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The policies, the actions, and the political-administrative organization of Emilia-Romagna region to combat the climate change: a social network approach

by

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Abstract

The importance of local stakeholders in the regional governments regarding climate change policies has received a deeper attention during the last years, especially include adaptation policies. The achievement of the European targets when implementing both mitigation and adaptation policies by providing multiple funds from European to sub-national level. However, European regions require a higher level of adaptation than mitigation commitments due to the vulnerability of the aforementioned territories. This paper applies a network perspective in the Emilia Romagna region to map the level of climate commitment in the local stakeholders' involvement. These local actors have been clustered to facilitate the investigation and a particular consideration has been given to the degree of participation in adaptation policies.

Keywords: climate change, adaptation, local stakeholders, social network analysis, regional policy

1. Introduction

There is a widespread acceptance that climate change is a priority issue involving science, society, and politics. The scientific evidence of the magnitude of global warming has been consolidated during recent years, as well as the awareness that greenhouse gas emissions, the use of fossil fuels and the unsustainable use of land and natural resources are all causes of the alteration of the climate system. Climate policies such as mitigation and adaptation strategies may reduce drastically the impact occurring at different levels of governance. Amongst the fundamental milestones at the international level, it has been recalled the United Nations Framework Convention on Climate Change (UNFCCC) with its conferences, the Kyoto Protocol in 1997 and later, the Paris Agreement in 2015. To face the catastrophic events originating due to climate change, it is important to increase the attention on focusing all the policy efforts in cutting CO_2 emissions as carbon dioxide, methane, and nitrous oxide (RJT Kleinet al.; 2005), as well as focusing on resilience practices (Smit et al., 2000; Smit and Wandel, 2006) in the most vulnerable cities, regions, and sectors into their planning activities. The European cooperation strategies such as 'Roadmap for moving to a low-carbon economy in 2050' is the response of these necessities. This long-term plan aims to a progressive reduction of the CO_2 emission level by 20% by 2020, 40% by 2030, 60% by 2040, and 80% by 2050 compared to 1990. Inregard, the point of departure of the European Union is the achievement of three pledges introduced by the "20/20/20" climate/energy strategy. The mitigation and the adaptation strategies have been split into three highlighted targets: the reduction by 20% of GHG emissions, the increase by 20% of the renewable source sharing and the implementation by 20% of the energy efficiency. At the European level, other relevant climate strategies are the Sustainable Development Goals (SDGs) which shed light on the decentralization of European regions. It is worth remembering that the general level of decentralization varies significantly from country to country (Hooghe and Marks, 2003) and "taking urgent actions to combat climate change and its impact" strongly depends on the vulnerabilities of the region.

There is a large consensus about the fact that mitigation and adaptation strategies are two relevant aspects of climate change policy. However, the implementation of climate policies at the international level is not as effective as the regional one (Tobin et al., 2018). The unbalanced relationship between mitigation and adaptation policy application is subject to the so called "Paradox of the lent targets", which is the inability of the EU Member States to successfully guarantee to meet their climate commitments without bringing their regions on board (Galarraga et al.; 2011). This happens, because there is a controversial debate amongst International and European policymakers and scientists that divides those who believe that the human activities have an impact on climate change against those who deny this assumption (Ghinoi et al., 2022; Kukkonen et al., 2018). This political issue leads to some considerations at regional level. For instance, the European sub-national governments struggle to implement adequate local strategies due to the barriers of information deriving from insufficient coordination with the international authorities (Biesbroek et al.; 2013), and due to the prevalence of mitigation policies over the adaptation ones.

Despite the topic of climate change not having an unanimous agreement amongst the international authorities, policymakers and scientists started to focus their studies on adaptation measures, due to climate issues being perceived as unavoidable in recent years (Javeline, 2014). A relevant contribution was given by Galarraga et al. (2011) which argues that local stakeholders play a crucial role in implementing tailor-made policies according to the needs of their territory. Moreover, Balland, Belso-Martínez, & Morrison (2016) suggests that local stakeholders' engagement in climate change activities increases the acquisition of expertise which makes up the core of the region's economic activity.

The importance of local stakeholders in the implementation of climate policies has been discussed by several other researchers, especially when participating in a network's perspective. Thanks to their closer proximity to citizens, they are more flexible than national government in applying mitigation and adaptation policies through different areas of interest such as energy, transport, industry, housing, and environment (Ibon Galarraga, Mikel Gonzalez-Eguino, Anil Markandyaand; 2011). For instance, academic researchers and key stakeholders like regulators, professionals, and legislators may be engaged as scientific experts in the climate change discoveries (Kelly G. Pennell et al.; 2013). In addition, the review of Reed (2008) documented that local stakeholder participation can strengthen the quality of environmental decisions, because local actors operate in closer to climate-related initiatives.

In this paper, the contrast between the international climate policy implementation and its insufficient support at the local level has been investigated inside the context of Emilia Romagna which represents one of the mid-sized European regions taking part of the 'Climate and Energy Package' for 2020 (Genovese et al., 2017). In terms of adaptation, the most exposed and vulnerable areas on climate change are the District of the Po River and the areas close to the Mediterranean Sea that affect the geographical, economic, social, and political dimensions. The involvement of local stakeholders to achieve the climate initiatives has recently received attention in the social literature, however it is still an unexplored field. The social network technique has been used to analyze the effective cooperation system of Emilia Romagna aiming to the "20/20/20" climate targets strategy across the disciplines that are working on mitigation and adaptation policies

In light of these considerations, this paper provides two key contributions. Firstly, a theoretical framework of the climate change issues applied to the social network perspective. Secondly, an in-depth analysis of the mentioned theoretical framework with an empirical study of the stakeholders' involvement in Emilia Romagna.

2. Theoretical background

2.1 The role of region in climate policies

Recently, the concept of climate change has received increased attention. The biggest problem is characterized in the long-term weather patterns that have an impact on the various regions of the World. Stabilizing the Earth climate will require a significant reduction in greenhouse gas (GHG) emissions, with coordinated efforts by the international governments (Stern, 2007; Pacala and Socolow, 2004; Wigley et al., 1996).

Those coordinates come from the major important international environmental treaties. The United Nation Framework Convention on Climate Change (UNFCCC)[1] has the main goal to combat the "*dangerous human interference with the climate system*". In 1994, The United Nation Framework Convention on Climate Change put in place different programs in such areas of agriculture, industry, energy production, transportation, forestry, and waste management through the introduction of adaptation and mitigation policies. A few years, some countries realized that the reduction of emissions needs more stringent rules, so in 1997 the Kyoto Protocol was signed, which was the first implementation of these measures under the UNFCCC. The Kyoto Protocol is based on the principles and provisions of the Convention, and it only binds developed countries and places a heavier burden on them. It has been recognized that developed countries are largely responsible for the current high level of GHG emissions in the atmosphere. From this point of view, the UNFCCC and the Kyoto Protocol will be more successful if the participation is guaranteed and if the principle of '*common but differentiated responsibilities*' is put into practice (Aldy and Stavins, 2008). In addition, the Paris Agreement remarks that "climate change is a global challenge faced by all with local, subnational, national, regional and international dimensions" (UN, 2015, p. 9).

Several research institutions intervene in decreasing the CO_2 emissions, for instance, the Intergovernmental Panel on Climate Change,[2] adopts mitigation and adaptation policies aimed at reducing future risks and the rate at which climate change spreads its impact on the environment (IPCC,2013).

At European level, the Agenda for 2015-2030 includes the Sustainable Development Goals (SDGs).

Goal 13 defines that it is necessary to "*Take urgent action to combat climate change and its impacts*" in which the mitigation and adaptation policies take place. This initiative is supported by the 'climate and energy package' of 2020: the EU set a concrete and binding goal that greenhouse gas emissions measured in CO2 equivalent should be reduced by 20% when compared to 1990 levels and the results are analyzed with different scenarios provided by the post-2020 horizon, to monitor the impact of climate change after the 'climate and energy package'. This is one step of a series of pledges: further stages will aim to avoid raising the bar of greenhouse gas emission by 20% by 2020, 40% by 2030, 60% by 2040 and 80% by 2050 compared to 1990 levels.

Below the international and national level, climate action is vibrant, but less attention has been paid to climate change policy among sub-state governments in Europe (e.g. the Kyoto protocol and the Paris agreement) (Mcwen Bomberg, 2013). Indeed, the studies on adaptation governance has been focusing either on the local governance levels (e.g. Hanssen et al., 2013; Termeer et al., 2011), given the geographical heterogeneity of impacts (Termeer et al., 2011; Adger, 2001). It has been remarked that sub-national governments are particularly vulnerable to climate hazard as they are the hubs of economic activity, concentration of population, socio-economic activity and infrastructure and shape the future trends of emissions (J. Corfee-Morlot, L. Kamal-Chaoui, M.G. Donovan, I. Cochran, A. Robert and P.J.Teasdale, 2010).

The promotion of adaptation in particularly vulnerable sectors has been approved by the EU with the "Under 2 Coalition"[3]. Starting from November 2015, an essential program has been undertaken addressing all EU regions aiming at strengthening their resilience. The program ensures an informed decision-making processes and the removal of knowledge-gaps by also involving the private sector. Climate change mitigation and adaptation strategy, 2018). This agreement is called Subnational Global Climate Leadership Memorandum of Understanding (Under2MoU). The regulatory authorities are able to implement broader policy changes thanks to the potential contribution of local governments (Engel, 2008; Nolon, 2009a; Kamal-Chaoui and Robert, 2009; Ostrom, 2010). Moreover, they have often been leading the way on climate policy, ahead of their national and state governments (Betsill and Bulkeley, 2005, 2006). For those reasons, regional governments have been

[1] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
[2] https://www.ipcc.ch/

[3] https://www.theclimategroup.org/under2-coalition

deemed a key actor for adaptation (Urwin and Jordan, 2008) and the benefits all related actions remain at a local level/community (Wilbanks, 2007).

2.2 The EU 'Climate and Energy Package 'and its implementation at regional level.

A vast number of studies conclude that the European Union is one of the largest energy consumers, and one of the largest greenhouse gas (GHG) emitters globally (P. Fernandez Gonzalez, M. Landajo, M.J. Presno, 2014). In order to keep the increasing global average temperature below 2°C, the European Union adopts the so called the "20/20/20" climate/energy targets. The "20/20/20" climate energy targets is part of a series of EU headline targets that the EU aims to achieve by 2020 as a medium run solution(O Geden, S Fischer, 2014). Using those pledges aiming at reducing greenhouse gas emissions (by 20%), and increasing the share of renewable sources (to 20%) as well as the energy efficiency, the EU Commission adopts the 'Climate and Energy Package' for 2020 with different documents and programs in specific areas of interests, such as energy, transports, water, and land use. These initiatives are under the guidance of a greater international challenge. In accordance with the 'Strategy for smart, sustainable and inclusive growth' (European Commission, Europe 2020) the European Commission put forward three mutually reinforcing pillars:

1. Smart growth, where knowledge and innovation are the base of a developing economy.
2. Sustainable growth, which is founded by the promotion of resource efficient, greener, and more competitive economy.
3. Inclusive growth which the main scope is to foster a high-employment economy favoring economic, social, and territorial cohesion.

These targets are critical and interrelated each other to combat the climate change. To guarantee that each Member State tailors the Europe 2020 strategy to each situation, EU the Commission translates the EU goals into national targets and trajectories.

These national targets are included into the 'Roadmap for moving to a low-carbon economy in 2050' that set the ambitious level of curtailing greenhouse gas emissions (by 20%) before 2020 (www.climateactiontracker.org.). It represents the most important program in terms of mitigation and adaptation. However, the signatories of Kyoto Protocol are focused more on mitigation targets than adaptation ones with a limited range of international policies (Kane et al.,2000).

This happens, because there is a controversial debate about the climate change issue amongst international policymakers and scientists. There is a faction who believe that human activities have an impact on climate , against a faction who deny this assumption (Ghinoi et al. 2022). This division amongst international policymakers leads to some drawbacks. The mismatch between the international and regional policies are subject to the lack of clear and shared strategies at global and local level (e.g. Biesbroek et al., 2010; de Koning et al., 2014). As well as the inadequate measures negatively affecting the implementation of the policies in local areas.

Despite the climate change issue captures the attention of several scholars, academics, and scientists, the adaptation to more frequent extreme natural events has been perceived as unavoidable (Javeline, 2014). Preparing for climate change is not a "one size fits all" process for subnational governments, and the international authorities do not recognize that the impacts of climate change will vary from place to place (Ostrom, 2009).

The explanation of the prevalence of mitigation over adaptation policies, can also be proved by other means. Indeed, most of the studies on vulnerability and adaptive capacity have focused on developing countries (e.g., Adger 2003; Eakin and Lemos 2010), and not on rural entities. The financial and technical resources of high-

income territories have a decisive role, (Ingold and Balsiger, 2015) and the policymakers a local scale have no instruments to directly access to these resources.

2.3 Vulnerability of regions as the key point of adaptation policy design

The first problem to address about regional climate policies is the existence of the 'Paradox of the lent Targets'. The 'Paradox of the lent targets' states that the implementation of any action related to climate policy is slower on subnational governments than international ones (Tompkins & Amundsen, 2008), even though local areas are integrative headquarters belonging to an higher international system, where the municipalities have substantial financial, constitutional, legal, political, and professional resources (M Granberg, I Elander, 2007).

Despite, the insufficient support of international climate agreements at regional areas, it has been detected a moderate and positive relationship between the regional climate policy ambition and constitutional powers (Royles and Mcewen, 2015). Some researchers as Mcewen and Bomberg (2014) propose their studies explaining why regions are climate pioneers: "the sub-national governments may decide to reach or even surpass the national or international target to distinguish its own territory from the belonging country" (Mcewen and Bomberg, 2014). Specifically, local actors who develop initiatives entail markedly more ambitious policy goals and further practical policy experimentation than usually found at global conventions (Galarraga et al., 2011; Hoffman, 2011). For example, local policymaking processes can be able to introduce innovative policies that can then be replicated in other local areas or even become national policies. They can be phenomenal ''laboratories'' for creative policies (Jose Antonio Puppim de Oliveira, 2009). Or taking Sweden as an example, the large municipal production of welfare functions labeled it as a decentralized welfare state (Sharpe, 1988). Municipal powers are exerted within a framework constitutionally legitimized by the state. Agrawal (2008) suggests that adaptation in climate change is inevitably local and will necessitate changes in response to multiple types of stresses, across multiple scales, and by many actors who may sometimes work at cross-purposes (Agrawal, 2008).

The weaknesses of regions can be considered as the point of departure to design the adaptation policy. The assumption of Galarraga et al. (2011) pointed out the relevance of local stakeholders as responsible actors for implementing tailor made climate policies rather than focusing on the general aspects of climate change. Gremellion (2011, p. 1234) describes that those European countries might be able to establish national programs to face the consequences of natural disasters, but "their resolution and management will depend to a great extent on local government".

2.4 Local stakeholders and network perspective to promote the climate change policies

Local stakeholder involvement in climate change policies has already been investigated by several researchers. Only recently, it has begun to keep an eye on the adaptation actions and on the viewpoint of integrating the climate policies into the notion of social network analysis. Moreno and Jennings (1934) introduce the idea of interpreting social structures with nodes or vertices (e.g., actors, individuals, or social entities) and ties (e.g., interactions or social relations). Scott et al. (1988) describes that those relations amongst individuals are based on the exchange of social, material and knowledge resources. Some examples of climate knowledge resources may be standards or codes of behavior which can encourage participation, information sharing, consensus building, and representation of various interests (Fransen and Kolk, 2007). Local stakeholders in social network perspective translate those different resources into policies and climate initiatives. The specific knowledge owned by local actors may be oriented to solve local environmental management issues, therefore, supporting the capacity to acquire new knowledge from others, creating relations on network and integrating different spheres of knowledge, are important activities to lay the foundation of a network structure (Jiao and Boons, 2017).

In social network literature, this assumption finds the support of the Gluckman's publication, *Analysis of a social situation in Modern Zululand* (1940a). Gluckman proves that the engagement of locals in a larger social system and in specific events sheds light on macro-level social processes. Climate change literature also mentions the application of game theory in a social network approach (Sally, 1995). Some findings demonstrate that "users of a common-pool resource tend to manage local resources more sustainably than when rules are externally imposed on them'' (Ostrom, 2000: 148). Furthermore, Gunnarsson-O¨stling & Larsen (2009) reports that the stakeholder's involvement in climate change policies can be captured by examining participatory scenarios and the way in which climate change issues are identified during the participatory process depends on the participant's contribution . Climate change policies and local actors' engagement in network approach is also recognizable in studies such as communicative planning theory (Healey, 1996). Indeed, the communicative influence quantifies how powerful are them in the decision-making process (Nichiforel, 2011). This is particularly true when implementing future-oriented policies in European metropolitan regions (Healey, 2000). Moreover, the sharing and the acquisition of expertise in the domain define the core of the region's economic activity, either through the building of formal relationships or through informal contacts (Balland, Belso-Martínez, & Morrison, 2016).

Many researchers subscribe to the notion that the stakeholder's involvement in climate change initiatives provides further interesting evidence. However, it is important to mark the difference between stakeholders' involvement in general climate change initiatives and stakeholders' involvement in 20/20/20 climate targets activities. This means, stakeholders have been divided between those who are directly influenced by the specific policies and measures (active stakeholders) in the 20/20/20 climate targets from those who are indirectly influenced (passive stakeholders) in general climate change initiatives (Grimble & Wellard, 1997). For instance, universities and research hubs give their contribution providing scientific assessments on climate change reports, to facilitate the translation of research findings into policies and programs (Kelly G. Pennell, Marcella Thompson, James W. Rice, Laura Senier, Phil Brown, and Eric Suuberg; 2013).

According to the three main pillars of climate change: the 20% of reduction in greenhouse gas (GHG) emissions, 20% of share of renewables in EU energy production, and the 20% of reduction in energy consumption, many subnational administrations may have control over areas that crucially affect greenhouse emissions, such as transportation and energy (De Oliveira, 2009), even though they are not often subject to direct international pressure or agreements (Collier & Lo¨fstedt, 1997). On the contrary, local and regional administrations may be directly engaged in climate target activities with an active participation of several organizations with important objectives such as resilience or environment-related questions (Ingold and Balsiger, 2015; Valiquette-L'Heureux and Therrien, 2013; Therrien et al., 2015).

In light of the above-mentioned literature, two central research questions have been suggested:

- Does it exist a net distinction between local stakeholders involved in climate change and local stakeholders involved to target 20/20/20?
- Do local stakeholders more involved in adaptation strategies rather than mitigation ones?

4. Data and methods

4.1 The empirical context of Emilia Romagna region

Diversity in the regional problems of post-industrialized countries reflect not only different levels of development and systems of government, but also different goals inherent geography, history and tradition. (Harry W.Richardson, Peter M.Townpoe, 1987). The attention of this study is focused on Emilia Romagna region for two reasons. First we shall examine the occurring issues of climate change in which mitigation and adaptation policies take place. Secondly, we will define the commitments of Emilia Romagna region to achieve the 20/20/20 targets.

The Intergovernmental Panel on Climate Change-IPCC(www.ipcc.com), with a special focus on the AR5 of 2014, have tried to find a definition capable of integrating and reconciling concepts from a wide range of

disciplines (ecology, epidemiology, social sciences, etc). Following the progressive economic and technological development, a consistent increase of water use has been recorded and since 2003 the Po basin has been characterized by frequent conditions of drought compared to demand, also determined by the more arid climate (Castellari S., 2014).

The Mediterranean Basin has been identified as a "hotspot" for climate change, a basin with annual trends of temperature rise and a marked reduction of rainy days. The study of Castellari (2014) confirms the trend about the time series in the Po basin. Taking a step back, anomalies have been noticed between 1961-2016: an increasing trend of minimum and maximum temperatures, both level seasonal and annual compared to the period of reference 1971-2000 (Strategia di mitigazione e adattamento per i cambiamenti climatici della Regione Emilia Romagna, 2018). The increase in extreme events will entail greater risks of hydrogeological instability in hills and mountains with consequent inconvenience especially for transport and production activities (Borrelli et al., 2014; Borrelli et al., 2015).

In response of the effects of climate change, the considerable participation of Emilia-Romagna to achieve the targets of 20/20/20 in climate change goals, involves several stakeholders: the European Commission counts 7755 has 7,755 signatories, of which as many as 300 municipalities in Emilia Romagna (Strategia di mitigazione e adattamento per i cambiamenti climatici, 2018). The adoption of the 'Strategia di mitigazione e adattamento per i cambiamenti climatici'(2018) is the establishment of a dialogue between sub-regional levels, in particular of local administrations that have joined on the Covenant of Mayors (SEAP). The Covenant of Mayors for climate and energy brings together committed local and regional authorities to implement the strategy of the European Union for the climate and stringent energy sustainability objectives on their territory.

Emilia Romagna is a representative mid-size European region (4.459.453 habitants) according to the NUTS classification[4] .The NUTS classification defines the regional boundaries and determine the geographic eligibility for structural and investment funds, and it is measured in GDP per inhabitant in PPS (% of EU-27 avg). GDP per inhabitant in PPS is the key variable for determining the eligibility of NUTS 2 regions in the framework of the European Union's structural policy. Emilia Romagna is classified at the rate of 118%, then it is part of the more developed regions (where GDP per inhabitant was more than 90% of the EU average), because GDP in PPS (purchasing power standards) eliminates differences in price levels between countries and allow for the comparison of economies and regions significantly different in absolute size.

The challenge for policymakers is to understand these climate change impacts in order to meet the 20/20/20 European target initiatives. In order to develop and implement the aforementioned policies, an optimal level of adaptation with the support of individuals or businesses has been required (such as agriculture and tourism) which may be able to respond to market signals or environmental changes to reach the 'autonomous adaptation'. These measures can be supported and strengthened by an integrated and coordinated approach at EU level.

However, it is worth to remember that this autonomous adaptation is unlikely to be optimal due to the existence of uncertainty, imperfect information, or financial constraints. In this context, the Italian territory, has approved the so called " Strategia Nazionale di Adattamento ai Cambiamenti Climatici" (SNACC), by adopting the decree of the Ministry of the Environment and of the Protection of the Territory and of the Mare and with the approval, in November 2017, of the National Energy Strategy (SEN), Italy has bridged the existing gap with the most advanced European regions that already for some time they had measured themselves with documents of plan and strategies for adaptation and mitigate.

4.2 Data collection

[4] https://ec.europa.eu/eurostat/web/regions-and-cities

The Emilia Romagna region is one of the mid-size European region committees for the achievement of the target 20/20/20 strategy, therefore, the data collection covers the period between 2008-2020 in line with the 'climate and energy package' of 2020. It embodies both mitigation and adaptation strategies. Those climate strategies have been traced in different area of interests in which Emilia Romagna implements their policies using European funds specifically usable for that period. Five competences have been identified :

1. General directive of Resources, Europe, Innovation, and Institutions.
2. General directive of Agriculture, and Fishing.
3. General directive of Land management and Environment
4. General directive of Health care and Welfare management
5. General directive of Knowledge-based economy, Job, and Businesses

The starting point of this project is the creation of a preparatory list of key local stakeholders that have been involved in climate initiatives using the information available from Emilia Romagna's website [5]. In addition, the process of data collection has been carried out with the following historical archives: the POR FESR 2014-2020[6], Piano Energetico Regionale[7], Piano Aria Integrato Regionale[8], Piano Regionale Integrato dei Trasporti[9], Piano Regionale di Gestione dei Rifiuti[10], Piano di Tutela delle Acque[11], Piano sociale e sanitario[12], Programma di sviluppo rurale[13], Fondo Europeo per gli affari marittimi europei[14].

The local stakeholders who benefit from the European funds have been selected using the nominalist approach. This method allows the researcher to find data focusing on citations and scientific articles (Collins, 1974; Lenoir, 1979; Small and Griffith, 1974). Usually, diaries, newspapers, journal articles, minutes of meetings and historical texts are useful for gathering network data, but in our case the research has been predominantly conducted through climate reports and regional programs.

Those local actors have been divided into six categories, according to the importance of organizational characteristics and representativeness on primary organizational activities: local and regional administrations and agencies, research centers and universities, business associations, social organizations and other beneficiaries that include all the spare actors that contribute to the climate change initiatives. Even though Emilia Romagna also includes 300 municipalities in the European Commission, local actors operating at a national and international level have been excluded from the pool of subjects. 97 stakeholders have been selected amongst which local administrations and agencies represents a significant part of the actors (45,36 % of the total).

[5] https://www.regione.emilia-romagna.it/
[6] https://fesr.regione.emilia-romagna.it/por-fesr/documenti
[7] https://energia.regione.emilia-romagna.it/piani-programmi-progetti/programmazione-regionale/piano-energetico-per
[8] https://ambiente.regione.emilia-romagna.it/it/aria/temi/pair2020
[9] https://fesr.regione.emilia-romagna.it/por-fesr/documenti
[10] https://energia.regione.emilia-romagna.it/piani-programmi-progetti/programmazione-regionale/piano-energetico-per
[11] https://ambiente.regione.emilia-romagna.it/it/aria/temi/pair2020
[12] https://mobilita.regione.emilia-romagna.it/prit-piano-regionale-integrato-dei-trasporti
[13] https://ambiente.regione.emilia-romagna.it/it/rifiuti/temi/rifiuti/piano-rifiuti/piano-rifiuti-vigente-2014-2021
[14] https://ambiente.regione.emilia-romagna.it/it/acque/temi/piano-di-tutela-delle-acque

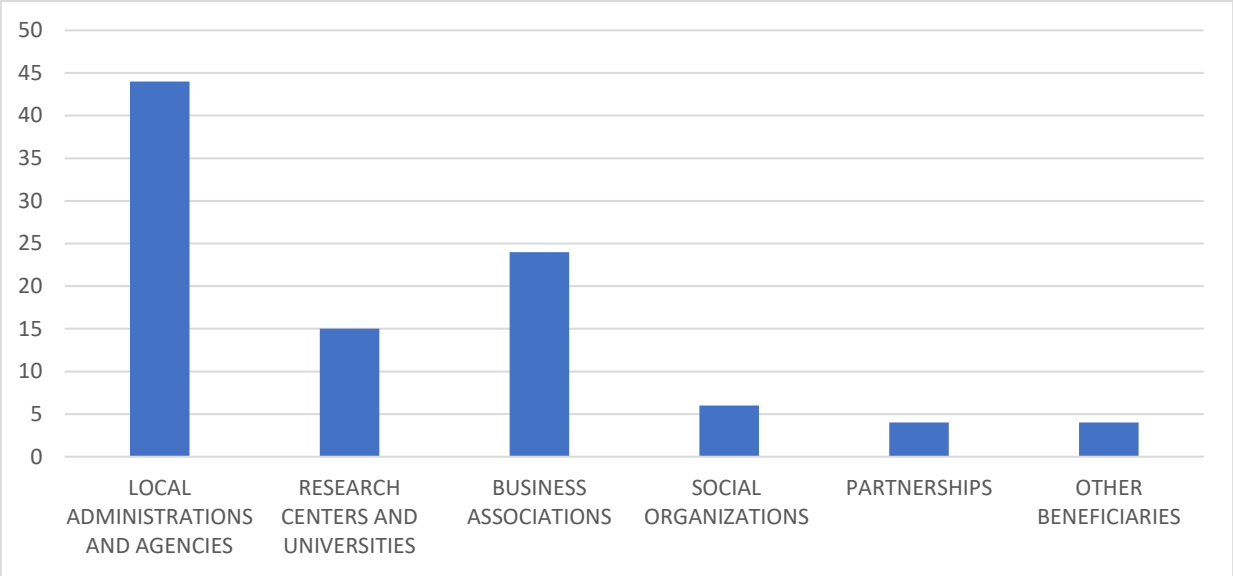


Fig. 1 Number of local stakeholders according to their organizational activities.

4.3 Method: the social network approach

Our database has been created by applying tools derived from SNA (Borgatti et al., 2009; Scott and Carrington, 2011).

Under the investigation of those stakeholders, the study of the database relies on some basic key elements of social theoretical framework. The study is based on the notions of 'points' and 'lines' firstly introduced by the psychologists Moreno and Jennings (1934). Those notions can be also recognized by the study of other researchers such as the anthropologists Botts and Barnes (1928) which define the meaning of 'network' as a "set of points some which are joined by lines". The 'point' also called 'vertices' or 'nodes' represents the stakeholders belonging to all categories of organizational activities. The stakeholders may be single individuals, social entities, or actors included in the social network structure, while the lines or ties have been used to observe the relationships linking together the vertices or nodes. To create ties and lines, it is required that the vertices have a value in common. In this case, the social capital is the resource embedded in one's social networks, resources that can be accessed or mobilized through ties in the networks (Lin 2001a: Chapter 2).

The availability of social capital estimates the degree of access to such resources and the potential pool of resources capable of generating returns. Certain structural features of the returns on social capital can be traced by the individual decisions (Cook and collegues; 1983), the actor influence through thoughts and behavior, the opinion of a group of norms (Friedkin; 1998) and the diffusion of innovation (Rogers;1995). Local actors gain access to the social network through the sharing of social capital; in fact, the formation of the network structure relies on the disbursement of European funds to the regional territory.

In order to mark the boundaries of the network, the case of Emilia Romagna does not consider its impact at the European or national level, because the analysis focuses on the regional scope. The extrapolation of the data strongly depends on historical archives, and a nominalist approach has been applied, to easily trace the network boundaries with such data (Knox et al., 2006). To find data, the citations are good instruments for uncovering the way the social stakeholders have been involved in creation of knowledge or in exchange of social and material resources (Cook et al.,1983). However, the application of the nominalist approach also presents some drawbacks. Compared to other methods of data gathering, for example the snowball sampling approach, the nominalist approach implies a limitation of our analysis because the presence of unidirectional

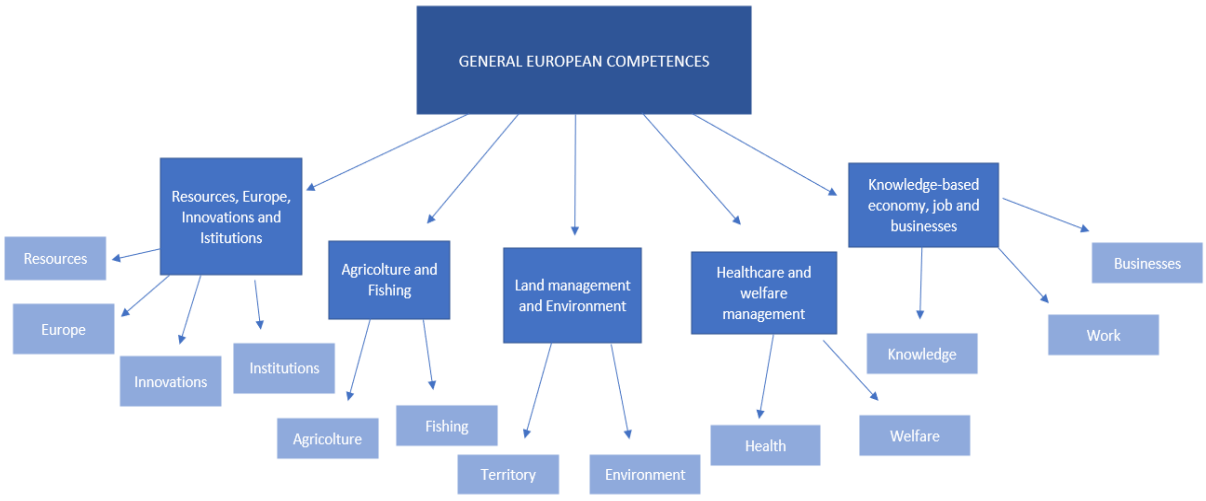
ties does not allow to compute some important measures in social network analysis such as the degree centrality, betweenness centrality (Freeman,1979), and brokerage (Gould and Fernandez, 1989) essential for the study of stakeholders' roles.

As soon as the network has been completed, the purpose of this analysis is discovering which cluster can drive the change. It means which cluster of stakeholders can differ from the others and does not take part of the 20/20/20 target activities. Based on the data collection, it has been considered the 2008-2020 period. It has been created a preliminary two-mode network that consists into vertices (local stakeholders) links to social events (European directives). The network design recalls the Warner's experiment reported on his book, the *Deep South* (1947). This is an example of two-mode network data, where the structure is organized into columns that represent events and rows that represent actors. In our case the matrix has been inverted, so the columns represent the local stakeholders, and the rows represents the social events in which they are related. This novel arrangement permits to focus the attention on each group of stakeholders related to general European competence.

Furthermore, aiming at an easier interpretation of clusters, the European directives have been split into further subgroups. Davis (1967) depicts in his work "Clustering and structural balance in graphs" that the social network can be balanced with the introduction of subgroups in the structure. Usually, two or more subgroups are applied to translate the social phenomenon (Freeman, 2004; Wasserman and Faust, 1994) into statistical terms, so negative ties are avoided.

According to Davis (1967), Cartwright and Harary (1956) the social events have been divided into thirteen subgroups starting from the European competences where they initially originate. The derived subgroups are listed as follows: Resources, Europe, Innovation, and Institutions for the first general competences, Agriculture, Fishing for the second one, Territory, Environment for the third one, Health and Welfare for the fourth one, Knowledge, Work and Businesses for the last one.

Fig.2 Subgroups of the European competences



Source: Own elaboration according to Davis (1967), Cartwright and Harary (1956) theoretical framework.

As White and colleagues (1976) have been mentioned, the structure of the matrix take form with the aggregating data of individuals. Afterwards, the analysis was undertaken using the software UCINET VI

(Borgatti et al., 2002), and has been updated the matrix with the introduction of attribute. An attribute is an additional information on every single individual, group or actors that represents the nodes of the network. In the case of our dataset, the actor attributes are defined based on their level of climate change participation. An attribute could be for instance age, socio-economic class, or religion without any attention to the role social relations plays grouping these actors. This allows the interpretation of the cluster approach on two-mode network.

5. Results

Through the two-mode network, after adding the actor attributes, we could identify four two-mode networks. This additional information allows us to group the stakeholders into specific clusters based on their level of participation in climate change actions. The sum of these four networks represents both the stakeholders' involvement in 20/20/20 target activities and the stakeholders' involvement in climate change initiatives, but the scope of the paper is separating local actors who are committed to 20/20/20 target activities from those who participate in general climate change initiatives. Then, the two-mode network further separates local actors between those who participate in mitigation activities and those who participate in adaptation activities. Due to the geographic location, the local stakeholders in the regional territory are expected to be more embedded in adaptation policies rather than mitigation ones.

As far as we concerned the two mode network data, the attribution we could give to each category of stakeholders assumes the following coding values:

- 0, if the stakeholders belong to the general climate change activities
- 1, if the stakeholders belong to the 20/20/20 climate targets, specifically to the mitigation activities
- 2, if the stakeholders belong to the 20/20/20 climate targets, specifically to the adaptation activities
- 3, if the stakeholders belong to the 20/20/20 climate targets, in both mitigation and adaptation policies.

Fig. 3 shows the two-mode network representing the general competences of each European directives affiliate with each category of stakeholders. The graph identifies the cluster of local stakeholders who participate in general climate activities, but it is not directly involved in climate targets. The group of stakeholders involved in climate change initiatives includes the organizational activities of research centers and universities, business associations, social organizations, and other beneficiaries apart from the local administration.

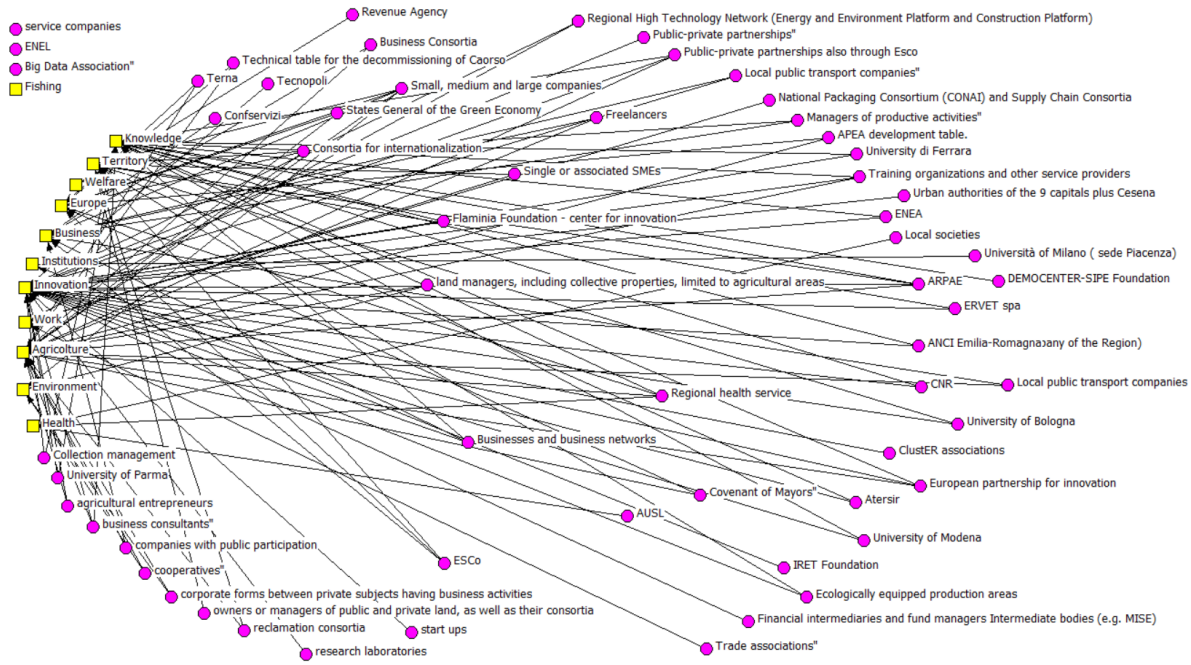


Fig. 3. Stakeholders involved in climate change initiatives.

Legend: yellow squares are the general competences, violet circles are stakeholders involved in general climate change initiative.

The violet circles represent a wide heterogeneity of local actors which are linked to all general competences except of the Fishing directive. Also, few nodes are isolated from climate change involvement, but this finding does not significantly affect the whole network, instead the exclusion of the local administrations and agencies has been considered interesting evidence.

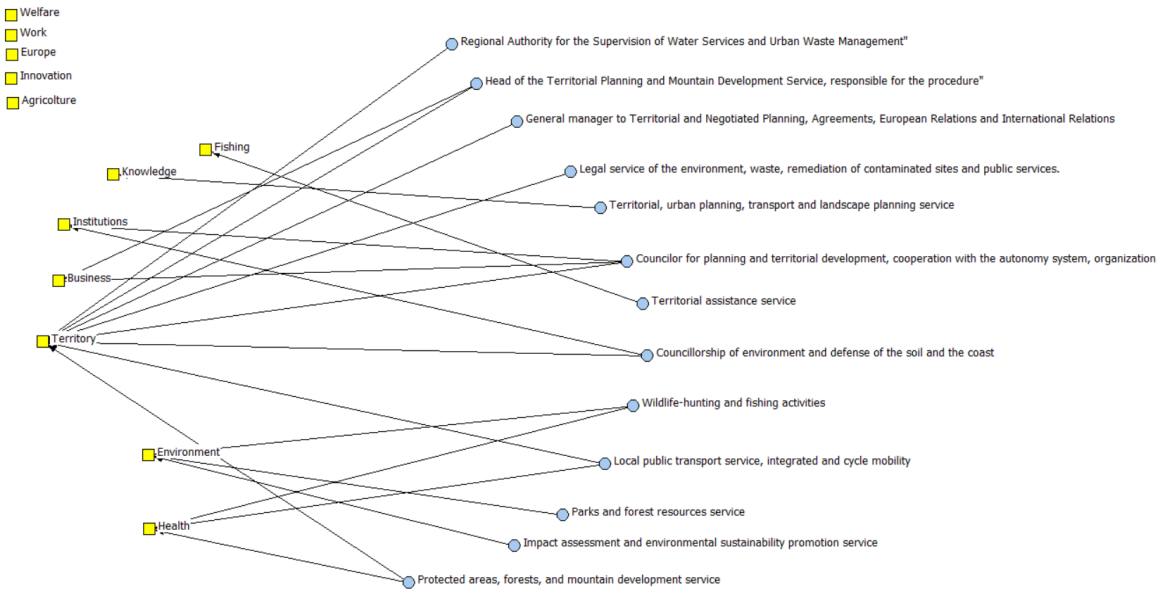


Fig. 4. Stakeholders involved in the target 20/20/20 strategy, only in the mitigation policies.

The fig. 4 depicts the cluster of stakeholders under the attribution belonging to the 20/20/20 climate change targets, especially concerning mitigation activities. It determines which organizational activities of stakeholders has included in this group. Simultaneously, fig. 5 portrays the cluster of stakeholders under the attribution of stakeholders belonging to the 20/20/20 climate change targets, specifically concerning the

adaptation activities. In both graphs, local administrations and agencies are considered the unique organizational activities that has been committed in the 20/20/20 climate change targets, excluding all the others.

The comparison between fig. 4 - 5 with the fig. 3 highlights a net distinction between the stakeholders who belong to the cluster of 20/20/20 European targets and those who belong to the cluster of general climate activities thanks to local administrations and agencies that drive the 20/20/20/ target commitments. This cluster marks the difference in pursuing the European climate activities; therefore, local administrations and agencies are considered agents of climate commitments at the regional level.

A fourth network has been created to show the application of the stakeholders' attribution belonging to the 20/20/20 climate targets, in both mitigation and adaptation policies.

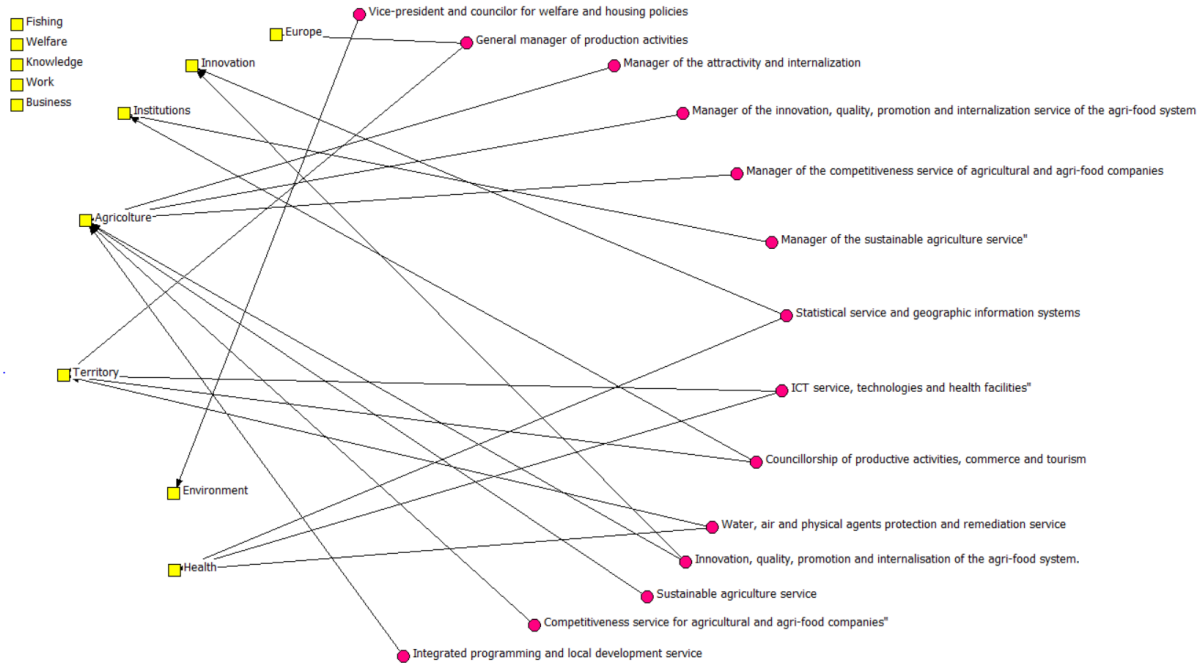


Fig. 5. Stakeholders involved in the target 20/20/20 strategy, only in the adaptation policies.

Legend: yellow squares are the general competences, magenta circles are local stakeholders involved the adaptation policies.

In fig. 6 the local administrations and the agencies have been confirmed as the cluster that drive the changes of climate issues, though in contrast with the previous networks, this cluster is closer to the core of the region. The unification of mitigation and adaptation strategies narrows the group of administrations and agencies into few and essential regional administrations including the Regional Council and Legislative Assembly.

All the networks concerning the represented 20/20/20 European targets in the fig. 4, 5 and the fig. 6 highlights that those local administrations and agencies are the driver of the 20/20/20 targets, whereas Fig. 3 shows a heterogeneity of stakeholders that exclude it. In particular, fig. 6 indicates a narrower group of local administrations that are key elements to face the climate change issues. Considering the obtained results, the use of cluster analysis has been proven fundamental to carry out the social network approach to understand

which group of stakeholders are essential and could lead the change deriving from 20/20/20 targets commitments.

Nevertheless, another question remains. As Ostrom (2014) already argues the impact of the climate issues at regional level is affected by multiple factors such as the geographical position, and socio-economic and environmental conditions (Ostrom, 2014). For this reason, the region requires a higher number of ties for adaptation policies to enhance the resilience of the vulnerable local activities. However, the prevalence of mitigation actions over the adaptation ones due to the ongoing debate amongst the international authorities is still considered a problem for regional policymakers.

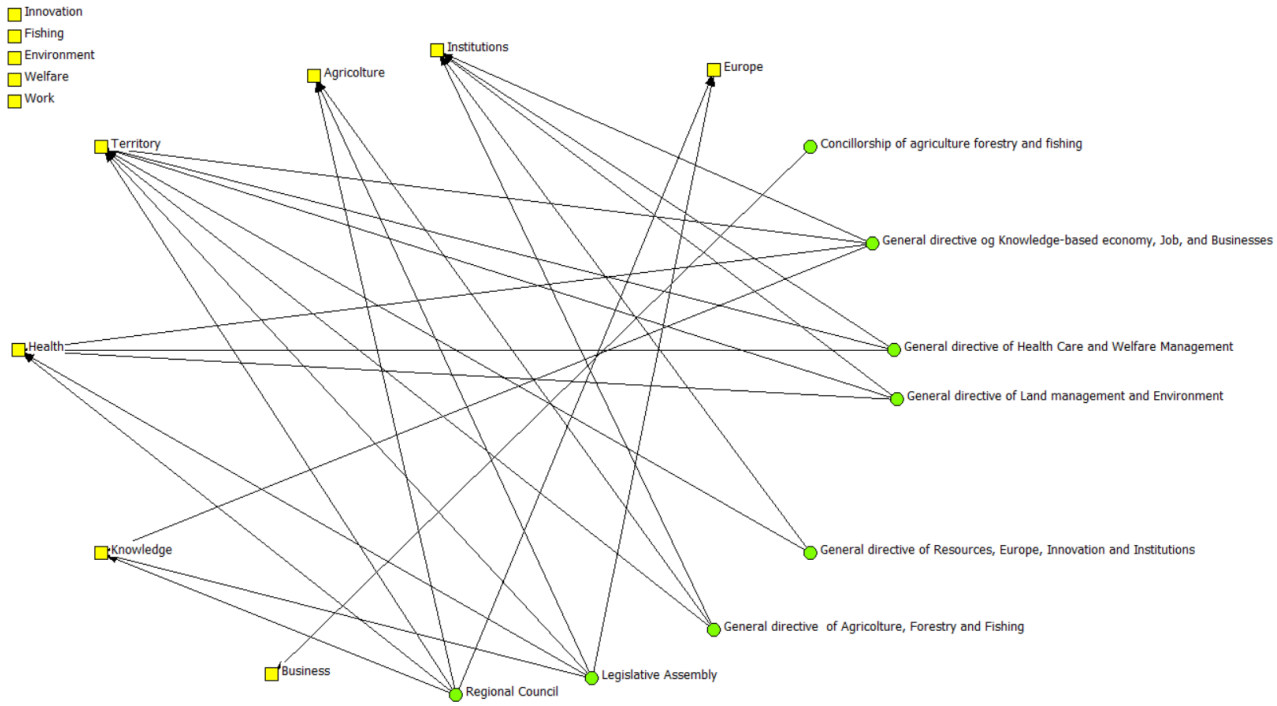


Fig. 6. Stakeholders involved in the target 20/20/20 strategy, both mitigation and adaptation policies.

Legend: yellow squares are the general competences, green circles are local stakeholders involved in both mitigation and adaptation policies.

The meaning of these assumptions has been found into practical findings. The comparison between the network concerning the stakeholders' involvement in fig. 4 with the stakeholders' involvement in fig. 5 may confirm or disprove the above-mentioned literature. To carry out the analysis the structural concept of network's 'connectedness' in terms of density of ties has been used in terms of density of ties as Wellman (1988) remarks. Fig. 4 and fig. 5 shows that stakeholders' commitments regarding adaptation policies have a similar density of ties concerning the number of nodes and linkages in comparison with stakeholders' commitments in mitigation policies:fig. 4 graph shows 14 local administrations and agencies (red nodes) against the 12 local administrations and agencies (blue nodes) of fig. 5. About the European directives, fig. 4 excludes few nodes such as Fishing, Welfare, Knowledge, Work and Business directives, whereas fig. 5 holds out the European directives of Innovation, Fishing, Environment, Welfare and Work. The network's engagement of local actors in adaptation policies is slightly denser compared to the mitigation ones, but this evidence is not consistent to answer the second research question. In conclusion the second hypothesis is not satisfied, because it is expected a higher density of adaptation over the mitigation policies rather than having the almost same homogeneity between them. Instead, the comparison of densities of ties presented in fig. 2 and 6 has a huge differences and number of vertices. These observations lead to assume that the homogeneity of adaptation policies is almost

the same of mitigation ones, despite in the second research question it has been expected a higher density of adaptation over the mitigation policies rather than having the almost same homogeneity between them.

6. Conclusion

The social awareness about the issues of climate change captivates policymakers, researchers, and scientists. The international community suggests facing this challenge with the adoption of mitigation and adaptation strategies.

Even though the climate change response finds a large consensus by the international community, the implementation of those measures is limited by the disagreement of a part of international stakeholders. This leads to impediments and limitations for local entities. The prevalence of mitigation measures over the adaptation ones conducts the implementation of climate policies to the insufficient coordination of local strategies with the international authorities (Biesbroek et al.; 2013). The "Paradox of the Lent targets" is a clear example (Tompkins & Amundsen, 2008). To address this issue, the study emphasizes the application of climate policies through local stakeholders of Emilia Romagna. It has been accomplished a social network approach by using the European funds during the 2008-2020 period to implement the European directions of Resources, Europe, Innovation, and Institutions; Agriculture, and Fishing; Land management and Environment; Health care and Welfare management; Knowledge-based economy, Jobs, and Businesses. The novelty of this paper is the analytical approach by which the mitigation and adaptation policies are studied in depth. The aim of this analysis is selecting which local stakeholders actively participate in the 20/20/20 European targets initiatives and separate them from those who are involved in general activities of the climate change issues. To do so, a two-mode network maps the local stakeholders accounting for nodes and ties and adding the attributions based on the level of climate change commitment. This arrangement allows to gather the local stakeholders into clusters facilitating the interpretation of the hypotheses. However, the network also reveals some statistical constraints due to the application of the nominalist approach, and further analyzing the role, the betweenness measure and the centrality measures on local stakeholders cannot be carried out, but it was still possible to gather important evidence.

In the first investigation, the results show that local administrations and agencies are the determinant cluster for the European targets initiatives especially if those are involved in both mitigation and adaptation policies included in 20/20/20 European targets. Compared to other groups local administrations and agencies are the only organizational activity committee in 20/20/20 European initiatives. Not by chance, other researchers support that they play a crucial role in planning local needs. Coherently with the evidence of the Tonnies' case study (1855-1936), the high involvement of people who are living in rural communities demonstrate that local administrations and agencies are closer to the concept of community compared to who are living in cities. Also, Skelcher deduces that the local organizational structure has been considered as "a unitary to a multiple system for governing local communities" (Skelcher, 2003). A special attention on local administrations and agencies define that this category is suitable to promote and improve the economic, social, or environmental activities of their area (ODPM, 2004).

The results of the first hypothesis reflects the above-mentioned literature instead, in the second set of results, the hypothesis is not satisfied. The work scrutinizes how sub-national governments can strengthen the adaptation measures to enhance the resilience of vulnerable local territories and to offset the uneven implementation of mitigation policies coming form the dispute of international authorities. It has been expected that local stakeholders are much more involved in adaptation strategies as opposed to mitigation ones, however "the capacity of sub-national governments to reach or even surpass the national or international target" mentioned by Mcewen and Bomberg (2014) has not been confirmed in practical findings. Despite the regional climate literature has repeatedly argued that adaptation initiatives should start from the local actors, the final outcomes of the networks highlight a significant number of mitigation activities. Even Giulia Gadani, Ibon Galarraga, Elisa Sainz de Murieta (2020) demonstrate in their evidence with a high percentage of regions lowly

committed to adaptation policies in the transnational network RegionsAdapt.[15] The case shows that adaptation commitments are given less importance than mitigation ones. This issue may be seen through different lenses. Taking a step back in 2013 and following the legislative framework at the regional level, climate actions in European cities (Heidrich et al., 2016), especially in Emilia Romagna were focused on mitigation strategies rather than considering adaptation measures as important as the mitigation ones. Only belatedly, thanks to the introduction of the "Strategia di mitigazione e adattamento per i cambiamenti climatici, 2018"[16] the diffusion of adaptation measures has been significantly extended.

The regional program sets different avenues of support for business and individuals in order to prepare Emilia Romagna to the autonomy of adaptation. The current evidence of the second investigation suggests slight progress from the past years, but it is still not sufficient to reach the goals of 20/20/20 European target initiatives. To attain the 20/20/20 European target initiatives it requires a greater number of varied and developed adaptation policies to be implemented at regional level. In light of the obtained networks, the effect of climate actions are already visible, but there is still room for improvement planned for the 2020-2030 period of European targets. The climate change literature provides some suggestions how to face this challenge. For instance, the paper of Galarraga et al. (2011) pointed out that the application of tailor-made strategies in specific territories can enhance the resilience of vulnerable activities. Indeed, local administrations and agencies are considered the agents of climate change issue that fill the gap between the unclear international legislative framework and its lack of support at regional level. As well, Gremellion (2011, p. 1234) and Juhola et al. (2012) underpin that the resolution on natural disasters and extreme events depends on the management of local government and the capacity of local policymakers to be committed in adaptation initiatives. Furthermore, in the context of political debate, local administrations may strenghten a proactive intervention behavior with the adoption of adaptation investments requested by a capable government (Ghinoi et al.,2021)

However, we cannot rule out the possibility that some complexities associated to local communities' engagement may occur. For instance, Lorenzoni & Pidgeon (2006) and O'Neill & Hulme (2009) demonstrates that many of the local stakeholders struggle in personalizing the importance of climate change to themselves, even though this issue will leave an unavoidable impact for other communities and future generations. This local stakeholders' attitude has been proven by recent studies of Leviston, Price, Malkin, and McCrea, (2014) who describes that those individuals do not completely trust the climate information to which they have access, thus react with a 'interpretation denial' (Leviston & Walker, 2012, p. 283).

The insights of Roelfsema et al. (2014) revealed that the application of the strategies is not adequate to reduce the impact of climate change by about 20% in 2020 period, therefore further series of pledges are needed in the following next decades from 2030 to 2050 period. The Sustainable Development Goals (SDGs) and the 'Roadmap for moving to a low-carbon economy in 2050' in the European framework provide an extension of the climate change policies over the post-2020 period. This allows to implement the remaining climate related activities beyond 2020. The European Commission cannot skip the unaccomplished goals, but these are postponed in the following commitments of the 2030 period. In order to increase the number of ties in adaptation policies amongst local administrations and agencies, the European community must adopt this long-term plan to become climate neutral by 2050.

The social network analysis is an optimal method for future developments and research on regional policies, because it sheds light on communities' activities in government actions (Wellstead & Stedman, 2011; Westerhoff, Keskitalo, & Juhola, 2011; Yun, Ku, & Han, 2013) detecting how policy measures gain relevance in local policymaking. It has been empirically demonstrated that social network is a flexible multidisciplinary approach for engagement and knowledge-sharing purposes of stakeholders. For instance, Mills et al. (2014)

[15] https://climate-adapt.eea.europa.eu/countries-regions/transnational-regions

[16] https://ambiente.regione.emilia-romagna.it/it/cambiamenti-climatici/temi/la-regione-per-il-clima/strategia-regionale-per-i-cambiamenti-climatici/la-regione-per-il-clima-la-strategia-di-mitigazione-e-adattamento-per-i-cambiamenti-climatici

uses social networks for conservation planning or Bodin & Prell (2011) apply it in natural resource management. Even more, Acar & Muraki, (2011), Schroeder, Pennington-Gray, Donohoe, & Kiousis (2013) and Vroegindewey (2011) use the networks in social media networks such as Facebook and Twitter. The social network analysis builds its own 'discipline' through the interactions of multiple research areas. This is considered as a unique 'paradigm' (Leinhardt, 1977) to understand the social world.

7. Appendix

Table 1. Cluster of local stakeholders involved in climate change initiatives

ID	STAKEHOLDERS WITH ATTRIBUTION 0
37	Revenue Agency
38	Regional health service
39	AUSL
40	Local societies
41	Regional High Technology Network (Energy and Environment Platform and Construction Platform
42	Financial intermediaries and fund managers Intermediate bodies (e.g. MISE)
43	Lepida (in-house company of the Region)
44	Urban authorities of the 9 capitals plus Cesena
45	University of Bologna
46	University of Modena
47	University di Ferrara
48	University of Parma
49	Atersir
50	Tecnopoli
51	ClustER associations
52	CNR
53	start ups
54	research laboratories
55	ANCI Emilia-Romagna
56	ERVET spa
57	ENEA
58	ARPAE
59	Università of Milano (sede Piacenza)
60	agricultural entrepreneurs
61	companies with public participation
62	cooperatives
63	land managers, including collective properties, limited to agricultural areas
64	reclamation consortia
65	owners or managers of public and private land, as well as their consortia
66	corporate forms between private subjects having business activities
67	business consultants
68	Training organizations and other service providers
69	Businesses and business networks
70	service companies
71	ESCo
72	Small, medium and large companies
73	Freelancers
74	Business Consortia
75	Local public transport companies
76	ENEL
77	Terna
78	Consortia for internationalization
79	Single or associated SMEs
80	Local public transport companies
81	Managers of productive activities
82	National Packaging Consortium (CONAI) and Supply Chain Consortia
83	Confservizi
84	Trade associations

85	Technical table for the decommissioning of Caorso
86	APEA development table
87	States General of the Green Economy
88	Covenant of Mayors
89	Big Data Association
90	Public-private partnerships
91	Public-private partnerships also through Esco
92	European partnership for innovation
93	IRET Foundation
94	DEMOCENTER-SIPE Foundation
95	Flaminia Foundation - center for innovation
96	Collection management
97	Ecologically equipped production areas

Table 2. Cluster of local stakeholders involved in the target 20/20/20 strategy, only in the mitigation policies.

ID	STAKEHOLDERS WITH ATTRIBUTION 1
12	Protected areas, forests, and mountain development service
14	Impact assessment and environmental sustainability promotion service
15	Parks and forest resources service
16	Local public transport service, integrated and cycle mobility
17	Wildlife-hunting and fishing activities
18	Territorial assistance service
20	Territorial, urban planning, transport, and landscape planning service
21	Legal service of the environment, waste, remediation of contaminated sites and public services.
29	Councillorship of environment and defense of the soil and the coast
31	Councilor for planning and territorial development, cooperation with the autonomy system, organization
32	General manager to Territorial and Negotiated Planning, Agreements, European Relations and International Relations
34	Head of the Territorial Planning and Mountain Development Service, responsible for the procedure
35	Regional Authority for the Supervision of Water Services and Urban Waste Management

Table 3. Cluster of local stakeholders involved in the target 20/20/20 strategy, only in the adaptation policies.

ID	STAKEHOLDERS WITH ATTRIBUTION 2
8	Integrated programming and local development service
9	Competitiveness service for agricultural and agri-food companies
10	Sustainable agriculture service
11	Innovation, quality, promotion, and internalisation of the agri-food system
13	Water, air and physical agents' protection and remediation service
19	Energy service and green economy
22	ICT service, technologies and health facilities
23	Statistical service and geographic information systems
24	Manager of the sustainable agriculture service
25	Manager of the competitiveness service of agricultural and agri-food companies
26	Manager of the innovation, quality, promotion and internalization service of the agri-food system
27	Manager of the attractivity and internalization
30	Councillorship of productive activities, commerce and tourism
33	General manager of production activities
36	Vice-president and councilor for welfare and housing policies

Table xxx. Cluster of local stakeholders involved in the target 20/20/20 strategy, in both mitigation and adaptation policies

ID	STAKEHOLDERS WITH ATTRIBUTION 3
1	Regional Council
2	Legislative Assembly
3	General directive of Agricolture, Forestry and Fishing
4	General directive of Resources, Europe, Innovation, and Institutions
5	General directive of Land management and Environment
6	General directive of Health Care and Welfare Management
7	General directive og Knowledge-based economy, Job, and Businesses
28	Concillorship of agriculture forestry and fishing

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