able to offer an operation service (data entry, information review, and audit, among others).

2.2. ZERØ development stage

ZERØ is in a development phase, starting in March 2018. The first operative version of ZERØ was presented on September 2018. For its development, Teimas has relied on its more than 10 years experience as developer of following ICT solutions to the waste management sector: Teixo [3], a framework aimed at implementing software solutions forwaste managers and carriers; Gaia [4] and Singer [5], 2 e-government platforms for the control of environmental traceability; and, finally, GReTel [6], a tool used by the Spanish corporation Telefonica to produce registers of all the waste generated in its work centres, regardless of the country in which they are located and their activities (office, base stations and R+D+i centres). This solution generates useful information such as key performance indicators, reuse ratios, waste recovery and recycling, among others.

2.3. ZERØ key features

ZERØ is up-to-date with regulatory and process requirements for sustainability management. It is compatible with corporate control, management and supply chain systems, and instantly accessible from any remote device.Moreover, it is multi-user, multi-business, multilingual and multi-country. Besides, this digital tool brings together, aligns and optimises the corporate processes of operational, documentary and financial waste management, providing internal management to centres, production units and material flows, as well as supervision of external suppliers.

In addition, ZERØ enables instant access to data repositories, and the creation of reports that can be exported to the most common formats, ensuring documentary traceability and compliance with legal regulations on environmental matters. In this sense, it allows the corporations to effectively build, automate, and visualize business and progress indicators, as well as executive dashboards. Moreover, it assists in the preparation of inspections, audits and reports on sustainability and corporate social responsibility.Fig.1: Example of KPIs displayed on ZERØ dashboard, as circularity, hazard level and treatments.

As a result, the data collected by ZERØ provide information for the Social Responsibility reports of the corporations, and improve the definition of the sustainability strategies and policies, with impact as well on the competitiveness of the company.

3. Conclusions

Taking into account the complex legal frameworks posed by the transition to the CE, the requirements to ensure the transparency and traceability of the waste management by the companies have increased, becoming a challenge in terms of fulfilment of legal obligations, administrative processes, costs and efficiency. Companies with no procedures at a corporate level will require as well an efficiency improvement, in order to consolidate and monitor the whole process. In this context, waste management will require new technologies, processes,services and business models in order to obtain data and information for decision making and resource allocation.

Systems as ZERØ represent an opportunity to ease the whole procedure and improve the responsiveness to the demands required by the recycling and circular economy fields.

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3.B. INNOVATION FOR CIRCULAR ECONOMY: TECHNOLOGY AND SOCIAL DIMENSION

3.B.1. Institutional and social dimensions of circular economy: The case of methanization

Nabila Arfaoui, Christian Le Bas, Marie-France Vernier, Linh-Chi Vo

Abstract

The literature on circular economy (CE) has become increasingly prominent in recent years. An important stream of research is this literature focuses on identifying the drivers and the barriers of successful CE. On the one hand, perspectives are diverse with regard to the determinants of moving forward circular economy (Fratini et al., 2019). There are skeptical points of view regarding the applicability of the conventional mechanism in a market economy such as price, profit and incentives. The different definitions and understandings of circular economy create difficulty for different types of stakeholders to participate in the process of implementing CE systems (Flynn and Hacking, 2019). Scholars have come to agree on only two points: there is no one best way for implementing the CE **(**Millar et al., 2019), and regulations and standards play an important role in driving the transition towards CE (Flynn and Hacking, 2019). On the other hand, there are hard and soft barriers to the CE (de Jesus and Mandonça, 2018; Rizos et al., 2015; Ranta et al., 2019). Hard barriers include technological challenges, high initial investment costs and market uncertainty, imperfect information lso Rizos et al., 2015). Soft barriers are institutional and regulatory context, social and cultural factors such as cultural acceptance of CE and customer preference for new products.

We argue that a gap in this literature is the lack of understanding about the governance system and the interaction among stakeholders as drivers and/or barriers of the CE. CE implementation requires the cooperation of different stakeholders. For a successful CE, there must be answers to questions related to the governance of different stakeholders such as: who gains/lose the most from the CE system? who is the leader? who controls? who make contribution? and the like (Korhonen et al., 2018).

In order to address this research question, we studies five methanization projects carried out in Coutances, Gaillon, Percy, Vire, and Le Mené in the Normandy region. Our research project was funded by the National Program Research PSDR (INRA, Administrative regions of Normandy, Britain and Pays de la Loire). During 2016 and 2018, we conducted 40 semi-structured interviews with different actors of these five projects. The objectives of the interviews were to 1) identify the barriers and the enablers of the projects and 2) understand their governance system. The interviews were recorded and then transcribed for analysis. The project actors participating in our study include local habitants, local farmers, project leaders, companies specializing in renewable energies production, and territorial authorities. From 2018 until the time of writing this article, we continued collecting articles published in local media, such as newspapers, magazines of local authorities, which provided updates on these 5 methanation projects. This secondary data source provided us with additional information on the outcomes and the progress of these projects.

We used the socio-ecological system framework developed by McGinnis and Ostrom (2014) as a guideline for our analysis. The framework highlights the socio-cultural, institutional, biophysical, and governance context constituting a socio-ecological system. The components include resources

systems, governance systems, resources units, and actors. Situated at a broader level are the social, economic, and political settings, and related ecosystems. At the heart of this framework is the action-situation, in which individuals interact with each other and thus jointly affect outcomes. The framework serves as useful foundation for microanalysis of different dimensions of system functioning and how they influence the achievement of sustainability goals across different systems, levels, and scales (Partelow, 2018).

Our findings show that the five projects have different degrees of success and failure. The first project started in Percy, but never materialized. We name it the *abandoned project*. The second one is in Coutances. We call it the *struggling project*, because it has been in conception since 2010. The third project is based in Vire. As the methanization unit is expected to start the operation in 2020, we call it the *succeeding project*. The fourth project is in Gaillon. It started operation in 2014 and has achieved financial success. However, it is currently being under notice from the legal bodies because the methaniztion unit generated the bad odor that had negative impact on daily life of the local community. We name it the *project with social failure*. Finally, the project in Le Mené is one of the very first projects of methanization in France. It started in 2010 but did not generate positive margin. It also suffered strong resistance from local habitants due to several technical issues that led to pollution in the local environment. The project ended up stopping the operation because of a big fire accident. It is called the *project of complete failure*.

Based on our analysis, the diversity in terms of success can be explained by three factors related to the governance of these projects: governance system, interaction between stakeholders within the governance system, and their relationship. The governance system is characterized by the number of actors and their collective choice rules, which indicate the formal and/or informal rules related to stakeholder participation. The interaction between stakeholders includes the process of deliberation to make collective decisions, the self-organizing activities representing collective activities to govern the methanization project, and information sharing to keep actors abreast of developments. The relationship between stakeholders is seen through their conflict and mental models. Our findings show that these three factors are crucial in determining the success or failure of a CE project.

Keywords: circular economy, methanization, socio-ecological system framework,

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3.B.2. Social aspect of distributing recycling via additive manufacturing: exploratory analysis of recycling intention at the International fair of Nancy

Anamaria Barrera, Fabio Cruz Sanchez, Hakim Boudaoud , Sina Leipold

Additive Manufacturing (AM), also known as Additive Processing Techniques, Rapid Prototyping Technologies (RP) or 3D Printing, is changing how products are conceived, designed and manufactured. These techniques use a computer to store and process geometric information and to drive the fabricator deposition of feedstock that is processed as points, lines or areas to create a part in 3D space (Bourell et al. 2017). Its application covers diverse domains, varying from engineering to dentistry, passing through physics, arts and humanities because of the variety of materials that can be employed (polymers, ceramics, metals and concrete) and the versatility of the product design. Usually, product design is performed by Computer-Aided Design (CAD) without any extra tool, which facilitates the production of parts with complex geometry diminishing its production time (Wendel et al. 2008). Polymer materials are a key area in the field of AM and are by far the most used material type (Ligon et al. 2017; Bourell et al. 2017). Moreover, the continuous reduction in the price of 3D printers makes easier their acquisition and therefore, increases their possibility to take stand in the manufacturing on medium and large scale next to conventional polymer processing technologies such as injection molding and subtractive techniques (Ligon et al 2017).

These recent developments on additive manufacturing could play an important role in the transition from a linear to circular economy because of its direct (or distributed) manufacturing capabilities. Circular economy concept tackles a central societal issue concerning the current principle “take, make, dispose" (lineal economy) and its negative effects in terms of the depletion of natural resources, waste generation, biodiversity loss, pollution (water, air, soil) and sustaining economic benefits (Geissdoerfer et al. 2017). As in 3D printing it is possible to extend the life of the product through its redesign, repair, remanufacturing and upgradability, this technology has demonstrated to apply the concepts of CE (Despeisse et al. 2017). Moreover, the recyclability promises one largest opportunity of integrating CE in the plastic’s value chain (Simon, 2019). Strategies of open and closed-loop recycling as well as upcycling and downcycling can open up to broaden the CE. In any case, the validation of plastic as a secondary raw materials in different industrial processes is the main challenge for CE.

Distributed recycling via additive manufacturing refers to use local material supply that boost recycling with highly distributed sources of consumer waste (Hart et al. 2018). This could be an approach to supply distributed fabrication initiatives. A more distributed material market may enhance the use of smaller concentrations of natural resources, leading to a reduction in transportation emissions and the environmental impact of intensive resource exploitation. Hence, AM can be seen as a recycling tool to reuse a thermoplastic waste material, and then influencing the structure of material supply to improve resource consumption efficiency. Indeed, using the open source technology is an important driver to boost local recycling process.

From a technical perspective, there have been several studies in order to validate the technical feasibility of polymer recycling (Cruz Sanchez et al. 2017) and applications using recycled printed parts such as drones (Mosaddek et al 2018), wood furniture (Pringle et al 2018) and small accessories (Zhong et al 2018). However, waste sorting at the source is an essential assumption for distributing recycling. Improvements in waste at source could improve urban sustainability and this strategy relies on advocacy and citizens' awareness and policy implementation. Hence, there is a gap in terms of citizens' awareness in this exploratory recycling approach. Moreover, one key aspect in order to facilitate the technical dimension of recycling is the social intention for recycling actions and

purposes. Indeed, the development of distributed circuits for plastic recycling could have the advantages of being economic as it implies low-cost equipment, and also environmentally clean as they permit the reduction of transportation (Ojala, 2008). The main hypothesis is to evaluate if AM could be a driver for the citizens to sort their waste at source given the potential of AM to fabricate objects from recycled plastic.

Thus, the research question is how to evaluate from the social aspects the possibility of recycling via additive manufacturing in order to implement local demonstrators to foster the circular economy ambition at a territorial level. Here, social aspect will be focused only on behaviour analysis. Several behavioral theories have been proposed with the aim of predicting the human behavior towards a determined action. For instance, the theory of human motivation is one of the most influencer theories in the study of human needs. It is concerned about the individual and those who have a close relationship with him, that is to say, family, friends, co-workers, etc. (Datta, 2013). Furthermore, the particular case of recycling behavior has been analyzed under the theory of planned Behavior (TPB). TPB was proposed to analyse individual' behaviours theoretically by the integration of attitudes, subjective norms, and perceived behavioural control.

Based on that, a recycling demonstrator was putted in place at the stand of the Lorraine Smart City Living Lab of the Université de Lorraine at the international local fair at Nancy. A questionnaire was made using the TPB theory in order to evaluate the research hypothesis.

The results of this research seeks in the long term:

- In the operational aspect, evaluate the social intention of recycling in the distributing recycling via additive manufacturing approach. Based on that, to explore strategies in order to facilitate the identification, sorting, and collection of waste niches. The citizens participation in this pres-step stages of the waste management is a key aspect to facilitate the technical viability reducing the cost implementation at downstream activities.
- In the methodological level, identify relevant indicators in order to foster the democratization of this recycling approach. For that, to validate whether 3D printing is a driver for recycling and how could could be feasible to improve the maturity (technical, social, economical) level identifying the opportunities and challenges to overcome.
- In the theoretical level, validate the relationship between circular economy and additive manufacturing in order to explore deeper the potentialities of these two fields for plastic waste issues. The creation of secondary raw materials is essential in the circular economy strategy of the EU and distributed recycling via additive manufacturing could be an example.

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3.B.3. Arising social risks and uncertainty management experiences from public research and development organizations: decision process analysis for responsible innovation in nanotechnology applied to wool’s productive chain in Argentina.

Silvana Curcio

Summary

The becoming of the circular economy approach and European policies are close linked to responsible innovation mainstream in the sense of the emerging need of make sustainable arrangements for production and consumption which are leaded by innovation.

Firstly, the research question is how much the innovation, research and development process have into account social spillovers that could be by the new product generate or co-generate even in uncertain contexts.This question derives from the idea of social risks in a society of capitalism characteristics and the role of the science and policy in taking into account the social needs and civil claims(Andrade & Laporta, 2009; Beck, 1992; Grote, 2009). The responsibility in research and innovation require to develop reflexive, receptive, anticipative, and deliberative characteristics from the design to the transfer and monitoring of programs of scientific research (Fisher & Rip, 2013; Von Schomberg, 2013). The main variables are risks (productive and technology risks) and management of risks. The social risks refer to economic disequilibrium in product and labor markets which could be able to occur in the interaction with the emerging technology unknown social effects. That means what prevails from local unemployment, loose of market share, damage to small producers (Sotelo Valencia, 2005). Technology risks refer to difficulties that new products fear in business and markets. That sums up to circular economy reflexive procedures for innovation.

Secondly, the methodology addresses qualitative and exploratory to quantitative and standardized schemes of analysis. To respond the question a focus was built around an exemplary case of innovation from a public research institution in Argentina. The National Institute of Agricole Technology develops innovation for rural productive activities (INTA, 2015). In this case, the process of innovation and transfer of a vaccine for lamb diseases, drawing from nanotechnology was explored through personal interviews to researchers, public officials and local producers. The innovation is meant to serve to wool production and value chain in Argentina, a raw material that is exported increasingly and historically. Lamb farming is developed in long lands in the southern region, Patagonia, and small with median and big producers get along with. In many cases, the activity is developed in extreme climatic and economic conditions,but it is the principal earnings in many rural families(Mueller,2013). After the interviews, a process of coding text and concepts was applied. After different categories emerge, the information was scaled for valuing and building a decision tree or bayes loss risk matrix (Chao, 1999; Saldaña, 2009). That reveals the different weight in the decision component for uncertain state of the world. It was also built the utility for several options of technology transfer.

Thirdly, the results obtained allow to understand which social and productive needs and risks, onto technology risks were taken into account, and how the decision of the final transfer reveals the utility of responsibility for the public institution.The way of management the social and technology risks revealed responsible as personal involved in the innovation frequently interact and were close proximity with producers and community, taken into account specific needs, demands and risks. For technologic purposes also with public purposes, the technology transfer as a public startup reported the minor loss of utility risk. Also, the results were validated comparing with advanced cases of public innovation in rural activities in Galicia. That results are just a form of model de decision, but they provide useful subjective and objective information for technology innovation management and public policy with aims of sustainable development.

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3.B.4. The recycling of automotive lithium-ion batteries: The case of the UK

Viet Nguyen-Tien, Robert J.R. Elliott, Gavin Harper

Keywords: lithium-ion batteries, electric vehicles, circular economy, recycle, life cycle assessment, supply chain, material flow assessment

Abstract:

Electric vehicles (EVs) are an important measure to tackle urban emissions and decarbonise in transportation. EV batteries, which are currently dominated by lithium-ion technology, are the heart of EVs as they largely determine the cost and performance of EVs. As such, the future of transportation is anticipated to introduce a dual resource problem. On one hand, it raises a question on how to handle heavy-weight spent lithium-ion batteries (LIBs) when they are too aged to serve EVs. Harper *et al.* (2019) estimate that over one million EV sales in 2017 would later result in 250,000 tonnes and half a million cubic metres of unprocessed pack waste. On the other hand, it is important to sustain the supply of materials, especially those considered critical to the production of EVs and LIBs (Olivetti *et al.*, 2017). These two problems tend to go together because the countries that host promising markets for EVs are also places where the governments and stakeholders express strong ambitions in developing a global leading EV industry.

The concept of “circular economy” provides a sound solution to both issues simultaneously (Pagliaro and Meneguzzo, 2019). Some retired batteries, such as relatively new ones from crashed cars, can be refurbished and reused in other EVs. Even batteries refused to use in EVs may still find their useful second lives in less demanding applications such as energy storage before reaching recycling. In an ideal scenario, recycled materials could be conversed and contribute to the production of new batteries. To this end, closed-loop recycling is promising to transform retired LIBs as an environment burden into strategic resources (Gaines, 2018) and strengthen local automobile industry.

While the recycling of automotive LIBs already proves it feasibility in many contexts, there remain multiple barriers to the implementation of this technology even in much developed economies. As the

current EV batteries are not well designed for recycling, further innovation is needed to improve the efficiency and versatility of the recycling process to handle many types of LIBs at a viable cost. Since the business is capital-intensive, the economies of scales mean that investment is very sensitive to the recycling demand, which is however uncertain because of many factors including but not limited to market size, EV penetration rates, LIB lifespans in their first life serving EVs and subsequent cascades of reuse and repurposes, waste management, and the competitiveness of the business. The logistics of spent batteries for recycling is also a concern due to hazards related to thermal instability of LIBs (Hendrickson *et al.*, 2015). For many of the issues mentioned above, policies and regulations can play a role in reducing business risks and optimizing the supply chain of the new recycling industry.

In this study, we introduce a quantitative assessment framework to address these concerns and support decision making including a Material Flow Analysis, a Geospatial Supply Chain model and a Life-Cycle Assessment. Our models include numerous techno-economic factors to evaluate the cost and benefit of LIB recycling, in both economic and environmental terms. The context of the study is the UK between 2030-2040.

The UK is an interesting case study for this kind of assessment. From the supply side, automotive is the most important manufacturing industry of the country. A recent study suggests that the UK automotive industry under fierce global competition would fail to attract EV production in the future without new battery gigafactories being built (The Faraday Institution, 2019). Raw materials for EVs however could be a challenge as they are scored with high supply risk for the UK including Cobalt (8.1), Lithium (7.6), Graphite (7.4), Manganese (5.7), Nickel (5.7) (British Geological Survey, 2015).1 The likely departure from the EU would further amplify this risk due to extra cost to access to larger resource pool of the region. However, government support for EV industry as expressed in UK Industrial Strategy and Automotive Sector Deal (2018) fail to address the future demand and security of raw material supplies for this industry (British Geological Survey, 2018). On the demand side, EV LIBs are already regulated by the Waste Batteries and Accumulators Regulations 2009 as industrial batteries and their landfilling is already banned. However, in fact there exists no recycling facility yet in the UK and as such the only legal route to handle LIBs that are no longer useful is sending them abroad and the nearest recycling facility is located in Belgium. Put it under Brexit context, the recycling does not necessarily mean a reclamation of resources for domestic use and there are increasing concerns on extra administrative and transportation cost to send LIBs abroad subject to changes in Britain's trading relationship with the EU. As such, the UK may need to seriously consider developing facilities for domestic recycling though as warned by Nissan the new industry should not be scaling-up too early before the availability of a sustained source for retired batteries (Business Energy and Industrial Strategy Committee, 2018).

Our Material Flow Analysis based on government commitments to ban internal combustion engine cars and vans in 2040 and regional-disaggregated data estimate that the demand for LIB recycling will grow rapidly from about 33 thousand packs in 2030 to roughly 289 thousand in 2040 with a variety of cathode chemistries. The recycling demand varies hugely across the regions with a larger demand in the south east part of the country. Our geospatial analysis suggests that for the central recycling scenario, the sole recycling plant should be located in the West Midland – the (weighted) centre of recycling demand. The optimised solution for the 2-plant scenario is a roughly equally split between two plants in West Midland and London. If one more plant is needed, it should be a small one in North West. Under such a circumstance, the capacity of the London- based plant should far exceed the two others. For the 4-plant scenario, the North West plant should be replaced by one in Scotland and one in Yorkshire and the Humber.

Based on EverBatt model (Argonne National Laboratory, 2018), we however find that the recycling business, if assumed totally dependent on domestic source, is not viable yet in 2030 as

pyrometallurgical and hydrometallurgical central recycling would respectively make a loss of $4 and $0.8 per kg cell. Thanks to the economy of scales, these businesses will turn to highly profitable in 2040 with a margin of up to $0.6 and $2.6 per kg cell. The viability of pyrometallurgical route however is sensitive to domestic competitiveness while the hydrometallurgical route remains profitable with up to three recyclers, who could share an estimated total profit of $51.4 million. As such, the recycling in 2040 could help reclaim a significant amount of materials useful for EV production including 640 tonnes Cobalt, 1.8 thousand tonnes (kt) Nickel, 2.8 kt Copper, 2.1 kt Lithium Carbonate, 1.5 kt Manganese, 1.5 kt Aluminium, and 3.5 kt Graphite.

Put under the context of closed-loop recycling in 2040, the hypothesised manufacture of NMC811 with a throughput of 10,000 tonnes/year would highly benefit from these recycled materials. We estimate that dependent on recycling routes, they would help reduce 1.6% – 6.8% production cost, 6.3% – 11.3% total energy, 11.8-17.9% water use, 15.4%-20.0% PM2.5 and 13.2%-14.0% GHG emissions from a cradle-to-gate perspective compared with manufacture with virgin materials.

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3.B.5. Three- dimensional (3D) printing as an emerging disruptive technology to manufacture new goods based on wood waste from local sources in a circular economy framework

German Ferreira, Carlos Gonzalez-Val, Santiago Muiñoz-Landin, Clara Palleiro

Abstract

To support the European Union (EU) Action Plan for Circular Economy, a set of successful three-dimensional (3D) printed democases is required for boosting multi-stakeholder incubation processes and supporting knowledge and tools (business models, legal and commercial agreements, successful

case-studies with time-lines, do's and don'ts etc). As a relevant indicator obtained in 2019 from the implementation progress of the EU Action Plan for Circular Economy, it highlights that comparing the number of 2012 jobs associated with the sectors involved with the circular economy compared to 2016, there is an increase of 6% (around 4 million jobs generated). In addition, it underlines that new business models have emerged and developed new markets within and outside the European Union space. Using 2016 again as a reference, the repair, reuse and recycling activities generated an added value of 147 billion euros representing an investment volume of approximately 17.5 billion euros [1, 3].

However, how should a region address 3D printing technologies as an emerging disruptive technology to manufacture new goods from local sources in a circular economy framework? It has been found that not all regions have a strategic document regarding the implementation of the circular economy. In addition, the regions that own them can be classified by strategy, road map and action plan. Thus, to answer this question, the region need to understand the concept of Circular Economy and the development of strategic documents (strategies, roadmaps, action plans) for its proper application according to the characteristics and resources of them. In this vein, the manufacture of wood-based furniture by using 3D printing technique, as aimed in the INEDIT project [2], is selected in this work as a route to accelerate the development of the circular bioeconomy in Galicia/Spain.

Wood as a building material is chosen because it is the only building material able to store CO_2 instead of producing it since large quantities of biogenic carbon are embedded in the wood raw material. In fact, $1m^3$ of the wood has a global warming potential above -600 kg CO_2e. In addition, according to "A cadea forestal-Madeira de Galicia 2017", Galicia represents 47% of total wood production in Spain, 1.9% of roundwood generated in the EU-28 and more than 3.5% of that obtained in the eurozone [3-5]. To maximise the benefits, the proposed value chain is based on an innovative process that provides a double approach to sustainability: first, the conversion of wood waste mixture which can be derived from wood waste rejected by other processes, which in turn is biodegradable; and secondly, 3D printing technique is considered a zero-waste manufacturing technology [6-7].

3D printing helps cut costs, optimise production and increase environmental performance by using only the exact amount of material needed, including biomaterials. As a key indicator, using 3D printing meant construction material usage was cut by 30 to 60% and costs by half. Other relevant benefits are identified:

- *Local production:* instead of manufacturing the components at one location in the world and then shipping them around, they can be printed close to the customer, saving on emissions and transportation energy. Only digital files (3D CAD files, STL, GCode., Etc.) and instructions for processing the wood beams and wood waste (sawing, conditioning, pretreatment, dispersion into polymeric matrices, etc.) are "crossing borders" in this process. Besides saving on transportation, it also creates local jobs.

- R***emove waste***: by working additively, you only use the material you effectively need for the final geometry, instead of starting from a larger billet. There is also less machining afterwards, so less wasted material.

- D***esign freedom***: With the design freedom that 3D printing offers, it is possible to design and create complex components, only applying material there where it is useful. Lightweight designs equal less material usage.

- M***aterial characteristics***: it is possible to create flexible and stiff characteristics with one material by modifying the geometry. This integration of functionality and parts minimises the number of materials

used and eliminates fastening methods like bonding or screwing. This makes recycling easier and more effective.

- R***ecycling***: 3D prints the product, use it and after its economic use take it back and reform the part into new material for new designs that can be printed again [7-9].

However, SMEs companies must overcome many difficulties. These include among others the need for successful environmental and technical criteria to evaluate the development of initiatives; system-wide evaluation of performance; SMEs involvements despite possible constraining economic gains; bridging the physical material and energy flow analysis to the analysis of the economic effects; and a need for more data to improve local sources detection. On the other hand, there are many economic drivers in view of changing economic conditions in the EU and worldwide such as the volatility of resource pricing; the high prices of emerging technologies; etc. In addition, companies face challenges in commercialising the solution due to a lack of regulatory standards and the designers', project developers' and owners' scepticism about the products' safety.

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4.A. POLICY PACKAGES FOR CIRCULAR ECONOMY

4.A.1. A policy package to promote circular economy in the electronics industry: a proposal based on the critical review of the current regulatory framework

Ángeles Pereira, Xavier Vence, Leandro J. Llorente-González, Beltrán Puentes-Cociña

Keywords: circular economy, policy packages, electronics, WEEE Directive.

This paper aims to formulate a policy package to promote the circular economy (CE) in the electronics sector. A policy package is a combination of policy instruments designed to address one or more objectives, formulated in order to improve the effectiveness of the individual policies that are part of it, by enhancing synergies and minimizing contradictions and unintended effects, while reinforcing the overall degree of implementability, in terms of political and social legitimacy and financial, technological and institutional feasibility (Givoni 2014; Givoni et al. 2013; Pereira et al. 2018). Several reasons support the need to address the shift towards a CE in the electronics industry. Firstly, the electronics sector is one of the largest generators of waste in the world (Baldé et al. 2015), due to prevailing patterns of production and consumption, sustained by rapid technological change and the phenomenon of planned obsolescence (material/qualitative, functional, psychological or economic) (Proske et al. 2017). Secondly, many of these wastes are hazardous and their inadequate management causes major environmental and human health impacts (EFFACE 2015). In addition, despite the existing regulations (e.g. Basel Convention), e-waste continues to travel long distances and frequently ends up in uncontrolled landfills or informal waste streams in low income and developing countries (Huisman et al. 2015; Palmeira, Guarda, and Kitajima 2018). Thirdly, being the EU a net importer of critical raw materials, the CE has become a key strategy to guarantee its materials self-sufficiency (European Commision 2015).

This paper applies a qualitative methodology developed within the H2020 R2Pi project, building upon three case studies of circular economy business models (CEBMs) in the electronics industry. First, desk research was conducted onto the political and regulatory framework of the Electronics industry in the EU. In this sense, a critical analysis of the current regulatory framework applicable to electronic waste (WEEE) in the EU was made. The objective was to identify which aspects act as enablers and which as obstacles to the development and implementation of the CE in theelectronics industry. Secondly, interviews were conducted with key informants from the three case studies. The main insights obtained were used as an input to build up an inventory of policies to promote the CE in the Electronics industry.

The WEEE Directive EU/2012 is the main standard that sets the guidelines for e-waste management (European Parliament and Council of the European Union 2012). In this sense, this paper critically analyses the Extended Producer Responsibility (EPR) scheme, on which this legislation relies to a large extent. It also examines the collection, preparation for reuse and recycling objectives set in the Directive. The Ecodesign Directive, the Basel Convention, the Directive on guarantees for consumer goods and other legislation at national level, as well as the regulation applicable to the trade of these products at international level are also revised. They are assessed with respect to the achievement of circularity objectives and some gaps and barriers are identified. Based on that, we prepare an inventory of specific measures to reinforce and/or close the gaps identified, starting from the general aim of transitioning to the CE. All the measures are assessed according to effectiveness and implementability criteria. Afterwards, the relations between the different measures and unintended effects that may

diminish their effectiveness. Throughout the process, the measures were also discussed with stakeholders involved in the EU electronics sector. Thus, the paper concludes with a proposal for an Effective Policy Package composed of 30 measures, comprising a combination of command and control and economic instruments (R&D subsidies, incentives, lower taxes) that reinforce each other in the general aim of promoting the development and implementation of CEBMs in the electronics sector.

The analysis in this paper includes: the initial revision of the main existing policies based on

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4.A.2. Fiscal instruments to promote the Circular Economy: application to the case of repair, maintenance and reuse activities in Mexico.

Sugey López, Xavier Vence

Summary

The Circular Economy represents a radical change with respect to the paradigm of linear production and consumption, which requires the development of new Circular Business Models in the different

productive sectors and also the development of productive activities (industrial and/or service) that favour the extension of the useful life of goods, in order to reduce the consumption of material resources and the generation of waste. Among these activities, those focused on repair, maintenance and reuse occupy a prominent place since they reactivate the use of products, prolong their useful life and postpone waste, while limiting the use of new resources and inputs in the creation of new products. The specific objective of the Circular Economy is to reduce resource consumption, energy and waste by a perpetual returning of used resources into the economy. All resources incorporated to the economic cycle have to be managed as permanent renewable resources".

In order to promote these activities it is possible to make use of different instruments of industrial, environmental and fiscal policies, among others. This paper examines the use of fiscal instruments for this purpose. The review of the literature shows that attention to this type of repair and remanufacturing activities, as a strategy to promote circularity and sustainability, is something that has hardly received attention, as is the possible role of fiscal instruments in this direction (Stahel, 2013; Dalhammar&Milios, 2016; EC, 2019). For its part, at the institutional level the European Commission (2019) has turned towards the repair of electrical consumer goods, electronic equipment and household appliances, as a strategy to extend the useful life and re-use of goods and strengthen the action plan towards a circular economy.

This research will draw on the literature and experience of different countries, particularly the EU, for the examination and application to the Mexican economy. The purpose is to examine Mexico's fiscal system, ascribed to economic repair and maintenance activities, as a drive towards a circular economy. To this end, the research aims to contribute to the study of the role of the tax system as a strategic actor and as a lever to promote the transition to a circular economy, in the line opened by some authors (Stahel, 2011:2013; Groothuis and Damen, 2014; Pardo and Schweitzer, 2018).

Most recent literature builds on the Polluter's pays principle and the double dividend, highlighting the economic, environmental and social advantages of environmental taxation built within the framework of environmental (or green) fiscal reform (Gago, Labandeira and López-Otero, 2016); Freire-González, 2018). In particular, the environmental tax instrument with the greatest study is the carbon tax (CO2) (Nordhaus, 2010; World Bank, Ecofys and Economics, 2017; Hagen, 2017; Pegels, 2016; Reynoso and Montes, 2016). In fact, it is a tax established by most OECD member countries (including Mexico), responding to the calls emerging from the Paris Summit on Climate Change and reiterated in successive IPCC (see, e.g., IPCC, 2019) and United Nations (UNEP 2019) reports, which demonstrate that the high intensity of carbon dioxide emissions is the pollutant that generates the greatest damage to the atmosphere and, consequently, global warming. However, there are many other ways in which pollution is generated and that have repercussions on the atmosphere, for example, a high level of waste and the excessive use of natural resources that indirectly also cause climate alteration acting as pollutants that block the action of photosynthesis, among other collateral damages. This form of pollution can also be addressed with changes in the performance of the tax system.

The level of waste and the use of resources could have an important brake if repair and maintenance activities increase their supply and consumer demand. To gain relative weight they need to reduce their costs to make them more attractive. This is precisely one of the conclusions drawn in the European Commission's reports assessing the use of the tax system and other economic instruments as part of the strategy and action plan towards a circular and sustainable economy (EC, 2016 and EC, 2019).

This work is based on the idea that fiscal instruments and measures help to promote repair and maintenance activities, which are considered as circular economy activities since they reactivate the

use of products, postpone waste and limit the use of new resources and inputs in the creation of new products. In addition, they encourage innovation in products with long life spans by encouraging R&D and design to address the serious problem of programmed obsolescence and to facilitate the repairability of all goods.

Thus, it is proposed to analyse the current tax system for these activities, assuming that taxes are a key element in altering the relative price and guiding demand. As Stahel (2013) points out, "A shift to a sustainable taxation constitutes a giant booster to multiply the benefits of a circular economy within a national economy".

In this case it is a question of seeing how the current tax system penalises labour-intensive activities such as repair, maintenance and reuse services as opposed to (robotised) manufacturing of new products. For this reason, the paper tries to evaluate the current situation and to define the bases of a system of fiscal incentives to stimulate these activities against the consumption of new products. When analyzing the most appropriate fiscal instruments for this specific case of promotion of circular activities, we will see the need to qualify the general opinion of prosecutors on the superior efficiency of taxes in relation to subsidies (Martínez & Roca, 2018). It follows a methodological approach of theoretical legal and conceptual reference frameworks, and an estimation approach in relation to incentives. As a result, a diagnosis is made of possible proposals for fiscal measures to promote repair and maintenance activities designed in the context of the circular economy.

Keywords:

Fiscal instruments; fiscal system; circular economy; repair and maintenance activities.

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4.A.3. Public and Private partnerships to overcome limited resources: How Israel uses and reuses precious water assets in its countrywide circular system?

Jeff Dodick, Steven Zecher, Yamit Naftali, Dan Kauffman

Key Words: circular economy, R2π project water recycling, desalination, conservation

Purpose and Research Questions

This presentation aims to present key findings about the macro (or country-level) Israeli water system. One of the goals of the *R2π* project was to collect insights from different stakeholders on the main

challenges faced by organisations within specific materials / products sectors during their transition towards developing circular economy business models.

The two research questions that were posed in all of the *R2π* case studies (18 in total) were:

1. What are the main obstacles to and enablers of to implementing circular economy business models (**CEBMs**)?
2. What are the key policy requirements needed to promote the widespread adoption of circular economy in Europe.

In this presentation, we focus on business models and circular economy policies connected specifically to the water sector based on the Israeli water system. Israel is a world leader in water conservation, reuse and desalination, so what was learned in this case study has applicability to the EU (which funded this research via its H2020 program) as well as for a world affected by global climate change.

Methodology

The case study revolved around qualitative research methods, involving interviews, observations and a series of business tools for analyzing the external and internal business environments of the case-study businesses. Prior to interviewing stakeholders connected with the case-study businesses, the *R2π* water team performed an in-depth research on the companies including a P, E, S, T analysis of the company. Based on on-site interviews with stakeholders from the case-study businesses it was possible to complete a *business model canvas* (providing a detailed summary of the strengths and weaknesses of the business environment including its CEBMs). As part of this stage, the *R2π* water team also created a value network map of to provide clarity on how material and value is currently flowing between this and other businesses. Also as part of this stage, the *R2π* water team employed a *Business Model Circularity Diagnostic Tool*, which was developed by the *R2π consortiun* for assessing circularity at product, business model, and system-level, as they relate to the conceptualisation of CEBMs.

In the next stage, the external environment *R2π* water team completed a business context map which summarized the opportunities of and threats to the case study businesses. The collected internal and external factors fed into a detailed *SWOT* analysis. In turn, the *SWOT* analysis permitted the *R2π* water team to understand the *enablers* and *barriers* to greater circularity in water sector-based businesses / industries, including those found within the EU.

The research focused on *Mekorot*, Israel's national water company, the central entity responsible for all water, related infrastructure, and related policies in the country. However, it also examined various organizations in both the private and public sector who are involved in designing technology, drafting policy, monitoring and measuring.

Results

Israel's water system is composed of private and public organizations along a circular value chain from water storage to waste treatment. Using a value chain approach, the *R2π* water team describe it as a largely organic, centralized system that mimics the natural water cycle, maximizing efficiency and rewarding performance. Israeli stakeholders are guided in their efforts by environmental need, government policy, as well as technological drivers which encourage cooperation and innovations. As

part of the EU's Horizon 2020 project, the *R2π* water team classify these relationships as a case study of prototypical business models that illustrate the efficient, continuous use of resources.

The Israeli water system has key characteristics of three CEBMs based on a typology developed by the *R2π* consortium: (1)"re-conditioning" (waste water is treated to a suitable level for reuse in agriculture); (2)"co-product recovery" (recovering waste materials such as sludge from the water to be used as fertilizer and energy stock); and (3) "access" (in which all water is owned by the public and is used subject to a fee per quantity paid to a regulated public authority that rewards conservation).

Although they are not technically part of the CE, Israel is involved in two other activities that are key to its water economy: water mining and conservation. In the former, **new sources** of water are developed, and includes primarily in Israel's case, desalination which is then subject to the three CEBMs above. In the latter, water is retained within the system to be used for a longer period. Both private and public sector businesses have invested time, effort and capital in developing technology (such as drip irrigation and leak detection software) and policies that are directed toward conservation.

The conditions enabling these business models have included overuse and damage to the natural aquifers, expensive and fragmented wastewater treatment, less regional rainfall, and growing population and water use intensity. As a result, the national government maintains public ownership of water resources, consolidated water authorities, built national water infrastructure systems, committed public support for new water technologies and solutions, including sea and brackish water desalination, and transparent water system measurement, monitoring, and security systems.

Israel has adopted a series of market and non-market measures which have successfully reduced water demand. Market mechanisms include: block pricing, extraction levies and water markets permitting trading (for the agricultural sector) have been effective measures. Non-market mechanisms include water quotas, non-quota use restrictions, demand management, and public awareness campaigns.

The government actively supports continuous innovation through direct and leveraged investments in research and development in both public and private firms. Importantly, public facilities serve as beta sites for testing and providing "proof of concept" for new technology; the result: over 300 companies involved in water sector technology, 120 of which are seven years old or younger and an estimated $2.5 billion in water technology and equipment exports annually. Moreover, Israel produces about twenty percent more water than it consumes itself annually, allowing it to export water to countries in its region.

In sum, Israel has developed a water-based CE with a value proposition providing clean, ready water on demand, reliable infrastructure and measurements systems to ensure effective service delivery.

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4.A.4. Systematic Literature Review of the Dutch Green Deals; Micro and Meso level Public-Private Partnership Agreement

Keywords: Circular Economy; Innovation; Public-Private Partnerships, Green Deal

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Abstract:

Introduction

In the Netherlands, the Dutch national government created a policy instrument, in 2011, that aims to provide a communication channel between firms and other stakeholders for projects to make the Dutch economy more green and sustainable (Ellen MacArthur Foundation 2016; van Langen 2017). This can be achieved through subsidies, but also by setting up public research initiatives, and, as often happens, through changes in regional and/or national laws.

Exemplary is the Green Deal arrangement between the car industry and the government to work on creating an internationally competitive smart grid for charging electric cars within a few years. Green Deals are mainly made in industries that are considered critical and of high priority by the Dutch government, the industries responsible for 75% of Dutch CO2 emissions, but can also be found in smaller sectors of the Dutch economy. In2012,a year after the first implementation of the policy in 2011, 225 firms had made a Green Deal arrangement, this increased to 655 firms in 2015(van Langen 2017).To date(13 December 2019)there have been 230 Green Deals, of which 169 have been finished and 61 are still being executed.

Research Question

For this research we aim to gather the state-of-the-practice of the Dutch Green Deals, specifically relating to innovation in the Circular Economy, bringing this policy instrument into the academic discourse. Our research question is: How many Green Deals are aimed at, and successful in, achieving Circular Economy innovation? To answer that question we first set the used definition of the Circular economy, of which there are many (Kirchherr, Reike, and Hekkert 2017).

Methodology

We will do a Systematic Literature Review of grey literature regarding the Green Deals. Specifically, the Green Deal agreements, and in the case of finished projects also the final project review. The literature is collected directly from the Dutch Enterprise Agency, part of the ministry of economic and environmental affairs through their portal on https://www.greendeals.nl/english.All Green Deals are filtered for their relevancy to the Circular Economy based on their abstracts, then a full text analysis of the selected Green Deals follows. Through the full text analysis, trends are identified that show the most important categories of how innovation is driven, what barriers are encountered, which interventions are applied and their rate of success.

Expected Results

The Dutch government, through the minister of Economic Affairs and the Dutch Enterprise Agency, have marked the Green Deal policy instrument a success (Rijksoverheid 2015, 2016). Though the Green Deals are not made solely for the Circular Economy, but for green and sustainable development in general, we expect some of the 230 Green Deals will not be relevant. However, from a first analyses we can say that many projects are indeed related to the Circular Economy and can bring innovation.

Green Deals can take the form of subsidies, making it a financial incentive, but often it is used for its ability to bring together stakeholder and change regulations. This generally takes the form of public research initiatives, it can also bring funding to academic research, which'outputs will be diffused to the Green Deal initiators. By changing laws and regulations, the Green Deals allow firms to perform innovative projects and circular business models, supporting both corporate entrepreneurship and new start-ups.

Discussion/Conclusion

By systematically analysing the Dutch Green Deals policy instrument outputs, we conclude on the effectiveness of the tool. Furthermore, we bring the Dutch application of this policy instrument into the academic literature so it can be further studied to improve the policy instrument and adapt it for other parts of the European Union and the rest of the world.

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4.A.5. Public procurement as a tool to promote innovative service business models

Ángeles Pereira, María del Carmen Sánchez-Carreira, María Concepción Peñate-Valentín

Public procurement is a relevant tool to promote innovation in services, especially in health or environment fields. The aim of this paper is to analyse the role of public procurement to trigger the adoption of business models for the Circular Economy (CE), focusing on energy efficient services. To tackle this objective, we carry out a literature review and an analysis of seven contracts between public sector and Energy Services Companies (ESCOs) in Spain.

Public procurement of innovation (PPI) can drive innovation by developing new markets through demand-pull (van Meerveld, Nauta, & Whyles, 2015). In this sense, PPI offers an opportunity for companies to innovate in services, being particularly relevant as a tool to contribute to the development of Circular Economy business models (Alhola, Ryding, Salmenperä, & Busch, 2019; Witjes & Lozano, 2016). Among sustainable business models, ESCOs represent one of the most promising models involving circular products and energy efficient services. An ESCO is "a company that is engaged in developing, installing and financing comprehensive, performance- based projects, typically 5–10 years in duration, centred around improving the energy efficiency or load reduction of facilities owned or operated by customers" (Vine, 2005, p. 691). The innovative business model of ESCOs has been suggested as a catalyst for system-wide sustainability transitions (Bolton & Hannon, 2016).

Usually, the shift to energy efficient street lighting presents two relevant barriers: street lighting is a major cost factor, and municipalities have limited budgets (Polzin, von Flotow, & Nolden, 2015). ESCOs

represent an opportunity to overcome these barriers through energy service contracts. In this sense, Polzin et al. (2015) state that services involving third-party contractors (such as the public sector) can reduce certain obstacles and, at the same time, stimulate the diffusion of energy efficiency technologies. Moreover, PPI has been confirmed to be a useful tool for local governments to achieve social and environmental aims (Lember, Kalvet, & Kattel, 2011). It also has several benefits for companies, such as opening new markets, generating knowledge and technologies useful to further develop new products and services, and fostering behavioural change in relation to innovation by companies.

In recent years, a few countries have developed Energy Performance Contracts (EPCs) as a tool for improving energy efficiency in public buildings. EPCs involve two benefits for the public sector: a technical risks reduction, as a consequence of transferring the risks to the energy specialized private supplier; and costs savings, helping to manage public funds more efficiently (Roshchanka & Evans, 2016). For private sector, EPCs with the public sector are an opportunity to broaden the market and to gain a relevant client. Thus, private companies may take advantage of PPI to shift to circular business models and to offer new green services that allow them to get competitive advantages while fulfilling a public requirement. At the same time, the public sector may use PPI to foster the development of more sustainable societies.

The ESCOs analyzed in this investigation are focused on developing innovative solutions for energy efficiency and adopting new systems and technologies for efficient energy management in buildings and street lighting. All the ESCOs offer services aimed to optimize consumption, reduce energy costs of installations and buildings, and minimize CO2 emissions into the atmosphere. These companies perform energy audits and monitoring, as well as measure the consumption of energy and resources. They set energy saving targets to be accomplished not only by the implementation of several improvements, but also by offering ongoing maintenance.

In this context, PPI projects have been launched with the objective of decreasing the costs for the public sector in the medium and long term, and acted as incentives to promote sustainable innovation by companies focused on reducing energy consumption and toxic emissions.

Most awarded companies in the cases analyzed share common characteristics: they are large companies belonging to the construction industry and offer multiple services. There are some small companies also related to construction. Only one of the smallest companies offers energy audits and energy management services, as their main activity. In this sense, although some relatively small companies are awarded, it seems the adoption of eco-efficient services through PPI is mostly handled by large multiservice companies, with experience in the field. Hence, circular business models through PPI could represent a better opportunity for larger companies. Furthermore, the fact that almost all these companies started their activity offering different services and products, and have added services related to energy and emissions management and control, proves the increasing market interest in this type of service. In this sense, public procurement may play a key role, contributing with its procuring capacity to the diffusion.

The cases analysed also show that some unintended effects of projects developed through PPI could be to promote sustainable business models among large companies, while the smallest ones do not have the opportunity to take advantage of financial resources and long-term contracts to do their circular innovation journey (Uyarra, Edler, Garcia-Estevez, Georghiou, & Yeow, 2014). In this sense, an effort should be made to promote the involvement of small companies in contracts with the public sector.

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Keywords: public procurement, circular economy, ESCOs, innovation, business model

4.B. CE BUSINESS MODELS

4.B.1. Economía circular y cadenas alimentarias cortas: el caso de LENTURA

Manuel Santos, Ángeles Pereira

Palabras clave: Economía circular, Canales cortos de comercialización, Proximidad, Sistema agroalimentario.

1. Introducción y objetivos

Este artículo analiza las potencialidades de las cadenas cortas como modelo de negocio para el desarrollo de la Economía Circular. En concreto, se basa en un estudio de caso llevado a cabo en el marco del proyecto H2020 R2PI. Lenturaes una asociación de productores primarios de Galicia que se caracteriza por un sentido de responsabilidad alimentaria amplio, estableciendo como meta principalofrecer unos alimentos saludables,para consumidores y entorno. Meta que engranan con una producción de temporada y sin insumos sintéticos, junto a una comercialización en proximidad y sin intermediarios, es decir, mediante los llamados canales cortos de comercialización(Maréchal,2008).Elestudio aborda dos objetivosespecíficos: analizar la congruencia entre el modelo deproximidad deLentura y los principios de laEconomía circularyevaluar losresultados medioambientalesy económicosque se derivan de sus actividades.

2. Metodología

Siguiendo la metodología del R2PI,en primer lugar,se utilizó el método Canvas, que otorga una perspectiva integralde los modelos de negocioa partir del estudiode bloques clave (Osterwalder & Pigneur,2010): clientes, relación con los consumidores, canales de comercialización, proposición de valor, actividades clave, recursos principales, socios clave, estructura de costesydistribución de ingresos.

Así mismo, se mantuvieronentrevistascon representantesde Lentura afin de esquematizarlos nodos que dan forma a su cadenade valor. Una vez construida esta cadena y después de completarlacon los datos económicos correspondientes, se realizó el análisis de flujo de materiales. Ésterecogelos principalesmovimientos de materialesque intervienen a través dela organización, así como entre la asociación, otros agentes económicos yel (eco)sistema base(Risku-Norja yMäenpää, 2007).

3. Resultados

A partir de los flujos de valor y materiales,se pudo observar como el modelo de proximidad y alimentación naturalde Lentura se corresponde con al menostres patrones de economía circulardefinidos en elproyectoR2PI:

•Aprovisionamiento circular: los alimentos son producidos de acuerdo conprácticas ecológicas (cultivos sin fitosanitarios ni insumos artificialesy defensa de la diversificación y la temporada como modelo de manejo).Característicasque hacen de su oferta principal elementos directamente retornables al medio.Aunque no son hegemónicas, las prácticas agroecológicashan sido identificadas entre numerosas cadenas cortas(Maréchal & Spanu, 2010; Galli & Brunori,2013).

•Recuperación de recursos:gracias a las relaciones deproximidad (físicay social) entre productores yconsumidores, Lentura mantiene un esquema de retornoaltamente eficientesobre los componentes técnicos ligadosa los alimentos (envases).Una realidad, la (eco)efectividadde los sistemas deretorno en proximidad, también evidenciadapor otros estudios(Galli y Brunori, 2013; Schweitzer et al.,2018).

•Recuperación de co-productos,derivada de la utilizaciónde recursos internos que en los modelos lineales terminarían desechados. Concretamente constituyen ciclos cerradosen torno alos desechosorgánicos del ganado, que emplean como abono natural. Igualmente, los excesos de producciónqueno alcanzanuna demanda efectivason empleados para diversificary enriquecerla oferta, a través de la elaboración depequeñas manufacturas como conservas,salsas o postres.

Con estos patrones y su modelo en general, Lentura consiguióen el ejercicio 2017 unmejordesempeño medioambientaly económicoque las cadenas largas convencionales,donde destacan:

•Una recuperación/reutilización del 80% de los envases de vidrio, del 97% delos de cartón y del 100%entre los plásticos duros.

•Por su modelo de abonado natural, la reintroducción de 140tde materia orgánica.

•Una reducciónde food miles(a 30km máximo) y de emisiones asociadassignificativa. Así, mientras que Lentura moviliza aproximadamente 13,80talimentos/t CO2emitidaen eltransporte, en el caso de legumbres y frutasobtenidas del comercio global, España no supera las 4,06t de legumbres y frutas/t CO2o las 3,95t de procesados/t CO2(Pérezet al.,2014).

•Retención del83% del precio final, cuota muy superior al 25% delconjunto de los agricultores españoles(MAPA, 2019).

•Reducción decostes en un valor estimado equivalente al 9% de sus ingresos.4.

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4.B.2. Business model drivers and barriers in the transition towards a Circular Economy: A case study analysis

Marie Briguglio, Leandro Llorente, Chris Meilak, Angeles Pereira, Jonathan Spiteri

This paper analyses the main barriers and drivers prevalent in businesses as they transition towards different types of circular economy business models (CEBM). The identification of factors that act as drivers can be key in the dissemination of good practices, and facilitate their implementation in other contexts and on a larger scale. In addition, the analysis of obstacles is essential to indentify gaps where policies are needed to create a more favorable framework for the circular economy to flourish.

Over the last few years a growing body of literature has focused on analyzing sustainable business models, but evidence on barriers and drivers remains relatively scarce. Previous research has highlighted the importance of distinguishing barriers according to different circular economy business models (Vermunt, Negro, Verweij, Kuppens, & Hekkert, 2019). In other work (Govindan and Hasanagic 2018), emphasis was placed on the importance of distinguishing factors belonging to the micro environment and the macro environment, together with the influence of different stakeholders.

The sample in this paper is made up of a variety of business model patterns, corresponding to 18 EU case studies that were conducted within the R2PI Horizon 2020 project over the period 2017-2018. The business models stem from different industries, including textiles, water, food, bio-waste, plastics, electronics and construction, which respond to the EU circular economy priority areas. The methodology applied is based on the content analysis (Braun & Clarke, 2006) of the 18 individual case study reports. Key factors were identified and clustered into 10 main barriers and 10 main drivers. The analysis distinguishes the relative importance of drivers and barriers by business size, CEBM patterns and industry.

In terms of the conditions that enable the transition to a CEBM, our analysis finds that business targets, the prospect of cost reduction and engaged and loyal customers are important considerations at the business level. Furthermore, positive demographic trends, environmentalism and burgeoning waste volumes, as well as a spectrum of enabling sectoral conditions matter at the contextual level. In terms of policy, it is both the presence of EU policy and national pro-circular policy and incentives that were found to matter.

In terms of the key barriers, the analysis finds these to include disadvantageous cost-benefit ratios at the business level, as well as lack of infrastructure, technology and financial support at the contextual level. These, together with a range of sectoral conditions, dynamic changes and problematic consumer

preferences create a significant number of barriers. Furthermore, policy itself militates against the transition to CEBM. Considerations here include the absence of regulation, the lack of fiscal measures that internalise external costs, and the extent of obstructive policy and bureaucracy.

In analysing the enablers and barriers across the CEBMs, the CE priorities and by case study size, further insights emerged. In our cases, national level policy, for instance, emerges as a more important enabler and barrier for SMEs than it does for large businesses. However, for larger firms, the issue of policy at the EU level, specifically concerning harmonization and uncertainty starts to become more relevant. Similarly, while enablers tend to be consistent across all CEBMs, certain barriers tend to be more CEBM-specific. In our case studies, for example, the re-conditioning CEBM recorded the lowest number of enablers and one of the highest number of barriers.

The distribution of enablers across the five EC priority also varied, emphasizing the need for targeted policy interventions within each area. For example, businesses within the critical raw materials priority mentioned the highest number of barriers per case, and among the lowest number of enablers per case, which may underscore the need for greater intervention in this area.

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Keywords: Circular Economy, business models, barrier, drivers, EU priority areas

4.B.3. Circular economy and repair activities: an analysis of the industrial structure and regional distribution in the EU

Francisco López, Xavier Vence

Keywords: circular economy, repair, repair activities, sectoral analysis, regional analysis, European Union.

A brief introduction:

Repair, not only as a practice but as a job and as a viable economic activity, has always been a relevant activity and it still exists today, even though with a secondary role, due to several reasons (Lefebvre, Lofthouse, & Wilson, 2018). Recently, it's been pointed out repair's great potential for sustainability since it delays replacement and thus production of a new object (EMF, 2016). Repair activities are considered a fundamental part of the circular economy's logic for its role in keeping products and materials in the economy, extending its useful life. Also, repair activities are considered as employment creators and labour intensive, which is also relevant on the regional and proximity level (Stahel, 2013 & EMF, 2013).

Repair, repairability and repair activities will play an important role in both the Circular Economy Action Plan and its implementation (European Commission, 2015 & European Commission, 2019). Some studies and reports have started to appear in the field of repair activities and repairability and its socioeconomical implications and consequences (Monier, et al., 2016 & Tinetti, et al., 2018) also on the regional implementation of the circular economy (Tapia, et al., 2019) yet the literature on repair activities, specially concerning its regional development, is scarce.

Research question

What are the socioeconomical characteristics and territorial implications of the repair activities in the European Union? Do they conform with the attributed properties for regional and socioeconomical development?

Methodology

We begin with the revision and analysis of relevant literature on repair activities and repair in the circular economy. On the empirical level, we compile data coming from Eurostat on the sectoral -aggregated- level and by countries and regions. The empirical analysis includes two parts, the first on the sectoral level, this is the EU aggregated. The second part is made on the territorial level for countries, regions.

On the first part, the sectoral analysis, we begin by describing the presence of repair activities in the official statistics, this is in the NACE rev.2, disaggregating to the maximum level possible in order to keep the analysis exclusively on repair activities. Secondly, we study the evolution of repair activities in relation to the average of the economy. Finally, we study the characteristics of the repair activities using data of value added and employment in order to compare them with the average of the EU economy.

On the second part, the territorial analysis, we analyse the presence of repair activities in the economies of member states, regions and municipalities. In order to obtain relevant data on the regional level we first need to calculate it from the country data. Once the data is obtained, we calculate some simple regression in order establish a relation between the main economic indicators and the presence of repair activities.

Results

The results obtained from the previous exercises allow us to picture an image of repair activities in Europe in recent times. The first result we must point out is that each one of the three repair activities

present in NACE rev.2 has different characteristics, in consequence, not all repair activities have the same socio-economic implications. This may be because repair services, depending on the object or product, can be demanded by consumers or by firms. Repair of machinery is demanded mostly by firms while repair of computers and mobile phones is demanded mostly by final consumers.

Based on the sectoral information compiled we can confirm that repair activities are in fact labour intensive and create more employment than the average of the economy in relative terms. In contrast, their labour productivity is lower than the average of the European Union. In terms of wages it oscillates depending on the activity, but it is generally lower than the average.

On the regional level, we confirm that none of the main economic indicators is useful to explain the presence of repair activities at the national level, nor at the regional, even though we may observe a positive correlation in the latter, which may be due to the fact that most repairs are carried out on the proximity level.

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4.B.4. How to innovate business models for a circular economy?

Mechthild Donner, Hugo De Vries

Keywords: circular economy, business models, innovation, agro-waste and by-products

Abstract

Circular economy is an increasingly popular concept and of growing interest for policy makers, companies and the civil society. It is considered as a new and alternative way to reconcile economic growth with the use of natural resources and to develop sustainable economic systems(Murray, 2017; Geissdoerfer et al., 2017).A shift from a linear to a circular economy requires a radical change at a system level, involving all actors of value chains in diverse economic sectors and at different action levels. At a business level, companies need to rethink and redefine how they understand and do business, and how they generate and offer value to customers (Pieroni et al.,2019). Hence, business model innovations are needed that offer new products or services and/or new market opportunities (EMF,2013). Therefore, business managers and researchers increasingly explore how circular business models can create economic growth while reducing negative effects on the natural environment (Bocken et al., 2019; Lopez et al., 2019).

The aim of our study was to understand and get insights into how business models innovate in order to contribute to the transition to a circular economy via agro-waste and by-product valorisation. The underlying question was if business model innovation for a circular economy is different from the linear economy.

Eight cases from France, Germany, Italy and the Netherlands have been studied in the framework of the H2020 project NoAW (No Agro-Waste). These cases have been selected because they are from different project-partner countries and represent various types of business models. All cases focus on agro-waste and by-product valorisation via either a simple closing loop or a cascading(bio-economy) approach implying many actors. For each case, interviews and on-site visits have been done. Data has been analysed according to the type of initiative, resources and transformation processes, value propositions, key partners, customers, strategic approaches and types of business model innovation.

Results show that there are two main ways how business models in the agricultural sector innovate in order to valorise waste and by-products. The first way consists in innovating the business model itself via either (i) completely new start-ups in form of associations or limited liability companies, and directly focusing on agro-waste and by-product valorisation;or (ii) via business reconfigurations and evolutions from rather classical farm or food processing activities to specialised companies or integrated business parks; these are also striving for circular economy approaches. The second way is to adapt single business model elements; here, innovations could be found in the form of new or higher value-added products, applications, materials or ingredients, combined new value propositions (product, service and/or technology platforms), new partnerships and (private-private or public-private) cooperation, new customers or distribution channels. Overall, technological innovation types are dominant and often precede organisational and social innovations, but a combined approach is also of ten observed.This is not surprising as within the domain of agro-waste valorisation, technological developments at least for high-value adding conversion pathways are still ongoing and often not yet in a mature stage.

From this explorative study, it can be concluded that business models in the agricultural domain are obliged to innovate themselves towards new configurations in order to close material loops and switch to a circular economy, but that existing innovations are still merely incremental and follow rather usual, linear business innovation strategies. Real disruptive technological or organisational innovations are still rare and then, they have difficulties to reach a marketable scale and to be economically viable.

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4.B.5. Development of sustainable Business Models for co-creation-ecosystems.

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Key Words: Business Model Innovation, Sustainable Business Models, Co-Creation-Ecosystems

Abstract

Innovative co-creation approaches of furniture, such as the Do-It-Together (DIT) approach, which includescustomers and manufacturers as equal partners both in the design and production of a product, offer customers the opportunity to have a greater influence on the sustainability and individualization of complex products like furniture. Digital Platforms offer the opportunity to connect different stakeholders, especially customers, along the value chain, so that customized furniture can be created with high personal value, which cannot be achievedwith classical creation approaches today. Therefore, they can be used to connect local production as a major element of hands-on customer integration and global production as an option to make use of the greatest possible innovation potential. Many platforms fall short in this regard as they do not have a business model that addresses all stakeholders. Furthermore, the aspect of sustainability is barely considered in existing platform models. Because business models are the basis of a successful DIT platform, we want to develop a procedure for the development of sustainable business models that addresses all relevant stakeholders along the value chain.In the future, this will enable the creation of sustainable and customized furniture which holds a new level of value for the customer. As a result, furniture elements transform from simple objects into value-creating assets, which customers can adapt to their needs throughout the product life cycle with the help of the DIT-ecosystem.

1.Motivation and Challenge

Against the background of advancing digitalization and a paradigm shift in innovation management towards open company boundaries, even for small and medium-sized enterprises, the value requirements of customers for consumer goods are increasingly changing from tangible to intangible

services and values. Individualized and sustainable products are gaining relevance in many areas. The customer demands that he receives access to products that are tailored for his personal use within a short period of time. Manufacturers must apply new, agile and flexible development and production approaches to identify and address rapidly changing customer needs. With the help of co-creation, the customer can be involved actively in the design of the product during the development phase. The classic Do-It-Yourself approach must be transferred into a Do-It-Together (DIT) approach, which addresses a whole co-creation ecosystem. At the same time, customers have realized that they need to change their behavior towards the environment and want to be empowered to better influence the sustainability of their products. The internet and associated digital tools such as platforms offer the potential to integrate customers, identify their needs and involve them at an early stage of the product development process. Furthermore, a platform facilitates the use of sustainable and recycled resources as well as the long-term development and use of furniture already manufactured. In the past, to increase sustainability in circular economies, the focus was mainly on technical solutions that improve individual silos but often lead to reductions elsewhere. In order to achieve holistic improvements in sustainability, the behavior of the individual stakeholders must be aligned to a holistic sustainable circular economy, driven by business model innovation1. Existingbusiness models and approaches to developing these do not consider all relevant characteristics of the sustainable DIT co-creation ecosystem. Therefore, this paper provides an approach to innovate business models for the DIT ecosystem and thus contributes to business model innovation in the circular economy.

2.Research Ambition

Several open innovation platforms already exist on the market. However, there are currently two shortcomingsregarding the business models these platforms are based on, which cause the products created on these platforms to not be entirely sustainable and which prevent the production of complex and important products such as furniture, which has an essential impact on the quality of life of consumers. One deficit of the existing platforms is that the business models do not focus on sustainable product design from the very beginning. Another deficit is that existing business models only include some but not all stakeholders (consumers, designers, makers and manufacturers) of the value chain during the product creation as partners at the same level. While business models of some platforms include a large community of consumers to capture their needs, the business model of other open innovation platforms is primarily production-oriented.2 Examples for consumer-oriented communities are QUIRKY and FANVOICE.3,4 On these platforms, the manufacturers are not integrated into the design process, which results in a need for a low manufacturing complexity of the products, and the production is focused on mass-production which opposes customization. Examples for production-oriented platforms are OPENDESK and IDEAPOKE.5,6 On these platforms, even complex products can be manufactured, but customers do not have the opportunity to participate in this creation process to a great extent. Because of this, the full innovation potential can only be utilized only if all respective roles of the co-creation value chain are involved in the business model for the platform.7,8 The research question to be answered in our project is: How can a sustainable business model for DIT-approaches be developed so that all stakeholders are involved in the innovation process as equal partners?

3.Research Methodology

Our approach is based on the Business Model Innovation Approach according to ESSER9. His approach proposes a division of the innovation of business model into five successive stages, which we adapt for our approach: 1. Analysis, 2. Strategy, 3. Design, 4. Organizational Impact and 5. Transformation. For the purpose of our project, the following understanding of a business model framework according to OSTERWALDER10, is used: A business model consists of the following four dimensions: 1. Stakeholders,

2. Value Proposition, 3. Value Chain and 4. Revenue Models. The adaption of the divisions proposed by ESSER is explained in detail. 1. Analysis: Firstly , the requirements for the sustainable DIT platform business model are deducted. For this, we identify all relevant stakeholders and analyze the stakeholder journeys to understand user relationships, the effects of the system on the value of the stakeholders and the effects of the users on the system. In addition, we determine the requirements of the stakeholders, especially regarding sustainability. Furthermore, we evaluate business model concepts of existing platforms. For that, we identify suitable platforms and collect information about their business models. In order to ensure an objective and unified comparison we analyze each business model in thefour dimensions. 2. Strategy: The requirements of the stakeholders are connected and lead to a common target for the DIT platform business models. In order to measure and focus on transparency sustainability objectives and key results (OKR) are derived and linked to these targets. Then the business models of other platforms are assigned to the previously developed stakeholder journeys and the business model targets. In this way, aspects from existing business models can be identified that match the new DIT business model.3. Design: Considering all stakeholder requirements and journeys, we develop viable business models based on the Business Model Canvas (BMC) and Value Proposition Canvas10 for each stakeholder. In a first step, the focus is on addressing the most important requirements of each stakeholder through value propositions. In a second step, the individual stakeholder BMCs are aggregated into a comprehensive BMC for the whole platform. In these two steps, aspects of existing business models are taken into account and further gaps are addressed by appropriate functions and services from the DIT ecosystem.4. Organizational Impact: In this step, the value-adding functions and services are linked to processes and activities for providing them. These processes and activities are applied to specific use cases and, depending on these, sustainable revenue models are implemented for the individual stakeholders. The viability of the model is verified by means of the use cases. Utilizing the results of the previous steps, we generate individualized business models. Successively, we evaluate the models as well as the use cases in terms of profitability, feasibility and collaboration.5. Transformation: To ensure the successful implementation of the new business models we design a transformation process. The foundation of the transformation concept is the analysis of the current business models of the stakeholders. Through the analysis, we generate a systematic process to adapt either the business model to the needs of the stakeholders or vice versa.

4.Expected Results

The project will provide a better understanding of the environment of DIT platforms. We expect to develop different business models for each stakeholder in the DIT environment, ensuring to close the gap between customer-orientated platforms and those focusing only on manufacturers. This will help to implement DIT platforms in other fields of industry having similar stakeholders. The concept of a transformation process will assist small and medium-sized companies to adapt their business models accordingly. Because the co-creation platform reduces the costly product development effort, manufacturers can reduce their development costs or, at best, outsource their entire development. New products are to be jointly designed and developed by different actors in an optimized value chain, while including the terms global design and local production. Furthermore, the transparent visualization of the sustainability of the product is an innovative driver of the circular economy. Successful platforms are a crucial tool to implement a sustainable circular economy where transportation can be limited to a minimum through local production.

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5.A. LOCAL AND REGIONAL CIRCULAR ECONOMY

5.A.1. Économie circulaire : Pour une transition durable des territoires. Le cas de la région Fes-Meknes

Lahbi Fatima Zahrae

Résumé

Cette communication a pour objectif de présenter l'engagement explicite qu'a pris la région Fès-Meknès au Maroc pour introduire dans sa politique régionale, la stratégie de l'économie circulaire qui recèle un potentiel économique, environnemental et social important pour le développement territorial durable de cette région.

Le modèle de l'économie circulaire est en train de se développer partout dans le monde, avec l'ambition de rendre le développement durable opérationnel, de revisiter les notions de performance économique et d'explorer des modes alternatifs d'interactions entre sociétés humaines et systèmes écologiques.Le fonctionnement de ce modèle consiste à éliminer la notion de «déchets» et la remplacer par celle de «ressources». La conception de ces ressources dans le contexte de l'économie circulaire correspond à un processus de leurs activation dans un territoire donné. Ils représentent ; « la découverte et l'actualisation d'une valeur latente du territoire par une partie de société humaine qui la reconnait et l'interprète comme telle, àl'intérieur d'un projet de développement local »(Corrado, 2004, p :23).L'économie circulaire a le potentiel d'accroitre l'efficacité dans l'utilisation des ressources naturelles et de réduire l'empreinte écologique, elle s'est avéré particulièrement performante et réalisable dans des pays comme le Canada(Phillips , 2016). Sa mise en pratique dans les pays du sud, et en particulier dans les pays d'Afrique du Nord comme le Maroc, cas pratique sur lequel ce papier se concentre, est envisagée avec des attentes considérables.

Au Maroc, des reformes ont été engagées pour appuyer la transition vers l'économie circulaire avec comme secteur stratégique celui des déchets. Ces réformes attirent l'attention sur l'importance de construire un modèle qui favorise des synergies entre différents acteurs et de renforcer la cohésion entre eux afin de limiter les impacts environnementaux, réduire les coûts économiques et contribuer à la durabilité des territoires. La transition vers ce modèle alternatif dépend fortement des collectivités territoriales qui jouent un rôle important dans la planification des stratégies de l'économie circulaire parce qu'elles ont le pouvoir de définir des orientations susceptibles de structurer la gestion des ressources naturelles et garantir la protection de l'environnement local.Depuis,de nombreuses initiatives dans ce secteur ont vu le jour, et ce dans différentes régions du pays. Certaines se sont contentées de convertir les décharges sauvages en décharges contrôlées, d'autres ont amélioré le service de gestion des déchets, en passant d'une logique de mise en décharge à une logique de traitement et de valorisation. Une gestion durable des déchets est appréhendée dans une approche qui prend en compte non seulement les différentes options de collecte et de traitement des déchets mais aussi la participation de toutes les parties prenantes (kurian,2006).La réussite de l'ensemble des initiatives de l'économie circulaire est conditionnée par une gouvernance de type partenariale pour garantir un développement harmonieux(Jean & Bisson, 2008).

Après une présentation du contenu, principaux axes des réformes engagées et de la portée des réformes,nous nous proposons d'étudier les perspectives de l'économie circulaire dans le contexte de la région Fès-Meknès. Nous allons dans ce cas utiliser la méthodologie qualitative, qui nous permettra d'analyser en profondeur les différentes pratiques de l'économie circulaire dans le cadre d'une politique régionale socialement responsable.

En portant notre attention sur ces pratiques, nous montrerons, d'une part, comment la transition vers ce nouveau modèle économique est susceptible de rapprocher développement durable (Andrews, 2015) et développement territorial (Durand, Bahers, & Beraud, 2017). De l'autre, comment l'évolution de la politique régionale de gestion des déchets constitue le résultat d'un ensemble de stratégies intentionnelles, construites par différents acteurs à savoir les collectivités territoriales, les producteurs des déchets, les gestionnaires des déchets sans oublier la société civile.

Ensuite, à travers une étude exploratoire, nous présenterons le cas d'une entreprise qui représente le modèle d'une économie circulaire. Cette entreprise,créée dans le cadre d'un partenariat privé-public, a pour activité principal la production du biogaz à partir d'un processus de valorisation des déchets ménagers, utilisé pour générer de l'électricité à des fins d'éclairage public.

Enfin, nous explorerons le potentiel de la région à investir dans de nouveaux projets de développement et à promouvoir des processus de production innovants dans les deux secteurs porteurs de la région à savoir l'agriculture et la construction. Ces deux secteurs ne sont pas encore exploités et sont susceptibles de contribuer au développement de la région par la création de la richesse et de l'emploi.

Mot clés : économie circulaire, politiques régionales, développement territorial, développement durable, gestion des déchets, processus innovants.

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5.A.2. Practices for implementing an intelligent circular economy in cities

Sangboliéwa Lanzeny Ouattara, Laila Aligod, Hebatalla Kaoud

According to the Strategic Implementation Plan of European Innovation Partnership on Smart Cities and Communities, *"Smart Cities should be regarded as systems of people interacting with and using flows of energy, materials, services and financing to catalyze sustainable economic development, resilience, and high quality of life; these flows and interactions become smart through making strategic use of information and communication infrastructure and*

services in a process of transparent urban planning and management that is responsive to the social and economic needs of society" (EC, 2013).

Indeed, the circular economy provides a feasible way for governments to seek more sustainable forms of development by increasing the overall eco-efficiency of economic systems (Geng, Y., & Doberstein, B. (2008)). Moreover, in the circular economy, the process innovative rethinking urban waste management infrastructures is not the only path for cities to reap the benefits of turning waste into a resource (Del Borghi & al. (2014)). Thus, what are the models, conditions and practices to foster the implementation of the smart circular economy in cities?

The aim of this article is to provide a literature review of international experiences with models, catalysts and practices of open eco-innovation that promote the implementation of an intelligent circular economy in cities.

Key words: Smart circular enonomy, open eco-Innovation, smart cities, wast management.

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5.A.3. Building new territorial development models through circular economy: a systematic literature review

Sonia Veyssière, Blandine Laperche, Corinne Blanquart

Literature on the implementation of circular economy takes into account spatial proximity in analyzing complementarities between outputs and inputs of localized activities (as stated in industrial symbiosis model). Spatial concentration of activities is then a key factor. However, territorial developement, which includes a localized coordination process between stakeholders, is partially addressed by literature on CE. Some insights are given about industrial symbiosis and industrial ecology and their contribution to territorial development (Baas, Boons, 2004; Chertow, 2007; Gallaud, Laperche, 2016) as well as local innovation dynamics and creation of eco-innovations (Torre, Brullot, 2019)

However, national legislations and public policies aim at promoting CE and industrial ecology in order to impulse territorial development dynamics. CE is supposed to support the creation of locally-rooted activities and value from secondary resources derivated from waste and material flows. But literature on CE rarely considers the multiple frames of coordination between stakeholders and the forms of proximity that characterize them. The influence of CE on resource creation resulting from the coordination between local stakeholders, which is central to territorial development,should therefore be highlighted. Through a systematic review of literature, our aim in this paper is to study how literature analyze this link between EC and territorial development. Previous systematic reviews on CE focus on defining the concept (Deus et al., 2017; Prieto-Sandoval et al., 2017; Merli et al., 2018) and circular business models (Lieder, Rashid, 2015; Nußholz, 2017; Pieroni et al., 2019) and none of them address this issue. Consequently, we will survey how CE literature deals with territory and its dynamics.

We defined a range of 552 publications including CE at territorial scale, using a set of 7 keywords, in Scopus, Web of Science and Cairn databases. Then we divided papers on territorial development processes from those on impacts of CE territorial strategy or practice. The final body accounts for 358 articles on which we perform a content qualitative analysis.

The review will contribute to analysis about the way circular economy is implemented on a territorial scale, actors and resources generated/mobilized and will shed light on the processes of territorial development linked with CE and their impacts. In this way, we will be able to lay the groundwork for defining a typology of circular territorial development models, based on the activation of one or more resources

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Keywords: circular economy; industrial ecology; territorial development; resources; coordination

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5.A.4. Innovation spaces as enablers of the circular economy within territories: a systematic literature review

Fedoua Kasmi, Ferney Osorio, Brunelle Marche, Laurent Dupont

The circular economy principles contrast with the linear model of production and consumption based on the " take-make-use-dispose" logics. It represents a new economic model capable of achieving a sustainable development that is inspired by the natural ecosystem functioning (EMF, 2012). The potential benefits of this new model of development, when developed at the territorial scale, are numerous for different stakeholders and multiple economic sectors. They are not only limited to reducing environmental imbalances but also result in economic and social gains enabling a sustainable territorial development (job creation, new activities, positive externalities…) (Gallaud, Laperche, 2016; Kasmi et al., 2017). Due to the multiple opportunities offered by the circular economy, its applications within modern economic systems and industrial processes have grown, resulting in new public policies and the emergence of new practices within companies (European Commission, 2015). However, achieving this sustainable economic and societal transition remains difficult. On the one hand, the

circular economy is still an imprecise concept whose areas and practices are difficult to identify and distinguish (Korhonen et al, 2018). On the other hand, the implementation of its practices at the companies or territorial level may be impeded by several obstacles that can be related to operational aspects such as technical and economic problems, but also organizational aspects linked to the regulatory context and the coordination and governance issues arising from the interdependencies between the concerned actors (Vanner et al, 2014; Gallaud, Laperche, 2016).

The transition to a circular economy requires new forms of eco-innovation to overcome these obstacles. Eco-innovations integrate all types of innovation aimed at reducing environmental risks. These need to be technological, to address technical issues, but also non-technological (organizational, institutional, regulatory, financial, etc.) to facilitate and promote cooperation between stakeholders (De Jesus, Mendonça, 2018; Vence, Pereira, 2019). However, in order to create favorable conditions for the circular economy implementation, it is necessary to switch over a traditional approach of eco-innovation (classical closed research & development in laboratories, then industrialization) to a more collaborative approach combining both technological and non-technological solutions. This raises the question of the required conditions and the types of environments promoting this open approach of eco-innovation that enables more radical changes.

Over the last few years, new structural and organizational entities facilitating the emergence of innovation have emerged. These are physical and/or virtual environments, playing the role of innovation intermediaries, provided with devices, tools and new methodologies designed to strengthen innovation capacities in a context of exchange, sharing and collaboration in order to achieve a goal of common interest (Morel et al., 2018; Osorio et al., 2019). These environments can be of different natures: workspaces (third-places, or co-working places), reflection spaces (living labs), tool spaces (fab labs) or a combination of all three (Scaillerez, Trembley, 2017). Such spaces enable different stakeholders (e.g.: companies, research centers, public actors, universities, and users) to form inter-organizational networks based on formal or informal public-private-people partnerships, engaging processes of creating, prototyping, validating and testing new technologies, services, products and systems in real-life contexts (Leminen et al., 2012).

Innovation spaces have been designed to address societal and environmental issues and phenomena by making innovative tools and methods available to a wide public (Santonen et al., 2017; Remøy et al., 2019). Thus, we can assume that these environments are conducive for the development of eco-innovation process that allow both technological and non-technological changes capable to support circular economy projects.

The growing interest in these innovation spaces as new innovation mechanisms has attracted the attention of several researchers and practitioners. However, the impact on their environment has been less explored (Almirall et al., 2012; Osorio et al., 2019). Through a systematic literature review, our objective in this article is to contribute to filling this gap by studying the role of these innovation spaces as a driving force for the development of the circular economy and thus their impact on the environmental and societal transition of territories. A question that is still relatively unaddressed in the scientific literature.

Our choice to carry out a systematic literature review is justified by the relevance of this approach, which is becoming increasingly recognized by the scientific community. When guided by a specific research question, this approach makes it possible to analyze the evolution of knowledge on a given topic and to identify its related trends and changes (Denyer, Tranfield, 2009). This study draws on previous research that has focused on the constellation of innovation laboratories (Osorio et al., 2019). Based on a bibliometric analysis of 1307 scientific publications (published between 2000 and 2018), this study highlights the links between the most common concepts referring to innovation spaces (innovation labs, living labs, fab labs, makerspaces, third places etc.). Furthermore, through content analysis it provides insights on the different impacts that these spaces can have on their community, environment and partners. To reach our goal of exploring the impact of innovation spaces on the circular economy, we will build on from the path established in this previous work by updating and expanding its bibliographic database on innovation labs/spaces while looking for intersections with the existent literature on circular economy.

The results of this research will provide a general overview of the literature dealing with relations of these two themes and will help to achieve our objective of showing that innovation spaces encompass the main characteristics of spaces conducive to eco-innovation. They are collaborative and scientific decision-making environments allowing: to develop different waste and resource management options; to deploy new technological solutions as well as new methodologies and forms of cooperation allowing to co-create solutions and circular strategies with local stakeholders and proposing governance instruments adapted to each territorial context.

Keywords: Circular economy, innovation spaces, eco-innovation, systematic literature review

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5.A.5. Can the circular bioeconomy dissolve in its own territory? The case of the ex-Champagne-Ardenne region (France)

Romain Debref

Keywords: bioeconomy, circular economy, territories, system, development, transition

Outlines

The environmental crisis and the announced end of an oil society are a high challenge of this century. There have been many warnings since the 1970s, as illustrated by the publication of seminal articles and books (Meadows et al., 1972; Cole et al., 1973; Georgescu-Roegen, 1975). The quest for infinite growth and our modes of development based on mass consumption were quickly considered to be the reason for the imbalances encountered with the biosphere. Experts, especially innovation and development economists, proposed alternatives to mitigate these tensions.

On the one hand, we find the desire to "close the loop" in order to better manage the spaceship Earth (Commoner, 1971). This idea has been going through the decades, structured around industrial ecology and "Cradle to Cradle" approaches ((Frosch, Gallopoulos, 1989; Braungart, McDonough, 2002; Boons, McMeekin, 2019). Today, they are gathered around the concept of the circular economy as a source of green growth (Ellen MacArthur Foundation, 2015).

On the other hand, we also observe, also in the 1970s, the emergence of the bioeconomy on the part of development economists, the concept of bioeconomy aimed at uniting the economy and life around a new development model: Georgescu-Roegen, Sachs and Passet (Georgescu-Roegen, 1977; Passet, 1979; Sachs, 1980). Today, the concept of the bioeconomy is the subject of much discussion and conceptual appropriation (Vivien et al., 2019).

Among these different definitions of the term bioeconomy, the European Union is structuring its own innovation strategies around a circular bioeconomy - "Sustainable and circular Bioeconomy, the European way" - with biorefineries as examples.

Methodology

The ex-Champagne-Ardenne region (France), now known as the Grand-Est Region, is considered one of the success stories of the European bio-economy, as illustrated by its bio-refinery located in Bazancourt-Pomacle (Nieddu & Garnier, 2010 ; Debref, 2012 ; Nieddu et al., 2014). Local public policies and manufacturers are attempting to apply this circular bio-economy within the territory in order to industrialize abandoned industrial basins.

Our research project, the BIOCA project (Bioéconomie en Champagne-Ardenne – PSDR4) has been studying for several years how the territory is restructuring around this subject.

Based on a series of interviews and field studies carried out over more than a year, we show how a circular territorial bioeconomy is being created. We propose to place this study in a perspective of development and innovation economy. Our objective is to show how trajectories and renewable resources (e.g. local biomass) are today appropriate to enable the looping of flows and matter. We underlined the importance of the coordination process, lock-in and critical masses (market and non-market) in order to allow the system to loop.

Results

We will see that the implementation of a circular bioeconomy strategy is based on a set of interpretation and interest that generates a cohabitation of a circular system, complementary but unassimilable, even nearby. This situation stems both from knowledge, capital and the appropriation of resources, but also from local communities coordinating around their identities and their own representation of the relationship between man and nature : a fully dominant design do not exist.

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5.A.6. Emergence d'un écosystème d'innovation pilote de la transition écologique et impacts sur les parties prenantes : le cas de la dynamique Live Tree à Lille

James Boyer

La transition énergétique et écologique nécessite non seulement le développement des technologies et des innovations soutenables mais aussi un environnement stratégique complexe et dynamique favorisant la coévolution et l'adaptation des agents économiques aux enjeux du développement durable (Kallis, et Norgaard 2010). Cette considération rejoint les approches en termes d'écosystème d'innovation qui visent à générer des trajectoires d'innovation ayant des impacts durables sur les parties prenantes mais aussi sur le territoire (Frosch and Gallopoulos 1989, Moore 1996). Un écosystème d'innovation se définit comme un contexte stratégique, caractérisé par des relations complexes entre des acteurs hétérogènes, qui favorise le développement des processus d'innovation et l'adaptation aux enjeux économiques, technologiques et environnementaux (Adner, 2006 ; Ritala et Almpanopoulou, 2017).

Les travaux de Torre et Zimbermann (2015) et Frosch et Gallopoulos (1989) soulignent la nécessité de prendre en compte la dimension écologique dans les écosystèmes. Ce courant met en avant le

développement des écosystèmes industriels dont les logiques de circularité et d'optimisation écologique des flux d'énergies et de matières constituent le cœur des processus d'innovation. En associant les logiques de concurrence, de collaboration ou de coopération complexes et les enjeux environnementaux et sociétaux, ce courant s'inscrit clairement dans le nouveau paradigme de développement durable et de la transition écologique. Cependant, les approches sur les écosystèmes d'innovation manquent cruellement d'études empiriques qui permettent de valider un certain nombre d'hypothèses issues des considérations théoriques (Ritala et Almpanopoulou, 2017). C'est dans ce cadre que se situe notre étude qui vise à traiter la question de recherche suivante : Dans quelle mesure la mobilisation d'une approche en termes d'écosystème d'innovation favorise la transition écologique et énergétique ?

Pour répondre à cette question nous mobilisons une étude de cas : la dynamique Live Tree à Lille (France). Live Tree est une initiative localisée (quartier Vauban-Esquermes) issu d'un master-plan de la région des Hauts de France « REV 3 » (avec plus de 800 projets suivis, un investissement public/privé estimé à 500 millions d'euros/an et 10 grands projets structurants) qui a pour but de favoriser et d'accompagner la transition énergétique et écologique. Live Tree avait comme objectif de générer des innovations et technologies à forte efficacité écologique, réduire l'empreinte carbone du campus de L'université Catholique de Lille et expérimenter de nouveaux modèles économiques autour de l'énergie, de la mobilité, de la gestion des déchets etc. Très tôt les porteurs de cette initiative ont adopté une approche en termes d'écosystèmes d'innovation réunissant des acteurs hétérogènes comme des académiques, entreprises y compris les habitants du quartier Vauban-Esquermes.

Notre étude cherche donc à analyser dans quelle mesure la dynamique Live Tree, adoptant une approche en termes d'écosystèmes a pu générer un contexte stratégique favorisant le développement des processus d'innovation soutenables et l'adaptation aux enjeux économiques, technologiques et environnementaux. En deuxième lieu quels ont été les impacts de cette démarche sur les parties prenantes et le territoire.

Méthodologie

Dans ce travail nous avons utilisé une approche historique pour analyser l'émergence et la dynamique de Live Tree, l'évolution les parties prenantes qui ont été impliqués dans cette démarche, l'évolution des réseaux d'acteurs, les outputs générés par cette dynamique y compris les impacts sur les parties prenantes. Nous avons aussi analysé le processus de génération, diffusion, et l'utilisation des technologies générées par Live Tree.

Nous avons réalisé des entretiens avec 5 parties prenantes de cette dynamique et 43 enquêtes de terrain auprès des acteurs impliqués directement ou indirectement dans ce processus.

Nous avons aussi évalué la diminution de l'empreinte carbone du campus de L'université Catholique de Lille et l'évolution du business modèle de Dalkia une des principales parties prenantes.

Résultats

Nos résultats préliminaires montrent que la dynamique de Live Tree, adoptant une approche en termes d'écosystème d'innovation, à travers des collaborations complexes entre acteurs hétérogènes (université, entreprises, structures publiques, habitants de quartiers …) a permis, non seulement de développer des technologies et de nouvelles pratiques mais aussi un contexte stratégique qui facilitent et favorisent la coévolution des acteurs vers des trajectoires d'innovation soutenables.

Premièrement nous pouvons citer i) des bâtiments démonstrateurs répondant aux enjeux d'efficacité énergétique, comme les bâtiments du *Rizomm* capables de produire eux-mêmes de l'énergie, de la stocker et de la mutualiser ; ii) des *Smartgrids* permettant de connecter en temps réel ces bâtiments, d'ajuster leur consommation et de redistribuer leur excédents d'énergie produits.

Comme éléments constitutifs d'un écosystème d'innovation issus de la dynamique Live Tree, nous pouvons citer la génération i) des « communautés de destin stratégique » (Gueguen et Torrès, 2004) réunissant les étudiants, chercheurs, habitants du quartier Vauban-Esquernes, ii) des tiers-lieux et espaces collaboratifs (Sarazin el al 2017), comme *Adicités* qui se basent sur les principes de l'économie circulaire et de l'écoconception iii) des nouvelles formations académiques (*Master Smart cities*) iv) des organismes pivot (Iansiti et Levien 2004) comme l'Université Catholique de Lille et l'entreprise Dalkia.

Comme impacts nos résultats mettent en relief la diminution de l'empreinte carbone ces bâtiments économisent plus 5g de CO2 pour la production de 1 kWh, sachant que la France génère en moyenne 50-80 g de CO2 pour la production de 1 kWh.

Nous pouvons aussi mettre en évidence l'intégration dans le business model de Dalkia l'exploitation des technologies sobres en carbones pour le chauffage, technologies issues de la dynamique Live Tree.

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5.B. RESOURCES, CIRCULAR ECONOMY AND IMPATCS

5.B.1. From a technological demonstrator to a sustainable supply chain demonstrator

Brunelle Marche, Fedoua Kasmi, F. Cruz - Sanchez, F. Mayer, Laurent Dupont

New products are becoming increasingly complex, involving an increasing number of stakeholders. Consequently, innovation cannot always be driven by the company alone. Research suggest that it is often a collective and open process (Boly, Camargo, et Morel 2016). Indeed, the development of a new product often requires new resources, a new delivery method, and a distribution of implementation tasks among several companies. As a result, innovation occurs within large systems of collaboration between customers and suppliers (Maniak and Midler 2008) or between end customers and companies (Váncza et al. 2011). Therefore, it is important to have a vision of the sequence of actors (i.e. the supply chain) involved in launching an innovation (Boly, Camargo, and Morel 2016).

Several studies argued that the product launch and launch conditions are not considered as success factors for innovation. However, recent research works emphasize that supply chain design is part of the new product development process (NPDP) (Sharifi, Ismail, et Reid 2006; Marche 2018). Thus, one of the major industrial challenges is to anticipate the design of the innovative product chain in order to define, at the design stage, an appropriate supply chain capable of supporting this new product.

Furthermore, these challenges are amplified by new additional environmental and societal issues that need to be considered in the NPDP. Companies are more inclined to integrate environmental concerns throughout their production chains to cope with the pressure of environmental regulation (European Commission 2019) and the evolving demand from consumers who are increasingly aware of the conditions in which products are produced and distributed (Teuteberg and Wittstruck 2010). In this context, scientific research is increasingly focusing on the notion of sustainable supply chains in which production and distribution systems are more environmentally efficient (Genovese et al. 2013). Closed-loop processes, eco-design, recycling, reuse, re-manufacturing of end-of-life products etc., are all strategies that characterize the sustainable supply chain and integrates within the R9 circular economy framework (from Refuse -R0- to Recovery -R9-) (Morseletto 2020). With these strategies the sustainable supply chain remains an important unit of action for the transition to circular economy (Aminoff et Kettunen 2016; Liu et al. 2018), with the purpose of tackle current linear economy logic "take-make-use-dispose" that caused negative environmental effects. The integration of circular strategies within the NDPD reduces environmental impacts but also generates economic benefits for companies (reduced material inputs and associated labour and energy costs) and promotes the creation of new markets through the production of new eco-innovative products (Ellen Macarthur Foundation 2012; Kasmi 2018).

The development of such eco-innovative product requires time, investment and important functional and structural changes involving new supply chain management modes based on circular economy principals. As a result, companies are seeking to demonstrate its technological, commercial and industrial feasibility before it is launched on the market using prototypes, models and demonstrators.

The notion of demonstrator refers to an innovation operated at or near full scale in a realistic environment (OECD 1993). The demonstration can be both part of the experimental development phase of R&D and the industrial emergence phases (Phaal et al. 2011). It consists in operationalizing the knowledge acquired through research or experimentation with the aim of testing and evaluating the conditions allowing the realization of a technological innovation project. The literature on the industry life cycle identifies several types of demonstrators and highlights their potential role in supporting the transition from new science to technology and finally to the market (Phaal et al. 2011; Moultrie 2015). These

works emphasize the capacity of the demonstration phase in improving the potential of future application of a new technology/innovation.

However, these studies remain focused on the technical aspects of the innovation demonstration (technological demonstrators, commercial demonstrators, price-performance demonstrators…), while the organisational and structural aspects related to the management of the adapted supply chain capable of supporting this technology are less studied. In this paper, we particularly focus on the notion of demonstrator considering not only the new technology/product but also all the relations and synergies between the stakeholders involved in its supply chain. Thus, based on the couple formed by a product and its supply chain (Marche 2018), how to design the sustainable supply chain demonstrator favouring the circular economy in order to ensure their feasibility before their deployment on an industrial scale?

To answer this question, a theoretical framework defining the sustainable supply chain demonstrator will be proposed based on a combination of the literature on demonstrators and sustainable supply chains. This theoretical analysis will be completed with the results obtained in the scope of the European project INEDIT[1]. The results of this analysis is a conceptual framework in order to formalize the invariants and requirements beyond the technical aspects that needs to be considered prior to a pre-industrial stage.

This research aims to:

- Provide a more precise theoretical definition of the notion of "sustainable supply chain demonstrator", describingin particular the attributes of a sustainable supply chain demonstrator;
- Specify the links between technology demonstrators and supply chain demonstrators (translation of technology demonstrator requirements into supply chain demonstrator requirements);
- Highlight relevant indicators specific to the circular economy, thus enabling stakeholders (companies, laboratories, territorial bodies) to assess the transition from technological demonstrator to a sustainable supply chain demonstrator and to validate whether industrialization is feasible, identifying the opportunities and challenges to overcome in the industrialization stage

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5.B.2. Innovation Processes in Circular Economy: insights from Anaerobic Digestion Project

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Keywords: eco-innovation, circularity, anaerobic digestion, resources, networks, territory

Research question:

The circular economy can be defined as an economy which goal is to minimize the use of raw material and energy to avoid their depletion and preserve the biosphere and the resources it provides (Frosch, Gallopoulos, 1989). One of its main principles is the creation of loops (circularities) in which the wastes produced by some actors become resources for other ones (Suárez-Eiroa et al., 2019). Other dimensions of the circular economy related to reuse, reduce or recover are also a source of circularities. The building of these circularities implies profound changes and therefore eco-innovations (Llorente Gonzales, Vence, 2019; Vence, Pereira, 2019) that can take place within and / or across different territorial scales, and different sectors, including agriculture (Simboli et al., 2015).

The main goal of our research is to characterize the innovation processes on which the building of circularities is based in the case of collective anaerobic digestion projects. Several studies suggest that both local and non-local resources and factors contribute to the development of circularities (Baas, Boons, 2004; de Jesus, Mendonça, 2018). We thus analyse the nature of the innovations, the characteristics of their creators, the respective role of local and non-local factors in their development. We want to answer this question: What are the scales and dynamics of coordination, resources circulation between various sectors and actors in circular economy initiatives driven by agricultural actors, and what are their explaining factors?

Contribution of the paper:

Our study is founded on a triple originality: in terms of object, in terms of theoretical framework, in terms of methodology. In terms of object, if more and more studies are dedicated to circular economy, quite few in social sciences focus on agriculture (Gallaud, Laperche, 2016) and even fewer on anaerobic digestion. In terms of framework, we will use the literature on innovation (more specifically environmental innovation) to explain the development of circular economy. This literature remains rarely mobilised to analyse circular economy except in papers that study the networks dynamics in local or broader circular economy initiatives (Taddeo et al., 2017; Mirata, Emtairah, 2005). We also mobilise the literature in geography of innovation in order to analyse the impact of spatial environment on these innovation processes, and particularly the role of related variety to take into account the interactions between various sectors and related activities (Galliano et al., 2019). In terms of methodology, we use a mixed-method from economic sociology: the quantified narratives. This method is particularly suited for the analysis of processes of innovation and their dynamic of embeddedness / decoupling (Grossetti et al., 2011).

Method:

We choose to undertake an analysis of collective anaerobic digestion projects. The fact that they are collective – and all driven by farmers - is interesting to question the problematics of governance and organisational innovation in the building of circular economy. In order to produce a more relevant analysis of the territorial dynamics of these projects and of the role of the spatial factors in their trajectory, we have chosen to select only initiatives in rural areas.

We built monographs of collective anaerobic digestion projects (already working or in progress) based on semi-structured interviews with their leaders. We have so far conducted 14 interviews of an average length of 1.30 hr. We conducted these interviews with a specific mixed-method: quantified narratives method. The latter provides guidelines to collect systematically information about the trajectory of a project / initiative. Thanks to it, we are able to rebuild the dynamic of the process, its different phases, the resources acquired along these phases and where do they come from (in terms of type or provider and geography). We also collected information about the characteristics of the projects and of their actors, what circulates between them. We thus have qualitative data and statistics about the evolution of resources and of their origin all along the process.

Main results:

Collective methanisation (anaerobic digestion) is based on knowledge and some coordinations that didn't exist before on the territory. The lack of knowledge shared between the agricultural and energy sectors is a barrier to project development. This implies organisational innovations that take time to develop and go hand in hand with processes of adoption of technical innovations and absorption of knowledge often brought by actors from outside of the territory and/or the agricultural sector. As a result, the collective's internal resources also play an important role, particularly the absorptive capacity most often embodied by one or two key people. We also observe a key role of already existing local personal networks and resources and of the sectoral and regulatory contexts.

These initiatives are strongly embedded from a relational and geographical point of view, which confirms the recent findings of Chodkowska-Miszczuk et al. (2019). However, they are not entrenched in local, as non-local demand and knowledge are essential for them. In other words, the closing of material and immaterial loops at a local scale remains partial and we can observe that they are complementary to "global pipelines" (Bathelt et al., 2004).

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5.B.3. Integrated sustainability analyses for roadside management: a cyclical causality model

BAUTISTA S., CAMARGO M., MOREL L., BACHMANN C

Abstract

Road infrastructure is a social, economic and political manifestation of a territory, correlated with the processes of transformation of the landscape, influencing the natural environment and social structures[1]. Linked to the roads are the surfaces dedicated to the roadsides where ecosystems, communities, communication networks, landscape, transport, among others, interact. In countries such as England, Belgium and France, studies highlight roadsides as potential sites for biodiversity conservation, generating ecosystem services for flood reduction, pollutant retention, noise abatement, carbon sequestration and many more [2].

The impacts of roads on ecosystems and landscapes are generally related to the fragmentation of ecosystems, proliferation of invasive and allergenic species, reduction of native biodiversity, alteration of the hydrological cycle, microclimatic changes, production of particulate matter, noise, water and soil pollution [3]. Roadside management can become a critical aspect of mitigating such impacts, as maintenance activities such as tree and shrub pruning, grass cutting, cutting frequencies, handling of residual plant material is complex due to the demand for large amounts of economic, technical and logistical resources [4].

There are many techniques to develop, maintain and enhance roadside spaces in a rational way. In order to preserve, restore and promote biodiversity in ecological corridors, recommendations for roadside maintenance by local authorities were made as part of the Grenelle II Environment Round Table. Since 2009, in Europe, a differentiated management of its roads has been developing more and more. Differentiated management is the differentiation of maintenance in space and time. A distinction is made between an intensive mowing mode and an extensive mowing mode, known as "reasoned" [5].

Reasoned mowing is "the set of good practices designed to rationalize roadside mowing so that environmental and economic issues are fully integrated and taken into account in achieving the objectives of maintaining safety and conserving road heritage" (Mackowiak 2012 cited by [5]). As part of a sustainable framework, of collective awareness, change of mentalities, landscape integration, and better living conditions near housing [6]. On roadsides, differentiated management can have several objectives and be applied at several scales. It can be located in certain sectors, generally selected for their major heritage interest. The objective is then turned towards their conservation and each sector will be managed in a different way and adapted to the problem in question (not just a late mowing). The second possibility is to apply this management to all road berms, as already practiced by some General Councils. The objective is then to consider biodiversity as a whole (both heritage and ordinary). However, it is no longer a question of applying different management for each roadside but rather of carrying out systematic late mowing on the entire road network. These two objectives can also be applied jointly [7].

It is a question of integrating roadside into the framework of territories, rehabilitating landscapes, living spaces, perceiving the roadside as many transversal axes around or creating an economic, ecological, cultural and social attractiveness, together with developing clean transport, making cities desirable, and thus generating attractive territories for local residents and promoting tourism, eco-tourism and rural tourism [8]. Recent trends of roadside verge research allow to highlight the need to adopt a transdisciplinary and systemic approach concerning territorial studies. Furthermore, we must also remark that it is vital that sustainable management of roadside verges develops a strong multidimensional vision from ecological, social, economic, technological and political points of view. Also, it need to be focused into non-deterministic or lineal models on strategies of roadside management and its integration in local dynamics, to fully contribute to sustainability territorial [2].

In that context, this work proposes an integrated sustainability analysis for roadside management through the development of the first stages of systems dynamics modeling. The application of system dynamics modeling in the study of roadsides is lowered. When performing a search in the Scopus database using keywords associated with roadsides and system dynamics, only one article was found related to the development of an assessment of roadside particulate emission, the paper introduces a model of system dynamics for analysis of road transportation PM10 emission [9]. The potential contribution of system dynamics modeling to the sustainable management of roadsides is relevant, as it allows observing the relationships between variables associated with different dimensions of sustainability.

System dynamics is a methodology used for modeling complex system [10]. Its facilities the distinction of feedback mechanisms and it is possible to understand how the decision-making about techniques to develop, maintain and enhance roadside spaces influence the sustainability or not of the territories that interact with roads verges. In this work the central focus is define dynamics hypothesis thought cycles loops diagrams with the aim to understand the relationships between the variables representing each kind of management techniques and social, ecological and economics concerns around a sustainability management of roadside. Finally, a set of recommendations will be presented to contribute to a management that promotes both the fulfilment of the basic functions of roadsides associated with road safety and protection of road heritage, and the promotion of ecosystem services and the well-being of communities.

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5.B.4. Littoral bas carbone sur la Côte d’Emeraude

Eve Ross, P. Y. Glorennec

Dans le but de redynamiser la technologie, l’entreprenariat d’un territoire, un nouveau modèle industriel est proposé dans le cadre de l’économie de circulaire. De nouvelles démarches sont proposées par les protagonistes. Les modèles économiques porteurs de croissance du présent et du futur sont modifiés par les stratégies politiques d’innovation intelligente. Le modèle industriel qui est proposé optimise l’utilisation des ressources naturelles et réduit ou éradique les déchets (Loi du 17 aout 2015 relative à la transition énergétique pour la croissance verte, le code de l’environnement, article L.110-1.1). Elle s’appuie sur le ré-utilisation, le recyclage l’écoconception, l’écologie industrielle, l’approvisionnement durable et la consommation responsable (rapport de l’Union européenne 2015).

L’écologie industrielle et les circuits courts peuvent contribuer à l’éclosion de la mise en place d’une démarche de développement durable à l’échelle d’un territoire. En effet la question du territoire est centrale. Les expériences d’écologie industrielle et de mise en place de circuits cours sont liés à leur situation géographique. Se pose la question de savoir quel sera l’impact de ces nouvelles expériences sur le dit-territoire en question, dans quelle mesure elle contribue à la création d’emploi ou au maintien de l’emploi, comment les ressources sont-elles préservées et quels sont les problèmes qui peuvent freiner les dynamiques mises en place (Gallaud, Laperche, 2016). Vence et Pereira (Vence, Peira 2019) souligne que l’éco-innovation peut améliorer la durabilité des systèmes. La relation entre l’éco-innovation et son rôle dans la transition vers une économie circulaire est prometteur. L’économie circulaire est fondée à partir de modèles commerciaux innovants. Les entreprises peuvent opter pour un modèle d’affaires différent qui satisferait les exigences de l’économie circulaire (Bocken, de Pauw, van der Grinten 2016). La société civile et publique doit être partie prenante pour renforcer les synergies entre les entreprises et les collectivités locales.

Dans ces grands axes, ces modèles économiques novateurs sont définis, et se mettent en pratique peu à peu, mais des risques peuvent créer des frictions, voire des contradictions entre les chaînes de valeurs mondiales et le nouveau paradigme circulaire (Lehmacher 2017, rapport OCDE, OMC 2013). Au niveau local et régional, une organisation est impérativement nécessaire pour mettre en place les activités de réutilisation, de reconditionnement, de régénération et de valorisation des produits. Ainsi, grâce à l’économie circulaire, un grand nombre d’entreprises et d’industriels ayant une activité au

niveau local et régional peuvent travailler avec les autres pays d'Europe et du monde. Ces réflexions et questionnements ont servi de base pour alimenter la démarche scientifique du projet scientifique qui est présenté ci- après, et ont également conditionné le choix du terrain et son ancrage géographique. Il est situé sur la Côte d'Emeraude.

Les raisons pour le choix du terrain sont les suivantes :

une réflexion menée au niveau du territoire (BreizCop, Plan Climat Côte d'Emeraude) concernant la Bretagne vertueuse d'ici 2030, et plus particulièrement l'utilisation du transport combiné pour réduire les effets du CO2, la dynamisation de la création d'emplois locaux et la réponse aux besoins des habitants en soutenant l'émergence de projets d'innovation sociale pour propulser le territoire à la pointe de la gestion des ressources et des espaces naturels,

1) une volonté des collectivités locales et des industriels de garder les jeunes sur le territoire une fois leurs études terminées et de créer de nouveaux métiers liés aux besoins générés par ce nouveau processus de production afin d'éviter la désertification (Plan 360),

2) L'aménagement maritime, prend en compte aussi bien les parties continentales que maritimes du trait de côte. C'est dans ce sens qu'a été proposé en 1999 le concept de

« Pays maritime » par Yves Lebahy. Ce concept, a été repris dans la Loi pour l'Aménagement et le Développement des Territoires de 1995 qui définit les pays comme des territoires sur lesquels les acteurs locaux — élus, socio-professionnels, acteurs associatifs — définissent eux-mêmes un projet de développement global et prospectif. La loi pour Aménagement et le Développement Durable des Territoires de 1999 donne plus de pouvoir aux Pays qui vont pouvoir développer leur territoire en prenant en compte le développement durable. L'aspect maritime ajouté par Yves Lebahy à la volonté de montrer la pertinence de cet échelon territorial particulier, notamment sur les espaces côtiers. Les réflexions de l'association des géographes de Bretagne (Pierre- Yves Le Rhun, Alain Le Sann, Yves Lebahy, Jacques Lescoat, Guillaume Marie, Jean Ollivro, Françoise Péron, Pascal Tocquer 2009), de Lebahy (Lebahy 2001) sur le lien des sociétés qui construisent leur histoire et définissent leur organisation territoriale autour de la mer, les nouvelles populations, les activités sur les rivages ouvrent la région à une nouvelle économie.

3) Lebahy (2001) propose de relancer le cabotage de proximité pour participer au développement local, en vue de revivifier le littoral. Le cabotage local avait été abandonné dans les années 1960 au profit du transport routier. Les infrastructures routières françaises étaient jugées de bonne qualité, les flux augmentaient et le prix du pétrole était avantageux. Actuellement, à la faveur de l'urgence climatique, il semblerait intéressant d'envisager de redévelopper le cabotage côtier avec une vision de développement durable et de transports doux. D'autres réflexions avaient été faites dans ce sens en 2003, par ex. Les Conseils économiques social et environnemental régionaux (Ceser) Atlantique (Bretagne, Pays de la Loire, Aquitaine) avait proposé de couvrir la façade maritime du Portugal à l'Ecosse en déployant une flotte de 300 caboteurs à voile. Chaque caboteur devrait créer 10 emplois de marins. Un quart de siècle plus tard, avec l'évolution et l'innovation technologiques, les caboteurs co-conçoivent les bateaux hybrides. C'est cette approche que nous avons choisi d'expérimenter sur la Côte d'Emeraude.

A cet égard, une étude a été menée dans un premier temps à travers des documents produits dans un cadre institutionnel, écrits établis de manière officielle ou légale et issus d'institutions qui opèrent à différentes échelles (Morandi, 2014) rendent compte de la concertation institutionnelle. L'analyse de la littérature scientifique ajoutée à cette concertation a permis de rédiger les hypothèses du projet qui feront ensuite l'objet d'une étude sur le terrain pour consolider la définition du projet littoral bas carbone.

L'hypothèse de départ est de montrer qu'une alternative aux transports routiers 100% gazole, en mettant en place des transports bas carbone associant des circuits terrestres courts, du transport maritime hybride de proximité, du ferroutage et de la batellerie, serait une excellente alternative pour développer un nouveau modèle économique de production et de consommation pour cette région et que ces nouveaux transports seraient générateurs d'activités et de création d'emplois non délocalisables. La production des acteurs locaux aurait un label indiquant le territoire de provenance et garantissant la qualité et le respect de l'environnement (par ex. Saint- Malo a créé le label « Saint-Malo »). La composante « terrestre » du projet concerne les échanges entre les territoires et suppose que les productions locales atteignent un volume suffisant pour justifier un transport par le cabotage local dans le cadre du transport combiné. Cela sera facilité par l'organisation de circuits courts et l'installation de magasins de caboteurs, magasins comparables aux magasins de producteurs, dans tous les ports qui donneront des points de vente immédiats aux entreprises. La liaison indissociable entre les composantes terrestres et maritimes fait que le projet n'a pas d'équivalent en Europe à notre connaissance. Les enquêtes de terrain se sont déroulées sur une période allant de 2017 à 2019. 132 personnes ont été consultées dans 15 ports de la Côte d'Emeraude et à Dinan. L'échantillonnage des acteurs concernés par le projet se veut aussi représentatif que possible car il y a plusieurs manières de percevoir la situation selon les générations, leurs catégories socio- professionnelles : députés et sénateurs, chargés de mission, industriels et chefs d'entreprises, maires et élus municipaux, membre d'associations, responsables portuaires, habitants, etc. L'enquête met en œuvre plusieurs techniques de recueil et d'analyse de matériaux. Trois axes d'investigation sur le terrain ont été privilégiés en lien avec les hypothèses formulées durant le processus de recherche. L'inclusion des acteurs politiques et économiques ainsi que les usagers dans l'action prend appui sur la notion de concertation, d'appréhension des pratiques et des représentations du transport maritime local et de la mise en œuvre du projet « Littoral bas carbone ». Une prédominance est accordée à la dimension qualitative (Mucchielli 2004) de la méthode, en faisant des incursions ponctuelles dans les démarches quasi-qualitatives (Paillé 1996).

Des enquêtes individuelles ont été faites qui font appel à l'entretien semi-directif. Un croisement avec ces données a été réalisé par la confrontation des résultats des matériaux recueillis pour orienter l'enquête. Parfois le recours au récit a été nécessaire. La réflexion a fait des allers et retours permanents entre observations, inductions, hypothèses, déductions entre empirie et théorie qui rendent le travail de mise en cohérence de la méthode de recherche complexe de par l'imbrication des méthodes. Le cadre de l'enquête de terrain qui associe des techniques, les croise, les adapte, met en place des stratégies de réalisation de l'enquête dans les meilleures conditions font écho aux composantes de la stratégie de recherche développée par Marengo (2013). L'intelligence collective a permis de vérifier les hypothèses, la faisabilité immédiate des lots concernant le développement du fret bas carbone et du cabotage de proximité et l'étude d'indicateur environnementaux (Llorente, Vence, 2019), des magasins du caboteur avec à l'intérieur de chacun des lots, l'observation de création

d'emplois, de nouveaux métiers et la définition de nouvelles formations à mettre en place. Les lots sont consignés dans un tableau de bord.

La première phase du projet a consisté en une expérimentation sur l'espace géographique Saint- Malo-Dinan, le résultat fera l'objet de la présentation de ce projet.

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5.B.5. Unveiling the potential of circular economy for Water Resources Management.

A. Dumont, R. Debref

Keywords: water, circular economy, innovation, territories, system

Nowadays, the concept of circular economy is being integrated into the strategy of international institutions, including the European Union, to tackle the ecological crisis (European Commission, 2019). One of the main priorities of this new paradigm is to manage the issue of waste, including plastics (Gallaud, Laperche, 2016). The diversity of definitions relating to the circular economy opens up new controversies, but also new opportunities for unexplored topics for green growth (Korhonen, Nuur, *et al.*, 2018; D'Amato *et al.*, 2019). In particular, this is the case when the circular economy is applied to land and resource management, in particular water (Si *et al.*, 2019). However, most studies focus on wastewater reuse without taking into account the other major components and functions of the water cycle. This trend is explained by the willingness to provide economic value to waste in order to relieve the pressure of extracting resources from the environment. In this context, our paper presents and discusses a series of opportunities in terms of innovation processes that aim to consider the full range of services generated by water for the circular economy.

Our methodology is based on an analysis of the literature review, while assessing different scenarios of resource use on the upstream/ downstream flow dynamics in a generic model of a river basin (including surface water and groundwater). We show how natural water cycles can be part of ongoing circular economic systems. First, we describe how the water cycle generates a series of functions and services and how the conservation of these functions creates resilience of socio-ecological systems. Secondly, we highlight the necessity that technical and organizational innovations reconnect natural water cycles with socio-economic systems in their implementation. In particular, we focus on how return flows are "naturally" reused when returned to the environment after use, contributing to the availability of water resources downstream in the basin. Thirdly, we study the determinants of the innovation trajectories that enable this to be achieved (e. g. regulation, science/technology, demand, institutions) (Debref, 2017, 2018; Calvo-Mendieta *et al.*, 2017)

Our work highlights several findings. First, we demonstrate that the classic expression of circular economy as wastewater reuse is a limited interpretation of the concept, even maybe going against its general principles, as it can generate more use of water resources, if reusing water does not imply a reduction in the withdrawals. Secondly, we identify several "missed opportunities," in a context where there is a risk is that the circular economy concept in the sphere of Water Resources Management is "hijacked" by the re-use community. Finally, we show that, in many cases, the root of circular economy for water cycle promotes an intensification of the use of resources with the finality of more economic

growth (depending on the definition adopted for circular economy), or that more value is created with fewer resources, which is often too simplistic, raising the issue of the risks of rebound effects (Polimeni *et al.*, 2008; Dumont et al., 2013; Giampietro, 2019).

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5.B.6. Evaluation de l'impact de l'économie circulaire sur les émissions de CO2 en Europe

Michelle Mongo

Résumé étendu

Le réchauffement climatique est un fait (IPCC, 2018) et la question n'est plus de savoir si nos émissions de gaz à effet de serre réchauffent la planète mais plutôt d'évaluer les conséquences de nos actions et d'identifier les solutions face à ce phénomène avant de perturber de façon irréversible tous les écosystèmes de notre planète. Dans ce contexte, l'action internationale en faveur du climat est un impératif et en signant l'accord de Paris sur le changement climatique en 2015, presque tous les pays du monde se sont engagés à maintenir l'augmentation moyenne de la température mondiale "nettement en dessous" de 2 ° C par rapport aux niveaux préindustriels et "à poursuivre l'action pour limiter la hausse à 1.5C ". De son côté, l'Union européenne s'est engagée à réduire ses émissions de gaz à effet de serre d'au moins 40% par rapport aux niveaux de 1990 d'ici 2030. Plus récemment, la Commission européenne a présenté une stratégie à long terme pour que l'UE parvienne à une économie sans impact climatique d'ici 2050 (Commission europenne, 2018). Le plan d'action en faveur d'une économie circulaire développé par la commission européenne (CE, 2019) illustre clairement les nouvelles orientations en matière de politique publique. Ainsi, il apparait nécessaire de changer de paradigme pour sortir d'une logique traditionnelle de développement économique linéaire visant à "produire, consommer et jeter" pour aller vers un développement économique qui tend à limiter le gaspillage des ressources et l'impact environnemental, tout en augmentant l'efficacité à tous les stades de l'économie des produits. Ce principe est qualifié d'économie circulaire et consiste en un système de production et de consommation reposant sur le recyclage, la réutilisation, la réparation, la re-fabrication, le partage de produits, la modification des modes de consommation et les nouveaux modèles et systèmes commerciaux (CE, 2019).

Au niveau macro-économique, l'économie circulaire est habituellement appréhendé à partir d'indicateurs liés à la gestion durable des ressources (CE, 2019; Moraga et al., 2019). Parmi lesquels on retrouve : la productivité des ressources, l'empreinte matérielle et enfin la production et le recyclage des déchets solides municipaux. Cet ensemble d'indicateurs examine les performances des États membres de l'UE dans la transformation de leurs économies en systèmes circulaires par le biais d'une réduction de la demande en ressources.

Les faits stylisés[1] montrent qu'à l'échelle de l'union européenne[2], les émissions de CO_2 tendent à diminuer (-23%) sur la période 2000-2015 tandis que dans le même temps la transformation des économies européennes en système circulaire tend à se renforcer. En effet, les données issues d'Eurostat montrent ainsi que la productivité des ressources et le recyclage des déchets solides municipaux n'ont cessé de croitre en Europe sur la période 2000-2015 (+42%) alors que la consommation intérieure de matière à connu une baisse significative sur cette même période (-19%).

Malgré ces faits stylisés qui montrent l'existence d'une possible relation entre l'évolution de l'économie européenne en système circulaire d'une part et l'évolution des émissions de CO_2 d'autre part, à notre connaissance il n'existe pas voire peu de travaux qui permettent d'analyser les relations entre ces deux types d'indicateurs. Et à plus forte raison lorsqu'il s'agit d'évaluer l'impact de l'économie circulaire sur les emissions de CO_2 à partir de modélisation économétrique.

Dans la littérature théorique, les travaux relatifs à l'économie circulaire sont habituellement dissociés de ceux relatifs aux déterminants des émissions de CO2.

D'une part dans la littérature relative à l'économie circulaire, l'économie circulaire est considéré de fait comme une solution face aux problématiques environnementales. Sur cette base les travaux s'intéressent davantage à la « substance » de l'économie circulaire, autrement dit aux différents principes, méthodes et à la manière dont ces derniers doivent être implémentés à différentes échelles (micro, méso et macroéconomiques) (Ghisellini, Cialani, & Ulgiati, 2016). D'autre part, au sein des travaux consacrés aux déterminants des emissions de CO2 le degré d'ouverture international, le

taux d'urbanisation, la structure de l'appareil productif, le niveau de richesse, l'innovation technologique et enfin la structure énergétique, constituent les principales variables habituellement utilisées pour expliquer les emissions de CO_2 (Cerdeira Bento & Moutinho, 2016; Du, Li, & Yan, 2019; Grossman & Krueger, 1991) . L'économie circulaire n'est dans ce cadre pas exploité pour expliquer les performances en matière d'émissions de CO2 des pays. Cette étude tente de contribuer au vide laissé par cette littérature en examinant à l'échelle de l'union européenne l'impact de l'économie circulaire sur les émissions de CO2 en Europe à partir d'un modèle autorégressif à retard échelonné.

Pour ce faire, nous avons utilisé les émissions de CO2 (exprimées en tonnes métriques par habitant) comme proxy de la performance des pays en matière d'émissions de CO2. La gestion durable des ressources a été utilisée comme variable explicative du modèle. Cette dernière a été approximée à travers trois variables à savoir l'empreinte matérielle (DMC), la productivité des ressources (RPROD) et enfin la part des déchets solide municipaux recyclés (RMWASTE), Enfin nous avons intégré une variable de contrôle (INDUS) qui correspond à la part des industries dans le % du PIB. À l'exception des données relatives aux émissions de CO2 et à la part des d'industrie dans le % du PIB[3], toutes les variables ont été extraites de la base de données sur les indicateurs d'Eurostat. Les tests de stationnarité[4] (Dickey & Fuller, 2006) et de cointégration de (Pedroni, 2004) nous ont permis d'opter pour le modèle autorégressif à retard échelonné proposé par (Pesaran & Smith, 1995). Ce dernier est le plus approprié dans le cas d'échantillon de petite taille et permet d'estimer les dynamiques de court et long terme.

Nos principaux résultats sur la période 2000-2015 montrent que : A long terme l'ensemble des indicateurs relatifs à la gestion durable des ressources présentent des impacts négatifs sur les émissions de CO2. Autrement dit, à long terme, la gestion durable des ressources tend à faire baisser les émissions de CO2 en Europe. Néanmoins, à court terme on observe des divergences concernant l'impact de ces indicateurs. En effet, il apparait ainsi que l'empreinte matérielle et la productivité des ressources présentent des effets significatifs et positifs sur les émissions de CO_2. Autrement dit, à court terme la demande d'extraction de matériaux[5] déclenchée par la consommation et l'investissement des ménages, des gouvernements et des entreprises dans l'UE de même que la quantité totale de matières directement utilisées par les économies Européennes contribuent à la hausse des émissions de CO2. Seul le recyclage des déchets solides municipaux tendent à faire baisser les émissions de CO2 en Europe.

Plusieurs orientations en matière de politiques publiques peuvent être dressées au regard de nos résultats.

Les résultats relatifs à l'effet de la gestion durable des ressources sur les émissions de CO2 à long terme confirment la nécessité d'un changement de paradigme en matière de développement économique. La transition vers une économie circulaire constitue une solution permettant de répondre aux enjeux climatiques.

Toutefois les résultats à court terme, soulignent le travail encore à mener pour aboutir à une gestion plus efficiente des ressources en Europe. En effet la demande d'extraction de matériaux déclenchée par la consommation et l'investissement des ménages, des gouvernements et des entreprises dans l'UE de même que la quantité totale de matières directement utilisées par les économies Européennes restent encore trop importante et contribuent en ce sens à une hausse des émissions de CO2 à court terme.

L'une des stratégies en matière de politique publique serait d'inciter à un changement de comportement des individus en matière d'usage et de consommation des biens et services. (Sorrell, 2010) admet qu'il est impératif d'inciter les individus à consommer plus efficacement ce qui implique

de réduire les impacts environnementaux associés à chaque produits et services. Il s'agit entre autres d'inciter les individus à consommer autrement en privilégiant les biens et services ayant un impact moindre sur l'environnement. Pour les partisans de l'économie écologique l'environnement doit être considéré comme le support de toute activité humaine dans laquelle la donnée d'entrée est la capacité de l'environnement à fournir des ressources et à absorber des déchets, et la donnée de sortie (résultante) le niveau de développement (Boutaud, Gondran, & Brodhag, 2006). C'est le principe de la soutenabilité « forte ». Il s'agit alors dans le cadre de la soutenabilité forte de s'appuyer davantage sur des mesures visant à accompagner les changements structurels profonds dans les modes de vie des individus.

Mots clés : émission de CO2, économie circulaire, gestion durable des ressources, Union Européenne UE-15, données de panel ; ARDL

Classification JEL : Q53 ; C23

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5.C. REGIONAL STRATEGIES FOR CIRCULAR ECONOMY: THE GALICIAN CASE

5.C.1. Análisis crítico de la estrategia gallega de economía circular, a partir de la metodologia del metabolismo socioeconómico.

Rosa Regueiro, Xoan Doldán

En el año 2015, la Unión Europea publicó un catálogo de medidas basadas en el paradigma de la economía circular, teniendo como eje de actuación las acciones sobre la extracción de recursos, el uso de bienes derivados de los mismos y la generación de residuos consecuente. A partir de aquí, el plan de acción para la economía circular de la Comisión Europea centra los esfuerzos en establecer medidas legislativas que logren reducir la generación y almacenamiento de residuos, y aumentar su reutilización y reciclaje, tratando de cerrar el círculo en el uso de materiales.

Tomando como referencia el plan europeo, la Xunta de Galicia ha puesto en marcha la Estrategia Gallega de Economía Circular 2020-2030, formada por ocho ejes prioritarios de actuación. Para su elaboración se contó con la participación de los diferentes agentes implicados (administraciones públicas, empresas, ciudadanos, etc.) buscando conseguir impactos positivos en los recursos (agua, aire, energía, alimentos, suelo, residuos), atendiendo a las necesidades específicas de Galicia. Dicha estrategia, pese a sus objetivos, debe contrastar su efectividad a la hora de cerrar el círculo de los materiales y ser más eficiente en el uso de la energía.

Aun cuando el horizonte temporal para la ejecución de dicha estrategia no nos permite evaluar sus resultados, en esta comunicación, se realizará un análisis crítico de los ejes de actuación de la Estrategia Gallega de Economía Circular, a partir de los indicadores existentes en diversos estudios a partir del uso de la metodología del metabolismo socioeconómico. Esta metodología ha permitido estudiar los flujos materiales y energéticos a nivel regional y mostrar algunos puntos débiles en el uso de recursos de Galicia, su dependencia material y energética, y la presión de la extracción interior sobre los ecosistemas gallegos. A partir de esta información pretendemos ofrecer una valoración preliminar de la idoneidad de las actuaciones previstas en la Estrategia gallega para resolver esas debilidades. Mediante el conocimiento de la intensidad demográfica, territorial y económica en términos de Input Material Directo y de Consumo Material Interior, se puede conocer el valor del flujo directo de materiales en la economía de Galicia (es decir, extracciones locales más importaciones, que se convierten en stocks, en residuos y en exportaciones). En definitiva, se hace una valoración de la "ecoeficiencia" de la economía gallega a partir de las propuestas de la Estrategia, que depende también del grado de cumplimiento de la legislación ambiental y de las políticas fiscales.

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5.C.2. The discourse of circular economy at a local level; an analysis of the implications of the implementation of the Circular Economy Action Plan in Galicia (Spain)

Josep Pinyol, Mario Pansera

Keywords: discourse analysis, circular economy, sustainability, public policy, Galicia.

Abstract:
The Government of Galicia (Spain) is in the process of approving a new strategy called Estratexia Galega de Economía Circular(EGEC) in an ambitious plan to transition the Galician economy towards a sustainable paradigm.The EGEC emerges from the need to promote an ease the transition towards a circular economy, and it aims to develop the strategic framework defined by the European Commission and adapt it to the economic, social and environmental particularities of Galicia(European Commission, 2018; Rodríguez, 2019). Although the EGEC is still a policy draft under a process of public review at the moment of writing this paper, we analyse the discourse embedded within the EGEC and the political context in which this has been composed, while acknowledging that this document has been exposed to a process of public review, but it still needs to be further promoted and explained to the Galician public opinion and it has to be presented and negotiated in the Galician Parliament to finally be approved.
This research aims to answer what are the ideological implications of the EGEC based on the analysis of the communicative elements that it employs. In this research, we adopt a discourse-based approach to understand the how different interest-groups seek to establish a particular narrative, or understanding of events as a mean to pursue specific political objectives(Jacobs, 2004). The key claim of the discourse-based approach is that language and discourses are not just as mere tool for social interaction, discourse is the way in which humans integrate linguistic and non-linguistic features to recognize different identities and build meaning and conceptualize reality (Jacobs, 2004; Nicolini, 2012).By using Critical Discourse Analysis (CDA),we explore how the EGEC is embedded within the existing discourses in the Galician political arena, what set of ideas and discourses are being reproduced by the EGEC and what are its implications of this policy from a discursive perspective.
To analyse and scrutinize those linguistic practices, Jacobs (2004) proposes framework based on Fairclough's work, that consists of a framework that consists of three categories; (1) 'text analysis',(2)'discursive practice' and (3)'social practice'(Jacobs, 2004).The sources to perform this analysis had been the media coverage on the debate on circular economy in Galicia, press releases, academic literature, and possibly interviews and correspondence with key policy actors. All these sources are essential to ensure a clear understanding not only of the policy proposal itself and the public reactions of the proposal, but to ensure a comprehensive understanding on the political context in which the EGEC is being debated.
The EGEC is a holistic strategy that has the ambition to implement a paradigm of a circular economy in Galicia. This implementation is motivated by (1) the need to adapt to a changing international context that is also adopting circular economy strategies with a special emphasis at the EU initiatives to promote the adoption of a circular economy at the EU level, (2) by a context of resource scarcity that is expected to affect the EU economy, and (3) by a recognized environmental crisis. At a Galician level, the EGEC is also expected to promote the reindustrialization of rural areas, support economic growth, job creation, and to stop rural exodus from rural areas in Galicia.
In our results, we find that the EGEC reproduces an eco-modernist understanding of the concept of circular economy, that recognises the environmental crisis in which we live, but also seeks to perpetuate the market-based capitalism and maintain the principles of a free-market and economic growth as a pathway towards a sustainable development. The EGEC is also disconnected to the existing environmental conflicts and debates within the Galician society, crafting a policy proposal strongly influenced by stakeholders from academic, political and business spheres, and free of influence from environmental NGOs and other civil society organizations.
This practice is also reflected in the expected impact of the EGEC, that focuses on issues as generating growth, encouraging financial and material efficiency, and opening up new markets, but does not meexplicitly addresses other issues as monitoring issues provoked as public health issues caused by pollution, addressing social justice when implementing this transition, or reframing the idea of societal welfare beyond the mere generation of employment.
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5.C.3. Design of a circular economy strategy. The case of the Galician Circular Economy Strategy

Michel Rodriguez

The European Union began in 2010 the transformation of the prevailing economic model until then, delivering in December 2015 a package of measures aimed at transforming the linear economy based on the pull-use-and-throw trinomy into a circular economy. Under this new paradigm, when we had waste in the old model, we now have potential resources that may be reused by the production system. That package of measures includes a number of proposals that will have a major impact on the various levels of both productive and economic and social as well as purely environmental ones.

With the fundamental aim of facilitating and promoting the transition of Galicia towards a true circular economy, the Galician Ministry of Environment and Regional Planning has promoted the design of its own circular economy strategy. The objective was to develop the framework established by the European Commission, adapting it to the Galician economic, social, natural, productive and energy peculiarities, entailing not only environmental benefits associated with the proper management of waste, the protection of soil, water, air, or water, but will also provide associated economic and social benefits.

This paper presents the main elements of the Galician Circular Economy Strategy designed by a team of researchers from the three Galician Universities. In order to develop the Galician Circular Economy Strategy, the first step was to perform a revision of the political initiatives developed to boost the circular economy within the space of the European Union. At the same time, a diagnosis has been made to reflect the current socio-economic conditions of Galicia and its state of affairs in the challenge of implementing the circular economy. From this analysis it is possible to identify 8 priority axes of action for the Circular Economy Galician Strategy. For each axis of action, several proposals have been elaborated in which different agents (public administrations, companies, citizens, etc.) must participate in order to achieve positive impacts on resources (water, air, energy, food, soil, waste).

The main aims of the Galician Circular Economy Strategy may be summarized as follows.

- Promote a knowledge-based economy, for which it is necessary to promote the technological development necessary to advance on economic circularity, encouraging public-private collaboration between research institutions and bodies, particularly in those strategic sectors of the Galician economy.
- Promote life cycle philosophy and eco-design in business culture, which will help reduce waste generation, as it is estimated that up to 80% of all environmental impacts of a product in its life cycle are determined by its design, both of the product itself and of the processes of production and consumption.

- Promote a circular economy information platform, thus allowing cross-cutting eco-design through the dissemination of information, both of good practices and of the agents involved in the development of circular technologies and business models in Galicia, allowing the creation of networks for the stimulating circular economy.

- Greater training and information, introducing the circular economy in formal and non-formal education, strengthening communication for the circular economy and promoting greater visualization of eco-designed products and services, with the ultimate aim of promoting sustainable consumption in through digital ecosystem.

- Encourage new business models based on the “use” of product, replacing product ownership with service consumption, promoting community use of goods and utilities, extending product life by promoting repair activities, and creating business spaces decentralized community and cooperative production.

- The circular economy as a demographic engine, highlighting the material and human resources of the territory, prioritizing the development of a biotechnological pole for the production of high value-added products in the primary sector that allows the reduction of waste.

- Eco-efficient urbanism, which adopts urban criteria aimed at achieving more sustainable settlements that minimize the use of land and the needs of motorized displacement, promoting the life cycle approach and other tools for the circular economy in construction and urban planning.

- Eco-efficient management of the water cycle, promoting the design, production and use of more efficient equipment, encouraging the re-use of water and resources contained in wastewater, and seeking to obtain high value-added products at closing the water cycle of urban and industrial water consumption.

- Prioritize circularity in waste management, observing the effective application of the waste hierarchy, promoting separate quality collection for composting and recycling waste as high value-added raw materials.

6.A. BUSINESS MODELS

6.A.1. Product-service system for circular economy: a scoping review

Marek Ćwiklicki

Keywords: product-service system, circular economy, scoping review

Abstract
The paper aims to find an answer to a research question: how Product-Service System (PSS) is described within Circular Economy (CE) context? PSS is defined as "an integrated bundle of products and services which aims at creating customer utility and value" (G. Bressanelli et al., 2017, p. 44). This approach does not refer directly to CE (Gnoni et al., 2017), but contributes to increasing resource efficiency, extending the product-lifespan, and closing the loop (G. Bressanelli et al., 2018; Frishammar & Parida, 2019). According to the study about modes and factors in the transition towards a circular business model, PSS is perceived as a key element in this process (Ćwiklicki & O'Riordan, 2019). Therefore the detailed analysis of PSS relations and context within CE is required in order for better understanding its meaning and driving force for CE.
The methodology employed for answering posted research question is based on scoping review guidelines (Tricco et al., 2018). Scoping review will covered papers indexed in Scopus database. The search phrase {"Product-Service System" and "circular economy"} in "Abstract" field returned 71 document results. The inclusion criteria cover: peer-reviewed journal articles, conference proceedings, books, and research reports, and a focus on PSS and CE. Exclusion criteria embrace policy documents and papers not written in English. Identified papers will be evaluated according to a set of criteria, such as: author, year of publication, source origin, purpose, methodology, concept, PSS types (Mont, 2002), key findings relating to the review question.
The results will be charted using a Microsoft Excel template. Next the content analysis will be performed of each paper selected to qualitative analysis. Finally it will enable to synthesis current state-of-the-art about introducing PSS for CE with distinguished main key areas.
The initial results demonstrate that PSS in CE is a recent development. Founded papers cover the period: 2008-2020. Since its first mentions date in 2008, there is a five years gap. From 2014 we observe increase in papers dealing with these topic (Fig. 1).

Fig. 1. Number of papers about PSS and CE in Scopus

Quantitative analysis of collected papers show diversified subject area of papers covering: engineering (31,5%), environmental studies (19,5%), energy (16,8%) and social sciences (12,1%), while the other areas do not trespass 10% share. As the content analysis, qualitative narrative analysis, is not yet finished, the complete results will be delivered during conference.

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6.A.2. L'économie circulaire dans le secteur textile : un retour aux sources ? Une étude de cas en Région Bruxelles Capitale

Marine Spor

Keyword: économie circulaire ; innovation ; textile;

Dans un article présentant un état de l'art complet autour de la notion d'économie circulaire, M. Geissdoerfer propose une définition du concept d'économie circulaire à partir de différents apports théoriques : « *Based on these different contributions, we define the Circular Economy as a regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling.* » (Geissdoerfer, Savaget, Bocken, et Hultink, 2017.) Dans le cadre de la politique bruxelloise de promotion d'économie circulaire, le secteur textile se distingue par l'ancienneté de sa structuration sur le territoire, la densité de ses acteurs et la professionnalisation de son secteur depuis une dizaine d'années. Un des impacts du Programme Régional en Économie Circulaire[1] est de donner une plus-value monétaire et marchande à ces « déchets ». Depuis 2018, les politiques publiques en place évoluent vers une action commune avec des organismes anciens de revalorisation des déchets textiles, relevant notamment de l'économie sociale, dont le professionnalisme est reconnu. Les « nouveaux commerces circulaires », c'est-à-dire dont le modèle d'affaires est vu comme pleinement circulaire, participent de la modernisation et profitent de la tendance mondiale de valorisation de la seconde main. Toutefois, leur modèle d'affaires est soit, très similaire au modèle des « fripes » (vente de textile de seconde main), soit pose des problèmes en termes de viabilité (rentabilité, difficulté de convaincre une nouvelle clientèle, obsolescence des vêtements). Dans le premier cas, l'économie circulaire dans le secteur textile réactualise des pratiques anciennes de consommation, parfois informelle, souvent encadrée par des structures solidaires ou caritatives, plus généralement appelées « fripes ».

Ainsi, sur le territoire bruxellois, la question est de savoir si ces nouveaux business-modèles circulaires représentent une véritable innovation commerciale ou s'ils participent d'un mouvement de revalorisation cyclique des déchets textiles. Ce mouvement remonte au XIX^{e} siècle, période à partir de laquelle, pour des raisons économiques (la fin de l'utilisation des déchets textiles comme matière première de l'industrie papier) et hygiénistes (l'invention du tout à l'égout), les chiffonniers et leurs pratiques de récupération textile ont progressivement disparu (Béguin, 2013).

Pour répondre à ces questions, nous nous appuyons sur un terrain réalisé entre juin 2018 et mai 2019, avec 47 entretiens semi-directifs et cartes mentales réalisées auprès de consommateurs bruxellois et de personnes-ressources (fonctionnaires, responsables d'association et entrepreneuses). Les consommateurs de ce secteur se reconnaissaient dans des valeurs spécifiques, comme la solidarité, l'éthique et la protection de l'environnement, valeurs qu'ils retrouvent dans les magasins dans lesquels ils consomment, indifféremment de leur caractère circulaire. Ce qui nous intéresse ici, c'est la manière dont les consommateurs répondent, voire revendiquent cette « promesse de différence » (Le Velly, 2017) qui se retrouve, pour partie, dans les commerces circulaires. À ce titre, le narratif instauré par la marque ou le commerce est particulièrement important, à l'instar de ce que l'on retrouve dans d'autres secteurs commerciaux (Badot, 2005). Le consommateur souhaite ici créer « une relation d'amateur-expert » par rapport au produit (Dubuisson-Quellier, 2018, p.83). Par ailleurs, le secteur de l'économie circulaire dans le textile semble ainsi se développer de la même manière que le secteur textile conventionnel (emplacements similaires, storytelling, logique de comparaison) en se concentrant dans les mêmes zones ce qui nous fait dire avec B. Wayens et J. P. Grimmeau que c'est bien « la comparaison qui crée la concentration. » (Wayens et Grimmeau, 2006), d'autant plus que le vêtement est un bien de comparaison par excellence. Tout comme l'on constate une concentration des magasins de fast-fashion, on constate d'une part une concentration des magasins de seconde main et d'autre part des commerces « circulaires » sur le territoire. Ainsi, dans un écosystème politique et économique favorable, coexistent sur le territoire bruxellois des acteurs anciens de la revalorisation, au maillage commercial très dense et des acteurs « nouveaux » qui réactualisent la fripe en tentant d'instaurer des modèles d'affaires innovants et circulaires (Tukker, 2015), la question étant de

comprendre quelle est la valeur ajoutée « circulaire » de ces commerces dans le secteur textile. La question est d'autant plus controversée que les stratégies de production des gros joueurs de la fast-fashion, si elles tendent de plus en plus à intégrer des enjeux circulaires (voir les actions de H&M notamment avec la Fondation Ellen MacArthur, sa gamme *Conscious* ou encore son programme de recyclage de vêtement), sont encore bien marginales. Au vu des logiques de production actuelles qui ne tendent pas vers la décroissance, on peut se demander, si l'on suit D. Bourg et C. Arnsperger, si l'économie textile sera un jour vraiment circulaire (Arnsperger et Bourg, 2016).
Nos résultats actuels prennent la forme d'une typologie du commerce circulaire organisée autour de deux axes : le secteur marchand et non marchand et le type de lieu d'échange avec pour pivot la circularité de leur modèle d'affaires. Dans ce schéma, deux types de commerce sur six correspondent à la description d'un commerce à la fois circulaire et solidaire, dont un n'appartenant pas au secteur marchand. Le même travail de typologie a été réalisé sur la question du vêtement autour des freins et des motivations des consommateurs à consommer circulaires : en fonction du type de commerce, les motivations et les freins peuvent se recouper comme être contradictoire, indiquant une valuation différente, au sens de Dewey (Dewey, 2008). Un travail de cartographie sur la distribution spatiale de ses commerces a aussi été réalisé : on constate une nette différence entre les commerces circulaires et les commerces d'économie sociale et solidaire dans leur distribution spatiale.

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6.A.3. Fast fashion and slow transition towards CE: an analysis of the leading mass market Inditex-Zara

Ángeles Pereira, Xavier Vence

The strong environmental impacts caused by the fashion industry are pressuring leading companies towards the adoption of new sustainable practices and business models. In the recent literature on business models for the Circular Economy, there is evidence of a good number of sustainable initiatives in the field of fashion (Fischer & Pascucci, 2017; Hansen & Schaltegger, 2013). In most cases these are start-ups, born with sustainability at their core. However, the achievement of a circular economy requires that the large market-dominant companies take steps in the same direction. The aim of this

article is to analyse and understand the incorporation of circularity principles into the business model of a leading company in the mass fashion market, Inditex (Zara). Specifically, we focus on two aspects: 1) the analysis of the changes of Inditex business model in order to move towards a circular model; 2) the critical assessment of the business model circularity from a wide system innovation perspective.
This paper is based on an in-depth case study conducted over 2017-2018 within the R2PI Horizon 2020 project. The methodology follows a qualitative approach, including desktop research and in-depth interviews with key representatives of the fashion holding. Theoretically, the paper builds upon the literature on sustainable business model innovation (Boons & Lüdeke-Freund, 2013) and the approach of sociotechnical transitions (Bidmon & Knab, 2018; Geels, 2005).
Inditex is working to develop a more sustainable sourcing business model and has created the Join Life collection.Join Life labelled garments are those that are manufactured according to more sustainable raw materials and fibres,as well as adopting the best production processes. Key milestones of this model are:
•Inditex is increasing the number of products in its collections that use renewable and circular raw materials,such as more sustainable and recycled fibres. Inditex brands (e.g. Zara) are the biggest buyers of moresustainable fibres such as Tencel™ Lyocell. The group is ranked fifth in the world in the consumption of organic cotton by volume.
•With a key supplier they have developed Refibra™, using Inditex's textile waste (from key suppliers) andwood sourced from sustainably-grown forests. All of the raw materials used by Inditex that come fromforests (viscose, lyocell) are FSC® certified.
•Inditex acts as an intermediary in the supply chain, linking specific suppliers to take advantage of fabricsleftovers, which are added to virgin materials to produce new fibres that can re-enter the garmentmanufacturing processes afterwards.
•Inditex has settled containers in all Zara and Bershka stores in Spain to collect clothes from customers.The customers are also able to deliver their clothes when they receive online orders at home. Moreover,Inditex also supports third sector organisations in a number of markets to set urban garments collectors.All clothes collected are donated to targeted NGOs, which classify, sort, clean, repair and recycle them.
The circularity of Inditex business model was assessed according to three dimensions: the product itself, the business model and the system. At present, Inditex scores on a middle position with regards to product circularity. The circular business model strongly depends on the design and composition of the garments. The holding has a strong control on materials and chemical composition of those materials, and also states a high value for use of recycled materials, from both own suppliers and third parties. On the contrary, Inditex recognizes low values to design for disassembly, biodegradability, design to return to a technical or biological cycle, to be repairable, to be upgradable o to be remanufactured.
In essence, the company's business model remains the same as the linear one. In other words, the Join Life value proposition does not specifically target different segments nor does it seek to develop greater awareness among existing customers. The revenues are clearly dependent on product sale while service-based models are very far in the holding strategic plans.
Inditex is making efforts in creating, in collaboration with third parties, a take-back scheme for clothing. Non-profit organisations in a number of countries are placing collectors in different urban spaces to collect used clothes. That means that these non-profit organizations are taking advantage of a gap in the system. They receive discarded garments and prepare them for a next use, e.g. through second-hand sales and donations, or for recycling when they cannot be longer used. Besides the collaboration with non-profit organizations, Inditex also has agreements with other industries. In this sense, most of textile waste is down cycled, meaning that pre- and post-consumer waste are usually sold as a filler to companies in the construction and automobile industries.
Opposite to fashion startups born with sustainability values at their heart, the case of Inditex shows that incumbent companies usually adopt strategies that do not radically challenge their linear-based competitive advantages. According to previous literature Inditex innovation towards the CE could be qualified as evolutionary, since changes basically occur in individual components of the business model

over time (Foss & Saebi, 2018) . It can also be identified as an upstream adoption mode, which basically focus on the supply chain and the cost structure (Urbinati, Chiaroni, & Chiesa, 2017). Based on other work (Schaltegger, Lüdeke-Freund, & Hansen, 2016), Inditex business model innovation towards circularity reflects common features with other mass market companies. They basicallyface the challenges of effectively combining some aspects of sustainability with the key characteristics of the product and purchase motivation for existing customers, increasing efficiency through expanded sustainable production and distribution systems, and reducing the cost of sustainable products through a rapid shift to large-scale production. The sustainability of the business model is mainly of technological character (Bocken, Short, Rana, & Evans, 2014) and the strategy adopted by Inditex is aimed at extending resource value, rather than to slowing resources (Nancy M.P. Bocken, de Pauw, Bakker, & van der Grinten, 2016).

Key words: Circular Economy, Innovation, Business Models, Sustainability, Fashion Industry

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6.A.4. The textile industry: in search of sustainable business models

Céline Merlin-Brogniart

Key Words: Functional economy, Circular economy, Service economy, textile sector

Purpose and Research Questions

The textile industry is the second most polluting industry in the world. Overproduction linked to fast fashion has accelerated the speed of collections since the 1990s, leading to a massive extraction of resources. Some players of this industry are looking for new solutions. The circular economy is one of the paths being considered. Is the transition to new business models conceivable? This presentation analyses the involvement of companies towards one of the new business models linked to the circular economy: the functional economy.

The functional economy is described by W. Stahel (2016, p.15) as "a circular economy where economic actors maintain the ownership of goods as well as the resources contained in the goods, which implies an internalization of risk and waste costs". This "performance model" (W. Stahel, 2006) uses the service economy to provide complex solutions to the limitations of the mass production and consumption model. (W. Stahel, 2016, p.15). Thus, "the economy of functionality derives economic benefits by avoiding transaction costs and exploiting efficiency and sufficiency solutions, and by providing users with system solutions ".

This presentation aims to present key findings about the economic transition of companies in the textile industry towards the functional economy. One of the goals of this research is to collect insights from different actors from this industry on the main challenges faced by their companies during their transition towards sustainable business models and in particular functional economy.

The research questions are the following: What are the main obstacles to the implementation of sustainable business models and what are the drivers? What are the key institutional requirements needed to promote the adoption of these sustainable business models?

Analytical framework, Methodology and main results

The scheme of resource efficiency presented by Giarini and Stahel is used as a grid for the analysis of the integration of sustainable strategies in the textile industry (Giarini, Stahel, 1989). This grid is extended by the analysis of the concept developed by Stahel of "functional Economy" in the 1980s, then brought to France by D. Bourg at the end of the 1990s. The transition from an industrial company to the functional economy is achieved by replacing the private appropriation of the product being sold with access to its use (Stahel, 1997, Bourg, Buclet, 2005; Du Tertre, 2006, Van Niel, 2014). Substituting the sale of a service for the sale of a material good can allow a reduction in the consumption of raw materials and energy, by creating "the highest possible use value for the longest possible time while consuming as few material resources and energy as possible. The aims is thus to achieve a higher competitiveness and increased corporate revenues (…)" (Stahel, 2006, p.145).The functional economy is therefore more sustainable than the current economy: by retaining ownership of the product, and providing maintenance, the company increases the product's lifespan and ensures its recycling.

The case studies are built around qualitative research methods, including interviews with actors involved in the textile sector, document analysis to examine the business models of the companies studied.

The results show that firms involved in these sustainable business models are engaged to different levels. These companies use elements of different analytical models because there are no precise guidelines on this subject. Furthermore, the different understandings of circular economy create difficulty for different types of stakeholders to participate to these sustainable economic systems. Models from the economics of functionality attempt to combine the environmental perspective with other dimensions of sustainable development. Service economics enables complex solutions to be envisaged. Currently, the textile "industry" is not able to offer closed loop solutions because it faces many barriers. There are hard barriers to the functional economy such as technological challenges, high initial investment costs, imperfect information) and soft barriers such as the institutional context, the standard of accountancy. The main obstacles are the lack of recycled resources, the non-transparency of supply chains, the lack of stakeholder involvement. The main drivers that lead stakeholders to think about sustainable models are market saturation and awareness of the impact of their activity on the planet.

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6.B. DO IT YOURSELF INEDIT

CE EXPERIENCES: TECHNOLOGIES, COMPANIES AND PORTS

- L'écologie industrielle dans le port de Dunkerque

Gwenaelle Cotonnec

Situé sur la Mer du Nord à 40 kilomètres de Douvres (Angleterre) et à 10 kilomètres de la frontière belge, le port de Dunkerque, port côtier de haute mer, s'étend sur une longueur de 17 km et couvre une superficie terrestre de 7 000 ha.

Classé 7ième port du Range nord européen qui s'étend du Havre à Hambourg, il est le 1er port français d'importation des minerais et de charbon, 1ier port français pour l'importation de fruits en conteneurs, 1ier pôle de fret ferroviaire français, 2nd port français pour les échanges avec la Grande-Bretagne et 1ier port fluvial du Nord/Pas de Calais. 3ième port français, le Port de Dunkerque est réputé comme port de grands vracs destinés à ses nombreuses implantations industrielles.

Port à vocation industrielle, il accueille à ce jour plus de 250 industries sur son territoire, dans des domaines aussi variés que la sidérurgie, la chimie, l'énergie et plus récemment l'agroalimentaire.

L'une des caractéristiques de ce tissu industriel est sa structuration selon le concept de l'écologie industrielle. En effet, dès l'arrivée de la sidérurgie sur l'eau (Usinor) dans les années 1960, des synergies entre industriels ont vu le jour au travers de la valorisation des gaz sidérurgiques et des gaz des hauts fourneaux. Durant les décennies suivantes, de nombreuses synergies sont apparues au gré des implantations industrielles sur le territoire portuaire : valorisation des eaux chaudes de la centrale nucléaire de Gravelines, développement d'un réseau urbain de chaleur, production d'électricité à partir de la chaleur, valorisation de co-produits en matières premières, …. C'est ainsi qu'une véritable toile industrielle s'est progressivement mise en place et continue de se renforcer au fil des années.

A partir des années 2000, le territoire a éprouvé le besoin de transcrire cette situation afin de mieux l'appréhender, de mettre en exergue les flux de matières et d'énergie existants entre les industriels et d'étudier les retombées socio-économiques et environnementales de l'écologie industrielle.

Fort de toutes ces connaissances, le territoire dunkerquois souhaite désormais se saisir de ce concept afin de valoriser les flux de matières et d'énergie résiduels en développant le territoire portuaire de manière optimisée. En ce sens, plusieurs études et projets sont actuellement en cours tels que le développement d'un outil de marketing industriel ou encore des études de faisabilité de valorisation des flux résiduels les plus massifiés.

- "Valorizando a terra galega. Transformando un residuo en recurso para os sectores agroforestal e gandeiro

Agroamb

1PRESENTACIÓN DO GRUPO AGROAMB

O Grupo Agroamb conformase a través dunha estrutura de catro empresas que permiten pechar o ciclo da produción agrícola, co aporte engadido da valorización de restos orgánicos biodegradables como fertilizante de uso agrícola. En concreto o conxunto das empresas do grupo que empezou soamente ca produción forraxeira (ca rotación de prado-millo), na actualidade dan servizos de

asesoramento e xestión á industria produtora dos residuos, realizan o transporte e o tratamento dos restos orgánicos biodegradables para finalmente elaborar os plans agronómicos e distribuír e aplicar o fertilizante na terra, xa convertido nun RECURSO de alto valor engadido: Ademais de realizar todos os traballos agrícolas necesarios para a adecuada aplicación usando a chamada agricultura de precisión xeorreferenciada, contribuíndo así ao aforro de enerxía, sementes, fertilizantes e produtos fitosanitarios. Camiño a 4ª revolución agrícola e a consecución dos Obxectivos de Desenvolvemento Sostibles da Axenda 2030.

O grupo está composto por as seguintes empresas participadas polos seus socios entre si. Unha estrutura empresarial que, entre outros galardóns e premios, recibiu en 2017 o da plataforma #Circulareconomyindustry, que incluíu ao grupo Agroamb como exemplo de negocio de economía circular europea, por pechar o círculo da materia orgánica.

E en 2019 foi unha das catro firmas privadas recoñecidas polas súas boas prácticas no eido do desenvolvemento sostible. A Comisión Europea concede estes galardóns a entidades que teñan impulsado a obtención da certificación EMAS como motor de cambio cara a unha transición sostible. Este recoñecemento foi moi importante para todoas as persoas que formamos Agroamb, o verdadeiro "motor" de éxitos coma este é "o compromiso e o nivel de desenvolvemento que temos acadado como equipo".

- Ónega Ares, S.L. Servizos agrícolas. Servitización. Agricultura de Precisión.
- Trobo Agrícola, S.C.G. Cooperativa agrícola de forraxes e cereais autóctonos.
- Agroamb Prodalt, S.L, CIF-B27257666, Ponte de Outeiro, Castro de Rei, Lugo www.agroamb.com

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RESUMO "Sentido da reciclaxe" "Economía Circular" "Desenvolvemento Rural Sostible" ."ODS".

Agroamb conforma hoxe un grupo de empresas de capital integramente galego cunha orixe familiar,nacidas no rural e para o rural. O seu precursor, emprendedor por natureza, comezou a súa actividade ligada ao campo, mercando e vendendo un produto tan galego como é a pataca no ano 1943, con só 14 anos. Toda a súa vida estivo dedicada ao traballo e cultivo da súa terra e a doutros, ofrecendo os seus servizos agrarios. Severiano Ónega Ramberde foi unha persoa adiantada á súa época que rexistrou en Lugoun dos primeiros tractores adquiridos da provincia coa intención de prestar servizos á comunidade.

A mesma mentalidade de colaboración e mellora foi a que levou os seus dous fillos a ampliar e modernizar esta actividade vinculada á terra e á agricultura. Severiano Ónega Ares, coa finalidade de aplicar un fertilizante orgánico de calidade aos cultivos da súa familia, converteuse no primeiro xestor en Galicia autorizado pola Consellería de Medio Ambiente para o uso de restos orgánicos en agricultura. Ese foi o xerme de Agroamb Prodalt que naceu co século (2000) como iniciativa de emprego local. A necesidade puntual dunha industria local de buscar solución aos seus, restos orgánicos e a experiencia previa na fertilización das súas parcelas, deulles aos irmáns o punto de partida, para a nova aventura empresarial. E deste xeito no 2000 o Grupo pechou o círculo, o que hoxe chamamos Economía Circular.

Álvaro e Severiano, dous irmáns emprendedores cun ADN especificamente agropecuario e con cega confianza nas vantaxes de alimentar o I+D+i coa colaboración das Universidades Galegas, e en especial coCampus Terra, apostaron pola innovación e a diferenciación para engadir valor ao rural galego. A

súa visión foi a que levou a empresa cabeza do grupo na actualidade, Agroamb Prodalt, a converterse en líder galego de xestión e valorización de residuos orgánicos biodegradables para uso en agricultura.

Agroamb Prodalt ofrece unha alternativa estratéxica, viable e sostible á xestión dos residuos orgánicos biodegradables xerados pola industria agro-alimentaria (conserveras, lácteas, cárnicas, etc) e as explotacións gandeiras, así como as plantas de tratamento de augas residuais, tanto urbanas como industriais. Foi a primeira empresa en Galicia autorizada para xestionar valorizando especificamente residuos desta índole e en obter a autorización de Planta Técnica para Elaboración de Fertilizantes. A planta de valorización de residuos orgánicos biodegradables en Ponte de Outeiro (Castro de Rei) procesa e recicla máis de 250.000 Tm/ano de residuos a través dun proceso pioneiro e controlado.

Sendo a xestión de residuos, probablemente unha das necesidades e dos retos medioambientais máis importantes do S.XXI, Agroamb Prodalt está a xerar riqueza, convertendo estes restos orgánicos destinados a ser residuos nun recurso para a terra,valorizándoos como fertilizante agrícola e forestal, o que produce unha mellora considerable da economía rural de Lugo, provincia de España na que o sector agropecuario ten maior peso.

Os residuos analizados previamente para determinar a súa aptitude para uso agrícola son tratados e hixienizados para, posteriormente, elaborar diferentes emendas e fertilizantes orgánicos que melloran as propiedades físicas, químicas e biolóxicas da terra galega. Deste xeito, ademais, benefícianse ambas as partes: os gandeiros poden asumir as súas obrigas sobre o tratamento dos xurros e os agricultores poden acceder a un fertilizante orgánico que ademais contribúe a reducir as emisións de CO2.

Neste contexto o futuro do rural require cada vez máis de coñecementos e innovación. O Grupo Agroamb ten un forte compromiso en contribuír a recuperar o emprego no rural e a xerar riqueza aproveitando os nosos recursos e as novas tecnoloxías. Nos últimos anos o grupo investiu máis de 2 millóns de euros só en investimentos de I+D+i en proxectos PGIDIT, Incite ou Feder, ConectaPeme e Interconecta; e outros 2 millóns de euros nas ampliacións das súas instalacións. E máis de 6 millóns en equipos agrarios e maquinaria especializada.

A súa filosofía de actuar no local para contribuír á mellora global, levou ao Grupo á continua mirada a outros países e a adherirse a iniciativas como o Pacto Mundial de Nacións Unidas. Ademais somos vogais do Comité Executivo da Rede Española, e traballamos activamente en diferentes iniciativas.

O eido e a preocupación pola protección e conservación da terra e da natureza do Grupo ponse de manifesto a través dunha iniciativa na que os irmás Ónega Ares, en memoria do seu pai, pretenden contribuír á conservación, mantemento e posta en valor do rural, a creación da Fundación Blas da Ponte de Outeiro (2012). A sensibilidade pola contorna queda tamén demostrada polo cumprimento de estándares como a ISO 14001 ou o sistema ambiental EMAS e a definición da declaración ambiental e a súa aplicación a través da política ambiental, así como o cálculo da pegada de carbono e a súa compensación, e a colaboración con diferentes entidades sociais e culturais.

Con este breve resumo postulámonos para na Conferencia poder contar a nosa experiencia empresarial, exemplo de economía circular no rural, que non é máis que a ferramenta que nos permite lograr os obxectivos de desenvolvemento sostible e unha economía baixa en carbono e a supervivencia como agricultores. Como nos gusta dicir seguimos innovando para non perder a tradición.

- Other invited speakers: vigo port, inditex