Learning from or with whom?: analyzing learning patterns in European Administrative Networks

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Abstract

European Administrative Networks (EANs) have increasingly been recognized as important instruments for improving implementation and compliance with European policies. As these structures foster the exchange of experiences and knowledge, they contribute to an ongoing process of mutual learning. Informal networks, in particular, were identified as conducive environments to learning due to their openness, trust-building and non-hierarchical orientation. While the literature on learning is extensive, little is known about the micro-dynamics that lead to mutual understandings and knowledge acquisition. This paper examines this gap through an empirical analysis of the Head of Environmental Protection Agencies Network (EPA Network). Based on an unique survey dataset, social network analysis and exponential graph models are used to trace the interaction patterns within the network and test which factors shape them. This paper sheds further light on intra-network relationships and on the functionality of EANs concerning mutual and collective learning.

Keywords: European Administrative Networks; Environment; Learning mechanisms; EU governance

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Introduction

Over the last decade, the environmental policy-area has been one of the main priorities at the European Union (EU)'s agenda. The launch of the European Green Deal in 2019, with the ambitious goal of achieving climate-neutrality by 2050 and "to protect, conserve and enhance the European Union's natural capital, and protect the health and well-being of citizens from environmental risks and impacts" (European Commission, 2019, p.1), is a clear illustration of such efforts. By setting long-term targets and pursuing transformative policies, the EU has reinforced its' position as a global leader on climate and environmental issues (European Commission, 2020).

Still, while the aims of the Green Deal and of the Commission's Environmental Action Programmes reflect a great deal of optimism, their implementation faces otherwise significant and long-standing challenges. Overall, it is estimated that the shortcomings in the implementation of environmental policy costs the EU approximately €50 billion per year (COWI & Eunomia, 2019). This can be attributed to the substantial divergence across member states in terms of the development and strictness of their environmental policy and in their ambitions in environmental protection (Knill et al., 2012; Liefferink & Wurzel, 2017). Furthermore, practical issues such as the lack of resources, capacity and skills of regulatory authorities enforcing legislation; and insufficient data, evidence and information to support policy implementation have long been highlighted by practitioners as substantial bottlenecks to the implementation of EU environmental policy across and/or within member states (IMPEL, 2015).

Noncompliance by member states is then a particularly serious threat to the accomplishment of the EU's environmental goals (Bondarouk & Mastenbroek, 2018). The EU has taken several measures to address these shortcomings. On the one hand, the Commission is able to launch infringement proceedings against member states that have failed to implement EU legislation or that have done so incorrectly (European Commission, 2020). The effectiveness of such measures may, however, be questioned, given that the environmental policy area has consistently been at the top of the list of open infringement proceedings over the last 7 years. On the other hand, financial and technical assistance have been offered to member states through EU funds and capacity-building programmes such as the LIFE programme (Börzel & Buzogány, 2019). In this sense, a central mechanism here is the development of transnational networks in order to foster cooperation between national regulators.

The role of networks in European governance has attracted considerable attention as they have expanded in numbers and across several policy arenas in the EU (Levi-Faur, 2011). European Administrative Networks (EANs) - also referred to as regulatory; transnational; or transgovernmental networks - can be seen as a reflection of the growing interdependence between national regulatory agents (Busuioc, 2016). Not only are contemporary policy challenges more complex, but they require shared collective responses. Therefore, problem-solving relies on smooth cooperation between national regulatory agents across borders and, to a certain extent, also with actors at the European level (Hartlapp & Heidbreder, 2017). This is where EANs are developed as structures that stimulate cooperation through

the pooling of resources such as expertise, exchange of advice, information and best practices (Mastenbroek & Martinsen, 2018; Börzel & Heard-Lauréote, 2009). Among of the main features of EANs is the promotion of mutual learning and the development of common understandings, problem definition and shared resolutions (Börzel & Buzogány, 2019).

The role EANs have in bridging the diverse actors involved in the implementation of EU environmental policy is fundamental to their potential in fostering learning processes. First, the interactions within the network allows for actors to improve their practices by reflecting on others' and on their own experiences, which leads to better collective results in policy implementation (Polak & Versluis, 2016). Furthermore, the engagement in EANs allows regulators to be up-to-date with new practices and technologies through the exchange with their peers, which is essential in a fast-paced and constantly evolving field such as the environment and climate. In this sense, EANs support the exchange of information, knowledge and expertise that is central to learning.

Understanding learning processes is a complex task as questions are raised concerning *what* is learned, *how, from whom* and *with which aim*. While there is a large volume of literature on learning in environmental governance, which covers diverse governance levels, actors, environmental issue-areas, and continents, there is an equally vast amount of conceptualizations and measures of learning (Gerlak et al., 2018; Zito & Schout, 2009; Maggetti & Gilardi, 2016). Still, the literature provides us with several findings that support that, indeed, learning does take place at the EU-level - albeit to different extents according to the actor at hand (Borrás & Højlund, 2015; Zito, 2009; Gilardi, 2010). It is less clear, however, on *how* and *under which conditions* this learning takes place.

As learning consists of an interactive process, it is dependent on the way in which information and communication flows between actors (Paraskevopoulos, 2001). While the argument for networks has been made in terms of their potential of promoting mutual learning and of developing shared ideas and innovation (Riche et al., 2017; Siciliano, 2017; McNutt & Rayner, 2018), the interactions at the micro-level - namely, within networks - that express these learning patters have received the attention of few researchers so far (Martinsen et al., 2020; Papadopoulos, 2018). Furthermore, more empirical work is needed in order to assess the factors that influence these processes. This leads to the following research question: *How do regulatory agencies learn within European Administrative Networks? Which factors drive the networked learning processes?*

First, it is important to highlight that this article follows the conceptualization of learning as the process in which new information, knowledge and experience is acquired, translated and disseminated across several actors, as posed by Gerlak & Heikkila (2011). The main focus here lies on how knowledge and expertise is disseminated within an EAN and which factors direct/influence these interactions. Actors may then learn from their peers within the network on how to deal with a certain situation, even if these circumstances do not happen in their domestic reality (Pink, 2015). In other words, even if learning does

not materialize into policy change, this does not mean that actors are not learning - rather, they are doing so through their interactions and knowledge exchange.

In order to assess learning processes within EANs, this article focuses on the dynamics taking place within the European Network of the Heads of Environment Protection Agencies (EPA Network). The EPA Network is a voluntary, informal network with the aim of promoting the exchange of experiences and perspectives on issues of practical implementation of environmental policy (Fawcett, 2015). While there are several agencies and networks dealing with EU environmental governance, the insights produced by the EPA Network have been recognized as central to the shaping and steering of supranational environmental policy-making by the Commission (Gemmell & Circelli, 2015), which highlights its' importance. Furthermore, as an informal network - without binding participation or decisions - in a field of high interdependence between regulators, it is a most-likely case in which mutual learning would take place (Polak & Versluis, 2016).

Still, it remains to be seen how regulators engage with each other in the exchange of knowledge and expertise. On the one hand, as national regulators have different resources and expertise, there is the expectation that a dynamics of 'students and teachers' will take place. In other words, the network provides certain participants with learning opportunities and others with teaching opportunities (Polak & Versluis, 2016). This, however, requires more empirical scrutiny - what are the implications for the network participants to be placed as a learner or a teacher? Is it a matter of performance or expertise that defines the direction of learning and the role of regulatory agencies in the network?

On the other hand, participating and interacting with others in EANs demands a considerable amount of resources such as time, staff and financial resources. Therefore, participants will be more selective regarding who they decide to maintain ties with (Vantaggiato, 2019). Rather than learning from differences, it is likely that in here regulators turn to peers that are similar to them as communication costs are lower and they can reach common understandings with more ease and faster. This similarity may be related to them facing the same type of issues (Papadopoulos, 2018), similar institutional settings (Martinsen et al., 2020), or due to similar political priorities.

This article builds on an online survey regarding the interaction patters between the members of the EPA Network - i.e. the 27 EU member states, Albania, Iceland, Kosovo (under UNSCR 1244/99), Norway, Serbia and Switzerland – and the European Environment Agency (EEA). They are asked specifically on their exchanges within the network regarding information. This data is then analyzed through Social Network Analysis and an Exponential Random Graph model.

The article is structured as follows. The next section provides an overview of the conceptualization of learning adopted in this study and the theoretical expectations. This is followed by a brief presentation of the case studied, methods applied and the operationalization of the explanatory variables. Then, the findings are shown and the article finishes with a discussion.

Theoretical Framework

Learning through networks

There is extensive literature on learning and its' implications across different disciplines such as political science, environmental governance, and public administration (Gilardi, 2010; Gerlak et al., 2018; Siciliano, 2017). Likewise, across and within these theoretical approaches it is possible to find a variety of concepts ranging from policy, organizational and social learning; single and double loop learning; to cognitive and reflexive learning (Riche et al., 2017). This has led to significant conceptual stretching, in which learning becomes this broad and abstract phenomena. Still, most studies share a common feature - namely, they have an explicit focus on outcomes such as changes of policies, of cognitive beliefs, of behaviors and/or of strategies (Gerlak et al., 2020; Zito & Schout, 2009). This allows us to capture whether and to what extent learning takes place as changes are easier to observe (Dunlop & Radaelli, 2017). However, these perspectives largely ignore how actors have reached these learning outcomes.

The interactions and exchanges between actors such as policy-makers in which they share their experiences, concerns and inputs are central to shaping the final form and/or potential changes to policies, goals, values and behaviors (Zito & Schout, 2009). In this sense, the process of learning, in which actors acquire, translate and disseminate new information, knowledge and experience, is equally or perhaps even more important than the learning outcomes shaped by them (Heikkila & Gerlak, 2013). Also referred to as collective or mutual learning, the exchange of different perspectives and knowledge is seen as the starting point of innovative and win-win solutions (Newig et al., 2018). Furthermore, as policy-makers face increasingly uncertain scenarios in which they must make decisions, learning from their peers' experiences is a way to reduce uncertainty and allowing actors to adjust their behaviour and responses to a certain situation more quickly (McNutt & Rayner, 2018). Therefore, learning processes are intrinsically connected to the way actors interact with one another in the exchange of knowledge and expertise, which in turn shapes the development and implementation of policy.

While learning may take place in any venue, research on the factors that facilitate learning processes have highlighted the importance of ongoing face-to-face and open dialogue, venues for collaboration and informal connections (Gerlak et al., 2020). In this sense, networks have presented themselves as attractive instruments to fostering learning. First, they structure and provide support to the interactions between different types of actors, which ultimately facilitates the production and sharing of new information and knowledge (Heikkala & Gerlak, 2013). Furthermore, they have a significant role in the resolution of complex policy issues in which actors have contrasting positions, needs and demands, as is the case with the environment (Newig et al., 2010). As networks promote a closer dialogue between participants, it leads to a more informed and creative decision-making in which different values and knowledge are incorporated.

Over the last years, the EU has attributed substantial importance to the fostering of learning processes both across member states and between the EU and other organizations (Zito & Schout, 2009).

It comes as no surprise then that governance arrangements such as European Administrative Networks (EANs) have expanded across several policy domains, with the environment being the most 'networked' of all (Levi-Faur, 2011). First, the structure of EANs facilitates interaction between diverse actors involved in the implementation and enforcement of EU environmental policy. More specifically, EANs bridge the gap between national and supranational actors by providing them with the space for direct and reiterated interaction, which takes place through the pooling of resources and exchange of knowledge and expertise (Mastenbroek & Martinsen, 2018; Börzel & Heard-Lauréote, 2009). This circulation of new information and perspectives reflects an ongoing learning relationship.

Furthermore, the informal nature of some EANs is a key factor to the fostering of mutual learning as it promotes a sense of openness between participants (Martinius & Mastenbroek, 2019). As voluntary and non-hierarchical structures, these EANs are seen as problem-solving mechanisms in which actors are free to share their challenges and to engage in the exchange of knowledge and expertise (Polak & Versluis, 2016). Thus, there is a focus on the development of trust between network participants, which in turn enhances the interactions within the network. As participation is voluntary and self-funded, the considerable engagement of national regulatory agencies in EANs shows that they value the knowledge and expertise brought forward by these networks (Fawcett, 2015), thus indicating that learning does take place.

Finally, as actors engage with each other in the network, they are able not only to reflect upon their own implementation performance, but also to evaluate the performance of their peers and to collectively set, specify and revise goals (Martinsen et al., 2020; Zeitlin, 2016). As venues for experimentation, EANs would allow participants to take the collective insights and test them 'on the ground' (Sabel & Zeitlin, 2008). These experiences and experiments can be expected to return to the network, which would lead to the refinement of policy measures, innovation and the update of the network's knowledge capital (Gerlak et al., 2020).

Overall, it is clear that the interactions within EANs are conducive to learning. More precisely, it is the exchange of information, knowledge and expertise that triggers learning and leads to the improvement of best practices, procedures, rules and capacity-building (Papadopoulos, 2018; Börzel & Heard-Lauréote, 2009). Still, a central question remaining here concerns how do national regulatory actors learn within the networks. As learning is an interactive process, it is crucial to assess not only how and actors communicate and exchange knowledge and expertise, but also with whom they do so (Paraskevopoulos, 2001).

First of all, it is important to recognize that national regulatory actors have vastly different levels of competences, expertise and resources (Vantaggiato et al., 2021). As actively participating in EANs demands a significant amount of time, human and financial resources, the asymmetry across network participants is central to network dynamics. A first implication in here is that not all regulatory agencies will be able and/or have the capacity to participate in network activities and interact as extensively in the

network as some of their peers. Therefore, it is likely that actors with higher budgets and staff dedicated to engaging in the network will be more involved in learning processes than those with more restricted resources available to them. In this sense, the administrative capacity of national agencies must be taken into consideration when analyzing network interactions in the context of learning.

A second implication of this is that it is not feasible for actors participating in EANs to interact with all other actors in the network. They must be strategic and careful in their choices regarding who to reach out to and with whom to maintain ties. It is usually the case that network participants only connect to peers they deem relevant and/or worthwhile (Vantaggiato, 2019). The following sections elaborate on possible interaction patterns and the factors that shape these learning relationships in the exchange of knowledge within an EAN.

Learning from whom?

A central assumption when it comes to *learning* is that actors are able to learn mainly from the different perspectives, knowledge and expertise that their peers bring to the table (Sabel & Zeitlin, 2008). As regulatory agencies diverge in regards to their competences, knowledge and expertise, actors will prioritize contact with and remain more attentive to the examples and recommendations from those they consider role models (Nedergaard, 2006; Papadopoulos, 2018). This type of dynamic reflects a teacher and learners/students relationship, which is reproduced in the network as certain actors receive learning opportunities while others have teaching opportunities (Polak & Versluis, 2016). This implies the existence of an underlying hierarchy in the network as participants will learn *from* another one, rather than *with* them.

There are clear benefits in this interaction for both parts. The advantages for those occupying the role of learners in the network are quite straightforward. Learners, which frequently consist of regulators with less resources and/or expertise, will have more direct access to high-quality information and expertise coming from their more experienced or successful peers (Vantaggiato, 2019). In this way, learners are able to further develop their capacities and learn new ways of dealing with specific policy issues and in achieving policy goals (Pink & Bertel, 2014).

Teachers, on the other hand, tend to be the regulatory agencies that are "in the lead when it comes to knowledge and expertise for adequate implementation" (Polak & Versluis, 2016, p. 116). In their perspective, there is little that they could learn from those in the 'learners' position. However, teachers have significant strategic benefits in these learning connections - namely, they are responsible for defining the content and direction of learning (McNutt & Rayner, 2018). This means that they can act as 'teachers of norms', in which they define and diffuse what are the appropriate practices, techniques, and standards for instance (Versluis & Tarr, 2013). In EANs, these actors are frequently at highly central positions as this enhances their opportunities to diffuse their knowledge, policy preferences and insights (Schrama et

al., 2020). Overall, teachers have significant influence over recommendations and practices put forward by the network, placing them behind at the driving wheel of the network.

In regards to environmental policy, the performance of member-states is a central factor in understanding the dynamics between learners and teachers. Environmental Protection Agencies (EPAs) frequently have their performance evaluated at the light of that of their peers in order to benchmark services and effectiveness (Gemmel & Circelli, 2015). If another agency is perceived to have more efficient practices, it is expected that their example will be followed by their peers (Arbolino et al., 2018). Given the transboundary nature of environmental issues, national administrations must pay attention not only to their efforts and results, but also to that of their neighboring states. This is because a stellar performance or emissions' reduction by a certain state can have their effect severely undermined by the lackluster performance or efforts of another. Consequently, this would compromise the achievement of collective EU goals (Börzel, 2002). Furthermore, this could lead to a distortion on the competition as a more lax environmental protection requirement translates into lower production costs in comparison to those with more strict regulations (Liefferink et al., 2021).

Overall, it makes sense to expect that regulatory agencies' performances in the implementation of EU environmental policy will determine which role they will assume when interacting in the network. While 'learners' would benefit from their more successful peers' expertise and resources, which contributes to improving their own capacities and implementation, 'teachers' would benefit from their central position in the network, which allows them to disseminate their standards, preferences and insights.

H1: Environmental regulatory agencies from states with a poorer performance in the implementation of environmental policy interact more with their peers coming from better performing states in the network

H2: Environmental regulatory agencies with a better performance in the implementation of EU environmental policy tend to occupy more central positions in EANs

Learning with whom?

While the idea of learning from differences comes intuitively, the literature focusing on EANs has shown that, in fact, it is the similarities across network participants that drives their engagement and interactions with each other (Martinsen et al., 2020; Schrama et al., 2020; Vantaggiato, 2019). This has been observed in terms of institutional structures (Martinsen et al. 2020), regulatory philosophies (Eberlein and Grande 2005), actors' beliefs, belonging to the same groups, among other factors. However, as environmental protection and climate change have attracted significant attention from the EU over the last decade, the domestic political background of member states becomes increasingly important to understand who interacts with whom in European networks (Bach & Newman, 2014; Martinsen et al., 2021).

Even though EANs are presented as venues to depoliticize certain issues and to promote more encompassing cooperation, the political preferences and interests of member states are imported into the network (Mastenbroek & Martinsen, 2018; Beyers & Kerremans, 2004). In other words, political cleavages are reflected on the network interactions, thus shaping how the exchange of knowledge and expertise will take place (Martinsen et al., 2020). In order to illustrate these political cleavages around environmental policy, we enter the traditional discussion around leaders and laggards in the EU environmental governance literature

Member states are described as environmental leaders when they present the highest level of ambition in pursuing environmental protection measures (i.e. the most strict standards) or when they are the first ones to adopt or introduce an environmental policy innovation (Liefferink & Wurzel, 2017). Meanwhile, those that are reluctant and/or resistant to the adoption of more demanding and comprehensive environmental regulations are classified as laggards (Knill et al., 2012). This resistance can be seen through the late adoption of EU environmental policy, insufficient enforcement of environmental measures and requirements, or even by not adopting them at all. This can be attributed to diverging interests driving political initiatives - while leading countries may prioritize environmental protection, laggards may put economic interests at the forefront, for instance.

As the categorization of a member state as a leader or laggard varies across environmental issues and through time (Liefferink & Wurzel, 2017), and the EPA Network deals with a large diversity of topics involving environmental policy, it is not the intention of this article to draw the line on which states are to be considered leaders or laggards in the network. Instead, the focus here lies on the extent to which environmental concerns may be prioritized over economic ones (and vice-versa) as this will shape the environment in which environmental protection agencies (EPAs) are inserted in. A national government that is more favorable towards the environment may provide more leeway and resources for experimentation and innovation in the implementation of EU policy, for instance. On the other hand, a less ‘green’-oriented administration may highlight the significant adaptation costs in pursuing more ambitious policies and search for solutions that fulfill only the minimum requirements of EU environmental policy.

Overall, actors tend to learn most often with those they consider similar to them and/or that are facing the same kind of issues and challenges (Papadopoulos, 2018). In this sense, it is likely that actors with the same set of preferences - i.e. towards more environmental innovation and enhancing environmental protection or towards stimulating their economy while doing the minimum efforts to avoid non-compliance costs - will gravitate towards their peers with the same preferences. Therefore, it is expected that EPAs from more environmentally-friendly states will interact with their ‘green’ counterparts while EPAs from less environmentally inclined states will look for peers in the same line of political preferences.

H3: Environmental regulatory agencies interact more with their counterparts coming from states with similar national political preferences towards the environment

The European Network for Heads of Environmental Protection Agencies (EPA Network)

The EPA Network is an informal network for the exchange of knowledge, experiences and best practices on common issues stemming from the practical implementation of EU environmental policy (EPA Network 2013; Levi-Faur 2011). The promotion of mutual learning is then at the core of the network's activities. Learning is pursued through more frequent, open and direct contact between national (and supranational) environmental agencies in thematic Interest Groups, where participants share interest and/ or concern on topics such as Green Economy and Climate Change, and in the general bi-annual plenary meetings. Furthermore, the EPA Network aims "to provide feedback to policy-makers about what works 'on the ground'" (Fawcett, 2015, p.329).

Membership to the EPA Network is voluntary, self-funded and open to all European countries. Currently, the network is composed by the directors of the Environmental Protection Agencies across all 27 EU member states, Albania, Iceland, Kosovo (under UNSCR 1244/99), Norway, Serbia, Switzerland and a representative of the European Environmental Agency (EEA) (EPA Network, n.d.). While their participation is not compulsory, networking is essential to national EPAs as it not only allows them to evaluate their own performance in comparison to the rest, but it also keeps them 'on the loop' for new technologies and innovations being pursued in other states (Gemmell & Circelli, 2015).

The participation of the EEA as a full-member of the EPA Network may raise questions as the involvement of EU agencies and/or the Commission in informal EANs can be detrimental to its' sense of openness and to member states' sharing of their experiences and information (Polak & Versluis, 2016). Still, this does not seem to be the case in here as the network shows a high level of participation (Fawcett, 2015). This suggests that national EPAs envision some value in the network and recognize that the insights they gain in interacting in the EPA Network are significant. Otherwise, they would not dedicate financial and human resources to be part of this informal EAN when there are other venues for cooperation in environmental governance in the EU.

Methods

Social Network Analysis and Exponential Graph Models

The results and analysis of this article follow a two-step method. First, social network analysis (SNA) is used in order to map out the bilateral interactions in the network, which is the first step in addressing *how* learning takes place. SNA allows us to visualize the overall structure of the network, thus illustrating the different paths through which information circulates (Schrama et al., 2020). This method also allows us to go more in-depth on which positions each actor is occupying and what are the implications of them doing

so as certain positions allows actors to have more influence over the network exchanges (i.e. exchange of knowledge, which leads to learning).

Two particularly important measures in here consists of degree centrality and betweenness centrality. Degree centrality expresses the local connectivity of a certain actor by looking at the number of (direct) connections they have with others in the network (Robins, 2015). Occupying a central position means that the actor would have more opportunities to diffuse their knowledge and preferred practices (Christopoulos & Ingold, 2015), thus shaping what and how learning would take place. This type of position / measures fits well with the conceptualization of 'teachers' in the network.

Betweenness centrality is also an interesting measure here, as it assesses the degree to which an actor is located in between the shortest communication path between other network points (Freeman 1977). This is a strategic position as it allows specific actors to facilitate, distort, or obstruct the transmission of information across the network (Freeman 1977). They are then highly influential in shaping which type of information is reproduced in the network.

The second step of the analysis tests the hypothesis on the expected patterns of interaction for learning in the EPA Network, which is done through Exponential Random Graph Models (ERGMs). The rationale behind this method is that networks self-organize over time, which means that the presence of a network tie influences the presence of others (Robins & Lusher, 2013). Therefore, it takes into account not only the network dependency structures, but also the effects of actors' attributes - and other variables - on network interactions (Martinsen et al., 2020; Vantaggiato, 2019). In here, ERGM allows us to assess the influence of actors' performance (H1) and political preferences (H3) towards environmental sustainability on the network interactions.

Data Collection

Dependent Variable

As the EPA Network's main task is the exchange of practical knowledge and expertise, which is in line with this article's interest in learning processes in EANs, the dependent variable here consists of the interactions within the EPA Network for the exchange of knowledge / information regarding the national implementation of EU environmental policy. This data was collected through an online survey conducted between October and December of 2021. This survey was distributed among all members of the network – namely, the heads of the 34 national Environmental Protection Agencies and the representative of the EEA in the network. The survey had a response rate of 85.7%[2], which is considered sufficient to properly represent and model the network as if there was no data missing (Borgatti 2006). As the heads of national EPAs have significant time constraints, there were instances in which their deputies or representatives engaging with the EPA Network have provided additional answers to the survey, which resulted in

[2] There were no replies from Greece, Luxembourg, Poland, Romania and Spain. Additionally, as the United Kingdom is no longer bound to the requirements of EU environmental policy, the environmental agencies from Scotland, Wales and England did not take part in this survey.

multiple answers for certain member states. In these cases, only the response that was more complete to the survey was considered.

Explanatory variables

First, the performance of states in regards to the implementation of environmental regulation is taken from the 2020 results of the Environmental Performance Index (EPI) by Yale University and Columbia University. This index uses data from 32 performance indicators across 11 issue categories within environmental governance ranging from environmental health and air quality to agriculture and greenhouse gas emissions per capita (Wendling et al., 2020). These indicators are aggregated into an EPI score, which allows us to identify current leaders and laggards in environmental performance. While there is significant differences on member states' performances across issues such as waste and biodiversity conservation, the use of an aggregated performance score makes sense as the EPA Network discusses and addresses a wide range of environmental topics.

In order to capture the political environment around each EPA, the indicator for national political parties' positions towards environmental sustainability was taken from the 2019 Chapel Hill Expert Survey and the 2019 CHES Candidate Survey (Bakker et al., 2020). The mean score of the parties with over 10% of the seats for each country is calculated and adopted as corresponding position for each country. In cases where a single party had more seats than the required majority in the legislative sphere, its' score was adopted for that country. In here, lower values correspond to a strong support to environmental protection - even at the expense of economic interests. Meanwhile, higher values means economic growth is prioritized over environmental protection.

Control Variables

The model controls for several variables concerning the attributes of network participants and network's structure. The first one consists of EU membership, as it has shown to be a significant factor in strong national environmental policy output (Liefferink et al., 2009). It is likely to have an impact on network interactions as EU membership tends to increase the communication between actors in different venues - such as international and EU-level institutions (Arts et al., 2009). Furthermore, member states can recognize similar challenges and problems more easily as they share the obligation of and are under more pressure to implement EU environmental policy. This is measured through a dummy variable.

The second control variable is the geographical proximity between member states as this has been identified as a relevant factor for understanding interactions in EANs (Vantaggiato, 2019; Papadopoulos, 2018; Martinsen et al., 2020). It is also highly likely to have an effect in the EPA Network's interactions as well as environmental issues have a transboundary nature and their effect can be more immediately felt by neighboring countries.

The bureaucratic capacity of each environmental agency is also central factor to their engagement in the network. As mentioned previously, participating in EANs is dependent on the resources national agencies dedicate to the network - staff size, in specific, has been pointed to have an effect on maintaining ties in the network (Vantaggiato, 2019; Martinsen et al., 2020). This capacity is operationalized as the staff level of the EPA taking part in the network. This data was obtained through the survey on the interactions within the EPA Network and was categorized as less than 1, one to two, two to three, or at least four full-time (or equivalent) employees (FTEs).

The final control variable is the transitivity of ties, which is a common feature in information exchange networks (Fischer et al., 2017). This is a tendency that interactions are more likely to take place between actors that are indirectly related - i.e. they both are directly tied to another network participant, but not to each other - than between two actors that do not share a common connection (Goodreau et al., 2009; Schrama et al., 2020). This consequently has direct influence over the interactions within networks, which can be controlled through the inclusion of a geometrically edgewise shared partner statistic (Schrama et al., 2020; Snijders et al., 2006).

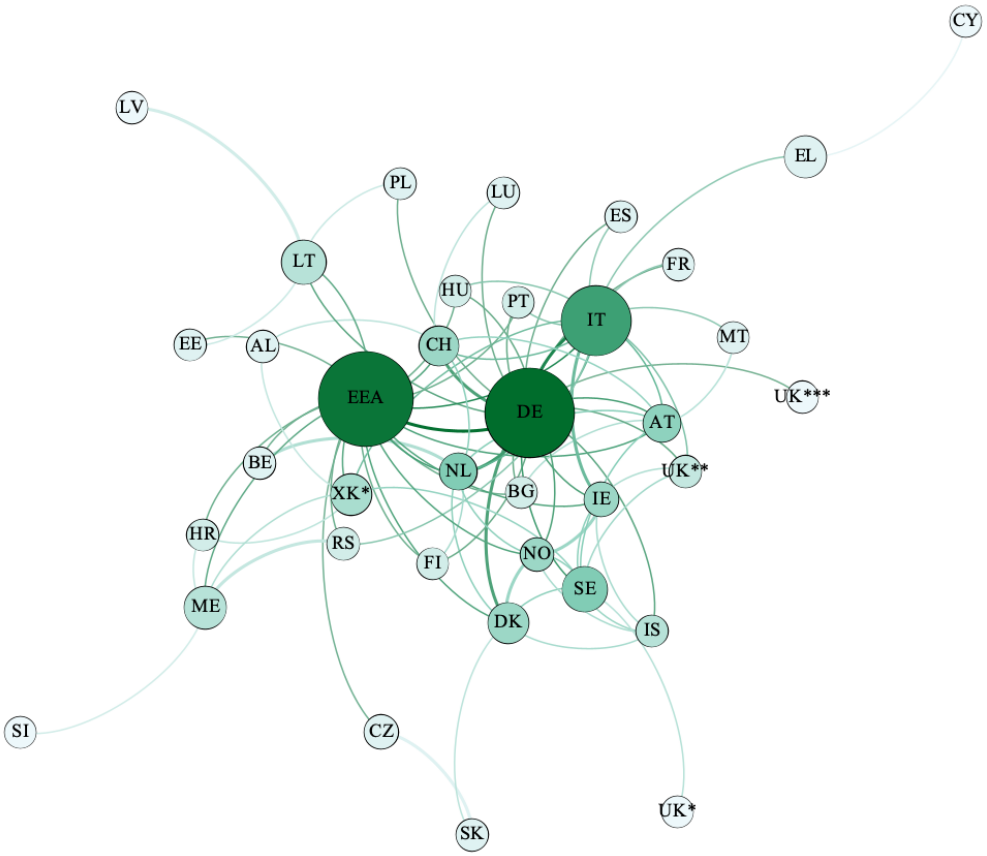
Results

Descriptive Results

The visualization of the network interactions, as done in Figure 1, is essential as a first step into approaching how learning takes place as it provides us with a deeper understanding of how the network functions in regards to the exchange of information and of emerging trends of who interacts with whom. A first observation in regards to the EPA Network is that the network is not too dense - namely, each EPA interacts on average with only 4 other environmental agencies. This is an interesting initial finding, which further endorses the image of informal regulatory networks as open spaces fostering innovative solutions. This is because a central danger to EANs is that, if they become too sense, they may become echo-chambers between the groups of similar environmental agencies (REF.). Very dense networks are typically closed-ff to external insights, which suffocates their innovative potential - which is clearly not the case with the EPA Network.

While the network structure is not dense, there seems to be a substantial exchange of information at its' centre. This can be attributed to the presence of a few outstanding 'networkers' - namely, Germany, with highest number of ties with other agencies (21 connections), followed by the EEA (20 connections) and Italy (15 connections). These agencies also occupy an important structural role as they serve as 'bridges' between different parts of the network that would otherwise not be connected. In this sense, they are able to filter what information is being disseminated in the network - thus shaping what is learned. The EEA is main bridging actor in the network with a betweenness centrality score of 0.34, followed by Germany (0.31) and Italy (0.20).

Figure 1 - Exchange of Information in the EPA Network



The shade of the node's color represents its' degree centrality - the darker the node, the more connected that node is. The size of the node corresponds to its' betweenness centrality - the larger the node, the more it serves as a 'bridge' in the network.

These results have several implications to how learning takes place within the EPA Network. The first insight in here is that not all network participants are exposed to information in the same way. While there are stronger ties and flows at the centre of the network, certain environmental agencies occupy peripheral positions and have very few or even a single connection to their network peers - as is the case of Cyprus, Latvia and Slovenia, for example. As learning is intrinsically connected to the exchange of knowledge, those with less access to the information being circulated have a smaller potential to learn then those at the centre. In this sense, this finding seems to support the literature in that, indeed, learning takes place selectively as actors learn to different extents and in different manners (Hobolth & Martinsen, 2013).

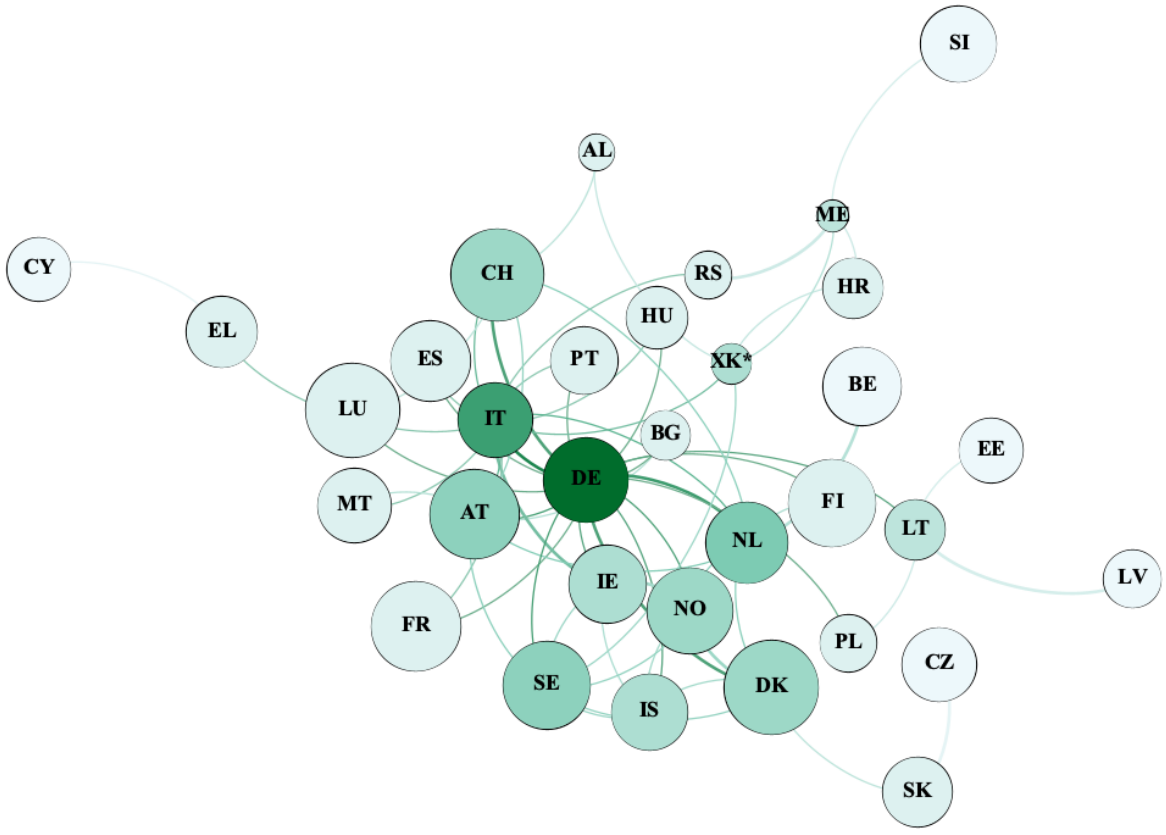
Another interesting insight in here is the highly central position occupied by Germany and the EEA. As the most well-connected environmental agency, the German EPA has more opportunities to infuse their knowledge, regulatory traditions, standards and policy implementation solutions into the network's processes and resolutions than other environmental agencies. It is also able to serve as a gatekeeper to the network, as it is able to filter which type of information circulates in the network, thus

shaping what actors learn. The elevated scores of the EEA suggest that the European agency is not too far behind the German EPA, which is a surprising finding given the informal nature of the EPA Network.

Both Germany and the EEA occupy the position of a 'teacher of norms', which is frequently used as a reference point for those regulators with lower resources or 'newer' members (Versluis and Tarr 2013). The findings uncover, however, that there is a wide diversity of member states seeking to connect with the German EPA and the EEA for knowledge such as Lithuania, Croatia, Switzerland, Germany, Czech Republic, and Belgium, for example. This is most likely tied to the agency's knowledge and expertise on EU-level regulation and its' requirements for a successful implementation. In this sense, both Germany and the EEA are central sources of knowledge and information, which makes them key players in the learning dynamics within the EPA Network.

As one of the main goals of this article is assessing the influence of performance and national political preferences towards environmental sustainability in shaping learning processes, the EPA Network must be treated as an intergovernmental network. Figure 2 presents then a visualization of the exchanges of knowledge within the network with the exclusion of the European Environmental Agency. A first striking finding is that, indeed, EPAs coming from states with higher implementation scores are remarkable networkers, with Germany at the top with 21 connections to other agencies, followed by Italy

Figure 2 - Exchange of Information in the EPA Network



The shade of the node's color represents its' degree centrality - the darker the node, the more connected that node is. The size of the node corresponds to its' score in the Environmental Performance Index - the larger the node, the better is its' environmental performance.

(15 connections), Sweden (9 connections) and the Netherlands (9 connections). This finding further cements the role of Germany as a 'teacher' in the EPA Network as the removal of the EEA does not have a substantial implication for the position of the national agency. Furthermore, it supports the expectation set in hypothesis 2, as better performance seems to be a decisive factor to occupying a highly central position in the EPA Network.

ERGMs analysis

[to be developed]

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