PREPRINT VERSION of:
Sanz-Hernández, A., Sanagustin Fons, M.V., López Rodriguez, M.E. 2019. A transition to an innovative and inclusive bioeconomy in Aragon, Spain. Environmental Innovation and Societal Transitions. 33, 301-316. DOI https://doi.org/10.1016/j.eist.2019.08.003

A transition to an innovative and inclusive bioeconomy in Aragon, Spain

Alexia Sanz-Hernández
María Victoria Sanagustín-Fons
María Esther López-Rodríguez
Department of Psychology and Sociology
University of Zaragoza, Spain

ABSTRACT

This research proposes a theoretical framework to reflect on bioeconomic transitions, which, in turn, is tested by a case study of innovative and inclusive socio-institutional practices in the context of a Spanish region, Aragon. This integrative proposal places the individual and the community at the core and considers a variety of spaces, levels, scales and actions for understanding the redefinition of individual and organisational roles involved in the bioeconomic proposal. It concludes that innovation and inclusion are crosscutting concepts and practices that are indispensable for developing social skills, community resilience and business activity and essential for tackling global and local challenges. We also highlight private sector efforts to make headway with transition at a time when the definition of future policy strategies is ambiguous.

Keywords: transition, bioeconomy, inclusion, innovation, corporate behaviour, case studies.

1. Introduction

Although the bioeconomic model—unfinished and yet to be constructed—can be integrative, it is complex to implement because it implies: a) the integration and interdependence of stakeholders, sectors and levels (Geels, 2002; Hermans, 2018) and scales; b) multidisciplinary by addressing knowledge and transfer challenges; c) convergence and symbiosis of production sectors (Velenturf, 2017); and d) redefinition of the relevance of each of these three capitals, monetary, biological and social (Giurca and Metz, 2018), as well as the relationship between them.

The bioeconomic framework is a model promoted by strategies in different parts of the world (United Nations, 2017). Bioeconomics -as well as circular and green economy- is one of the well-established alternative models for sustainability management through knowledge transfer (D'Amato et al., 2017): 'bio-based economy' or 'Knowledge-Based

BioEconomy (KBBE)' (Cavallo and Gerussi, 2015), with an inherent aim: transition (Van den Bergh et al., 2011).
In the European context, the bioeconomy strategy (European Commission, 2012) marks a milestone in national government commitments and design of public policies to promote new ways of innovating, producing and creating jobs; the EU framed this strategy in Horizon 2020. In 2014 it already included the 'Innovative, Sustainable and Inclusive Bioeconomy' with a budget of €44.5 million (€42 million the following year) with the aim of outlining political priorities for social change (societal challenge). The 2018 update of the European bioeconomy strategy pretends to maximise its contribution towards the 2030 Agenda (United Nations, 2015), as well as the Paris Agreement (European Commission, 2018). Since its original formulations outlined by Georgescu-Roegen in the 1970s and in the Meadows report (Meadows et al., 1972), an alignment can be observed between the bioeconomic proposal and 2030 Agenda and its Sustainable Development Goals (SDGs) (United Nations, 2017: 14; Heimann, 2018), with the pledge of leaving no one behind.

Academic discourse emphasised three main approaches in the analysis of the bioeconomy: the bio-technology vision, the bio-resource vision and the bio-ecology vision (Bugge, Hansen and Klitkou, 2016); the social vision was a supplementary or residual approach (Aquilani et al., 2018). Actually, the social dimension of the bioeconomic is increasingly receiving attention in the academic literature (Sanz-Hernández et al., 2019). Consequently, both sustainability transitions and inclusion, have been placed at the epicentre of the official and academic bioeconomic discourse for social change and regional development, although there is still a shortage of empirical evidence about two axial issues: How can a bioeconomic focus championing innovation and inclusion contribute to societal transition? And, what role can actors play?

This paper refers to the role of firms (as essential stakeholders), towards societal transition based on the analysis of the positioning and implementation of innovative and inclusive behaviours aligned with the bioeconomic proposal. Two main contributions are made: 1) The interpretative theoretical framework can serve as a reference to analyse the behaviour of several actors (individual or collective) in societal transitions. It provides a global and agglutinating view of both the already existing debate on the role of innovation, and the incipient academic discussion about the role of inclusion in the bioeconomic model. Many authors highlight the axiality of the concepts of inclusion and innovation (i. e. van der Have and Rubalcaba, 2016), but no systematic proposals address inclusion in an integrative, global manner across the entire organisational framework for bioeconomy. 2) The trace signs of societal transition are presented, specially at an organisational level (firms' level) in the Spanish region of Aragon, showing the positions and social strategies of companies, with special emphasis on inclusion and innovation.

To carry out this research, a methodological design was proposed with the following phases:

-Elaboration of an interpretive framework based on an overview of the literature (background) from a bioeconomic perspective
- Selection of the analysis context and the cases to be analysed
-Trace of signs of bioeconomic transition from the analysis of positions/practices of companies, a) through the review of organizational documents; b) Semi-structured interviews with entrepreneurs and company managers.

The article is structured as follows from here. Second section contains theoretical framework; the third section is about method using several secondary sources, statistics and qualitative techniques and a description of the context in which we develop the analysis; the forth section contains results and discussion about different ways of socioecological transitions implemented in the companies selected. Finally, we make some relevant conclusions based on the theoretical framework, the proposed model and the data coming from the methodology applied.

2. Theoretical background and framework

The bioeconomic model has been seen by some actors, defenders or detractors of "growth" (or even "sustainable growth"), as an alternative solution and opportunity for societal transitions required by global challenges and problems (Sanz-Hernández et al., 2019). These transitions aspire to be more democratic (Hölscher et al., 2018; Audet, 2014), more sustainable (van der Bergh and Grazi, 2014; Ashford and Hall, 2018), shared socially (Patterson et al., 2016; Avelino et al., 2017), responsible (Drews and Van der Bergh, 2016), and fairer (Wagner, 2016; Rauschmayer et al., 2015; Martin, 2016). They are focused on meeting human requirements (Nussbaum et al., 2016), to become what Sen (2017) and Hall and Lamont (2009) call successful societies, precisely, because they overcome inequalities. However, important gaps are observed in citizen involvement in making these transitions (Drews and van den Bergh, 2016), that need more research and specific proposals (Matthias et al., 2011).

On the other hand, the complexity and slowness of change processes affecting existing institutional rules, regulations and culture in the transition process (Van den Bergh et al., 2011; Hermans, 2018) suggest that it would be necessary to establish interpretative models, considering actors (Korhonen et al., 2018).

From the previous literature, we have developed a model to investigate the bioeconomic transition in which innovation and inclusion are crosscutting concepts. The proposal is integrative, multilevel, multiscale and multidimensional. It also allows for considering several stakeholders 'analysis planes (individual, organisational or societal) to form a holistic interpretative system.

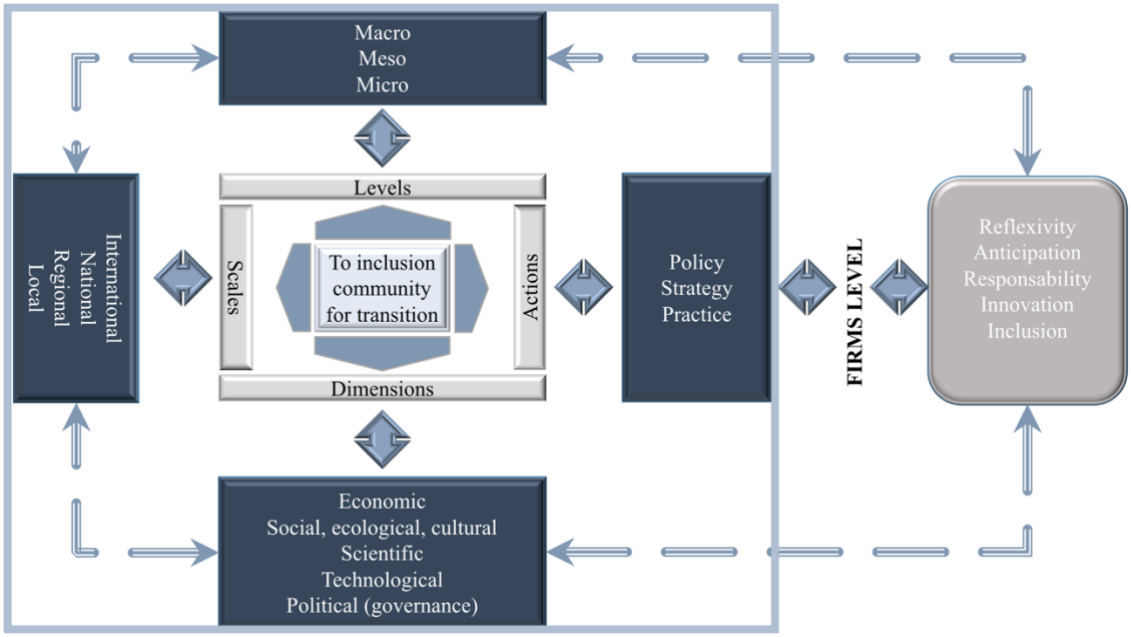

Figure 1. Theoretical framework for an innovative and inclusive bioeconomy

Firms are an essential actor for tackling sustainability challenges because with their innovative and inclusive actions they participate in the delimitation of the bioeconomic model, impacting on the different levels, scales and dimensions of territorial ecosystems:

a) Levels, ranging from micro-levels (individuals, homes, organisations and communities) (Etzioni, 2001; Sales de Aguiar et al, 2016), to global meso- and macro-levels (institutions, states and cultural frameworks) (Martinez and Cooper, 2017).

b) Scales of impact on the environment: local, international or global (Bauman, 2004).
c) Actions specified in policy, strategies and practices. Innovative and collaborative attitudes to the bioeconomy (Bosman and Rotmans, 2014; Van Lancker et al., 2016; Hansen and Bjørkhaug, 2017; Juerges and Hansjürgens, 2018), can be considered basic tools to overcome economic crisis, solve social problems and generate new ideas and ways to develop (Loorbach et al., 2016; Drucker, 2014; Kleinknecht, 2016; Avelino et al., 2017). This requires the collaboration of multiple stakeholders (Bryson et al., 2017; Haxeltine et al., 2016) and social acceptance of innovations and its importance for social development and the transition towards a new economy. In addition to the innovation attitudes and actions, inclusion, responsibility/accountability, anticipation and reflexivity are needy in the bioeconomic institutionalisation process to reach its objectives, primarily integrity and commitment (Asveld, Ganzevles and Osseweijer, 2015).

d) Dimensions. Specifically, it includes five dimensions for analysing the role, position and relationship of stakeholders, with respect to: environment, market, policy/governance, science and technology. This are associated with environments where transitions can impact: 1) sociocultural and ecological, 2) economic, 3) political and, finally, 4) scientific-technological.

Firsly, in its *sociocultural and ecological dimension*, the bioeconomy involves redefining economic roles and prominence for users, consumers (McCormicket al., 2016) and prosumers (Toffler, 1999). According to von Hippel (2005), in the knowledge society, it is not just knowledge producers (scientists and engineers) that innovate, but also suppliers, distributors, users and manufacturers. Developing this formula requires fairness (justice), full participation, education and a change in lifestyle, especially young people's (Duarte et al., 2017).

Secondly, responsible innovation—the basis of the social justice demanded—characterises the *economic dimension* of the bioeconomic proposal (Viaggi, 2015; Shorthall, 2015), which, based on applying knowledge, can contribute to reducing inequality in the economic sectors associated with it (Ferreira Filho, 2013).

Thirdly, from a *political* and discursive level European Union has expressed its commitment to innovation as a future proposal, specifically, the Europe 2020 Strategy (smart, sustainable and inclusive) fosters and outlines promoting a learning, co-learning and innovative society as a priority (BEPA, 2011:7). The bioeconomic proposal should impact on the change related to how states, organisations and citizens conceive and implement good governance (Devaney et al., 2017) of natural resources (regulation, use and preservation) in their daily practices. Some of the studies that have focused on how to expand implementation of a bioeconomic model as a basis of regional development (Radulescu et al., 2018; Devaney and Henchion, 2017), point out the need to involve citizens in key decisions, facilitating citizen participation processes or, to put it another way, responsive bioeconomy (Mustalahti, 2018). Consequently, inclusive development (George et al., 2012; Sisto et al., 2016) and inclusive growth (George et al., 2012; Grundel and Dahlstrom, 2016) only fit into an inclusive governance scenario. This framework is also only feasible if people commit effectively to the bioeconomic model (Sleenhoff and Osseweijer, 2016).

Finally, the *scientific-technological dimensions* are directly related to innovation systems (Regional Innovation Systems, RIS, Conen, 2012; Sectoral Innovation Systems, SIS, Malerba, 2002; or Technical Innovation Systems, TIS, Suurs, 2009) and the social appropriation of knowledge. In this transition, every actor can provide a base of knowledge to promote social innovation initiatives (Deffuant et al., 2005; Cohen et al., 2017; Caulier-Grice et al., 2012) or open innovation (Chesbrough, 2003; Chesbrough et al., 2006; Tödtling et al., 2011) and can also activate social impact dynamics with their social commitment (communication, socialisation and mobilisation) (Sanz-Hernández, 2019), which can be applied to a variety of policies and political or business strategies.

As we have seen, the concepts of innovation systems, innovation communities, social innovation and open innovation have been addressed in the most recent literature. However, this is not the case with the concept of inclusion systems or inclusive communities. As a matter of fact, the difficulty in putting the SDGs that Spanish companies are currently outlining (Global Compact Spanish Network, 2018) into organisational practice, partly lies in this lack of crosscutting and integrates reference

models at an operational level. Organisations interested in improving inclusion need to know exactly what does it mean and how to progress towards it.

Firms can contribute to creating a strong and dense structure of multilevel cooperation and alliances including all the stakeholders. This has progressed from a triple-helix model involving academy, business and public authorities (Fransman and Tanaka, 1995; Etzkowitz and Leydesdorff, 1997) to a quintuple-helix model (Grundel and Dahlström, 2016), with the quadruple-helix model based on democratising innovation (von Hippel, 2005) leading to bottom-up inclusion. Civil society is the fourth agent/stakeholder, resulting in a people's economy, a step that is needed to arrive at the bioeconomic model. Failing to do this would consolidate paradoxical situations of imbalance in the functioning of the institutional-governmental and business helices at the expense of training and the civil society (especially in developing regions), leading to economic growth and business benefits, technological development and innovation, but also high levels of inequality, social injustice and impoverishment (Sartori and Mazzoleni, 2003; Latouche, 2009).The quintuple helix is additionally adding the helix (and perspective) of the 'natural environments of society' because it is 'ecologically sensitive' (Carayannis et al. 2012) and emphasises the role of sustainable and responsible innovation as the architect of social growth during the socioecological transition phase towards new ways of producing, consuming and working (Truffer et al., 2015).

We also believe firms can also contribute to build social skills based on a standard of individual, collective and corporate resilience is essential (Sheffi, 2015; Tengblad and Oudhuis, 2018). That is why the concept of community takes on new strength and is designed on the basis of shared places seeking to responsibly confront the challenges of globalisation and its impacts (Wilson, 2014), such as potential recessions due to uncontrollable events of permanent risk (Wójcik, 2015) or inequalities (Giddens, 2018). A new concept of responsible community has arisen as a result (Luard, 2016), which is centrally focused and it conditions the success of the bioeconomic model when it is put into practice (Siegner, et al., 2017).

In this innovation framework, integrated inclusion systems need to be designed to make headway with an inclusion-based bioeconomy (D'Amato et al., 2017; Seigner et al., 2017, Bryden et al., 2017; Swaans et al., 2014) by forming inclusion communities that consider all the above-mentioned levels, action plans, areas and environments to impact and to impact from (two-way impact flow). (Figure 1).

Companies should play a key role to dynamize, channel and operationalize innovation oriented to sustainability challenges, through: investment in R & D, investment in bioeconomic professional qualification, private funds for territorial bioeconomic development, sustainable production and development of value chains, participation in interinstitutional and multi-stakeholders networks, measurement of their learning, innovation and transfer, and co-creation of knowledge with other actors.

In terms of inclusion, firms actions would be relevant in these matters: compliance with social regulations, sustainable employment generation linked to new job profiles,

employees training, strengthening of interactions with workers, reduction of the wage gap, diversity in government bodies, non- discrimination, health and safety, impact assessments in local communities, local development and cooperation programs; and finally, social evaluation of suppliers and all agents in the value chain.

3. Method and Context

For this study we used an interpretative approach (Charmaz, 2006), to outline signs of a bioeconomic transition, especially in innovation and inclusion areas. To obtain information on the change that is occurring in the social institutional level (and more in depth at the firm's level), we adopted a multi-method qualitative methodology, using both the case study design for the research plan and grounded theory, for data analysis and theory building (Siggelkow, 2007; Eisenhardt and Graebner, 2007; Díaz Andrade, 2009).

3.1. Context

To contrast bioeconomic theoretical proposal with empirical practices, firstly, we wanted to pay attention to the socio-institutional action (policy, strategy and practices) for sustainability (and inclusion as an essential part of this). In Europe, several countries (Germany, France, Finland, Ireland, Sweden, Norway and Italy) have approved bioeconomic strategies at a governmental level; Spain specified its bioeconomy strategy in 2016 (Spanish government, 2016). As part of fostering a competitive and sustainable economic activity linked to the use of biological resources, benefiting from pre-existing knowledge and generating new knowledge have been deemed essential. This knowledge includes public-private collaboration at research, technological development and productive sustainability levels, the use of clean energies, responsible consumerism and taking advantage of waste to generate new power sources and new products and industrial supplies (Reverte, 2015; Malinauskaite et al., 2017; Margallo et al., 2018). An important milestone in the political and strategic arena was the creation of the Spanish Bioeconomy Observatory (2017) to adapt to European and national strategy and to identify and support local and autonomous community stakeholders and encourage institutional and social cooperation.

Institutional concern in Spain for environmental sustainability and the impact of climate change is certainly nothing new. Spain has participated in all world and European treaties and agreements to protect the environment (Appendix A). It also participates in developing the quintuple helix perspective leading to the emergence of new industrial sectors, such as renewable energies or new agroecological production systems (Soto et al., 2016; Guzmán et al., 2017; Infante-Amate et al., 2018; Sánchez et al., 2018).

Government and institutional interest in ecological transition has been joined by business initiatives. Lainez et al. (2018) state that the importance of economic sectors associated with the bioeconomy is high in Spain, "accounting for an estimated 6.5% of the gross domestic product (GDP) and employing around 9% of the working population, with more than 900,000 farms and more than 30,000 companies" (2018:

90). Of the sectors considered, the important contributions made by the agri-food sector in Spain are highlighted (exceeding 17% of exports in 2014). Next in importance are the other sectors associated with the bioeconomy in this order: the industries of wood, cork and pulp, the fishing sector, the sector of biotechnology not related to health, the sector biomass producer and transformer sector for energy generation and creation of bioproducts (Lainez et al., 2018: 90-91). The mentioned authors also highlight the capacity to generate knowledge in the domain of the bioeconomy (greater participation of Spanish entities in the Social Challenge of Horizon 2020 'Bioeconomy') and a close and balanced public and private participation if we consider all regions.

However, these signs of progress in bioeconomic transition nationally translate into huge disparity at the regional level due to the distribution of powers in the Spanish political system—hence the advisability of incorporating several scales and regional focus in the analysis.

We have paid attention to three special circumstances to select the analysis context.

a) Firstly, Aragon is predominantly a rural agricultural and livestock region. Like most of the Spanish autonomous communities (16 out of 17), Aragon identified the agro-food sector as one of its main priorities. However, it has not outlined a strategy for the bio-based economy as nine other Spanish regions already have (Lainez, 2018).

b) Secondly, Aragon provides good examples of the type of firm found nationwide, with a high percentage of companies with only one self-employed worker (53,9%) and high percentages of SMEs (0,8 % medium; 5,2% small; 39,9% micro and only 0,2% large companies) (Ministerio de Empleo y Seguridad Social, MEySS, 2018) (figure 2).

c) Thirdly, the region has shown an acceptable commitment to innovation (according to two essential sources, the European Regional Innovation Scoreboard and Innovation Survey of Spanish Statistical Office, INE). According to the Regional Innovation Scoreboard, Aragon was a Moderate + Innovator in 2017, and its innovation performance had decreased over time. This innovation level is acceptable, similar to other Spanish regions and only exceeded by the Basque Country. Concerning the second source, the INE Innovation Survey (Spanish government, 2017), the figures in the last report on the input-output relationship (innovation intensity compared with innovation impact per autonomous community), are good for Aragon as it is the fourth autonomous community for impact (percentage of the turnover associated with new or improved products). In other indicators, such as innovation intensity (percentage of expenditure on innovative activities out of total business turnover), Aragon drops to tenth place in the ranking of Spanish autonomous communities. This position places it in the 'follower' category (according to the proposal of the Boston Consulting Group matrix method) in other words, the one with a high innovation impact but low intensity. This group contains organisations that invest less in research than in innovation, marketing or promotion of their new products.

3.2. Cases selection process

To select the sample of cases (firms), we used theoretical sampling (Glaser and Strauss, 1967). Cases have been selected according to a series of specific and significant characteristics, in relation to research object. The process implies the advancement and regression in the phases of sampling, data collection and analysis, until the data saturation or the lack of relevance in the new collected information.

We followed these criteria: 1) Aragonese firms; 2) linked to the bioeconomy; 3) integrated in networks of bioeconomic firms; 4) with a high aggregated responsible management (RM) value; 5) that could have strategies for alignment with SDGs; 6) and even inclusion management. Criterias 1 and 2 are exclusive; the others are highly relevant.

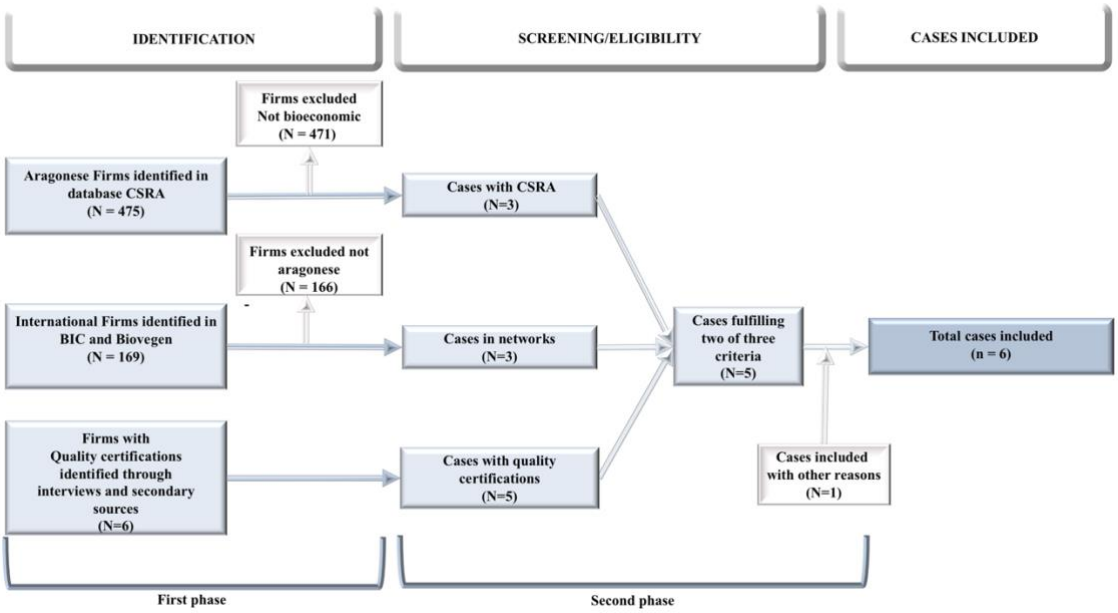

Figure 2. Flow diagram of the firms' exploration and selection process

Despite not meeting the pre-established criteria, case 6 was subsequently incorporated because it could provide appropriate comparable data and potentially valuable. The six selected companies were considered "good participants", according to the definition of Morse (1994): they had knowledge and experience that the researchers required, they were in a process of reflexivity, they had time and they were willing to participate in the study both in interviews and facilitating access to secondary data.

Identifying Aragonese stakeholders in the bioeconomic framework is extremely complex due to the lack of structure in the analysed context and the lack of official recognition of the subsectors forming it. Analysing interactions is equally complex. However, the study of some networks has been more revealing.

To form this sample, we first analysed the most important international networks of bioeconomy organisations (Bio-Based Industries Consortium, BIC, and BIOVEGEN) in

the European context to outline Spanish and Aragonese participation and locate companies that fulfilled criteria 1) to 3) of the above-mentioned theoretical sampling.
This first revision allowed us to advance in a two-dimensional organizational classification as a tool for the subsequent phase of the study of innovation and inclusion in companies. Regarding innovation, we can establish the following organisational classification:

1. Organisations that appropriate knowledge generated externally to create a product that meets demand. These are young organisations that essentially learn. Learning organisation.

2. Organisations that have a high level of external receptivity and generate enough internal knowledge to develop new products or services, but with a low or medium research orientation. Oriented learning for innovation organisations.

3. Organisations generating internal and external knowledge, in other words, they behave innovatively with a high R&D investment, participate in interinstitutional networks and projects and transfer results to new products, sectors and even contexts. Interactive knowledge-based organisations.

4. Organisations with a high innovative and inclusive behaviour, concerned about measuring and amplifying their impact on sustainable development. They are committed to the Paris Agreement and 2030 Agenda, and implementing SDGs into their strategic vision and planning. Interactive society-based organisations.

Referring to inclusion into business practices, we have created a typology that help us making organisational comparisons in this inclusion domain.

1) Companies that only apply regulations (regulation-oriented firms)
2) Companies that are in favour of 'justice' and implement isolated actions (justice-oriented firms)
3) Companies that have implemented an inclusion model as part of their local business strategy (inclusion-oriented firms)
4) Companies that also contribute to generating skills, developing capabilities and meeting needs (Nussbaum, 2011) (global inclusion-oriented firms)

To sum up, the process of finding signs of bioeconomic transition in the Spanish context has resulted in establishing an organisational typological matrix as a tool to understand how organisations' transition behaviour evolves, specifically in relation to inclusion and innovation actions. (See Figure 6, in section 4; it shows the matrix with the data referring to the location of the analysed companies).

In second phase, we searched for Aragonese companies that fulfilled criterion 4) of being RM oriented (Laash and Conaway, 2014; i. e. social responsibility strategies), based on official external recognition by certification bodies of social responsability practices (Corporate Social Responsibility of Aragon seal, given by the Government of Aragon, CSRA). We also analysed companies with at least two certifications (despite of these are really standard quality management), considering that this accredited the firm

as being in transition towards a business culture with social and environmental sustainability. Firms with triple certification are more oriented towards sustainability objectives in three dimensions. The following standards were adopted as a reference: a) ISO 14001 for environmental management systems with the seal of the Towards Zero Waste certification; b) OHSAS 18001/ISO 45001 for occupational health and safety management; c) ISO 9001 for quality management is based on eight basic quality and excellence principles: a customer-focused organisation, leadership, involvement of all personnel, process approach, system approach to management, continuous improvement, factual approach to decision-making and mutually beneficial supplier relationships.

Finally, the sample of firms for a more in-depth organisational analysis was formed by six firms distributed throughout the region. Their main details are shown in Table 1.

Companies	Entreprise size	Start activity	Persons employed	Volume of Business	Activity associated to bioeconomy	Bioproducts/ bioservices	Criteria fulfilled (Figure 2)
Case 1	Large	1975	1589	209 M€	Paper industry Waste valorization	Pulp, paper and cardboard	QUALITY CERTIFICATIONS
Case 2	Large	1986	1500	500 M€	Agricultural Biotechnology Vegetal Food	Biofertilizers	BIOVEGEN AND BIC QUALITY CERTIFICATIONS
Case 3	Small	1992	40	12 M€	Agro-livestok biotechnology Animal Food	Bioservices	CSRA BIOVEGEN QUALITY CERTIFICATIONS
Case 4	Small	1998	25	5 M€	Agricultural Biotechnology Vegetal Food	Biofertilizers	BIOVEGEN QUALITY CERTIFICATIONS
Case 5	Small	1997	44	58.325€	Manufacture of plastic containers	Bioplastics	CSRA QUALITY CERTIFICATIONS
Case 6	Micro	2016	4	_ (Investor recruitment)	Bioindustry Biotechnology	Ecomaterials	CSRA

Table 1. Characterisation of cases included in the study

Data were collected using a multi-method qualitative methodology of case studies (Stake, 2006), focused on reviewing the organisations' internal documentation (sustainability reports), reviewing existing secondary sources (reports, surveys, websites), and interviews of key informants at the firms (CEOs, R&D, human resources and/or strategic planning managers).

4. Results and discussion

All the cases have in common that they are in an open process of reflection with respect to the bi-directional impact of their bioeconomic practices and actions. They are aware of their important role and ability to promote a socio-economic model based on justice and equity through innovation and inclusion.

In this section, we present and discuss about the way in which companies perceive the bioeconomic transition by levels, the bidirectional impact of their actions, attending to scales (local / global), and considering the dimensions contemplated in the theoretical framework; finally, we collect their position and action in policy, strategies and practices to bioeconomic transition.

4.1 Firms' perception about bioeconomic transition by levels

Those responsible for the companies interviewed have emphasized a series of aspects related to the levels that facilitate or hinder their contribution to the bioeconomic transition (figure 3).

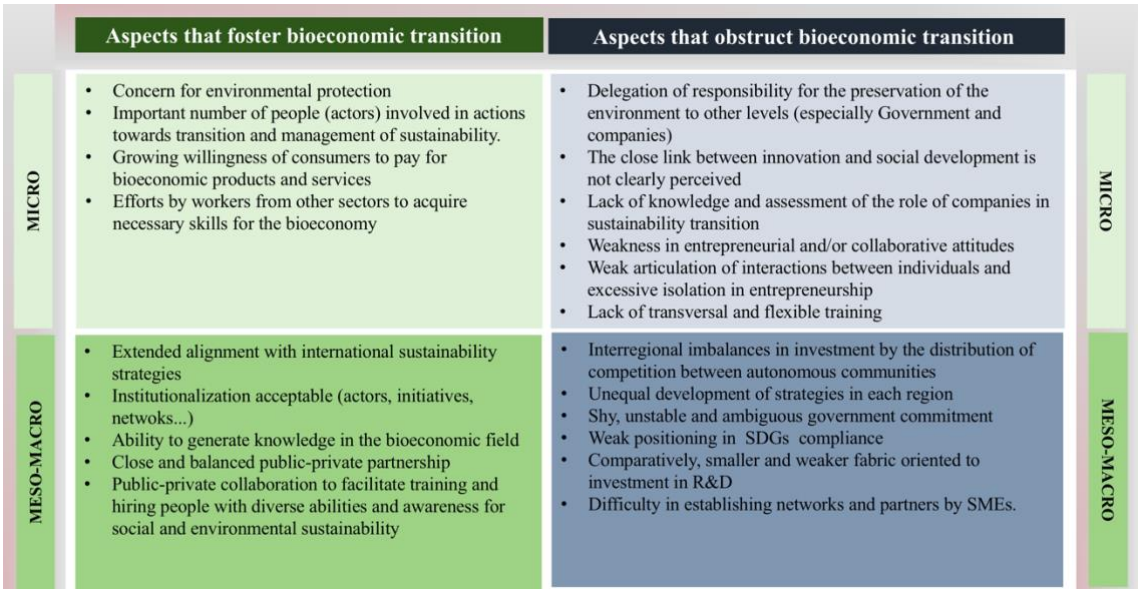

Figure 3. Firms' perception: Aspects that foster or obstruct bioeconomic transition in Spain by levels.

At the micro level, companies highlight the key role of individuals, in two fundamental roles: as consumers and as suppliers, both workforce and talent.

In the development of this sector we have two major drawbacks, the attitude of the consumer and the difficulty in attracting highly qualified talent (...). (Case 2, I-01)

The first is related to the social acceptance to pay bioeconomic products and services; it is still limited, although growing. The second is linked, both with the capacity of the environment to form a transversal and flexible way to people (educative gap), and with

the demographic vulnerability of the rural territory; it is unable to retain and attract people and talent.

The educational system is far behind our needs and also our territory is not attractive to work (Case 3, I-02).

Where there is less territorial vulnerability (urban environment), there are no people with transversal training in all disciplines (especially in the environment), (case 6, E01). In this framework, an important public and private effort is recognized in the activation of labour integration strategies in different ways. One of those ways is the "recycling of people", coming from sectors in crisis in Spain in recent years such as construction or the coal sector and thermal energy. Another way is the training and insertion itineraries for vulnerable groups, channelled through special employment centres (case 5). However, from this stand precisely that the attitude of companies is a threat to progress in a bioeconomy even, due to the distrust of employers in vulnerable subjects and in the training network (from the very paternalistic and protective point of view). Therefore, many companies prefer to outsource their social action strategies.

It is complicated not so much by people but because "ordinary "companies (...) are afraid of hiring, because they associate it with a series of disadvantages in the labour market: communication problems, violence, absenteeism, lack of skills, need for support. And it's not like that. (Case 5, I-01).

At the meso / macro level, the analysis carried out presents us with an environment that advances in the institutionalization of sustainability models. In particular, Aragonese innovation and inclusion initiatives (both present and future) in bioeconomy are quite significant political/institutional, business or social strategies that give us an idea of how they have been institutionalised in the region. These initiatives are becoming the catalysts of social change, and favour bioeconomic transition, by generating or facilitating employment, accessibility, support for collectives at risk of exclusion, respect or protection of the environment, and contributing to sustainable, innovative and inclusive social development.

However, from the point of view of the companies institutional and governmental level presents numerous weaknesses. For example, they emphasize that *governmental strategies are not always clear on this point*, (case 4; I-04), especially because *Spanish distribution of competences complicates the implementation of a decisive bioeconomic model and generates inequality between regions* (case 2; I-01), in terms of policies and strategies to promote the bioeconomic model.

4.2. Self-perception about bidirectional impact of actions

At this point, the informants have reflected on the double meaning of the impact of the actions and practices they perform, and on how they in turn are conditioned to achieve the objectives of their bioeconomic strategic planning. All incorporate in their vision their commitment to the territory, because there is a strong link with the territory that forces us to try to do things for it (case 2; I-02).

However, they differ markedly in self-perception about their own capacity for impact, and in the strategies proposed for a more effective impact.

After asking companies about their impact orientation at different scales, the majority acknowledges focusing on the regional and national level (cases 1, 2, 3 and 4), although their impact strategy tends to be international, both due to their capacity for implementation productive, as of alliances. In addition, only one company clearly translates its orientation to impact globally and claims to be planning strategies aimed at this (case 2). On the other hand, only one of them expressed its local orientation (justified by its dedication to labour inclusion in the territory, case 5). In turn, they all receive recognition and acceptance of their actions by the socio-institutional environment, something that makes them one of the actors most oriented to the dynamics of the fivefold helix.

On the other hand, several companies have mentioned threats to the implantation and capacity of impact of the bioeconomic model in several areas: a) in the labor market for the inclusion of the most vulnerable groups to the labour force, already mentioned; b) in the productive system to introduce socio-ecological practices in the design of processes and use of inputs beyond the regulations and c) in the political environment. The so-called 'timid governmental commitment' (case 1; I-01), that lacks strategic clarity and long-term stability is harming both the capacity for business impact and the intensity of the strategies of the companies in the territory (mostly SMEs, figure 2), for a better international positioning.

We are aligned with European strategies (...) but we have a weakness: we need to have partners, and in Spain there are very few SMEs that can truly dedicate money (Case 5, I-02).

The people we interviewed agree on the idea that interactions between stakeholders are not well structured, so we could say that the stakeholders are isolated in their actions in the region. The position and willingness of companies to establish alliances and form part of networks seems relevant, both to delimit their market and to make decisions about the territory with which they are related and in which they impact.

4.3. Position / relationship of companies in relation to environments

We have asked the informants and analysed the companies about their position and relationship with the different environments in which they are implemented: a) Environment; b) Market; c) Policy / governance; d) Science and technology.

In general, companies recognize having a visible position in the environmental situation, both for their production model and process design, as well as for their practices. Some informants have acknowledged that they are still in the embryonic stage of designing selective mechanisms both for the selection of suppliers and for attracting investors committed to the bioeconomic model, but all are perceived as a key element for change.

You have to be responsible with what you produce and with the supplies you use ... We must change (case 6; I-01).

We have the responsibility to promote change and a lot of capacity to do so. There is a vocational part, that comes from you, of commitment to the territory. But then there are other things that are conditioning you; we are very conditioned by external agents: the market and consumption habits, regulation, the education system. (Case 2, I-01).

The informants have highlighted the following issues as essential to ensure necessary cultural change: a) regulatory and facilitating regulations; b) real involvement (investments and well-defined and sustained strategies made by governments and local authorities); c) institutional recognition of the concept of 'justice' in accessing resources (in many cases these are public, such as water and power) and accepting financial responsibility for the implications of this recognition; and d) essential involvement of educational institutions in generating capabilities, new profiles and skills for active participation in all the dimensions of the new social order.

At the same time, some informants have stated that society does not value sufficiently the entrepreneurial effort to cause the change of model, since this is the one who must change in lifestyles. In this sense, the Spanish society has demanded investments to preserve the environment and are highly concerned with protecting it, although they delegate this responsibility to the government rather than tackling the challenge individually or in their own homes (official surveys, CIS, 2015).

Part of the effort of the companies is aimed precisely at strategic designs to generate new products, processes and technologies that are transferable globally, seeking a broader environmental and social impact. In several cases, their sustainability report shows that in the economic dimension, the most part of benefits runs directly as a reinvestment into the company. Mainly, they are working in R + D + I as part of their strategy (i.e. case, 1, 2 and 3). It is a strategy that, 1) incorporates eco-innovation and circularity as an objective (compared to 2015, the eco-innovation landscape in Spain is rather stable, Spain is ranked number 9 in the Eco-IS 2017; EC, 2017); and 2) it gives relevance to the scientific-technological dimension to generate new ways of producing, consuming and working, integrating diverse sources of knowledge through alliances involving several stakeholders. For example, case 2, 3 and 4 are working and researching with different actors in Artificial Intelligence or Big Data applied in production processes circular economy: *the use of mineral fertilizers is going to be finished but purines are considered as an opportunity for the future of our society and economy (case 3, I-01).*

In this sense, they perceive another threat to the transition: the attitudes and practices of the population in the face of innovation, entrepreneurship and collaborative work (figure 5). According to the charts, Spanish society does not clearly perceive the close link between innovation and social development nor does it show any signs of strength in entrepreneurial or collaborative attitudes which leads some authors to question the

possibilities of the challenge of the collaborative approach in Spain (Frenken and Schor, 2017).

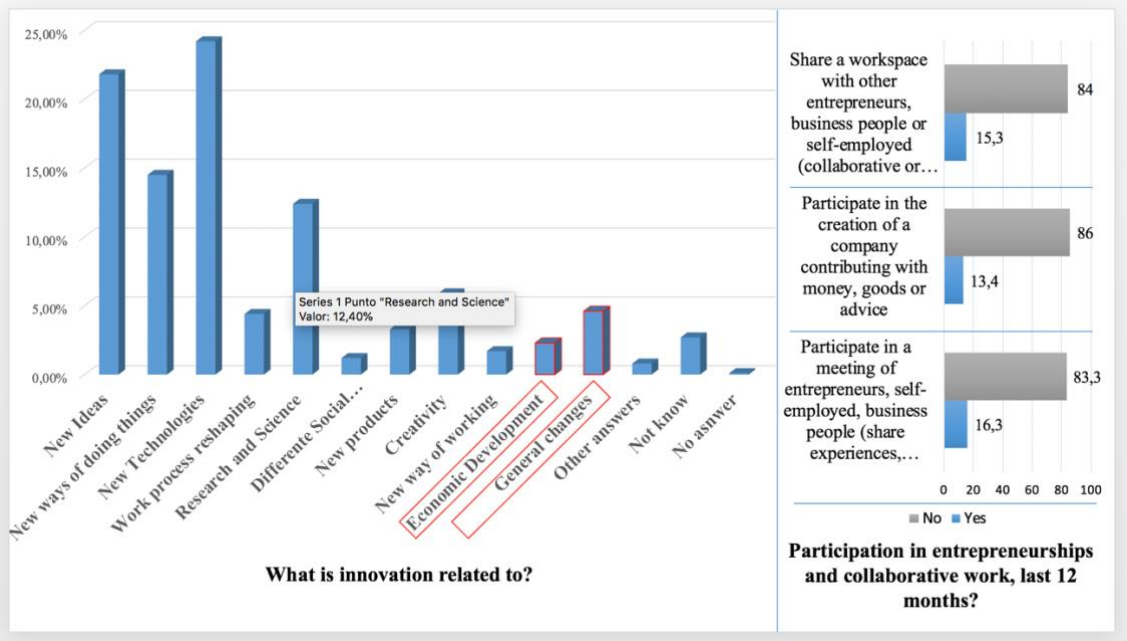

Figure 4. Social perception about innovation and participation in entrepreneurships and collaborative work in Spain.

Source: Author's from CIS, 2015. The questions of the surveys were: 1) What is innovation related to in Spain? And 2) Have you participated in entrepreneurships and collaborative work for last 12 months?

Companies' CEO highlight a need for change agents that promote entrepreneurial and collaborative attitudes (Sánchez et al., 2017). Spain is transitioning towards the new economy, but training and education are needed if this is to be extended to the entire population. Spanish people still need to commit to this model, which they are either not aware of, or fear, or resist for several reasons that have not yet been analysed in this context.

4.4. Companies' actions promoting bioeconomic transition

In the framework of the actions, we have collected information in three levels: policy, strategy and practices.

At the policy level, the largest companies (case 1 and 2) are in a recent process of convergence in terms of orientating business principles, subscribing to the United Nations Global Compact (UNGC), Paris Agreement or 2030 Agenda principles. Only one company highlights the 2030 Agenda as an opportunity (case 2), and 3 of them are working on it, especially *in terms of environmental care*. (case 6; I-01).

Spanish and Aragonese firms 'commitment to SDGs is low. A report by the Global Compact Spanish Network (2018) emphasises that 68% of participating firms are

committed to SDGs and 56% say they are running a project aligned with the 2030 Agenda. Only 36% say they notify their contribution in their sustainability report and only 22% have stated they make measurable commitments to some of the Agenda's goals and objectives. Finally, 24% say they have included SDGs in their firm's strategic objectives. This report highlights that Aragonese firms aligned with SDGs focus their activity as follows: 65% on goals 5 (Gender Equality) and 13 (Climate Action), and around 60% on goals 3 (Good Health and Well-being), 8 (Decent Work and Economic Growth) and 15 (Life on Land).

The social responsibility framework has never convinced us, although if you do not have the seal it seems that you do not do responsible management. Instead, we found it more interesting to align our strategy with the SDGs. Problem: we are not specialists in this and we do not know how to apply it or how to measure our contribution and progress. (case 2; I-01).

The SR framework is also promoting the social and environmental commitment of companies through the certification systems or CSR data available on social media (sustainability report, for example). In Aragon, the RSA seal has grown remarkably in the last three years, expanding from 216 organisations in 2015 to 374 in 2017 and 474 in 2018.

We have incorporated social responsibility criteria in all our processes and we present annual reports of social responsibility. We are in the social market. It is that we are socially responsible. (Case 5; I-02).

Some company's CEO believe certification tools are valuable *because it activates reflexivity within the company* (case 5; I-01) and they have incorporated social responsibility criteria in all their processes and present annual reports of social responsibility. But others consider that *in our economic framework and with the size of Aragonese firms, these are excessively bureaucratic tools that not help to substantially improve business management* (case 4; I-01). Even, some consider that it is not an essential tool because *it ends up becoming an end in itself* (case 2; I-02).

Similar disparity happens with reporting standards. Cases 1, 2 and 3 are in an incipient process of selection of format, metrics and media used for sustainability reporting, although all companies have recognized the need for transparency and accountability. Global Reporting Initiative (GRI) and GHG Emissions' Protocol frameworks are the two sustainability frameworks that they are adopting.

In terms of strategies, firms we consulted also recognise that they are in an embryonic phase of organisational and adaptive change, but they all to some extent highlight their efforts to positively comply with the European Bioeconomy Strategy (2012, 2018).

Finally, in terms of practices, organizational change towards a bioeconomic model is a slow process that involves planning, implementation and evaluation in the five actions within the organizations we have highlighted: reflexivity, anticipation, responsibility / accountability, innovation and inclusion.

This process has been consecutive in the case of the oldest companies that have traditionally attached great importance to innovation and anticipation actions (case 1, 2). In recently established organizations, the incorporation of actions in the areas analysed is simultaneous (case 6).

For a long time, things have been done without thinking. Today we have a vision more together, more global, more committed. You realize that your goals are unattainable without others. (Case 2; I-02).

The recognition of interdependence is a constant in the interviews, but this factor is not always reflected in the stimulation of aspects directly related to it such as: generation of collaborative networks, strengthening of alliances and increasing the participation of groups and communities in their own development organizational for the exchange of knowledge or innovation in products and services. The companies analysed, precisely because of the way in which the sample was made, are in a good position, especially in terms of innovation, anticipation and reflexivity.

The company has been involved in all the sustainable strategies for the last ten years or even more; just because we consider that bioeconomy is a very specific sector to orientate our behaviour and commitment towards the green bet. So, we have been doing a deep reflection about that (case 3; I-01).

We have also observed that the orientation to innovation is the most relevant action for most of the companies studied, being conceived as something inherent to the sector in which they move. Some of them (1, 2, 3 and 6) are highly proactive in acquiring funds for R&D, innovation and in implementing production transformations (due to the involvement of the committed companies rather than the number involved) and in participating in multi-stakeholder networks and collaborative alliances.

Although these firms' knowledge appropriation level is differential, it demonstrates behaviour that is clearly innovation-oriented for production processes, products and environmental protection. Concerning their research strategy—irrespective of their investment capacity—and their participation in knowledge helices, a far weaker research orientation is noticed.

Along with innovation, anticipation is understood by companies as a necessary practice for change and success.

Our sector revolves around the whole issue of sustainability and circularity, which is why we are considering it as a key, because everything is going there. Our business is based on proactivity and anticipation. (Case 1; I-01).

The company was created to try to anticipate solutions to the serious environmental problem. (Case 6, I-01).

In contrast, responsibility and inclusion practices are not clearly reflected in explicit business strategies, despite being part of the organizational culture (case 5 is an exception for its own purpose).

The first problem is the lack of precision in the definition and delimitation of inclusive practices. Some recognize: *I really do not know how inclusion is being defined* (case 2; I-02).

The social complexity is relevant in relation to these transitional aspects. Companies have very complementary answers towards them. So that, there are different ways to live and experiment the inclusion and the social responsibility among the companies analysed:

We are a family (case 3; I-03).

Our action for inclusion is a foundation because we are convinced that an added effort must be made by the vulnerable groups of the territory (...) (case 2; I-01).

In this way, we find different conceptions and degrees of formalization (internal / external) in relation to inclusion as a business practice: a) specific actions within the framework of altruistic behaviour (case 1, 2 and 3), b) commitment with the territory articulated in shared strategies with the community (case 1, 2, 3, 4 and 6), and c) initiatives articulated in the business project itself and within the local / global strategic vision of the company (case 2 and 5) .

The larger companies recognize that these actions are very clear in the strategic vision of the CEOs, but they are unfamiliar or unknown to the rest of the organization.

I think my company is very reflexive where it has to be, I mean the top hierarchical level within the organization (...) But today, that has not yet penetrated all the layers of the organization to be part of our culture. We have to work more in communication. (Case 2, I-02).

Using the before mentioned matrix, in the figure we have located the companies analysed in relation to the two relevant areas of action, examined in this research: innovation and inclusion, based on their own valuations.

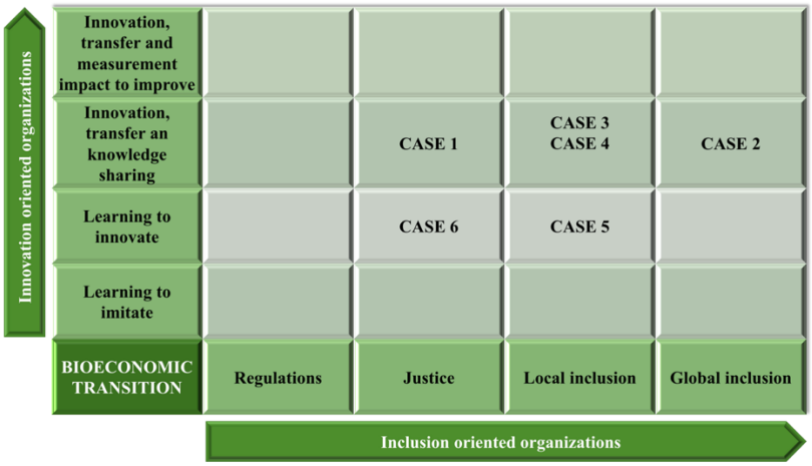

Figure 5. Interpretive matrix of organisational behaviour concerning innovation and inclusion.

It is clear that companies are immersed in a process of organizational change towards the assumption of behaviours that promote sustainability. The interviewees highlight the importance of the following key targets in this process: awareness + training + commitment + transparency + communication. Nevertheless, they all highlight that the basis of the transition to inclusive management begins with awareness (reflexivity) of shortfalls and gaps. Proactive companies that want to position themselves as leaders in the sustainability transition are detecting the numerous difficulties that the incorporation of the social dimension of sustainability in organizations poses. The most cited are:

a) ambiguity of the political frame of reference (that guides strategically but also allows to establish comparisons and know the organizational positioning, own and foreign);

b) the weakness of regulation (for example, sustainability reporting is not to compulsory norm for small companies, less than 500 workers, for those that exceed that figure, the mandatory in Spain was established in December 2018);

c) the lack of definition of what are inclusive actions and their lack of expression in corporate social responsibility standards. Nowadays in the region of Aragon (Spain) it is possible to find a gap between companies' commitment with the sustainable transition, mainly because public recognitions have been oriented towards some eco-labels and corporate social responsibility standards which are put into question by the own companies; the sense is that those standards do not answer to real points about an innovative and even transition;

d) the economic and technical difficulty of the companies to dedicate effort to the measurement of the ecological and social footprints of their products, (5 of the 6 companies have introduced emission reduction criteria in their production processes, but none measure the social footprint):

e) Finally, absence of corporate awareness of the positive social of their action (not in terms of what it costs, but what it contributes).

In this way, the recognition of interdependence and the importance of reflexivity is key in the process of implementing a bioeconomy including where the goal is that: *everything is so normalized that it costs you to question whether or not you are inclusive and socially responsible* (case 2; I-02).

After presenting the results, we can say that a bioeconomic focus championing innovation and inclusion can contribute to societal transition by: 1) acting as a reference model that demonstrates its economic and social performance and efficiency; 2) measuring their social impacts and their contribution in reducing inequalities at different scales and increasing the territorial resilience; 3) launching pilot experiences (for example, living labs) and analysing their social, economic and social sustainability environmental, and 4) working cascading and collaboratively with similar purposes: *zero waste without valorization, zero consumption of water and energy, zero CO2 emissions and zero social inequalities* (case 2, I-02).

In addition, each of the actors has its own responsibility. In particular, companies could contribute to the societal transition in the following ways: 1) turning problems into

opportunities and challenges overcoming collectively; 2) diversifying and developing know-how based on substitution and efficiency (new raw materials, new resources, new by-products and new and more efficient processes); 3) showing how individual business interests can become cooperative projects for the common good; 4) sharing knowledge; 5) measurement impacts; 6) connecting actors of the value chains: producers, waste transformers, by-products researchers and consumers; and, finally, 7) giving access to civil society with its great capacity to innovate, share knowledge, produce and consume in another way.

We have approached the complexity of the bioeconomic transition measurement of the from a qualitative approach to open a reflection on the companies' needs that have integrated innovative and inclusive practices, measure and communicate to other actors, their contributions to the societal transition. However, it is a necessary condition for the development and implementation within the companies of measurement systems that evaluate their current situation and their impacts in the medium and long term, with appropriate specific indicators (for example, GRI). In this process, the homogenization of the methods (variables, parameters and indicators) is key to establish comparisons among actors, sectors and spatial and temporal frameworks.

5. Conclusions

This study answers back to a central research question about the role of one relevant actor in sustainability transitions, firms, in the bioeconomic framework. For it, firstly, we present a theoretical approach that presume a contribution to the knowledge of the social dimension of bioeconomic transition. Secondly, we test this model in a case study, in a well-defined context—Spain—and in economic sectors associated with the bioeconomic. Analysed firms are pioneering in its approach in the aragonese context; practices, products and services implemented are innovative and have a huge impact on the areas where they are located.

The signs show that we are clearly advancing towards a societal transition and that the bioeconomic sector is playing an important role; but there are many aspects that need to be improved because are weakening or slowing down the transition. The study gives these keys to policy-makers and entrepreneurs, especially in vulnerable and aging regions (as aragonese region), where is very important the recognition of the interdependence of stakeholders, sectors, spaces and levels. To incorporate inclusion systems/communities can help to consolidate resilience and long-term sustainable outcomes in organisations, based on responsible innovation in business strategies and for bolstering their social capital, networks and interactions.

At firm level, there are considerable differences in how these organizations fulfil their commitments and their business practices. Firm size does not seem to be a determining factor in the transition towards a well-established bioeconomic model while progressing towards a fairer, more inclusive and more cohesive society; however, studies should be conducted to deepen this issue, including all firms associated with bioeconomy.

In general, analysed firms are active in generating interactions with other regional organisations and participating in innovation networks to meet demand, but they should increase their research investment. They are also at different stages in internalising the integration sustainability policy and strategies in its social dimension. They demand backing or regulation in their area. They would like a cultural context more informed and proactive, and society accepting change in lifestyles. All this suggests policymakers need to establish courses of action.

This exploratory study has not examined the quantification of the impact level of the analysed behaviours. Comparative measurement systems should be established using known variables that can quantify, firstly, the level of appropriation and impact of the knowledge developed (knowledge level, qualifications, applicability/generalisation, dissemination/transfer, measurement and expansion of impacts and autonomy, or level of generating own solutions and solutions for others) and, secondly, the level of appropriation and impact of inclusive practices (presence, internal scope, dissemination/transfer, impact, alignment with policy/strategies of sustainability…). Analysing the development of stakeholder behaviour, interactions and the formation of the innovation networks and inclusion systems they are trying to build would also undoubtedly be of considerable interest. Firm location in an initial phase may also be an ideal starting point for piloting inclusion community experiences and analysing the development of the transition process.

Acknowledgements

This study was partially co-financed by the Regional Government of Aragon in the framework of Research Group Socioeconomy and Sustainability: Environmental Accounting, Circular and Corporate Economy and Resources (University of Zaragoza), Ref.: S33_17R.

References

Aquilani, B., Silvestri, C., Ioppolo, G., Ruggieri, A., 2018. The challenging transition to bio-economies: Towards a new framework integrating corporate sustainability and value co-creation. Journal of Cleaner Production, 172, 4001-4009. https://doi.org/10.1016/j.jclepro.2017.03.153

Ashford, N. A., Hall, R. P., 2018. Achieving Global Climate and Environmental Goals and Governmental Regulatory Targeting. Ecological Economics, 152, 246-259. https://doi.org/10.1016/j.ecolecon.2018.06.002

Asveld, L., Ganzevles, J., Osseweijer, P., 2015. Trustworthiness and responsible research and innovation: the case of the bio-economy. Journal of Agricultural and Environmental Ethics, 28 (3), 571-588. DOI 10.1007/s10806-015-9542-2

Audet, R., 2014. The double hermeneutic of sustainability transitions. Environmental Innovation and Societal Transitions, 11, 46-49. https://doi.org/10.1016/j.eist.2014.02.001

Avelino, F., Wittmayer, J. M., Kemp, R., Haxeltine, A., 2017. Game-changers and transformative social innovation. Ecology and Society, 22(4). https://doi.org/10.5751/ES-09897-22044

Barbeito, A., Lo Vuolo, R. M., 1989. La modernización excluyente. Transformación económica y Estado de Bienestar en Argentina,CIEPP/UNICEF/Losada, Buenos Aires.

Bosman, R., Rotmans, J., 2014. Benchmarking Finnish and Dutch bioeconomy transition governance. Dutch Research Institute for Transitions, Rotterdam, The Netherlands.

Bryden, J., Gezelius, S. S., Refsgaard, K., Sutz, J., 2017. Inclusive innovation in the bioeconomy: concepts and directions for research, Taylor & Francis. DOI: 10.1080/2157930X.2017.1281209

Bryson, J., Sancino, A., Benington, J., Sørensen, E., 2017. Towards a multi-actor theory of public value co-creation. Public Management Review, 19(5), 640-654. https://doi.org/10.1080/14719037.2016.1192164

Bugge, M., Hansen, T., Klitkou, A., 2016. What is the Bioeconomy? A Review of the Literature. Sustainability, 8, 691–22. doi:10.3390/su8070691

Bureau of European Policy Advisers (BEPA), 2011. Empowering people, driving change: social innovation in the European Union, France.

Carayannis, E. G, Barth, T. D, Campbell, D.F.G, 2012. The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. Journal of Innovation and Entrepreneurship. https://doi.org/10.1186/2192-5372-1-2

Caulier-Grice, J., Davies, A., Patrick, R., Norman, W., 2012. Social innovation overview: a deliverable of the project: The theoretical, empirical and policy foundations for building social innovation in Europe (TEPSIE), European Commission–7th framework programme. European Commission, DG Research, Brussels.

Cavallo, M., Gerussi, E., 2015. Bioeconomy, circular economy and industrial symbiosis: towards a new concept of productive processes. Eco-Industrial Parks, 43.

Charmaz, K., 2006. Constructing grounded theory: A practical guide through qualitative analysis. Sage, London.

Chesbrough, H.W., 2003. The era of open innovation. MIT Sloan Management Review, 44(3), 35–41.

Chesbrough, H., Vanhaverbeke, W., West, J. eds. 2006. Open Innovation: Researching a New Paradigm, Oxford University Press, Oxford.

CIS (Centro de Investigaciones Sociológicas), 2015. Barómetros de opinion.

Coenen, L., Benneworth, P., Truffer, B., 2012. Toward a spatial perspective on sustainability transitions. Res Pol. 41(6), 968–979.

Cohen, M. J., Brown, H. S., Vergragt, P. J. (Eds.), 2017. Social Change and the Coming of Post-consumer Society: Theoretical Advances and Policy Implications, Taylor & Francis, Oxford.

D'Amato, D., Droste, N., Allen, B., Kettunen, M., Lähtinen, K., Korhonen, J., Leskinen, P., Matthies, B.D., Toppinen, A., 2017. Green, circular, bio economy: A comparative analysis of sustainability avenues. Journal of Cleaner Production, 168, 716–734. doi:10.1016/j.jclepro.2017.09.053

Deffuant, G., Huet, S., Amblard, F. 2005. An Individual-Based Model of Innovation Diffusion Mixing Social Value and Individual Benefit. American Journal of Sociology, 110. https://doi.org/10.1086/430220

Devaney, L., Henchion, M. Regan, A., 2017. Good Governance in the Bioeconomy. EuroChoices, 16(2), 41-46. DOI: 10.1111/1746-692X.12141

Devaney, L. A., Henchion, M., 2017. If Opportunity Doesn't Knock, Build a Door: Reflecting on a Bioeconomy Policy Agenda for Ireland. The Economic and Social Review, 48 (2), 207-229.

Díaz Andrade, A., 2009. Interpretive Research Aiming at Theory Building: Adopting and Adapting the Case Study Design. The Qualitative Report, 14 (1), 42-60. Retrieved from https://nsuworks.nova.edu/tqr/vol14/iss1/3 (Juny 19, 2019).

Drews, S., van den Bergh, J. C., 2016. Public views on economic growth, the environment and prosperity: Results of a questionnaire survey. Global Environmental Change, 39, 1-14. https://doi.org/10.1016/j.gloenvcha.2016.04.001

Drucker, P., 2014. Innovation and entrepreneurship, Routledge, London.

Duarte, R., Escario, J. J., Sanagustín-Fons, M. V., 2017. The influence of the family, the school, and the group on the environmental attitudes of European students. Environmental Education Research, 23(1), 23-42. https://doi.org/10.1080/13504622.2015.1074660

Eisenhardt, K. M., Graebner, M. E., 2007. Theory building from cases: Opportunities and challenges. Academy of Management Journal, 50 (1), 25-32.

Etzkowitz, H., Leydesdorff, L., 1997. Introduction to special issue on science policy dimensions of the Triple Helix of university-industry-government relations, Science and Public Policy, 24 (1), 2–5. https://doi.org/10.1093/spp/24.1.2

Etzioni, A., 2001. La Tercera Vía hacia una buena sociedad, Minima Trotta, Madrid.

European Commission. 2010. Europe 2020 Flagship Initiative, Innovation Union. SEC (2010), 1161. Brussels, 6.10.2010 COM(2010) 546 final.

European Commission, 2012. Innovating for Sustainable Growth: A Bioeconomy for Europe, SWD (2012). 11 nal. Brussels, 13.2.2012. COM(2012) 60 nal.

European Commission, 2018. A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment. https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none (accessed inmarch 29, 2019).

Ferreira Filho, J. B. 2013. Food security, the labour market, and poverty in the Brazilian bio-economy. Agricultural Economics 44, supplement 85–93. DOI: 10.1111/agec.12053

Fransman, M., Tanaka, S., 1995. Government, globalisation, and universities in Japanese biotechnology. Research Policy, 24(1), 13-49. https://doi.org/10.1016/0048-7333(93)00748-I

Frenken, K., Schor, J., 2017. Putting the sharing economy into perspective. Environmental Innovation and Societal Transitions, 23, 3–10. https://doi.org/10.1016/j.eist.2017.01.003

Geels, F.W., 2002. Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Res Pol. 31(8/9), 1257–1274.

George, G., McGahan, A. M. Prabhu, J., 2012. Innovation for inclusive growth: Towards a theoretical framework and a research agenda. Journal of management studies, 49(4), 661-683. https://doi.org/10.1111/j.1467-6486.2012.01048.x

Giddens, A., 2018. Globalization. In Sociology of Globalization (pp. 19–26), Routledge, London.

Giurca, A., Metz, T., 2018. A social network analysis of Germany's wood-based bioeconomy: social capital and shared beliefs. Environmental Innovation&Societal Transitions 26, 1e14. https://doi.org/10.1016/j.eist.2017.09.001.

Glaser, B., Strauss, A., 1967. The discovery of grounded theory. Chicago, Aldine Press.

Grundel, I., Dahlström, M., 2016. A Quadruple and Quintuple Helix approach to regional innovation systems in the transformation to a forestry-based bioeconomy. Journal of the Knowledge Economy, 7(4), 963-983. https://doi.org/10.1007/s13132-016-0411-7

Guzmán, G. I., de Molina, M. G., Fernández, D. S., Infante-Amate, J., Aguilera, E., 2017. Spanish agriculture from 1900 to 2008: a long-term perspective on agroecosystem energy from an agroecological approach. Regional Environmental Change, 1–14. https://doi.org/10.1007/s10113-017-1136-2

Hall P. H., Lamont, M. (eds), 2009. Destigmatization strategies and their impact in health and boundaries: Social inclusion as a dimension of successful societies. Cambridge University Press, New York. https://doi.org/10.1016/j.socscimed.2016.03.021

Hansen, L., Bjørkhaug, H., 2017. Visions and Expectations for the Norwegian Bioeconomy. Sustainability, 9(3), 341. https://doi.org/10.3390/su9030341

Haxeltine, A., et al., 2016. A framework for transformative social innovation. TRANSIT working paper, 5, 2-1.

Heimann, T., 2018. Bioeconomy and Sustainable Development Goals (SDGs): Does the bioeconomy support the achievement of the SDGs? American Geophysical Union. doi: 10.1029/2018EF001014

Hermans, F. 2018. The potential contribution of transition theory to the analysis of bioclusters and their role in the transition to a bioeconomy. Biofuels Bioprod. Bioref., 12, 265-276. https://doi.org/10.1002/bbb.1861

Hölscher, K., Frantzeskaki, N., McPhearson, T., Loorbach, D., 2019. Tales of transforming cities: Transformative climate governance capacities in New York City, U.S. and Rotterdam, Netherlands. Journal of Environmental Management. 231, 843-857. https://doi.org/10.1016/j.jenvman.2018.10.043

INE (Instituto Nacional de Estadística) 2018. Regional Innovation Scoreboard and Innovation Survey.

Infante-Amate, J., Aguilera, E., de Molina, M. G., 2018. Energy transition in Agri-food systems. Structural change, drivers and policy implications (Spain, 1960–2010). Energy Policy, 122, 570–579. DOI: 10.1016/j.enpol.2018.07.054

Juerges, N., Hansjürgens, B., 2018. Soil governance in the transition towards a sustainable bioeconomy. A review. Journal of Cleaner Production, 170, 1628–1639. https://doi.org/10.1016/j.jclepro.2016.10.143

Korhonen, J., Giurca, A., Brockhaus, M. & Toppinen, A. 2018. Actors and politics in Finland's forest-based bioeconomy network. *Sustainability*, 10, 3785. doi:10.3390/su10103785.

Kleinknecht, A., 2016. Innovation patterns in crisis and prosperity: Schumpeter's long cycle reconsidered. Springer.

Latouche, S., 2009. Pequeño tratado del decrecimiento sereno, Icaria Editorial, Barcelona.

Lainez, M., González, J. M., Aguilar, A., Vela, C., 2018. Spanish strategy on bioeconomy: Towards a knowledge based sustainable Innovation. New biotechnolgy. 40, 87–95. http://dx.doi.org/10.1016/j.nbt.2017.05.006

Loorbach, D., Avelino, F., Haxeltine, A., Wittmayer, J. M., O'Riordan, T., Weaver, P., Kemp, R., 2016. The economic crisis as a game changer? Exploring the role of social construction in sustainability transitions. Ecology and Society, 21(4). http://dx.doi.org/10.5751/ES-08761-210415

Luard, E., 2016. The globalization of politics: the changed focus of political action in the modern world. Palgrave Macmillan UK. DOI 10.1007/978-1-349-20590-5

Malerba F., 2002. Sectoral systems of innovation and production. Res Pol 31(2), 247–264.

Malinauskaite, J., Jouhara, H., Czajczyńska, D., Stanchev, P., Katsou, E., Rostkowski, P., Anguilano, L. 2017. Municipal solid waste management and waste-to-energy in the context of a circular economy and energy recycling in Europe. Energy, 141, 2013-2044. https://doi.org/10.1016/j.energy.2017.11.128

Margallo, M., Aldaco, R., Bala, A., Fullana, P., Irabien, A., 2018. Contribution to closing the loop on waste materials: valorization of bottom ash from waste-to-energy plants under a life cycle approach. Journal of Material Cycles and Waste Management, 1-9. https://doi.org/10.1007/s10163-018-0709-6

Martin, C., 2016. The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism? Ecological economics, 121, 149-159. https://doi.org/10.1016/j.ecolecon.2015.11.027

Martínez, D. E., Cooper, D. J., 2017. Assembling international development: Accountability and the disarticulation of a social movement. Accounting, Organizations and Society, 63, 6-20. DOI: 10.1016/j.aos.2017.02.002

Matthias, R., Kalnay, E., Zeng, N., Franklin, R. S., Rivas, J., & Miralles-Wilhelm, F., 2011. Sustainable prosperity and societal transitions: long-term modeling for anticipatory management. Environmental Innovation and Societal Transitions, 1(1), 160-165. doi:10.1016/j.eist.2011.03.004

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W, 1972. Los límites del crecimiento: informe al Club de Roma sobre el predicamento de la humanidad (No. HC59. L42 1973.). Editorial Fondo de Cultura Económica, México.

McCormick, K., Neij, L, Mont, O., Ryan, C. Rodhe, H., Orsato, R., 2016. Advancing sustainable solutions: an interdisciplinary and collaborative research agenda. Journal of Cleaner Production. 123, 1-4. DOI: 10.1016/j.jlepro.2016.01.038

Morse, J. M., 1994. Designing funded qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research, 220-233. Sage, Thousand Oaks, CA.

Mustalahti, I., 2018. The responsive bioeconomy: the need for inclusion of citizens and environmental capability in the forest based bioeconomy. Journal of Cleaner Production, 172, 3781-3790. https://doi.org/10.1016/j.jclepro.2017.06.132

Nussbaum, M.C., 2011. Creating Capabilities: The Human Development Approach. Harvard University Press, Cambridge MA.

Radulescu, M., Fedajev, A., Sinisi, C. I., Popescu, C., Iacob, S. E., 2018. Europe 2020 Implementation as Driver of Economic Performance and Competitiveness. Panel Analysis of CEE Countries. Sustainability, 10, 566. doi:10.3390/su10020566

Rauschmayer, F., Bauler, T., Schäpke, N., 2015. Towards a thick understanding of sustainability transitions—Linking transition management, capabilities and social practices. Ecological economics, 109, 211-221. doi:10.1016/j.ecolecon.2014.11.018

Red Española del Pacto Mundial (2018). Las empresas españolas ante la Agenda 2030. https://www.pactomundial.org/wp-content/uploads/2018/07/Las-empresas-españolas-ante-la-Agenda-2030_def_p.pdf (assessed in august, 20, 2018).

Reverte, C., 2015. The new Spanish corporate social responsibility strategy 2014–2020: a crucial step forward with new challenges ahead. Journal of Cleaner Production, 91,327-336. DOI:10.1016/j.jclepro.2014.12.041

Sales de Aguiar, T. R., Fearfull, A., & Sanagustín-Fons, M. V. S. (2016). Calculating the carbon footprint: Implications for governing emissions and gender relations. Accounting Forum, 40, No. 2, pp. 63-77. https://doi.org/10.1016/j.accfor.2016.04.001

Sanagustín-Fons, M.V., 2011. Valores y ética empresarial. Un enfoque sociológico. Editorial Trotta, Madrid.

Sánchez, J., et al, 2018. Trends in Land Use in Spain and their Meaning to Bioenergy Production. In Li Ruopo and Andrea Monti (eds.) Land Allocation for Biomass Crops (87–38). Sprinter. https://doi.org/10.1007/978-3-319-74536-7_2

Sánchez Hernández, J. L., Nicolás Penela, A., Alonso Santos, J. L., Moro Gutiérrez, L., 2017. Urban renewal, social innovation and alternative economic practices in intermediate cities: a case study from the Oeste Quarter (Salamanca, Spain). Ería, 1(1), 67–82. DOI: 10.17811/er.1.2017.67-82

Sanz-Hernández, A. 2019. Social engagement and socio-genesis of energy poverty as a problem in Spain. Energy Policy, 124, 286–296. https://doi.org/10.1016/j.enpol.2018.10.001

Sanz-Hernández, A., Esteban, E., Garrido P., 2019. Transition to a bioeconomy: perspectives from social sciences. Journal of Cleaner Production, 224, 107-119.https://doi.org/10.1016/j.jclepro.2019.03.168

Sartori, G.; Mazzoleni, G., 2003. La tierra explota. Taurus, México.

Sen, A., 2017. Elements of a theory of human rights. In Justice and the Capabilities Approach (pp. 221–262). Routledge.

Sheffi, Y., 2015. The power of resilience: How the best companies manage the unexpected. MIT Press. Cambridge.

Shortall, O. K., Raman, S., Millar, K., 2015. Are plants the new oil? Responsible innovation, biorefining and multipurpose agriculture. Energy Policy, 86, 360–368. DOI: 10.1016/j.enpol.2015.07.011

Siegner, M., Panwar, R., Kozak, R., 2017. Making the bio-economy more inclusive: The role of community forestry and agro-forestry. Jahrbuch der Österreichischen Gesellschaft für Agrarökonomie, Band 26, 229–238. DOI: 10.24898/OEGA.JB.26.24

Sisto, R., van Vliet, M., Prosperi, M., 2016. Puzzling stakeholder views for long-term planning in the bio-economy: A back-casting application. Futures, 76, 42–54. https://doi.org/10.1016/j.futures.2015.04.002

Sleenhoff, S., Osseweijer, P., 2016. How people feel their engagement can have efficacy for a bio-based society. Public Understanding of Science, 25(6), 719-736. https://doi.org/10.1177/0963662514566749

Soto, D., Infante-Amate, J., Guzmán, G. I., Cid, A., Aguilera, E., García, R., de Molina, M. G., 2016. The social metabolism of biomass in Spain, 1900–2008: From food to feed-oriented changes in the agro-ecosystems. Ecological Economics, 128, 130–138. https://doi.org/10.1016/j.ecolecon.2016.04.017

Spanish government. 2016. The Spanish Bioeconomy Strategy. 2030 Horizon. http://bioeconomia.agripa.org/download-doc/102159 (accessed in march 29, 2019).

Spanish government. Ministry of Economy, Industry and Competitiveness. 2016. Spanish National Plan for Scientific and Technical Research and Innovation 2013–2016.
<http://www.idi.mineco.gob.es/stfls/MICINN/Investigacion/FICHEROS/Spanish_RDTI_Plan_2013-2016.pdf/>. (Accessed in October 5, 2018).

Spanish government. 2017. Documento de trabajo ICONO: encuesta de innovación, 2016.https://icono.fecyt.es/sites/default/files/filepublicaciones/doctrabajoicono_encuestainnovacion.pdf (accessed in april 12, 2019).

Spanish Goverment, 2018. Estrategia Española de Bioeconomía: Horizonte 2030. Plan de Actuación 2018. http://bioeconomia.agripa.org/attachment/5e8c2a70-c40a-41b9-be6c-798d7d009eb2/planactuacion2018_eebio (accessed in march 29, 2019)

Siggelkow, N. (2007). Persuasion with case studies. Academy of Management Journal, 50 (1), 20-24.

Stake, R. 2006. Multiple Case Study Analysis, Guildford Press, New York.

Suurs, R.A.A., 2009. Motors of Sustainable Innovation: Towards a Theory on the Dynamics of Technological Innovation Systems. Utrecht University, Utrecht.

Swaans, K., Boogaard, B., Bendapudi, R., Taye, H., Hendrickx, S. and Klerkx, L., 2014. Operationalizing inclusive innovation: lessons from innovation platforms in livestock value chains in India and Mozambique. Innovation and Development, 4(2), 239–257. DOI: 10.1080/2157930X.2014.925246
Tengblad, S.,Oudhuis, M. (Eds.) 2018. The Resilience Framework. Organizing for Sustained Viability. Springer, Singapore.

Tödtling, F., Prud'homme van Reine, P., Dörhöfer, S., 2011. Open Innovation and Regional Culture Findings from Different Industrial and Regional Settings. European Planning Studies, 19 (11): 1885–1907. http://dx.doi.org/10.1080/09654313.2011.618688

Toffler, A., 1999. La Tercera Ola, Plaza y Janés, Barcelona.

Truffer, B., Murphy, J. T., Raven, R., 2015. The geography of sustainability transitions: Contours of an emerging theme. Environmental Innovation and Societal Transitions, 17, 63–72. https://doi.org/10.1016/j.eist.2015.07.004

United Nations, 2015. Transforming our world: The 2030 Agenda for sustainable development.https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

United Nations, 2017. Bioeconomía en América Latina y el Caribe Contexto global y regional y perspectivas. Santiago, Comisión Económica para América Latina y el Caribe (CEPAL).https://www.cepal.org/es/publicaciones/42427-bioeconomia-america-latina-caribe-contexto-global-regional-perspectivas. (accessed inmach 28, 2019).

Van den Bergh J.C., Truffer, B., Kallis G., 2011. Environmental Innovation and Societal Transitions: Introduction and Overview. Environmental Innovation and Societal Transitions 1, 1–23. https://doi.org/10.1016/j.eist.2011.04.010

Van der Have, R. P., Rubalcaba, L., 2016. Social innovation research: An emerging area of innovation studies? Research Policy, 45(9), 1923-1935. https://EconPapers.repec.org/RePEc:tik:inowpp:20161111

Van Lancker, J., Wauters, E., Van Huylenbroeck, G., 2016. Managing innovation in the bioeconomy: An open innovation perspective. Biomass and Bioenergy. 90, 60–69.

Velenturf, A.P.M., 2017. Initiating resource partnerships for industrial symbiosis. Regional Studies Regional Science 4, 117e124. https://doi.org/10.1080/21681376.2017.1328285.

Viaggi, D. 2015. Research and innovation in agriculture: beyond productivity? Biobased and Applied Economies. 4(3): 279–300.http://dx.doi.org/10.13128/BAE-17555

Von Hippel, E., 2005. Democratizing innovation, MIT Press, Cambridge, MA.

Wagner, W. E., 2016. Leadership for a better world: Understanding the social change model of leadership development. John Wiley & Sons.

Wield, D., Hanlin, R., Mittra, J. Smith, J., 2013. Twenty-first century bioeconomy: global challenges of biological knowledge for health and agriculture. Sci Public Policy, 40 (1), 17-24. https://doi.org/10.1093/scipol/scs116

Wilson, G. A., 2014. Community resilience: path dependency, lock-in effects and transitional ruptures. Journal of Environmental Planning and Management, 57(1), 1-26. https://doi.org/10.1080/09640568.2012.741519

Wójcik, D., 2015. The Butterfly Defect: How Globalization Creates Systemic Risks and What to Do about It. Journal of Economic Geography. 15, 250–252. https://doi.org/10.1093/jeg/lbu043

Decade	Summits of the Earth and Relevant Landmarks
1960-1970	First Environment Directive on the classification, packaging and labelling of dangerous substances (67/548)
	Framework directive on atmospheric pollution produced by motor vehicle explosion engines (70/220)
	Stockholm Conference (1970)
	Launch of the first European action program on the environment 1973-1976
	"Birds" Directive, on the protection of birds and their habitats (79/409) (1979)
1980-1990	Directive on the quality of water for human consumption (80/778)
	World Charter of Nature (1982)
	The Brutland Commission (1983)
1990-2000	Directives to limit the use and release of genetically modified organisms (GMOs) (90/219 and 90/220)
	Preparation of the Green book on the urban environment.
	Article 6 of the Maastricht Treaty, under which all EU policies and activities must integrate environmental protection (1991)
	-Earth of the Earth (1992) -Directive "habitats" on the conservation of natural habitats and of wild flora and fauna (92/43) -Book Green on the impact of transport on the environment - A community strategy for the development of transport that respects the environment. (1992)
	-Firm of the Kyoto Protocol to limit the reduction of greenhouse gas emissions in developed countries. (1997) -Communication of the Commission. -Energy for the future: renewable energy sources (1997) -Book White for a strategy and an action plan. (1997)
	Millennium Ecosystem Assessment (1998-2005)
2000-2010	Millennium Ecosystem Assessment (1998-2005) Earth Charter (2000) Millennium Development Goals (UN) (2000) Framework directive on water policy (2000/60) European Program on Climate Change to help the EU meet the Kyoto objectives. (2000) White Paper on Environmental Responsibility. (2000) Green Book. - Towards a European strategy for security of energy supply. (2000) Green Paper on trade in greenhouse gas emission rights in the European Union.
	-Sixth Action Program for the Environment 2001-2010: Environment 2010, the future is in our hands - Opening of EMAS to other economic sectors and the public. (2001) -Green Book. - Promote a European framework for corporate social responsibility. (2001)
	-Conference of Johannesburg (2002) -Ratification of the Kyoto Protocol on climate change. (2002)
	-Directive 2003/4 / EC on public access to environmental information. -Measures for the participation of the public in the preparation of certain plans and programs related to the environment (2003)
	Thematic Strategy in the Urban Environment. (2005) Green Paper on energy efficiency or how to do more with less. (2005)
	Green Book.- European strategy for a sustainable, competitive and secure energy. (2006)
2010-2020	Strategic Plan for Biological Diversity 2011-2020 and the Aichi Targets "Living in harmony with nature"
	European strategy 2020
	Rio + 20 (2012)
	2030 Agenda (2015)
	European Bioeconomy Strategy (2012, 2018)
	Spanish Bioeconomy Strategy (2016)
	Paris Agreement (2018)

Appendix A. International and European environmental targets for the bioeconomy (1960-2020).

Source: Author's from European Commission, 2012, and Spanish Ministry of Ecological Transitions, 2018.