



Colombo, L. A., Pansera, M., & Owen, R. (2019). The discourse of eco-innovation in the European Union: An analysis of the Eco-Innovation Action Plan and Horizon 2020. *Journal of Cleaner Production*, 214, 653-665.

<https://doi.org/10.1016/j.jclepro.2018.12.150>

Peer reviewed version

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Link to published version (if available):
[10.1016/j.jclepro.2018.12.150](https://doi.org/10.1016/j.jclepro.2018.12.150)

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Abstract

In recent years, the search for innovative pathways towards sustainability has been brought to the forefront of international agenda settings. While international organisations and institutions, such as the United Nations and the European Union (EU), mobilised around the grand challenge of sustainability, on both a local and a global scale, eco-innovation as a key concept (or buzzword) started emerging and consolidating in policy documents and funding schemes. By focusing on the European context, this paper aims to explore how the discourse of eco-innovation has been framed by the EU research funding programmes Horizon 2020 since the introduction of the 2011 Eco-Innovation Action Plan. The review was conducted by using content analysis methods designed to disclose the framing of eco-innovation in the EU programmes. The article presents three main findings: the eco-innovation discourse in the EU programmes has mostly become constructed around the notion of eco-efficiency; eco-innovation is overwhelmingly framed as a dialectic between the state vs private actors whereas stakeholders in the third sector such as cooperatives, non-governmental organisations, social enterprises, and community-based initiatives are largely neglected; eco-innovation as a buzzword has been losing relevance through the years in favour of the new rising discourse of the 'circular economy'. The article concludes by highlighting that the construction of a new discourse on circular economy may provide the opportunity to embrace more eco-centric and inclusive approaches to economics, towards stronger sustainability and not-for-profit organisations.

Word count (including table/figure captions and references): 10,832

Keywords: Eco-innovation, eco-efficiency, European Union policy, Horizon 2020

1. Introduction

Addressing the grand environmental and societal challenges of our times requires efforts on several fronts to foster a transition towards a fairer and more sustainable economy. Over the last few decades, public, private and third sector's organisations have mobilised around a variety of key concepts (or buzzwords) such as sustainable development, smart growth, green growth or inclusive growth and circular economy. These buzzwords often underpin an ecomodernist worldview that emphasises the role of technological innovation as a salvific instrument to address the paradox of achieving endless economic growth in a finite planet (Asafu-Adjaye et al., 2015). A key guiding principle in the ecomodernist frame is the idea that technological change should be somehow environmentally sustainable. This perspective has favoured the proliferation of buzzwords such as eco-innovation, innovation for sustainability, environmental innovation, green innovation (just to mention a few) that are now increasingly popular among scholars and policy makers (Schiederig et al., 2012). Van Dieren 1995 dates these back to the 1972 United Nation Stockholm Conference on the Human Environment. But it is after the summit in Rio de Janeiro of 1992 that the discourse about technological development and environmental issues gained real momentum. Since then, such adjectives as eco, environmental, green or sustainable have been increasingly used in connection with the word innovation (Franceschini et al., 2016; Pansera, 2012), intersecting with natural sciences and engineering (Hueting and Reijnders, 1998), innovation studies (Freeman and Soete, 1997), and competitiveness and entrepreneurship studies (Porter and Van der Linde, 1995).

Since the summit in Rio de Janeiro in 1992, the European Union (EU) has been leading initiatives aimed at addressing environmental challenges implementing a number of policies and financing research programmes. The strategic buzzword that the EU has adopted to mobilise its discourse on

environmental sustainability and technical change is “eco-innovation”. In 2011 the European Commission (EC) financed the Eco-Innovation Action Plan (EcoAP) (European Commission, 2011a). Since then, eco-innovation discourse has crystallised in the reports and official documents of the EU. Nevertheless, whilst eco-innovation as a concept has received increasing attention, its meaning and practical implications remain contested (Franceschini and Pansera, 2015). The aim of this paper is to explore how the discourse of eco-innovation has been framed by the EU, to unravel its meanings and to shed light on its recent evolution, from the time of the Eco-Innovation Action Plan over the subsequent seven years within the financial framework of Horizon 2020 (European Commission, 2014a). In particular, the research chooses to linger on two specific components, which are the framing of eco-innovation across the EU research funding initiatives since 2011 (i.e. the *what* of eco-innovation) and the main stakeholders targeted by these European initiatives (i.e. the *who* of eco-innovation).

This paper argues that the use of buzzwords in the discourse of powerful institutions like the EU is crucial to understand the internal mechanisms that underpin the emergence and evolution of policy making. The study of language-in-use (i.e. discourse and discursive practices, narratives and frame analysis) has become increasingly popular among those scholars interested in researching the intersection between science, technology, society and politics (Nicolini, 2012), and more recently, in the study of environmental politics (Dryzek, 2013; Feindt and Oels, 2005; Hajer and Versteeg, 2005; Stevenson and Dryzek, 2012). The importance of this kind of analysis has been exposed by an increasing number of scholars considering “discourse” in the Foucauldian sense (Foucault, 1984) as constitutive i.e. as a form of action and a way of making things happen in the world rather than a mere description and representation of it (Nicolini, 2012). The practical implications of this reasoning are evident in the allocation and distribution of social goods, such as sustainability (Gee, 2011). Hajer & Versteeg (Hajer and Versteeg, 2005) advocated for example the use of discourse/content analysis in environmental politics for three main reasons. First, discourse analysis reveals that ideas such as “nature” or “environment” are *social - constructed* notions that are historically situated and which evolve (Morton, 2012). Second, different discourses of sustainability have the capability to shape and, sometime, delimit the range of policy options. Third, discourse analysis allows disclosure of the strategies deployed by powerful (and also minority) actors engaged in environmental controversies (Hajer and Strengers, 2012; Hajer and Versteeg, 2011; Stevenson and Dryzek, 2012). Therefore, analysing the discourse on eco-innovation within the European policies and financial frameworks is not just a linguistic exercise, but a practical, politically relevant, contribution. By unravelling the multiple meanings within the eco-innovation discourse this paper actively participates in its constitution, exploring alternative pathways and ultimately seeking to enable a greater variety of actors to take part in the transition towards sustainability.

The paper starts by briefly setting the theoretical background, introducing the notion of eco-innovation, outlining the main narratives identified in the literature on eco-innovation and contextualising eco-innovation within the EU political and financial framework. In the third section a detailed account of the methods used to conduct the analysis is provided and research findings are discussed. In the context of the analysed EU initiatives, this review explores whether the notion of eco-innovation has remained framed as eco-efficiency or is evolving towards a more nuanced and complex framing. In addition, this paper explores how the notion of eco-innovation is framed around the role of different actors; in particular the private and public sectors and the biodiverse eco-system of social enterprises, cooperatives and other civil society organisations (or third sector).

2. Framing Eco-Innovation

2.1. The buzzword eco-innovation

As illustrated in the introduction, within the EU political discourse, socio-technical change towards environmental sustainability has been increasingly framed in terms of “eco-innovation” (Eco-innovation Observatory, 2011). But the notion of eco-innovation is far from being a stable, monolithic concept: rather it is interpretively flexible and the subject of multiple, often contested, framings and definitions. Etymologically, the word “eco” derives from the Greek οἶκος (*oikos*), literally meaning “home” but also, in a wider sense, “family” and “planet” (Liddell and Scott, 1897), while “innovation” descends from the Latin “in-novare”, as in to make something new, or to change something already existing (Smith and Hall, 1870). Recalling the Schumpeterian tri-partition between product, process and service in innovation practices, Fussler and James 1996 stated that eco-innovation implies the development of new products, processes or services which provide both economic and environmental benefits. More recently, Klemmer and Lobbe 1999 have suggested that eco-innovations are those actions pursued by a variety of stakeholders (including firms, politicians, unions, associations, churches, private households) that develop new behaviours, products and processes that contribute to a reduction of environmental burdens or contribute to specific sustainability targets. In addition, Rennings 2000 has provided a broader definition, arguing that eco-innovation can occur not only within firms operating in a market economy, but also within non-profit organizations that embrace different normative values, motivations and scopes. In general, however, the notion of eco-innovation appears to have remained framed within the boundaries of industrial dynamics embedded in a market economy logic i.e. eco-innovation is thought to be a source of disruptive technical change and economic (possibly green) growth (Andersen, 2004; Berkhout, 2011; Carrillo-Hermosilla et al., 2009; Carrillo-Hermosilla et al., 2010; Hellström, 2007; Organisation for Economic Co-operation and Development, 2011).

2.2. Eco-efficiency Vs. Eco-effectiveness

Eco-innovation, arguably, is in fact an example of discursive hybridization, an umbrella term that shelters multiple meanings (Rip and Voß, 2013) – i.e. one that connects two previously separate discursive spheres: sustainability and innovation. This is evident in some of the attempts to theorize eco-innovation that draw both on innovation and sustainability theories. Carrillo-Hermosilla et al. 2009, for example, suggested that eco-innovation can be framed across three levels of ambition:

- (i) Add-on and/or end of pipe solutions: Eco-innovation as *incremental improvements of pre-existing technologies to reduce environmental impacts*;
- (ii) Sub-system changes: Eco-innovation as *increasing the efficiency of the use of resources*. This approach is also known as eco-efficiency paradigm (Kemp and Andersen, 2004; World Business Council for Sustainable Development, 2000) or Ecological Modernization (Jänicke, 2008; Mol and Spaargaren, 2000);
- (iii) Eco-effectiveness or systemic changes: Eco-innovation as radically new technological/organizational solutions that lead to eco-efficiency leaps (i.e. closed-loop systems and cradle-to-cradle design) but also generate new patterns of production and consumption that have the *potential to reshape the relationships between human beings and their surrounding ecosystems*.

Despite this, the evidence reveals that in practice eco-innovation remains rather simplistically framed in terms of eco-efficiency (Franceschini and Pansera, 2015; Hellström, 2007; Jänicke, 2008) rather than eco-effectiveness. One possible explanation might be that eco-innovation is grounded in an ontology based on a positivistic (and techno-optimistic) attitude towards the seemingly unlimited capacity for technologies to address environmental degradation i.e. the lure of the techno-fix (Castro, 2004; Hopwood et al., 2005; Scoones, 2007). In this vision, technology and innovation will eventually solve problems such as environmental degradation and pollution, climate change, soil erosion, and biodiversity loss by improving the efficiency of production and consumption of resources without the need for deeper transformative and paradigmatic change. This position, also known as “weak sustainability”, frames human and natural capital as interchangeable (Martinez-Alier, 1995). This argument, however, is problematic for a number of reasons. First, eco-innovation framed as eco-efficiency does not successfully address the Jevons’s paradox of resource/energy *rebounding* i.e. the theory according to which greater efficiency leads to more consumption and therefore, paradoxically, to a more rapid depletion of resources (e.g. the increased consumption of coal in England in the 19th century, following increased efficiency in coal-use) (Polimeni et al., 2008). Second, natural capital can’t be always replaced by human-manufactured capital (Martinez-Alier, 2002). The richness of ecosystems, the ecological services they provide (in particular those that are intangible such as cultural resources, the sacredness of a river, a mountain or a forest) and the importance of their biodiversity can’t be easily replaced by human artefacts or technology. Third, eco-efficiency improvements have limits, ones that technological solutions may be able to stretch but which are limits none the less (Franceschini and Pansera, 2015). The risk then is to unreflectively present eco-innovation (framed as eco-efficiency) as a panacea for sustainable development without critically and reflexively considering its limitations and shortcomings. This paper reviews how the EU research funding programmes have framed eco-innovation and how its discourse has evolved. In particular, the interest of this research is to explore whether the framing of eco-innovation has evolved within the EU Horizon 2020 programme from one of eco-efficiency to a broader concept of eco-effectiveness.

2.3. The discourse of Eco-innovation in the policies of the European Union

The commitment of the EU to technological change as a means to achieve sustainable development dates back the early 1990s (Soete and Arundel, 1995). Despite the existence of several terms used worldwide to convey the concept of innovation for environmental sustainability – e.g. “environmental innovation”, “sustainable innovation”, “green innovation”– the EU decided to place the keyword “eco-innovation” explicitly at the centre of its policies on sustainability. The “Competitiveness and Innovation Framework Programme” (CIP) in its guidelines presented eco-innovation as a means to achieve the ultimate goal of sustainable development. The CIP stated that eco-innovation is any form of innovation that delivers significant advances toward the goal of sustainable development. A particular emphasis was given to the reduction of impacts on the environment and to the achievement of a more efficient and responsible use of natural resource and energy (European Commission, 2007). Furthermore, the European Eco-innovation Observatory was designed to assess and measure eco-innovation performance of the union and produce “good practices” reports to support policy making (Eco-innovation Observatory, 2011). This review focuses on two EU initiatives designed to promote and finance eco-innovation: the “Eco-Innovation Action Plan” (EcoAP) launched by the Commission in 2011, and the “Horizon 2020” Programme that started in 2014. The EcoAP replaced the previous Environmental Technologies Action Plan (ETAP) and is the core of the EU strategic policies to promote eco-innovation among the members of the Union. The overall environmental policy framework is the 7th Environment Action Programme (EAP), which

guides the environmental research and innovation policies of the EU, including the EcoAP. The guidelines presented in the EcoAP are supposed to be implemented through the research funding schemes of the Union. In particular, EU's Seventh Framework Programme for Research and Technological Development (FP7) – and now Horizon2020, the CIP and LIFE+. In addition, the structural and cohesion funds might be also used to implement eco-innovative projects. As regard to the Horizon 2020, the programme is the biggest EU Research and Innovation scheme ever created a budget of nearly €80 billions over 7 years (2014 to 2020). In the words of the EU commission the programme “promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market” (European Commission, 2014b). The commission sees Horizon 2020 as a means to drive economic growth and revitalise jobs creation in a stagnating European economy.

3. Research methods

In order to understand how the EU constructs the discourse of eco-innovation, this research focused on the analysis of key documents and funding schemes designed to foster innovation within the Union: The Eco-Innovation Action Plan (2011) and the work programmes of Horizon 2020 (across the three editions 2014-15; 2016-17; 2018-20). According to the information published by the EU, the preparation of these documents involved a public consultation of stakeholders ranging from industry and research to representatives of civil society organised in Advisory Groups. The consultation activities also included the European Innovation Partnerships and European Technology Platforms (European Commission, 2018a). Nevertheless, no further information is provided to specify what third parts actually contributed to frame the programmes linked to eco-innovation. The analysis adopted an approach based on content analysis of archival data, which has been increasingly used in organization (Aguinis et al., 2007; Duriau et al., 2007) and communication literatures (Semetko and Valkenburg, 2000). In particular, a strategy of summative content analysis was adopted. That has been previously used to analyse the framing of political (Semetko and Valkenburg, 2000) and environmental debates (Wiese et al., 2012). The approach consists in focusing on counting the frequency of specific words or content with the purpose of understanding their contextual use (Kondracki et al., 2002). This process of quantification is therefore an attempt not to infer meaning but, rather, to explore the use of specific keywords in different contexts (Hsieh and Shannon, 2005). Texts were analysed following a qualitative grounded theory approach extensively used for inductive theory building (Corley and Gioia, 2011; Gioia et al., 2012; Miles and Huberman, 2003).

The analysis started considering the frequency of the keyword *eco-innovat** in the EcoAP and Horizon2020 programmes. Sentences containing the keyword *eco-innovat** were isolated and collected in two databases. The first one included extracted sentences from the EcoAP, the second from the three editions of Horizon 2020. Each sentence was labelled with information about the context in which it was extracted i.e. type of document, year of publication, title of the section in the document and page. Sentences containing the keyword *eco-innovat** within indexes, titles, footstep notes, as well as sentences containing Eco-Innovation as a proper name (e.g. generally referring to the Action Plan), were excluded from the databases.

The first stage of analysis was conducted manually, with the aim of building the data structure. Initially, focusing on each database respectively, document-centric terms and codes were used. Sentences were grouped together and organised within categories that adhered faithfully to the text being analysed (Gioia et al., 2012). For example, the sentences “The assistants will help SMEs seize the business opportunities created by eco-innovation” (European Commission, 2011a, p. 11) and “The potential of eco-innovation is recognised by the business community” (European Commission, 2011a, p. 17), with others, were grouped together in a category called ‘Business opportunity’, as a

first order concept. 'Business opportunity' was chosen as a category name to reflect the very vocabulary used by the text under analysis. Then, using researcher-centric themes and dimensions, the analysis proceeded by axial coding, seeking similarities among the concepts previously identified (Gioia et al., 2012; Strauss and Corbin, 1990). For example, the first order concepts 'Market-related barriers' and 'Investment risks' were aggregated in a second order theme called 'Economic challenges (threat)'. Finally, as a third round of coding, further aggregate dimensions were extracted. For example, the second order themes 'Potential to generate economic value (opportunity)' and 'Economic challenges (threat)', with others, were aggregated in a broader dimension called 'Private sector'. Having developed the full set of 1st order concepts, 2nd order themes and aggregate dimensions, we built the data structure (Gioia et al., 2012). As a second stage of analysis, NVivo11 was used as supporting software. Through a process of "theoretical sampling" (Gioia et al., 2012; Orton, 1997), the frequency of a list of selected keywords in the two databases was considered (see Table 1). Initially, the process focused on keywords relating to the main stakeholder groups targeted by the EU, representative of the private, public and third sector, and identified through a combination of document-centric and research-centric selection. Lastly, a final round of keywords identification and quantification was performed, focusing on concepts and tentative relationships emerging from the analysis (see Table 2). For a complete overview of the data structure obtained by the content analysis, please see the Data Statement annexed to the article.

4. Research findings

4.1. The Eco-Innovation Action Plan

Within the Eco-Innovation Action Plan, 77 sentences containing the keyword *eco-innovat** were coded and included in the database. Looking at the context within which each keyword was used, similar extracts were grouped together and 19 categories (1st order concepts) emerged as a result. Proceeding through axial coding, the second level of analysis identified 9 themes (2nd order themes) underlying the categories. Finally, 3 aggregate dimensions were extracted from the themes (see Data Statement). Looking at the 19 categories emerging from the first level of analysis, the review focused on the following question: "How is eco-innovation framed by the Eco-Innovation Action Plan?" To address such question, the SWOT framework was used as an established analytical tool for categorizing environment-related concepts and ultimately for assessing the formulation of action plans (Dyson, 2004; Pickton, and Wright, 1998). With that question and framework in mind, data were coded as Opportunities (of pursuing eco-innovation), Threats (facing eco-innovation), Weaknesses (challenges of implementing eco-innovation to be addressed by the Commission) and Strengths (strategies implemented by the Commission in order to foster eco-innovation). Three further underlying themes emerged from the text and its categorisations. As a following step, these were coded through theoretical conceptualisation in Private, Public and Third sectors.

Within the EcoAP, eco-innovation was firstly found to be considered as an important business opportunity (7 times), although its potential to generate social and environmental value was equally appreciated (7 times). Market barriers (4 times) and investment risks (2 times) appeared as threatening economic challenges for the uptake of eco-innovation, while regulatory barriers (1 time) were also mentioned. In terms of weaknesses, the Action Plan highlighted the need for further public measures to be implemented, such as supporting policies for eco-innovation (4 times) and public investments in eco-innovation in the private sector (2 times). In addition, the need to raise awareness and generate a better knowledge (2 times) and social acceptance (1 time) of eco-innovation and the need to accelerate it in economic and environmental terms (1 time) were also

pointed out. Finally, the Plan took account of the strategies implemented by the Commission in support of eco-innovation, including: supporting its market penetration (9 times) and mobilising funding in order to address its financial challenges (7 times); accelerating eco-innovative policies (11 times), reinforcing legislative measures (3 times) and indicators for eco-innovation (1 time); and ultimately supporting cooperative strategies such as public dialogue (7 times), multi-stakeholder partnerships (3 times) and networking activities for eco-innovation (5 times). More broadly, 29 times the key-word eco-innovation was used in a context that relates with the private sector, 22 times with the public sector and 26 times with the third sector.

The second stage of analysis showed that eco-innovation focussed on the private and public sectors, completely excluding the third sector. While Small and Medium Enterprises (SMEs) and Businesses in general appeared frequently in close relation to eco-innovation, as well as public bodies such as the Commission and the Member States, no reference was made to the main players of the European third sector, such as social enterprises, cooperatives and community supported organisations. Interestingly, the database on EcoAP contained the word “community” only once and not in relation to civil society, but to the “business community” instead (European Commission, 2011a, p. 17). As Table 1 shows, this trend was confirmed by comparing the words’ frequency in the database (including sentences with *eco-innovat** as a keyword, as previously extracted from the Action Plan) and in the whole Action Plan document (20 pages). The relatively high frequency of public sector related keywords was influenced by the role played by public institutions in writing and publishing the document (i.e. the Action Plan is a document issued by the European Commission itself).

<INSERT TABLE 1>

Results from Nvivo queries and further keywords selection and quantification suggested that eco-innovation in the Action Plan was very much locked into a narrative of eco-efficiency, with a high emphasis on technological modernisation and economic growth, to be achieved through public-private partnerships. This was confirmed by the narrative on sustainability within the EcoAP and in relation to eco-innovation. Sustainability as a keyword appeared only three times in the whole Action Plan, of which once in the database on eco-innovation (see Table 2).

<INSERT TABLE 2>

The Plan supported “*initiatives promoting environmental technology but with a sharper focus on eco-innovation in both the private and public sectors*” and considered “*global sustainability goals to contribute to their attainment*” (European Commission, 2011a, p. 15). Although the quote eloquently provides further account for the findings so far discussed, it is not enough to represent the narrative on sustainability. We therefore combined word counts and word trees from Nvivo. In Figure 1 and Figure 2 we show the semantic context in which the word “sustainable” was used in the EcoAP documents. From the analysis, sustainability emerged as mostly related to sustainable development and economic growth, confirming the weak narrative previously figured.

<INSERT FIGURE 1>

<INSERT FIGURE 2>

Sustainability through eco-innovation did not consider the limits of the biosphere as a boundary for the growth of the economic system. While a systemic approach to eco-innovation was never adopted by the Action Plan, none of the four references to the keyword “limit” actually referred to resource scarcity, the bio-physical limits of the planet, nor limits to economic growth. In addition, the only account of effectiveness within the EcoAP database referred to cost-effectiveness in a

context of market uptake and economic resilience of eco-innovation, framing eco-innovation once again in a business-related narrative (European Commission, 2011a, p. 2).

In short, the first stage of analysis showed that, within the EcoAP, eco-innovation was considered as an opportunity to generate economic, social and environmental value. However, it was a concept mostly related to the private sector. The second stage highlighted the exclusion of third sector players from the discourse on eco-innovation. The third one exhibited the discourse on eco-innovation as still locked into a narrative of eco-efficiency, with a weak approach to sustainability.

4.2. Horizon 2020

For the Horizon 2020 work programme analysis, the analysis started by searching for the frequency of the keyword *eco-innovat** throughout the 17 Horizon 2020 work programmes and across the three editions 2014-15, 2016-17, 2018-20 (see Table 3).

<INSERT TABLE 3>

Despite an enormous difference in length between Horizon 2020 and the Eco-Innovation Action Plan (the latter is only 20 pages long while the former's work programmes can be over 100 pages each), the keyword's frequency was much lower in Horizon 2020, and dropped dramatically over time. From 33 matches across the work programmes of Horizon 2014-15, it decreased to 14 in Horizon 2016-17 and dropped to only 3 in Horizon 2018-20. While the lower frequency of eco-innovation mentions was expected, given the broad scope of Horizon 2020, the variation over time is an interesting finding.

The first round of coding was then performed, labelling each section of extracted text according to emerging concepts in relation to eco-innovation. The three Horizon editions were kept separate, in order to have a clearer picture of the evolution of the EU discourse on eco-innovation in the last five years. A complex and diverse set of concepts emerged from the analysed text, identifying 9 1st order categories across the work programmes (see Data Statement). These first categorisations were then considered through theoretical lenses, seeking an answer to the question "How is eco-innovation framed by Horizon's work programmes?" Drawing from the eco-innovation narratives' classification operated by Carrillo-Hermosilla et al. 2009, 2010, each concept was coded as eco-efficiency, eco-effectiveness and green growth. As a following step, these 2nd order themes were collated in 2 aggregate dimensions, reflecting weaker and stronger approaches to sustainability.

Within the 2014-15 work programmes of Horizon 2020, eco-innovation was found to be mostly framed in terms of weak sustainability (32 times), more than doubling those references to a stronger approach (15 times). Eco-innovation in relation to eco-efficiency was mostly framed in terms of energy-efficiency (3 times) and resource efficiency (9 times), with reference to eco-design and product life cycle management as well (4 times). In addition, the theme of green growth was associated with the potential of eco-innovation to generate economic growth (2 times), issues related to the market uptake of eco-innovation (8 times) and more general references to eco-innovative businesses (6 times), mostly explicitly referring to SMEs. Finally, eco-effectiveness as a framework for eco-innovation was envisaged in relation to societal factors and challenges, such as sustainable consumer behaviours and lifestyles, (7 times) and with an explicit reference to a "systemic" or "circular" approach (8 times).

The following editions of Horizon 2020 were found to seal the decline of eco-innovation as a buzzword in the EU discourse, however still confirming a greater disposition towards weak sustainability (17 times in 2016-17, 2 times in 2018-20) over a stronger approach (4 times in 2016-17, no times in 2018-20). Interestingly, in the context of eco-effectiveness, eco-innovation always appeared in close relation to the terms “circular economy”. In one case “systemic eco-innovation” and “circular economy” appeared to be considered as synonyms (European Commission, 2017, p. 57).

The second stage of analysis confirmed the general trends previously observed in the Eco-Innovation Action Plan, but with some important contextual differences. As Table 4 shows, within the Horizon 2020 database and across the work programmes, eco-innovation was again considered as interplay between the private and the public sectors. The table shows no references relating eco-innovation to the main European not for profit organisations, suggesting the third sector was yet again neglected in the discourse on eco-innovation. However, and simultaneously, the broader EU discourse is opening up to include stakeholders from the third sector. The work programmes of the Societal Challenge n. 12 (as per Table 3, that is the section in Horizon containing the great majority of references to eco-innovation), the role and potential of third sector actors in the context of innovation started being acknowledged and appreciated. For instance, the 2014-15 work programme states that “The innovation actions in this call are expected to offer particular opportunities to SMEs, social enterprises and other organisations” (European Commission, 2015a, p. 24). In addition, “citizens’ associations” (European Commission, 2015a, p. 63; European Commission, 2017, p. 70), NGOs (European Commission, 2015a, p. 63; 2017, pp. 35, 69, 70; 2018, pp. 8, 72, 83) and Civil Society Organisations (European Commission, 2017, p. 35; 2018, pp. 8, 72) were included. Interestingly, the most recent edition of Horizon 2020 openly recognised as a weakness of its work programmes that the involvement of pertinent stakeholders such as third sector organisations remains low (European Commission, 2018b, p. 8). However, while some of the third sector’s actors started to be acknowledged, others were still neglected. For instance, explicit consideration of the role of cooperatives is yet to be developed.

<INSERT TABLE 4>

Results from Nvivo queries and further keywords selection and quantification confirmed that eco-innovation in Horizon 2020 was still heavily related to a narrative of eco-efficiency and ecological modernisation. However, the emergence of circular economy thinking in relation to eco-innovation opened up the discourse to more systemic approaches. The narrative on sustainability within Horizon 2020 reflected this tendency.

<INSERT TABLE 5>

Although sustainability as a keyword held a very low frequency in the Horizon database, i.e. as related to eco-innovation, associated word counts and word trees from Nvivo showed an evolution in the discourse towards a more complex framing of eco-innovation and a more systemic approach that included accounts of sustainable lifestyles and consumption behaviours. Figure 3 shows the semantic context in which the word “sustainable” is used in the H2020 documents. Unlike the EcoAP, the word is increasingly associated to more complex dynamics such as the analysis of consumption behaviour and life styles and “circular economy”, a concept that started to strongly emerge especially in the last H2020 work programme.

<INSERT FIGURE 3>

Another interesting evolution in the H2020 documents in the use of the notion of “limits”. Although the frequency of the keyword “Limits” appeared to be the same in the whole texts of EcoAp and Horizon SC 12, it depicted very different results in qualitative terms. Indeed, in the latter text, the word “limit” did refer to the planet bio-capacity. In particular the text specifically referred to the need to implement climate action and improve resource efficiency to meet the needs of a growing global population within the limits of the planet’s ecosystems.

In short, the first stage of analysis showed that eco-innovation as a ‘buzzword’ has been losing relevance through the three editions Horizon 2020, in favour of the new rising discourse of the ‘circular economy’. Yet again, eco-innovation in Horizon 2020 work programmes was largely framed in terms of weak sustainability. The second stage confirmed that the third sector was neglected in the discourse on eco-innovation. However, third sector actors have started being acknowledged, their role in the context of innovation being recognised and appreciated. The third one showed an evolution in the EU discourse on eco-innovation towards a more complex framing and a more systemic approach.

5. Discussion

The analysis of the EU funding programmes provided three main findings. First, from the Eco-Innovation Action Plan to the three editions of Horizon 2020, the EU narrative concerning eco-innovation was one of weak sustainability. Eco-innovation in the text analysed resulted prevalently framed in terms of eco-efficiency, as a business opportunity for the private sector and a driver for economic growth (often referred to in terms of “green growth” and “sustainable development”). The notion of “eco-efficiency”, in turn, is associated to incremental “sub-system changes” aimed at increasing the productivity of pre-existing technologies without necessarily questioning the wider socio-technical contexts in which they are deployed (Carrillo-Hermosilla et al., 2009). In the analysis, the notion of eco-innovation appeared often coupled with the notion of “green growth”, traditionally linked to the Ecological Modernisation paradigm (Castro, 2004). According to the Organisation for Economic Co-operation and Development (OECD) (2018) green growth means promoting economic growth without compromising the environmental services on which society well-being relies. It is therefore a formulation of weak sustainability that doesn’t aim at transforming (or even questioning) the economic paradigm that has contributed to creating the environmental and climate challenges we are facing today (Kallis et al., 2012). Ecological modernisation and green growth, both approaches very visible in the EU funding programmes analysed, have been considered by a vast range of literature as twin approaches (Guo and Tseng, 2017; Jänicke, 2012; Shkarupa et al., 2016), the former often providing the theoretical basis for the latter (Lorek and Spangenberg, 2014). Moreover, even though the social dimension of eco-innovation was acknowledged in both the EcoAP and Horizon 2020 work programmes, the EU discourse seems to be still locked into a for-profit, market logic. In the EcoAP, the strategic importance of systemic measures to foster eco-innovation was recognised, including the need for its social acceptance and its potential to generate social and environmental value. On the other hand, the social value associated with eco-innovation was instrumentally ascribed to the creation of economic value. For instance, social acceptance was approached as a market barrier, whereas the opportunity to generate hybrid value was considered dependent on economic growth. In other words, the EU discourse on eco-innovation was shaped around the discourse of environmental (neo-classical) economics, according to which economic growth is a prerequisite for environmental protection and social development (Stern, 2004). In compliance with this approach, the EcoAP proposed to accelerate market uptake and dissemination of eco-innovation as prerequisites for improved environmental performance (European Commission,

2011a, p. 3). Furthermore, even where eco-innovation was considered as “a key driver towards a greener and more sustainable economy”, beyond being a mere business opportunity, it was still framed as a source of economic growth and creation of new jobs (European Commission, 2011a, p. 16). The same dynamic emerged across the work programmes of Horizon 2020, where the economic dimension of eco-innovation was substantive and prevalent over the social and environmental ones and was instrumentally considered. Compared to the EcoAP, Horizon 2020 approached eco-innovation through a more systemic perspective, framing this with an appreciation of the shortcomings of the eco-efficiency approach. For instance, Horizon 2020 placed eco-innovation in relation to the themes of sustainable lifestyles, consumer behaviour, urban patterns, community-centred approaches and socio-economic issues. However, despite this eco-efficiency still remained at the heart of Horizon 2020 work programmes and was considered as a main driver of eco-innovation. Therefore, sustainable lifestyles and consumption behaviour were considered as long as they facilitated the market uptake of eco-innovative solutions (European Commission, 2015a, p. 8); while “eco-innovative SMEs in all areas” should show “a strong ambition to develop, grow and internationalise”, to ultimately “reach and accelerate their full green growth potential” (European Commission, 2017, p. 89). In addition, despite the emergence of the buzzword “sustainability transitions” in the EU discourse and Horizon 2020 work programmes, the analysis showed this was not the case for the eco-innovation discourse, in neither the EcoAP nor Horizon 2020. The first finding is further supported by the language used by the 7th Environment Action Programme. In such policy framework, innovation measures, including eco-innovation, are expected to “improve resource efficiency” and “required throughout the economy to improve competitiveness in the context of rising resource prices, scarcity, raw material supply constraints and dependency on imports” (European Union, 2013, p. 182).

The second finding regarded the scarce emphasis given to crucial stakeholders in the third sector. According to Bruni and Zamagni 2007, the private sector is represented by the market as a main institution, it considers self-interest as a reference principle (the *homo economicus*) and seeks for efficiency as an ultimate value. The public sector is represented by the State and its institutions, justice is its reference principle and equity its ultimate value. The third sector is expression of the civil society: it is based on multi-stakeholder practices, grounded in reciprocity as a reference principle and it considers social and environmental missions as their ultimate goals. In the EU discourse that emerged from the documents analysed the main stakeholders of eco-innovation are the private and the public sectors, whereas the role of the third sector and household non-commodified exchanges are completely neglected. The two grand narratives of neoliberalism and social democracy, with the market and the state as their main institutions, have marked the story of the twentieth century, its political conflicts and socio-economic paradigms. After the fall of the Berlin wall and the redefinition of the European and global political scenarios, a Eurocentric “end of history” seemed to crown neoliberalism as “the only alternative” (Harvey, 2007). However, the recent economic crises, coupled with social inequality and environmental degradation, has shaken the neoliberal paradigm and paved the way for a multitude of alternatives to flourish (Escobar, 2015; Pansera and Rizzi, 2018). Social enterprises, cooperatives and other civil society organisations have displayed great resilience to the crises and are blooming throughout Europe. Their intrinsically stronger approach to sustainability, and their potential to generate social and environmental value have been stressed by a wide range of research (Cato, and Hillier, 2010; Hillman, 2018; Jackson, 2009; Murray, 2009). However, their critical role in tackling the societal and environmental challenges of our times is still largely underestimated. The EU discourse on eco-innovation is no exception. While public and private players, such as the Member States and European SMEs, found great recognition across the EcoAP and work programmes of Horizon, never did a third sector

stakeholder appear in relation to eco-innovation. However, the analysis of Horizon 2020 overall showed a little but steady opening to social enterprises, associations, NGOs and CSOs. The language used by the 7th Environment Action Programme confirms the business orientation of the eco-innovation discourse. As it states: “The business sector is the primary driver of innovation, including eco-innovation” (European Union, 2013, p. 182). While recognising the need for inclusivity, beyond a narrow market-orientation, targeted organisations remain circumscribed to the private sector. As it follows: “However, markets alone will not yield the desired results, and in order to improve their environmental performance, small and medium-sized enterprises (SMEs), in particular, require specific assistance with the uptake of new technologies, including through research and innovation partnerships on waste” (European Union, 2013, p. 182).

Finally, the third finding is that the concept of eco-innovation is disappearing from the EU discourse. Gradually outflanked by the buzzword “circular economy”, the frequency of the keyword eco-innovation has dramatically dropped over the last seven years, while the frequency of circular economy has in parallel drastically increased (Figure 4).

<INSERT FIGURE 4>

The chart above, built from the results of a Nvivo word frequency query, shows that in the whole Eco-Innovation Action Plan the keyword “circular economy” had never appeared. Interestingly, four years later, the Circular Economy Action Plan (European Commission, 2015b) did not include any reference to “eco-innovation” as a concept (the only reference founded refers to The Eco-Innovation Action Plan policy document). Nevertheless, Horizon 2020 linked these two concepts, gradually strengthening their relationship. While Horizon 2014-15 (SC 12) started associating eco-innovation and circular economy, the same work programme in 2016-17 paired them up and equated them. In addition, along with paring up eco-innovation with circular economy, Horizon 2020 introduced the word “systemic” as a prefix of eco-innovation. Circular economy and systemic eco-innovation increasingly became the focal point of the European discourse on eco-innovation. This shift is also evident in the public discourse of the programme EcoAP:

“In recent years, many of the EcoAP goals have come together in the concept of the circular economy — an economy that learns from nature in that it wastes nothing. Eco-innovation is key to delivering many aspects of the circular economy: industrial symbiosis or ecologies, cradle-to-cradle design and new, innovative business models.” (European Commission, 2011b)

However, the relation between these two concepts is still unclear, as well as the meaning inferred by “systemic eco-innovation”(de Jesus et al., 2018; de Jesus and Mendonça, 2018).

The evolution of the European discourse on eco-innovation towards a more systemic approach, informed by circular economy, may have different political-economic implications. On the one hand, it may provide the opportunity to re-orient paradigmatic approaches to business, paving the way for the consolidation of alternative ways of organising (Goworek et al., 2018; Parker et al., 2014). For instance, where notions of circular economy are grounded in a strong approach to sustainability, the pursuit of endless economic growth ceases to be the *raison d’être* of business organisations, notions of biophysical limits become central and profit generation turns into the mean, rather than the end, of the process of organising. On the other hand, where circular economy remains locked in a narrative of weak sustainability, the convergence between discourses of circular economy and eco-innovation doesn’t produce any re-orientation of the ‘business as usual’ approach. Similarly to eco-innovation, as framed in the narrative of green growth and ecological modernisation, circular

economy can be weakly considered to push the frontiers of environmental sustainability by creating workable relationships between ecological systems and economic growth. This is supposed to be achieved not only by reducing the use of environmental resources, or by delaying the cradle-to-grave material flows (as a reductionist view of sustainable supply chain management strategies may suggest), but rather by creating metabolisms that allow for methods of production that are self-sustaining, true to nature and in which materials are used over and over again (Ghisellini et al., 2016; Bocken et al., 2016).

The EU has initiated many strategies aimed at delivering what it has called “smart, sustainable and inclusive growth”, including the Resource-Efficient-Europe flagship initiative (European Commission, 2011c), which is based on circular economy and it aims at improving resource efficiency while identifying and tackling the trade-offs between economic development and environmental protection. More recently, the European Commission has announced an ambitious new Circular Economy Package (European Commission, 2015b); the proposed directives are aimed at *closing the loop* of product lifecycles through greater recycling and re-use, with the objective of bringing benefits for both the environment (fostering energy savings and reductions in Greenhouse Gas Emissions and promoting resource efficiency) and the economy (boosting the promotion of green jobs). This approach, however, is not unproblematic. Many scholars have argued that in the European context, where dominated by free-market ideologies, companies are already capturing most of the economically attractive opportunities to recycle, remanufacture and reuse. This leads them to claim that reaching higher levels of circularity may involve an economic cost that European economies cannot cope with, especially as companies are already struggling with high resource prices (Ellen MacArthur Foundation, 2015). Indeed, benefits from recycling of materials tend to decrease until a cut-off point is reached where recycling could be economically too expensive to provide a net benefit. For this reason, while environmental benefits may be obvious, the implementation of circular production systems and supply chains is often challenging from an economic point of view, as market dynamics and the lack of incentives may lead to higher cost of production (Genovese et al., 2017). If the EU discourse seems to have weakened the simplistic formulation of eco-innovation, framed as eco-efficiency, in favour of the more sophisticated narrative of circular economy, the complexity and challenges that this apparently new approach presents remain under-theorised. The political economy of the circular economy paradigm in the discourse of the EU remains an uncharted territory.

6. Conclusion

The European discourse on eco-innovation emerged from this analysis as locked into a weak approach to sustainability. The analysis also revealed that EU eco-innovation discourse is mainly framed around private/public actors excluding third sector organizations such as NGOs, social enterprises and community-based initiatives. Nevertheless, a more systemic perspective, based on circular economy, is making its way. While further research to explore the relation between eco-innovation and circular economy is needed, this paper wishes to call for more research to analyse the EU discourse on circular economy, to unravel its meanings, theoretical and normative underpinnings and paradigmatic references. The evolution of the eco-innovation discourse towards circular economy may provide the opportunity to unlock the EU narrative of weak sustainability, leaving behind environmental economics to embrace more holistic and eco-centric approaches to economics such as those proposed by ecological economists (among many others). Such shift may also be supported by the new discourse on *sustainability transitions*, emerging in the EU programmes but not yet related to eco-innovation initiatives. In addition, the evolution of the eco-

innovation discourse towards circular economy may provide a chance for the third sector to emerge in the EU discourse and acquire a more prominent role in the EU future innovation policy. Although circular economy strategies are often still tightly linked to green growth, ecological modernisation and market-based paradigms, the idea of circular economy, combining economics, ecology and design, can also choose to walk an alternative path, enabling a more profound system change.

7. References

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8. Appendix

<INSERT TABLE 6>

<INSERT TABLE 7>