

Article

Implementing Regional Circular Economy Policies: A Proposed Living Constellation of Stakeholders

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Abstract: The transition towards the circular economy (CE) entails transformative and system-wide changes, implying involvement, alignment, and cooperation between all stakeholders at all levels. However, debate continues around how best to achieve this. Additionally, little attention has been paid to developing models for identifying and mobilising all relevant stakeholders to implement CE policies at the regional level. This study sought to remedy these issues by analysing the relevant academic literature and policy documents and making the first attempt to adjust existing models—not only for the purpose of stakeholder mapping, but also for the proposition of a living constellation of stakeholders who should be considered when designing the transition towards a CE in a regional scenario. The CE-centric quintuple-helix model developed and proposed here promotes the emergence and deployment of trilateral networks, hybrid organisations, and development/cooperation platforms. This model adopts a balanced, participatory approach that requires a new constellation of stakeholders. Its foundations are built on the traditional industry–government–academia nexus and enlarged by the inclusion of the civil society sphere and the environmental subsystem. The environment is represented as the nucleus of the model, inspiring and triggering actions by the remaining four subsystems. The model is then implemented into two European regions with CE initiatives (Spain and Greece) to demonstrate its practical application.

Keywords: regional circular economy; circular economy; stakeholders; quintuple-helix model; policies; smart specialisation; place-based approach; Green Deal

1. Introduction: Anchoring Europe's New Agenda for Sustainable Growth in Regional Settings

'A functional global circular economy can be built incrementally starting from the interconnection of national circular economies that rely on interconnected regional circular economies' [1].

By ratifying the Paris Agreement and its own 2050 long-term strategy [2], the European Union (EU) has committed itself not only to tackling environmentally related issues, but also to becoming a carbon-neutral and pollution-free continent by 2050. This legally binding vision was translated into the EU's new sustainability agenda, 'the European Green Deal' [3]. This ambitious strategy is indissolubly intertwined with sustained efforts to boost competitiveness, improve modernisation, and ensure the prosperity of the EU member states, while safeguarding equal social benefits for European society. The monumental effort required to reach those targets will entail a systemic transformation, across policy areas and government levels. The magnitude of the needed changes attests to the

extensive range of policy actions needed for the implementation of the Green Deal [4]. By no means can this be accomplished without realisation of the policies at the local and regional levels (henceforth level 2 of the EU Nomenclature of Territorial Units for Statistics (NUTS 2) is used when referring to European regions) [5]. Accordingly, local and regional authorities (LRAs), as the primary adoption level, are on the frontline of the change and therefore a focal component of this transition. Even before the launch of the Green Deal, European LRAs had undertaken many initiatives directed towards climate neutrality. Nevertheless, there has been little consideration of the local and regional perspectives in the Green Deal Communication [4].

In addition, the leading role of many European LRAs, as pioneers in the transition towards the circular economy (CE), has not been emphasised or acknowledged in the new circular economy action plan (NCEAP) [6,7]. Ground-breaking regional circular initiatives have produced promising outcomes in different fields, and their scale-up is crucial for the transition to the CE. The attainment of the European CE policies is hence strongly associated with initiatives at the local and regional levels. The EU measures will need to take into account the protagonist role of the LRAs in vast numbers of vital aspects of the CE transition, as well as the importance of coordination for ensuring effective multilevel governance [7]. The legal competences of the LRAs in different policy areas for the CE differ across the EU. In Italy, for instance, waste policy is established at the national level, regions devise their own waste management plans and govern how waste management is applied, and local governments manage municipal waste collection and treatment [7,8]. Hence, the CE initiatives on the ground are developed primarily at the regional level, due to the LRA competencies and legal power [7].

Regions and cities are often perceived by practitioners as pioneers in the transition towards sustainability, frequently instigating changes before national policies have been devised. This is because of their scale and controllable economic systems; their proximity to environmental, social, and economic issues; and their ability to use the local experiences of relevant stakeholders [9,10]. Additionally, they are in the best position to detect and address the main challenges, which often require inter-institutional policy responses at all levels. Regions are responsible for framing and putting into practice a wide range of policies in different fields. In many instances, regions have legislative and regulatory power to create and deploy strategies and manage EU structural funds, thereby boosting innovation and resource efficiency. More importantly, they have deep knowledge and understanding of their local territories, their capacities, and their potential, which puts them in the most favourable position for establishing appropriate framework conditions, enforcing targeted policies, mobilising regional stakeholders, and boosting synergies between various economic sectors [10,11]. Acknowledging the role of regions and the regional authorities, the European Committee of the Regions (CoR), launched the 'Green Deal Going Local' initiative, which is a working group with the goal of positioning cities and regions at the core of the European Green Deal [4,12].

Nevertheless, the full potential of the CE to support regions still remains to be unlocked; according to the new OECD Synthesis Report (2020), 'unlocking the potential of the CE in cities and regions implies going beyond solely technical aspects. It requires putting the necessary governance in place to create incentives (legal, financial), stimulating innovation (technical, social, institutional) and generating information (data, knowledge, capacities)' [13].

Furthermore, the CE transition will entail a place-based perspective, as each region will transition in a territorially differentiated manner. Despite clear similarities between EU regions in terms of lifestyles, modes of production, and technology, there are also notable polarities in the factors determining the implementation of sustainability transition. Some are of the kind and gravity of environmental impact, accessible resources for regional stakeholders, groups of stakeholders, and the networks and institutions that can deliver the transition (as well as actors who might resist the process). Tech innovation

aptitude, the political power of fossil fuel incumbents, and prospective nature-based solutions will also vary across regions, as will the visions and priorities in political agendas. Hence, the directionality of the transition efforts will be determined, whether discovering alternatives to the losing segments of society, as in resource- or coal-intensive regions, or managing niches for innovative tech solutions, as in high-tech urban regions [14]. On these grounds, regional and local governance of transitions will be contrasted, so that ‘regionally differentiated transformation trajectories’ that mirror regional needs and capacities can be devised [15].

Moreover, the process of multilevel governance is highly relevant to the CE transition, and the level on which activities need to be managed is contingent on both the allocation of capabilities and resources and the geographic scale of drivers and impacts [15]. Real stakeholder involvement is vital for the management of the transition and the safeguarding of societal support. The acknowledgement of actors besides government policy-makers is crucial, because these wider groups of stakeholders have diverse capacities and will impel actions in different fields. Ultimately, alongside the involvement of diverse actors is the alignment of their diverse views towards the same vision, thereby ensuring coordinated stakeholder mobilisation [14].

Therefore, it could be concluded that a transformative system-wide change is needed for the effective implementation of the Green Deal and, hence, the CE transition. This includes the precondition of working across governmental levels, territorial scales, policy areas, and sectoral boundaries [14]. Equally important is the broad and profound mobilisation, involvement, and alignment of stakeholders, as the government alone cannot implement the transition. However, debates continue on how best to achieve this, and far too little attention has been paid to developing models for identifying and mobilising relevant stakeholders for implementing CE policies at the regional level. Crucial questions remain unanswered, such as the following:

- Who are the relevant stakeholders that should be involved in the implementation of the CE at the regional level?
- How can they be mobilised, involved, engaged, and aligned?
- How can they promote or hinder the transition?
- How do they interact among themselves?
- What are their roles?

This paper attempts to provide answers to these questions, with the goal of identifying an inclusive and permanent coalition of stakeholders to act as a living constellation in the process of CE implementation and a method of designing platforms that will ensure the inclusion and engagement of different stakeholders throughout the transitioning process at the regional level. Therefore, the paper has been divided into five parts. First, the concept and method of the study are introduced (Section 2). Second, the conceptual research is performed using a literature review to analyse relevant academic literature and policy documents, with the goal of identifying the underlying premises that should be considered for the development of the model (Section 3). Following this, desk-based research was conducted to identify the most important studies on innovation models used to foster regional economic growth and promote innovation and entrepreneurship. The outcome of this work is the proposed model for mobilising, involving, and aligning stakeholders in regional CE transition and designing platforms for a long-lasting stakeholder coalition (Section 4). A practical application of the developed model is then provided, looking at two European regions in Spain and Greece (Section 5). Finally, the implications of this study are delineated and the future lines of inquiry emerging from this work are laid down (Section 6).

2. The Concept and Method of The Study

To develop the regional model that will contribute to a more inclusive and permanent coalition of stakeholders, acting as a living constellation in the transitioning process

and reflecting different stakeholder's needs, the research was designed according to the scheme illustrated in Figure 1. The development of the model entailed three interlinked and dependent processes, depicted as different steps in the process-flow chart, adjusting the methodology originally proposed by Avdiushchenko (2018) [16].

In Step 1, the conceptual boundaries of the model were set by selecting the underlying premises for further development of the model. A literature review of both academic and grey literature was conducted, and the findings are presented in Section 3. The model must be based on a multistakeholder framework, allowing a multilevel representation from one category of stakeholder (i.e., national, regional, and local government in the government helix). This will ensure wide stakeholder involvement, with engagement and co-operation also considered. The place-based principle and RIS3 approach, tackled in Section 3, should also be taken into account, given their importance to the context, as elaborated subsequently. Moreover, the model should represent a balanced approach to CE implementation, allowing each stakeholder to act in their domains: a top-down approach stimulating government involvement when setting the strategic vision of the region and ensuring the enabling conditions for the thriving of the CE, as well as the emergence of bottom-up initiatives, such as grassroots movements, green entrepreneurship, and innovation. Finally, the environment must be considered in the model not only as a trigger for action that will stimulate all involved stakeholders to act, but also as a nucleus. Conserving the regional environment, its biodiversity, the natural capital, and ecosystem functions is the kernel of the transitioning efforts, and the balanced development model reflects these considerations.

In Step 2, the desk-based research was performed, and the focus was on identifying studies that had developed innovation models to foster regional economic growth and promote entrepreneurship and innovation. Four previously developed models were identified and analysed in detail. Based on the underlying premises, several pillars were selected from each model and used in the development of the model. This is further elaborated in Section 4, where the exact development of the model is described in a logical sequence.

In Step 3, the practice-oriented research was conducted and the developed model was practically applied (Section 5). First, an attempt was made to categorise stakeholders involved in CE initiatives from the Greek ecosystem, presented in Section 6. Following this, a short case study was developed, with the model implemented in a Spanish scenario for a regional CE strategy.

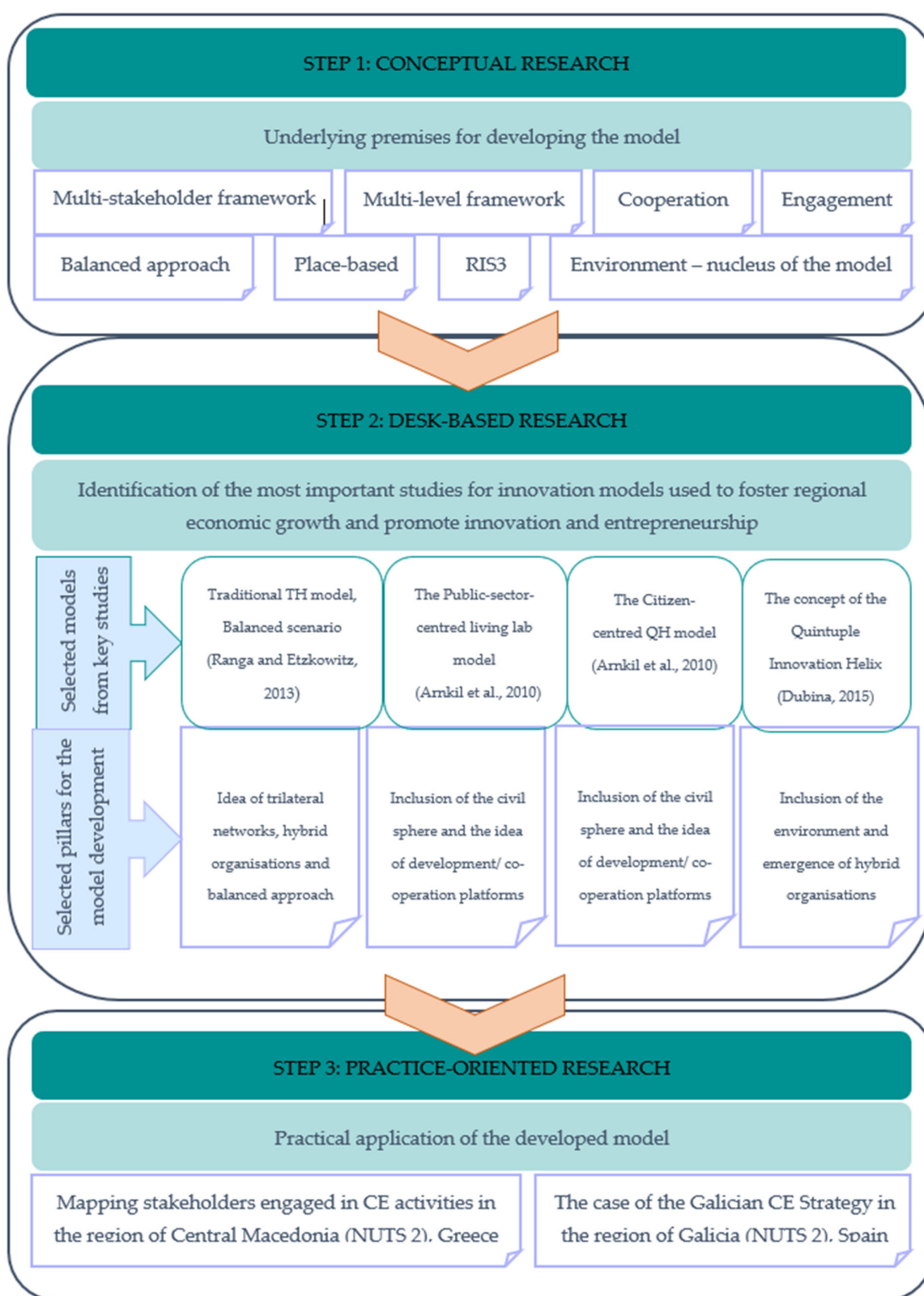


Figure 1. Research design for developing the circular economy (CE)-centric quintuple-helix (QNH) model (source: adjusted from Avdiushchenko (2018)).

3. Conceptual Research: Setting The Underlying Premises of The Model through Literature Review

3.1. An Opportunity for Europe to Generate Value from Diversity

‘Smart specialisation is the necessary implementation strategy for the Green Deal. It combines direction (top-down approach by setting long-term goals that foster joint investment commitments) and autonomy (bottom-up approach for finding the most successful economic solutions through joint experimentation of new system solutions)’ [17].

The system challenge that Europe is confronting to become the first carbon-neutral continent by 2050—and the enormous investment flows this requires—remain unprecedented. In the Green Deal Communication [3], the European Commission solicited policies and provided directionality to funding in a wide range of areas. Smart specialisation strategies (RIS3 or S3) that concentrate on new development prospects for all regions in these areas cannot be disregarded in such an approach. The realisation of the Green Deal requires the mobilisation of all resources and all stakeholders across the whole EU. The assignment of smart specialisation is precisely that: pinning down new prospective activities, taking into account the unique characteristics of all places [17]. Larosse et al. (2020) position the RIS3 as a fundamental delivery mechanism for the EU’s new sustainability agenda, contributing to the capitalisation from the diverse EU innovation ecosystem and circumventing fragmentation. Additionally, it can integrate the orientation of the Green Deal strategy with the search and cocreation alley (entrepreneurial discovery) in the direction of sustainable growth in all European regions. Both the Green Deal and RIS3 are perceived as transformational policy frameworks, and RIS3 seeking directionality and place-based dynamics can be beneficial for the Green Deal. Hence, the RIS3 is a key element of Green Deal success [17].

RIS3 represents a multilevel policy approach. The EU’s new sustainability agenda is described by Larosse et al. (2020) ‘as a smart specialisation strategy for the whole of the EU in a global economy in transition, claiming global leadership in clean technologies and exporting successful solutions’. Nevertheless, worldwide reorganisation of value chains for sustainability will involve decoupling material and immaterial manufacturing (design globally, produce locally) [17]. Furthermore, Larosse et al. (2020) add the following:

This “de-globalisation” of material flows (because of internalisation of transport costs and more efficient digital technologies for local production) will be an opportunity for the re-industrialisation of Europe with a circular economy model, closing loops at the level closest to the users of customised product-service combinations. In such a transition, the capacities of quadruple-helix clusters in EU countries, regions and cities, to adapt to the new sustainability enhancing regulations with new technologies and new social contracts, is our best competitive asset [17].

However, the implementation of these globalisation and reshoring efforts is not without caveats, due to the complex and multilayered global value chains that have developed in recent decades. Additionally, the issue of ensuring critical mass emerges in such a scenario, in terms of both resources and also skilled labour force, as this is required to enable the smooth operation and functioning of the localised value chains. Moreover, the decoupling narrative proved to be problematic, often due to the lack of coordination, remanufacturing, and recycling, which ultimately means there is no decrease in production and, hence, no environmental benefits [18].

McCann and Soete (2020) identify ‘smart specialisation strategies for sustainability’ as the policies from the extensive EU portfolio most relevant to laying the ground of the Green Deal strategy. They define these as being established on local policy initiatives confronted differently with regional environmental issues, which have learned from their own RIS3 how to ‘motivate, induce and coordinate entrepreneurship and learn from other regions confronted with similar challenges’. In that respect, the Green Deal puts forward the importance of diversity within Europe, rather than scale: the impending realisation of

the Green Deal and the NCEAP will consequently rely on the acknowledgement of diversity in the local rather than national characteristics of the individual territories. This is an opportunity for Europe to generate value from diversity [19].

3.2. The Role of RIS3 within the Place-Based Narrative

‘Place-based policies are geared towards using local characteristics, complexity and interconnectedness to spur local and more inclusive growth. Place-based strategies combine proximity and critical mass to both bring together a set of stakeholders but also to access knowledge and funding to pursue chosen development strategies’ [17].

The regional dimension plays a leading role in encouraging and governing economic recovery, and this is increasingly recognised in the literature [20]. This growing attention has been motivated by a place-based approach to devising regional development strategies and making best use of endogenous resources. This very collaborative approach brings together regional stakeholders (governmental institutions, private businesses, educational institutions, and nongovernmental organisations (NGOs)) to work jointly [10,17,21]. Therefore, it integrates two central aspects: ‘first, it assumes that geographical context really matters for its social, cultural, and institutional characteristics, and second, it focuses on knowledge development in policy intervention, by promoting interactions of enterprises, local groups and policy decision makers’ [22]. The place-based development approach acknowledges that most of the knowledge required to fully capitalise on prospective local economic recovery and to design customised institutions and investments is not easily accessible to the state, big corporations, and local and regional stakeholders. It is rather acquired through a participating and purposeful course of action by local and external actors [22].

The foundation corner of the RIS3 concept of regional growth trajectories, covered in Section 3.1, is the place-based approach. In this context, different regions within the EU have diverse economic and institutional configurations, preconditions, and challenges, which determine their economic and industrial development and their policy challenges for stimulating innovation, competitiveness, and growth [21]. According to CoR (2019), the smart specialisation principle pivots on the following idiosyncrasies [21]:

- ‘Diversification based on knowledge flows from a firm-level process where knowledge, core competences and resources from existing industries are used in new industries and where entrepreneurs combine their knowledge with knowledge from other industries or knowledge providers [23].
- Strengthening and exploiting the “connectivity” between related activities within a region as well as between the region and other regions that can bring in new knowledge and resources related to existing activities in the region [24].
- Economic activities are linked to place identity, not only economically, but also physically, socially, environmentally and culturally, so interactions between these factors bind the economic activities to the specific place [24]’.

The first two features are represented well by the triple-helix (TH) approach, in which cooperation among and within knowledge institutions, government, and industry determines and advances knowledge flows [21]. Initially conceived by Etzkowitz and Leydesdorff in the 1990s, the TH model considers innovation as a multifaceted process that does not occur in a single institution, but rather in trilateral networks composed of the interacting helices of industry, academia, and government. Traditionally, this model has represented a viable framework for characterising innovation systems at a regional level [25].

The quadruple-helix (QRH) approach is widening the industry–government–academia nexus by highlighting the active role of citizens, not only as final consumers and innovation users, but also as an important element of the innovation system (e.g., the case of social innovation). Therefore, such an approach acknowledges the contribution to the innovation cycle derived from the inclusion of civil society and citizens [25]. Taking civil

society and citizens into the equation contributes to more innovations beyond the science- and technology-based. Hence, the QRH innovation models put an accent on cooperation in innovation, where civil society and citizens are considered active components of the innovation system. The responsibility of industry and academia is to support civil society and citizens, and the government is putting forward the regulative framework and financial support to determine and adopt innovation strategies [21].

The quintuple-helix (QNH) approach incorporates the spatial element into the QRH model [21]. It reasons that the distinctiveness of a territory is defined by the physical place, including the landscape, environment, physical infrastructure, and buildings [24]. It puts forward all prospective distinctive features of a place, taking into account the physical, human, and place-based potential. This can include a wide range of features, from human resources, know-how, skills, and competences to the preferences of citizens in the territory in terms of infrastructure, buildings, harbours, landscapes, natural capital, and technical facilities [21].

In this context, the built environment is a sector that pressurises to a great extent the natural ecosystems [26]. Therefore, the regeneration of the built environment plays a crucial role in the transition towards a CE [27]. The strategic importance of the necessary actions on the built environment has been a subject of enquiry, reflecting the benefits of embracing multidisciplinary and multiscale approaches [26–28]. Pomponi and Moncaster (2017) propose a three-level division: the macro-level, encompassing systems of cities or urban agglomerates [29]; the meso-level, including buildings [26]; and the micro-level, considering manufacturing components [30]. In their study, they suggest six fundamental dimensions for CE research in the built environment: governmental, economic, environmental, behavioral, societal, and technological. Additionally, they include both bottom-up and top-down approaches as boundary conditions [26]. Similarly, Cruz Rios and Grau (2019) distinguish between bottom-up and top-down CE initiatives in the built environment, which when combined could provide enabling conditions for promoting the adoption of CE practices [31].

The TH and QNH approaches differ primarily in the ‘innovation ecosystem’ that concatenates social systems and environments with a diverse set of stakeholders and organisations in a specific geographical area, containing universities, small and medium-sized enterprises (SMEs), large corporations, government innovation networks, and knowledge clusters [24]. The natural environments of society and the economy are considered drivers for generating knowledge and innovation; hence, smart specialisation makes a substantial contribution to a place-based strategy by introducing innovation as a defining driver [21]. However, as discussed in the following sections, this paper does not present the environment and the whole spatial element as a mere driver of innovation, but rather as a starting point. Considering the natural characteristics of the region, the preservation of natural resources, its biodiversity, and the functioning ecosystem should be the starting point for action, and this should be reflected in the efforts of the other helices.

3.3. A Regional Pact for Sustainable and Fair Growth

‘The transition to the circular economy will be systemic, deep and transformative, in the EU and beyond. It will be disruptive at times, so it has to be fair. It will require an alignment and cooperation of all stakeholders at all levels—EU, national, regional and local, and international’ [6].

The transition towards a CE is a systemic change [32]. Besides the steered engagements impacting every stage of the value chain and key sectors, it is essential to develop a suitable setting for the flourishing of a low-carbon CE, where resources can be mobilised. Innovation has a leading role in this systemic change. Reconsidering the *modus operandi* of manufacturing, consuming and converting waste into high-value-added goods entails

new technologies, processes, services, and business models. Therefore, promoting research and innovation (R&I) is key to fostering the transition, which will be instrumental in supporting the competitiveness and modernisation of the EU industry [21].

Taking into consideration the geographic, environmental, economic, and social aspects, a low-carbon CE will be different in each European city and region. The industrial structure of the city or region is also a fundamental feature to be accounted for, with service- and resource-intensive sectors demanding distinctive types of support. For example, the difficulties with applying resource-efficient transportation, district heating systems, and a sharing economy are much higher in less accessible territories (e.g., islands and peripheral regions), in contrast to metropolitan areas with a larger critical mass [21]. As pointed out in the CoR report (2019), ‘the diversity of territorial contexts translates into different needs and opportunities that circular economic approaches should address’ [21].

Instrumental to effective, timely, and just implementation of the NCEAP and the Green Deal is the involvement of a wide range of stakeholders and the harnessing of their experience and knowledge [4,17,21]. The engagement is needed at all altitudes, from European to local, and by all actors, including government, industry, academia, civil society, and citizens [13,21]. Including technical support from researchers and institutes, capitalising on the innovative approaches from industry, and encompassing bottom-up approaches from the wider public improves the resilience of policies, contributes to wider and faster acceptance, and ultimately leads to better outcomes [4]. Dynamic, unambiguous, and fitted communication strategies are a prerequisite for the inclusion of all stakeholders. Nevertheless, information alone is insufficient: raising awareness of CE costs, benefits, challenges, and opportunities is equally relevant. Different groups of actors have different objectives and motives for shifting towards the CE. For this reason, it is crucial to encourage all parties to seek common aims, incentivising them to establish framework conditions for building synergies at the correct scale and minimising future liabilities for society at large [13].

Taking the QNH approach and accounting for the RIS3 and place-based principle, Section 4 introduces the new regional model for promoting long-term inclusive coalitions between stakeholders for planning together the transition towards a CE in a regional context.

4. Desk-Based Research: Proposing A Living Constellation of Regional Stakeholders

4.1. The Proposed Circular Economy-Centric Quintuple-Helix Model

This paper proposes a CE-centric QNH model (Figure 2) for mapping all stakeholders involved in the transition towards a CE at the regional level. The model has the three helices from the traditional TH constellation: industry (economic system), government (political system), and academia (higher education system). These helices represent a balanced regime, allowing the emergence of trilateral networks. In the balanced regime, the helices are the closest to each other, and their sections of influence are so diffuse that this leads to new organisational arrangements and connections at the intersection point (innovation in innovation) [25]. These can refer to collaborative research and development (R&D) projects or ‘hybrid’ forms of organisations (incubators, venture capitalists) [33]. As highlighted in the OECD Synthesis report, ‘the circular economy is a shared responsibility across levels of government and stakeholders’ [13]. The transition towards an economy that is more circular relies on the capacity of the industry helix to move towards more sustainable business models—for instance, by using secondary material, recycling, sharing. Knowledge institutions, being part of the academia helix, contribute to boosting R&I, while the government helix establishes framework conditions, setting the strategic common vision, and providing investment and appropriate incentives to build the economic and financial case for the CE [13]. Adequate funding can encompass grants, subsidies, direct and indirect investments, and public–private partnerships (via which the LRAs can

enable the emergence and progress of circular efforts). Additionally, national and EU funds can be utilised, with LRAs applying directly to EU funding programmes [7].

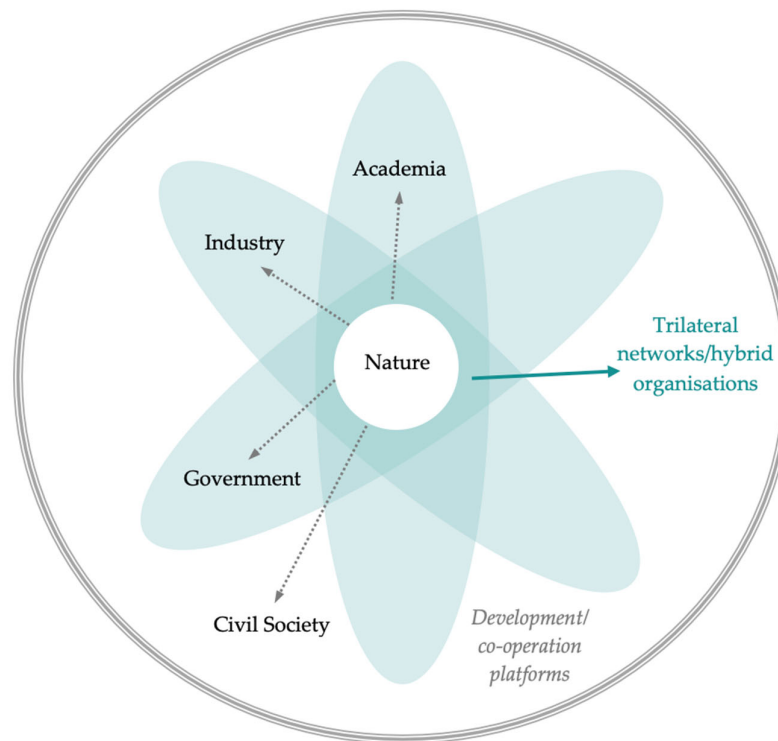


Figure 2. The circular economy-centric quintuple-helix model ([25]; adapted using models from [33–35]).

The CE-centric QNH model is based on various seminal contributions from the literature. First, the model recognises the fundamental role of the social dimension (i.e., society), as specified by Arnkil et al. (2010) in the public-sector-centred living lab model and in the citizen-centred QRH model. The former is focused on the advance of public organisations and services, where users/citizens work together with R&D experts for the development of public services. The latter is aimed at developing innovation that is relevant for the citizens, and thus the owner of the innovation process can also be represented by a group of citizens. Correspondingly, the first model represents the top-down approach, while the second leans more towards the bottom-up perspective [34]. The CE-centric QNH model is situated in the middle of the spectrum, representing the balanced approach, where every helix has a specific role to play, each with its own importance and magnitude [25]. The last model used as a reference here is the QNH model, as depicted in the work of Dubina (2015). The natural environment is represented as the fifth helix of the model, not containing any stakeholders that can undertake tangible actions, but acting as a driver of innovation and inspiration for the remaining stakeholders [25,35]. The CE-centric QNH model, however, captures the conservation of the environment as the backbone of all CE initiatives, with the actions and engagement of all stakeholders reflecting their objectives of preserving the natural capital.

In contrast, the CE-centric QNH model depicts the natural environment (the spatial dimension of the model) as the nucleus of the model. As such, the QNH model is an ecologically sensitive model, suitable for driving a socio-ecological transition. The environment is not perceived as a mere helix; rather, it is seen at the centre of the model, as a driver of innovation, influencing and inspiring the other helices, and moreover as a reference point for all CE efforts, aiming to preserve the natural ecosystem. This is a pivotal feature of the balanced development model, allowing it to drive the transition towards a

CE, given that, in a CE context, innovations, technological solutions, and production methods should be true to nature, regenerative, and restorative by design [25]. The inclusion of the natural environment in the model is also aligned with the place-based approach and RIS3, as elaborated in previous sections. Correspondingly, the boundaries of the model are delineated by the borders of the civil society and citizen helix, since it is this helix that consists of individuals who can undertake actual activities. In this model, the civil society helix does not encompass only organisations and associations representing a collective voice of citizens, but it refers to the inclusion of citizens as individuals and true protagonists of the transition [25].

4.2. The Proposed Approaches and Development/Co-operation Platforms

Another concept adopted in the model is one of development/co-operation platforms. Arnkil et al. (2010) suggest that these ‘could be seen as a supplement to traditional cluster and regional innovation policy and as a new kind of intermediary organisation that supports the involvement of users in the R&D&I activities’ [34]. In the CE-centric QNH model, development and cooperation might exist within a single helix (i.e., a unilateral approach) or between more helices (i.e., a multilateral approach), as depicted in Figure 3. The proposed platforms do not serve as a mapping exercise for identifying different groups of actors, but rather as a proposed inclusive and long-term coalition of stakeholders that will direct the transition at the regional level and be involved and engaged in the process from the very beginning.

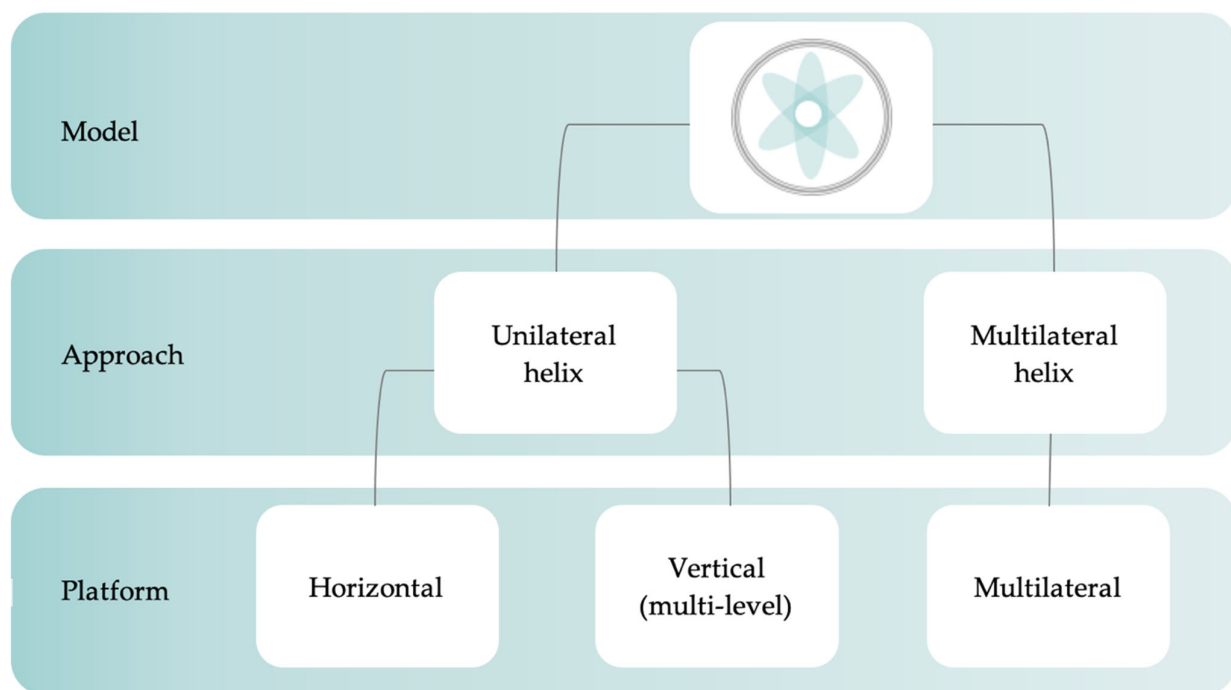


Figure 3. The circular economy-centric quintuple-helix model—proposed approaches and development/co-operation platforms [23].

Within the unilateral helix approach, the following types of platforms may exist, depending on the types of cooperation between the involved actors:

- Horizontal platforms, which exist between same level actors (i.e., cooperation platform between research institutions, illustrated in Figure 4);
- Vertical (multilevel) platforms, which exist between different levels of actors (i.e., cooperation platforms between local, regional, and national public authorities, illustrated in Figure 4).

In contrast, multilateral platforms, being grounded in the multilateral helix approach, occur between actors from different helices (i.e., research institutions, government, industry, NGOs), as represented in Figure 5 [25].

As already stated in Section 4.1, the proposed CE-centric QNH model is promoting a balanced approach. The transition towards a CE needs to be stimulated by a mix of bottom-up initiatives, as an outcome of shifting social inclinations and grassroots movements, and from top-down efforts and enabling framework conditions directed by the government, in order to have full inclusion of stakeholders. A combination of correctly selected and designed policy instruments will be needed to encourage the transition at national, regional, and local levels for a successful implementation [36]. Central to this is the participatory process of creation (i.e. ‘codesign’ and ‘cocreation’), which entails a different creative process, diverse stakeholder participation, and distinctive mode of knowledge to the frontline of public sector innovation and decision making [37].

In Section 5, an example of a Spanish regional initiative is presented, and stakeholders and platforms from the Greek ecosystems are introduced to better illustrate the proposed model.

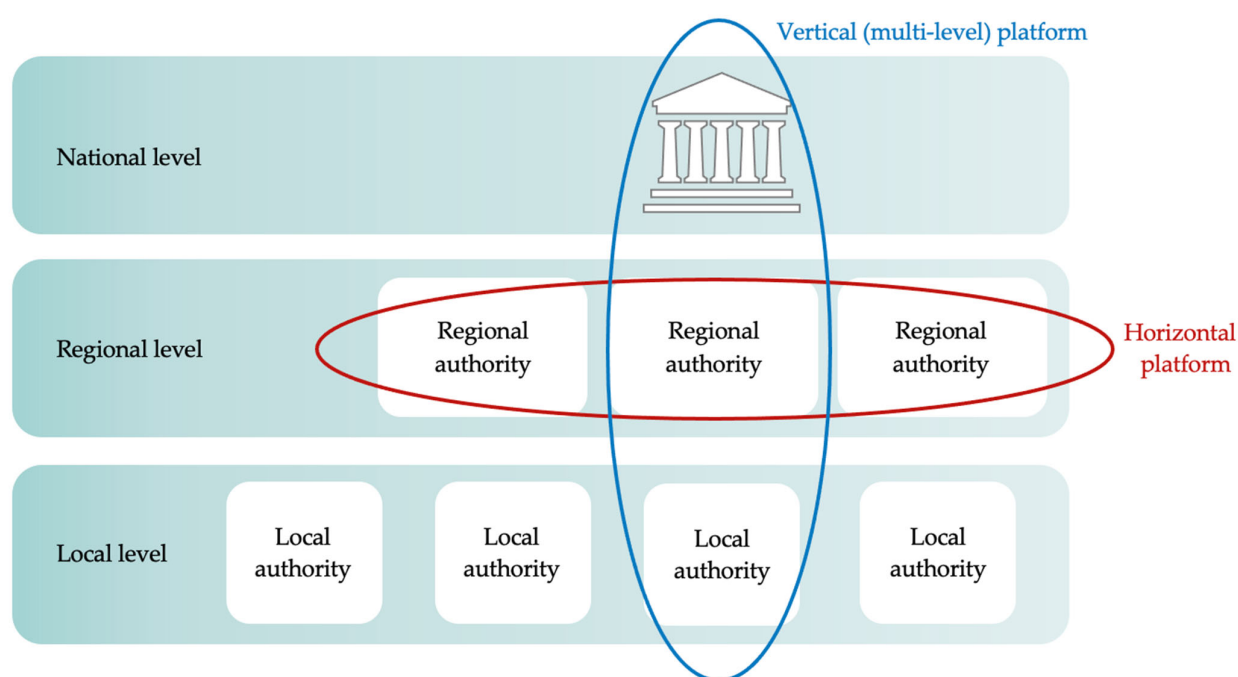


Figure 4. Vertical (multilevel platform) and horizontal platform.

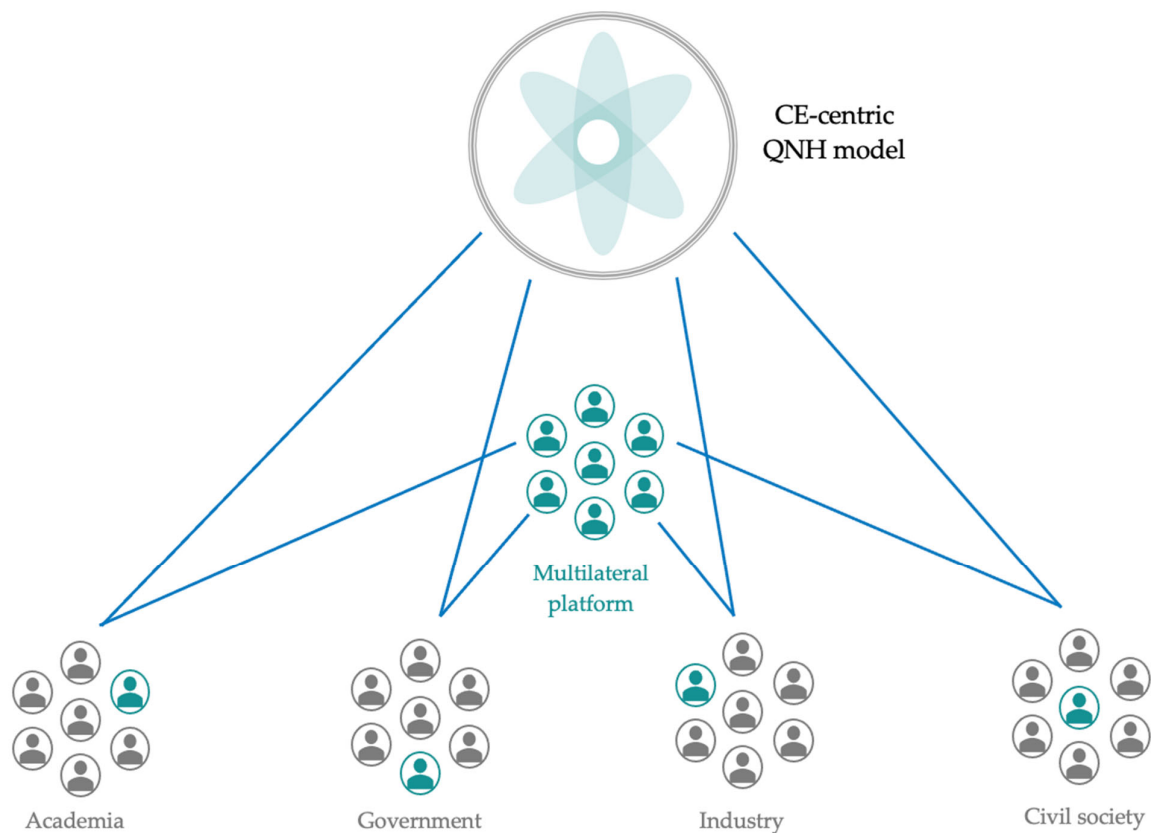


Figure 5. Multilateral platform (the circular economy (CE)-centric quintuple-helix (QNH) model).

5. Practice-Oriented Research: Practical Application of The Model

5.1. The Greek Case: Region of Central Macedonia

Table 1 provides examples of stakeholders engaged in CE activities (primarily from the region of Central Macedonia, NUTS 2 level region in northern Greece, NUTS code: EL52 [38]) to clarify the proposed categorisation by the CE-centric QNH model. Initially, the stakeholders associated with the academia, government, industry, and civil society helix are presented, followed by a hybrid organisation example. The platforms or networks in the unilateral and multilateral helix approach are then introduced.

These stakeholders are undertaking CE initiatives individually and on different fronts, but they are jointly contributing to the transition towards the CE in the region of Central Macedonia. The South-East European Research Centre (SEERC) conducts multidisciplinary research to make academic contributions and build capacity in many contemporary areas, including the CE. Through public–private partnerships and involvement in multidisciplinary projects, it plays a role in knowledge generation and the promotion and dissemination of the CE concept and underlying actions [39]. The Regional Development Fund of Central Macedonia, acting on behalf of the Region of Central Macedonia, is the key partner organisation for devising the first action plan for the region, *‘Towards Bio-Based Circular Economy’*, which was published in 2019 as part of the BIOREGIO Interreg Project. Additionally, the region of Central Macedonia, as the governing body of the region, integrated CE actions at the Regional Operational Programme (ROP) 2014–2020 and is currently integrating CE actions in the next ROP period 2021–2027. Targeted strategic activities of RIS3 at the regional level to enforce CE are also ongoing, as is a revision of the regional waste management plan [40]. Biogas Lagada SA is an industry stakeholder that reuses livestock waste for production of biogas and fertilisers and is therefore an example of a circular business model in the region [41]. ‘Let’s do it Greece’ is the largest voluntary

action in the country, engaging and uniting citizens with a common environmental preservation purpose [42]. The Centre for Renewable Energy Sources and Saving (CREC) is the national entity for the promotion of renewable energy sources (RES), the rational use of energy (RUE), and energy saving (ES). Managed by an administrative council of seven members—including representatives from the General Secretariat of Research and Technology (Ministry of Education and Religious Affairs, Culture and Sports), the Public Power Corporation, and the Hellenic Federation of Enterprises—CREC operates in two main activity areas, as a National Energy Centre and as a Research and Technological Centre for RES/RUE/ES [43]. This explains its hybrid nature and its categorisation as such.

The Association of Greek Regions (EN. P. E.) is the representative body of the 13 NUTS 2 level regions in Greece, established with the objectives of permanent structured cooperation, promotion, and representation of all Greek regions. Thus, this entity is a type of horizontal platform that enables cooperation between actors within the government helix on the same level. One of its many purposes is to undertake ‘preventive and repressive measures against the climate change and its consequences and the environmental protection always in cooperation with competent bodies of the government and the European Union’ [44]. The European CoR is the advisory body that represents European LRAs and through which LRAs can share their views on the EU legislation that directly influences cities and regions, including CE transition [45]. As this includes governmental actors at different levels, it is a representative case for a vertical (multilevel) platform. Finally, the Cluster of Bioeconomy and Environment of Western Macedonia (CLuBE) is a non-profit legal entity founded among local actors and stakeholders of the region of Western Macedonia (NUTS 2 level region in western Greece, NUTS code: EL53 [38]). The cluster was established by the TH of the regional bioenergy and environment segment; within this field, it is developing R&D and business activities intended to ‘reinforce smart, bio, green and circular economy in the region and neighboring areas’ [46]. Hence, it is a type of regional multilateral platform in which stakeholders from different helices pool their efforts for a common purpose.

Table 1. Stakeholders from the circular economy-centric quintuple-helix model and development/co-operation platforms, with examples of Greek stakeholders engaged in circular-economy activities. The majority of the actors are from the region of Central Macedonia.

Stakeholder	Example
Academia	South-East European Research Centre (SEERC)
Government	Region of Central Macedonia
Industry	Biogas Lagada SA
Civil society	Let’s do it Greece
Hybrid organisation	The Centre for Renewable Energy Sources and Saving (CREC)
Development/co-operation platform	Example
Horizontal	The Association of Greek Regions (EN. P. E.)
Vertical (multilevel)	The European Committee of the Regions (CoR)
Multilateral	The Cluster of Bioeconomy and Environment of Western Macedonia (CLuBE)

5.2. The Spanish Case: Region of Galicia

In 2019, the Government of Galicia (NUTS 2 level region in northwest Spain, NUTS code: ES11 [38]) approved the strategy document ‘*Estratexia Galega de Economía Circular*’ (EGEC), which is an ambitious plan to transform the Galician economy into a CE. The EGEC emerged from the need to promote and ease the CE transition, and it aims to develop the strategic framework defined by the European Commission, adapting it to the economic, social, and environmental particularities of Galicia [47]. Although the EGEC is a draft policy still subject to public review (as of 2020), the document presents very interesting insights about the implementation of CE policy at the local level. The EGEC is based

on a holistic strategy with the ambition of implementing a paradigm of a CE in Galicia. This implementation is motivated by (1) the need to adapt to a changing international context in which CE strategies are being adopted, with an emphasis on related EU initiatives, (2) the context of resource scarcity that is expected to affect the EU economy, and (3) a recognised environmental crisis. At a Galician level, the EGEC is also expected to promote the reindustrialisation of rural areas, support economic growth and job creation, and prevent the exodus from rural areas in Galicia [25].

However, the EGEC also reproduces an ecomodernist understanding of the concept of CE. This understanding recognises the environmental crisis with which we are living, but it also seeks to perpetuate market-based capitalism and maintain the principles of the free-market and economic growth as a pathway towards sustainable development. The EGEC is also disconnected from existing environmental conflicts and debates within Galician society, crafting a policy proposal strongly influenced by stakeholders from academic, political, and business spheres and free from the influence of environmental NGOs and other civil-society organisations. This practice is further reflected in the expected impact of the EGEC, which focuses on issues such as generating growth, encouraging financial and material efficiency, and opening up new markets. However, it does not explicitly address other issues such as public-health concerns caused by pollution, the question of social justice when implementing this transition, or the reframing of ‘societal welfare’ beyond the mere generation of employment [25].

It is therefore apparent that the application of the CE-centric QNH model could allow the government of Galicia to better understand the stakeholders who need to be mobilised for the development of a more participatory strategy for the transition towards a circular region [25].

6. Implications and Future Research Agenda

This paper has given an account of the need for mobilising, involving, and aligning all relevant stakeholders for the effective implementation of the regional CE. First, arguments for anchoring the CE implementation and hence the realisation of the EU Green Deal at the regional level were introduced. Additionally, the role of LRAs in this transition was highlighted. Afterwards, the links between the smart specialisation agenda, the place-based approach, and the EU’s new sustainability agenda were established, calling for a regional truce to achieve sustainable and fair growth on European grounds. The systemic nature of the CE transition was emphasised, as was the need to engage all stakeholders at all levels. Subsequently, the absence of a viable model for engaging all relevant stakeholders in the regional circular ecosystem was highlighted as an important cavity in need of address. In this way, this study has developed a model not only for mapping stakeholders in the regional CE context, but also serving as a living constellation of regional stakeholders and a method of designing a platform for the long-term coalition of stakeholders who will plan together the transition at a regional level. Taking the traditional TH nexus (academia–industry–government), the model was extended to reflect the importance of the social dimension of the transition. However, the nucleus of the model was the environment, acting as a driver for commitment and action to tackle climate- and environment-related concerns. Existing concepts such as trilateral networks, hybrid organisations, and development/co-operation platforms were also acknowledged as vital for a successful and fair transition. Examples from Greek stakeholders were presented, and the preliminary application of the model in the Spanish case of Galician CE strategy was detailed.

Despite its conceptual nature, this study offers some insights into the groups of stakeholders who must be taken on board to successfully implement the NCEAP and fulfil the promises of the Green Deal. Nevertheless, more research is needed to better understand and define the borders between the helices, the hybrid organisations, and types of development/co-operation platforms. As the research field remains in its infancy, this could be achieved by performing fieldwork and analysing grey literature rather than academic contributions. Future research could also concentrate on the investigation of the different

roles stakeholders can assume and the identification of diverse pallets of incentives and stimuli that can trigger circular action. Equally important would be to delve into the obstacles encountered by each stakeholder when engaging in CE activities. Considerably more work is needed to determine ways of engaging with different stakeholders, stimulating action, co-operating, cocreating, participating, and aligning in the circular journey into which Europe is heading. Finally, if the debate is to be moved forward, a better understanding of the practical application of the model and approaches is needed to advance the CE-centric QNH model and propose approaches for the development and co-operation platforms. This could be accomplished by initially applying the model in different regional contexts and in wider scenarios.

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