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RESEARCH ARTICLE

Governing a multilevel and cross-sectoral climate policy implementation network

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Abstract

For national governments to meet their international climate change obligations they need to develop and implement plans that involve coordinating the actions of local, regional and national level actors from across multiple sectors. When this occurs, it can lead to the formation of a policy implementation network. Surprisingly, there is a limited understanding of the characteristics of the members of such networks, the structure of the multi-level and cross-sectoral ties among them, and about how they relate to how these networks are governed. This paper initiates the development of such knowledge by calculating a variety of network statistics to analyse the policy implementation network formed to carry out Ireland's signature climate policy—*The Climate Action Plan 2019*. Results show that national level actors dominate, and that cross-level and cross-sectoral collaboration are limited. The plan is governed by a network administrative organisation (NAO), with the Department of the Taoiseach (Irish Prime Minister) filling the role. How the network is structured and governed increases the likelihood that the network will be stable, have a unity of purpose and be able to meet its objectives. However, the dominance of national-level actors and its centralized structure are likely to make it challenging for the NAO to gain the support of local-level actors. This paper's methodological approach can be applied in other contexts to understand inter-actor relations and how these affect the responsibilities, challenges and opportunities of the actors involved in the implementation of a national environmental policy.

KEYWORDS

climate change, Ireland, multi-level governance, network analysis, network governance, policy implementation

1 | INTRODUCTION

Mitigating the effects of anthropogenic climate change is amongst the biggest challenges facing humankind. Under the Paris climate accord, nation states are now a key arena where actions to address the problem are taken. Consequently, many national governments are now devising national plans and strategies to outline how they will reduce

their greenhouse gas emissions. Because of the complexity of the climate problem, it is imperative that these plans consider the multi-level and cross-sectoral nature of the challenge. Indeed, the Summary for Policymakers of the IPCC Special Report on Global Warming of 1.5°C stresses that addressing climate change requires accountable multi-level governance that involves a variety of state and non-state actors and institutions (IPCC, 2018). For national governments to meet their

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international obligations they will need to involve and coordinate the actions of local, regional, national and international level actors from across multiple sectors when developing and implementing their plans. When this occurs, it leads to the formation of purpose-oriented policy implementation networks, which can be defined as 'a network comprised of three or more autonomous actors who participate in a joint effort based on a common purpose' (Carboni et al., 2019).

There is no consensus in the literature about how best to evaluate a policy implementation network (Kenis & Provan, 2009). This is because any choice of evaluation criteria is shaped by normative values rather than by objective facts. This has led researchers to rely on a variety of different theoretical frameworks and to use a range of different measures (Raab et al., 2015; Turrini et al., 2010). Scholars have examined the initial conditions that enable the formation of these networks to explain how their purpose came to be defined (Bryson et al., 2015; Emerson et al., 2012). They have investigated the size and the diversity of a network's membership to ascertain which resources are available and mobilized, to identify potential sources of conflict and to determine the network's stability (Dal Molin & Masella, 2016; Saz-Carranza & Ospina, 2011; Sørensen & Torfing, 2009). Public management researchers have focused on how these networks are governed to understand how decisions are taken and to see if cooperation is formalized (Agranoff & McGuire, 1999; Provan & Kenis, 2008; Sørensen & Torfing, 2009). Others have concentrated on outcome variables, such as participants' evaluations and perceptions of legitimacy (Provan & Milward, 1995), the extent to which a network meets its own performance indicators (Sørensen & Torfing, 2009; Van Raaij, 2006) and how the network is evaluated by the broader community (O'Toole & Meier, 2004).

Surprisingly, we have a very limited understanding of the characteristics of the members of these networks, the structure of the multi-level and cross-sectoral ties among them, and about how this is related to how they are governed. There is therefore a need to develop such a body of knowledge (Park & Lim, 2018). This paper takes a preliminary step in this direction by analysing the network created to implement the Irish *Climate Action Plan 2019* (DCCAE, 2019).

The paper focuses on analysing the network structure and how it is governed rather than on outcomes for three reasons. First and foremost, at this early stage it is not possible to know if the plan will achieve its objectives of leading Ireland to meet its 2030 EU emissions reduction targets and of laying the foundations for achieving net zero carbon emissions by 2050. Put simply, because the Climate Action Plan is at the start of its life it is too early to evaluate its outcomes. Second, in the absence of the counterfactual where no plan was created, it is not possible to evaluate the relative contribution of the plan to the Irish state's emissions reduction obligations. Third, evaluating a plan to tackle climate change by counting the number of actions that the government has successfully implemented in its own plan could be argued to be akin to allowing the government to set its own test and then issuing its own report card. In fact, the government has undertaken such a review on a quarterly basis since the Plan's publication in June 2019.

The next section presents our theoretical framework: the first part introduces policy implementation networks and discusses what

we can learn from analysing their structure; the second part discusses how these networks are governed. We then describe our case, the data and the network methods that we use to address our research questions: (i) What are the characteristics of the members of the network and how are the multi-level and cross-sectoral relationships among them structured? (ii) How is the network governed? (Carboni et al., 2019; Planko et al., 2017; Turrini et al., 2010). Following this, we present our results and discuss our findings. The paper then concludes with some reflections on the study and some thoughts about directions for future research.

2 | POLICY IMPLEMENTATION NETWORKS

The complex web of interactions that characterize the relationships among the actors involved in the delivery of a policy programme is a networked phenomenon. The actors and the relationships among them can therefore be conceptualized as a policy implementation network (Milward & Provan, 2003). Purpose-oriented policy implementation networks are comprised of actors that interact to solve some common problem that no actor could address alone (Agranoff & McGuire, 2003). These networks are formally constituted multi-actor arrangements set up by government as a means of coordinating the effective delivery of a public service or the implementation of a policy (Isett et al., 2011). They are also meso-level social structures that consist of a configuration of horizontal and vertical relationships among interdependent actors, and which can include a combination of local, national, regional and international actors from across multiple sectors. By studying a policy implementation network, we can elucidate the structural pattern of the relationships between the network's members and determine how their actions are coordinated to meet the network's purpose. We can also establish how different actors are integrated, where power and control reside, identify which actors are responsible or co-responsible for which tasks, and explain how it is governed (Planko et al., 2017).

2.1 | Network structure

The way in which actors are integrated into a network is shaped by the number of ties among its members, the degree of network centralization, and the extent to which some actors occupy more central positions than others. Networks that are better connected usually enable information to flow more efficiently than those that are sparsely connected. In centralized networks, the actors in central positions can channel information to others while also prioritizing network tasks (Sandström & Carlsson, 2008). Centralized networks have been found to be better for coordination and are thought to work especially well in public service delivery if institutional norms support cooperation and collaboration (Provan & Milward, 1995). Accordingly, our analysis of the Irish Climate Action Plan's implementation network begins by investigating how connected and centralized it is, and by identifying the most central actors.

There is a need to distinguish between the vertical and the horizontal dimensions of networked policy implementation, especially for problems like climate change that require a multi-level and cross-sectoral approach. The vertical dimension refers to the relationships between local, regional, national and international actors. The horizontal dimension refers to the relationships between actors from different sectors. Multi-level governance as a concept for understanding environmental protection emerged from the Earth Summit in 1992. The approach has been widely used to understand the dynamics of climate governance (Betsill & Bulkeley, 2006; Di Gregorio et al., 2019; Schreurs, 2017). Multi-level climate governance refers to the ways in which the actions of actors that putatively operate at different levels of governance are engaged and coordinated to develop, implement and monitor policies designed to reduce greenhouse gas emissions (Westman et al., 2019). The approach recognizes the existence and the role of mutually interdependent actors from multiple different policy sectors that operate at different governance scales and which are involved in the resolution of a policy problem. The approach is employed because it is presumed that it can help close the policy gaps between levels of government through vertical and horizontal cooperation.

Cross-sectoral collaboration refers to situations where government actors work with organizations from across sectors to address a public problem that they cannot address alone (Bryson et al., 2015). It is argued that a policy problem is more likely to be comprehensively addressed when actors from different sectors collaborate than if they and the government were to work independently (Kettl, 2015; Rethemeyer, 2005). The approach can be of particular benefit when the knowledge and the capacities needed to address a problem are held by a range of different actors with expertise in complementary areas of relevance. Collaborations between actors from different sectors may be instigated by network managers if they believe that the separate efforts of these actors have failed or are likely to fail to address a problem (Agranoff & McGuire, 2001). Their success can depend on the existence of a consensus among participants that a problem exists, that the participating actors trust one another, that they agree that a collaborative approach is necessary, that they understand the structure of the network and how it is governed and are familiar with the processes being used to meet the network's objectives (Ansell & Gash, 2008; Bryson et al., 2006). The second step in our analysis is to investigate how actors from different sectors and from different governance levels are integrated into the implementation network created by the development of the Irish Climate Action Plan.

An analysis of cross-sectoral and cross-level collaboration contributes to the understanding of climate policy integration (Adelle & Russel, 2013; Candel & Biesbroek, 2016; Jordan & Lenschow, 2010; Jordan & Lenschow, 2010). Because climate change is a policy problem that touches all sectors of society, from transportation to industrial production, from agriculture to housing and urban planning and beyond, it can only be addressed through governance solutions that integrate climate policy with policies in these various sectors. The climate policy implementation network that we analyse is an attempt to

do so by bringing together actors representing various sectors and by giving them tasks that integrate climate policies into the policy sectors in which these actors already occupy key places. Our object of study, thus, is an example of what van Asselt, Rayner and Persson (2015, p. 389) identify as the administrative coordination approach to climate policy integration, though we are unable to differentiate in this study between 'weak' and 'strong' variants of climate policy integration. Understanding the potential and the challenges of the climate policy implementation network, therefore, is a part of understanding climate policy integration more generally.

2.2 | Mode of governance

Governance refers to how decisions are made, how power is shared, and how cooperation is engendered (O'Leary & Vij, 2012). Much of the literature on governance and policy implementation networks has sought to understand how public authorities or network managers foster cooperation and coordinate the interactions among network actors so that policies can be implemented effectively (Gronow et al., 2019; Klijn et al., 2010; Provan & Milward, 2001). Provan and Kenis' (2008) widely cited paper on modes of network governance identifies and classifies three forms of network governance. According to the shared governance model, the number of participating actors in a network is small and power is widely distributed. All the participating actors contribute relatively evenly to the management and steering of the network's activities, with decisions being made based on consensus about the network's goals and about how they are to be achieved. In the lead agency model, one actor is responsible for managing a network's activities. The level of consensus about the network's goals are moderate, but because most of the power is concentrated in the hands of one key member of the network the capacity of the network to develop positive outcomes is highly dependent on the level of trust among actors. The network administrative organisation (NAO) model is similar to the lead agency model. The main difference is that NAOs are not key members of the network that they manage, but instead are separate entities that exist to manage or oversee the activities of the network actors. We address our second questioning by determining which of these three forms of networked governance best describes how the Climate Action Plan is governed.

3 | IRISH CLIMATE POLICY AND THE CLIMATE ACTION PLAN 2019

Ireland is a climate laggard (Little, 2017; Torney & O'Gorman, 2019). The country has the third highest per-capita emissions in the EU and placed 41st in the Climate Change Performance Index 2020, making it among the worst performers in Europe (Germanwatch, 2019). In its 2018 annual review of the country's progress towards its targets, the Climate Change Advisory Council concluded that Ireland was 'completely off course' and described future projections as



'disturbing' (Climate Change Advisory Council, 2018). The Irish Environmental Protection Agency (EPA) projected that if no additional measures are implemented (beyond those in place in 2019) then greenhouse gas emissions in sectors outside of the EU Emissions Trading Scheme would decrease by 5% by 2020, meaning that Ireland will fall far short of the required 20% reduction from 2005 levels. In the past, Irish climate policy choices have aligned with the preferences of powerful interests and those involved in Irish climate politics have failed to learn from those with which they disagree (Torney, 2017; Wagner & Ylä-Anttila, 2018; Wagner & Ylä-Anttila, 2020). The country will need to radically change the breadth, the depth and the urgency of its response to climate change if it is to meet its emissions reductions obligations.

Against this background, the Irish parliament tasked a Citizens' Assembly with deliberating on the topic of 'how the state can make Ireland a leader in tackling climate change'. In autumn 2017, the assembly considered complex policy questions related to climate change in a comprehensive and deliberative way (Devaney, Brereton, et al., 2020; Devaney, Torney, et al., 2020). After hearing from a range of scientists and policy experts, the members published a list of 13 high-level recommendations in April 2018 (Citizens' Assembly, 2018). Their report showed that Irish citizens wanted the government to be far more ambitious in their response to climate change than it had been to date.

A Joint Oireachtas (Irish parliament) Committee on Climate Action was established in autumn 2018 to consider the Assembly's recommendations as well as additional evidence presented to the Committee during its deliberations. In March 2019, the committee published a report, *Climate Change: A Cross Party Consensus on Climate Action* (Houses of the Oireachtas, 2019), which set out over 40 recommendations to steer Ireland towards a low carbon future. The Irish parliament unanimously endorsed the plan as part of a resolution declaring a 'climate and biodiversity emergency'. With that, there was a consensus that the Irish state needed to drastically improve its response to climate change.

Soon after, in June 2019, the government published the all-of-government *Climate Action Plan 2019*. The purpose of the plan is to provide the details of how the state intends to meet its EU target of reducing its carbon emissions by 30% between 2021 and 2030 and creating a resilient, vibrant and sustainable country (DCCAE, 2019). The plan contains 183 actions within 13 different policy areas that extend to all sectors of Irish society and its economy. For each action, the plan sets out the steps necessary for delivery, a timeline for delivery and the actor/s responsible for ensuring delivery. Progress can therefore be tracked and measured. It is a cross-sectoral plan in that it includes measures across the sectors responsible for Ireland's greenhouse gas emissions. The plan takes a multi-level governance approach, by including local, regional, national and international actors and detailing their roles in implementing the actions in the plan.

The plan proposes a new governance framework to ensure oversight and accountability to replace the existing framework set out in the *Climate Action and Low Carbon Development Act 2015*. The plan establishes a Climate Action Delivery Board within the Department of

the Taoiseach, co-chaired by the Secretary General to the Government (the most senior civil servant and head of the Department of the Taoiseach) and the Secretary General of the Department of Communications, Climate Action and Environment, to oversee the delivery of all the actions in the plan and to ensure that Government departments and public bodies are held accountable. It calls for the establishment of a standing committee of the Oireachtas focused on climate change to hold government departments and public bodies to account for the actions on climate change. It will also establish a Climate Action Council (CAC) as a successor to the existing Climate Change Advisory Council. The purpose of the CAC will be to advise and monitor Government progress in reducing emissions.

4 | DATA AND METHODS

Social network analysis (SNA) is a set of relational methods for identifying, mapping and measuring connections between people, groups, or organizations (Hanneman & Riddle, 2005). Any of these entities can be the nodes in a network, while the connections between them can encompass any type of relationship or flow of resources.

We draw our network data from the *Climate Action Plan 2019: To Tackle Climate Breakdown* (DCCAE, 2019). The boundary of the network therefore only extends to those actors that are specifically named as being responsible for at least one action in the plan. As such, the boundary is defined and limited by the plan, and our data is for the whole network. There are 109 actors named as being either responsible or co-responsible for at least one action in the plan.¹ We use the Irish State Administration Database to categorize each actor according to the sector within which they primarily operate (Hardiman et al., 2020²). There are 183 actions detailed in the plan. Many of these actions require several steps to be taken in order to be delivered. For our analysis, a tie exists between two actors if they are responsible for any step that is part of the same action. For example, Table 1 shows that for Action 56 that there are three steps necessary for delivery (left side) and that there are three different actors involved in at least one step of the action (right side). In our network, a network tie is present between each possible pair of the three actors involved in Action 56: (i) Sustainable Energy Authority of Ireland, (ii) Dept. of Housing, Planning and Local Government, (iii) Dept. of Communications, Climate Action and Environment.

In a two-mode network, nodes are divided into two sets X and Y (referred to as modes), where only ties between nodes in different sets are possible. In our analysis, the actors are the first node type, while the actions are the second. As such, we use our data to create an $n \times m$ adjacency matrix where the rows are the 109 actors and the columns are the 183 actions. We multiply this $n \times m$ adjacency matrix by its transpose to construct an 'Actor by Actor' square matrix. In this matrix, the rows and the columns are actors and the cells contain the number of actions that each pair of actors ij are jointly responsible for. In this study, we analyse a binary transformation of this 'Actor by Actor' matrix, where the presence or the absence of the co-responsibility for at least one action between a pair of actors ij is encoded using binary elements.

4.1 | Structural properties

We calculate two statistics for the structural properties of the network: network density and network centralization. Network density is the proportion of the potential ties in a network that are actual ties. The higher the density in a network, the more ties that there are between the network's actors. Network centralization is a measure of the extent to which the actors in a network have a tie or ties with a focal actor or a subset of actors. Network centralization measures range from 0 to 1, where 0 means all actors have the same level of centrality and 1 indicates a maximally centralized network. The more centralized a network, the more centred the actors are around the focal actor/s. We perform conditional uniform graph tests on both statistics to investigate if the network is more/less dense or more/less centralized than would occur by chance.

TABLE 1 Action 56 from the climate action plan

Action 56: All new buildings (public and private) to be near zero energy building (NZEB)	
Steps necessary for delivery	Actors responsible for action
1. Publish methodology for compliance with NZEB in all new buildings	<ul style="list-style-type: none"> - Sustainable Energy Authority of Ireland - Dept. of Housing, Planning and Local Government
2. Implementation of tighter regulations on major renovations <ul style="list-style-type: none"> • Transpose energy performance of buildings directive legislation into law for major renovations and nearly zero energy buildings 	<ul style="list-style-type: none"> - Dept. of Housing, Planning and Local Government
3. Advance performance requirements of building regulations to NZEB standards to facilitate phasing out the installation of oil boilers in new dwellings where feasible	<ul style="list-style-type: none"> - Sustainable Energy Authority of Ireland - Dept. of Housing, Planning and Local Government - Dept. of Communications, Climate Action and Environment

4.2 | Actor centrality

We calculate two measures of network centrality: degree centrality and betweenness centrality. Degree centrality counts the number of ties that an actor has to others in the network and is an indicator of prominence. The betweenness centrality metric is a measure of centrality based on the shortest paths between pairs of actors. Those with higher betweenness centrality scores occupy more linking positions, indicating that they more often act as an intermediary actor or bridge between otherwise unconnected actors. These statistics enable us to ascertain the sector and the level of governance of the most central actors in the network.

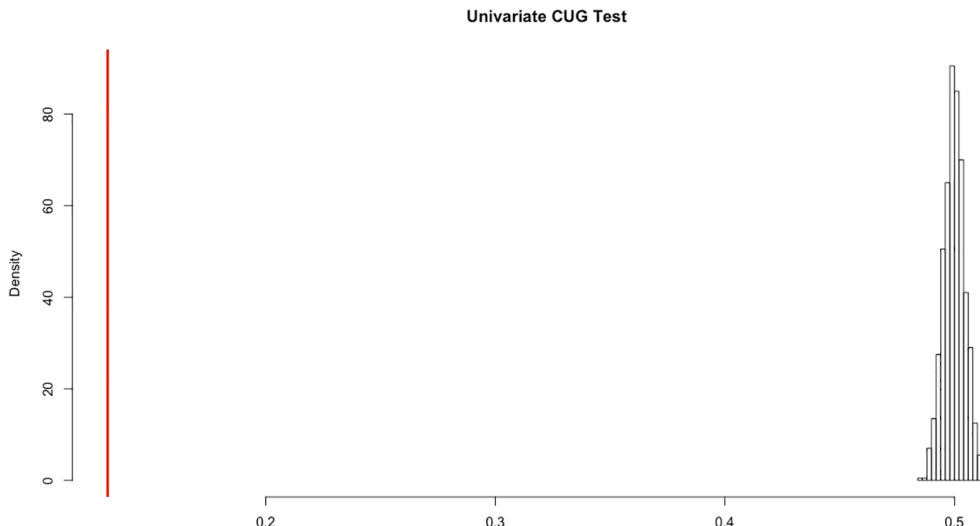
4.3 | Multi-level and cross-sectoral analysis

We use two methods to investigate if actors from the same or different governance levels tend to be co-responsible for the same actions (cross- and multi- level interactions) and if actors from the same or different sectors tend to be co-responsible for the same actions (intra- and cross-sectoral interactions). First, we calculate an E-I Index measure for homophily, which compares internal and external group ties (Krackhardt & Stern, 1988). The index ranges from -1 (complete homophily) to +1 (complete heterophily). We perform permutation tests on the observed E-I values to assess if they are statistically significant. Second, we estimate ANOVA density models to investigate whether the distribution of ties between levels (and between sectors) is uniform or whether there was significant variance in cross-level (cross-sectoral) densities.

5 | RESULTS

The conditional uniform graph tests show that the density of the network (0.13) is lower than would occur by chance (Figure 1) and that the network is more centralized (0.69) than would occur by chance (Figure 2). The network is dominated by national level actors (Table 2), with only one non-national level actor amongst the 10 actors

FIGURE 1 Conditional uniform graph density. Density, controlling for network size [Color figure can be viewed at wileyonlinelibrary.com]



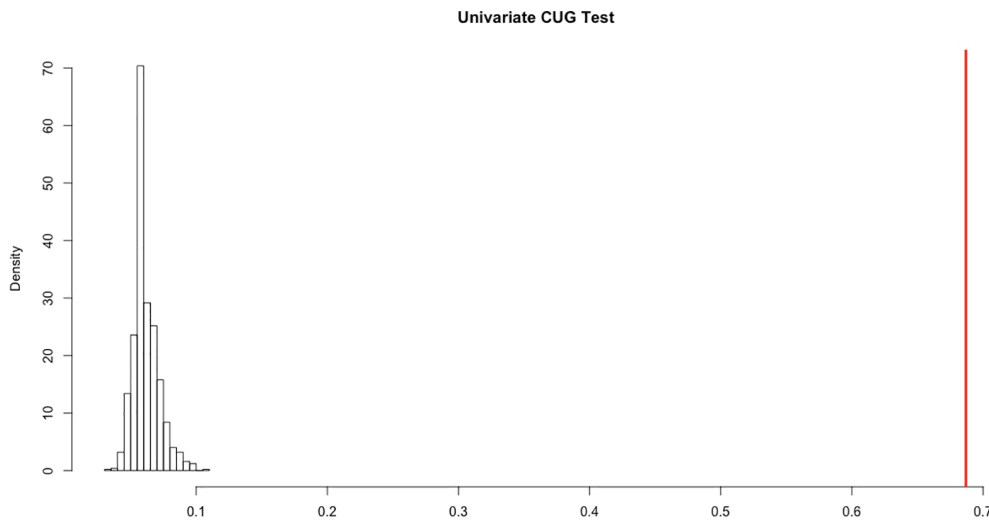


FIGURE 2 Conditional uniform graph test. Degree centralization, controlling for network size [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 2 Actors by governance level

Local	11	9%
Regional	10	9%
National	84	78%
International	4	4%

responsible for the most actions—the local authorities, which encompasses all 31 local councils (Table 3). Actors from just three sectors make up over half the actors in the network (Table 4). The two actors responsible and co-responsible for the most actions are from the Environmental Protection sector (Tables 4 and 5). The same two actors are linked to the most otherwise unconnected actors (Table 6).

Figure 3 shows that the mean degree of actor centrality by governance level decreases from national, to local, to regional and then to international. National level actors are on average co-responsible for more actions than the actors from any other level, and that international actors are co-responsible for the least number of actions. The mean betweenness centrality scores decrease in the same order, indicating that national level actors are on average linking more otherwise unconnected actors than actors from any other level. No international actors link otherwise unconnected actors. National level actors are therefore not only responsible or co-responsible for implementing more of the actions in the plan than others, but they are also the primary bridge between actors at other levels.

Figure 4 shows that the actors with the highest mean degree of actions for which they are co-responsible come from three sectors: Environmental Protection; Agriculture, Fisheries and Forestry; and the Housing and Community Amenities. Actors from the same three sectors also have the highest mean betweenness centrality scores, indicating that they more often than others provide a link between otherwise unconnected actors.

The E-I index for homophilous ties between actors at the same level of governance is -0.417 and statistically significant. This indicates that actors are more likely than chance to share responsibility

for actions with actors that operate at the same level of governance as themselves. Actors at all four governance levels have more ties to those that operate at the same level as themselves than they do to actors at a different level (Figure 5). The results from the ANOVA density model are not significant for any pair of governance levels, indicating that there is no variance in the cross-level densities. This means that there are no two governance levels where the actors therein are more densely connected to one another than the actors in any other two governance levels.

The E-I index for homophilous ties between actors from the same sector is 0.645 and not statistically significant. This indicates that there are not more or less instances of cooperation between actors from different sectors than would occur by chance. The ANOVA density model results are not significant for any pair of sectors, indicating that there is no variance in the cross-sectoral densities. This means that there are not any two sectors that are more densely connected to one another than any other pair. Figure 6 shows the density of the ties between the actors from the 12 different sectors.

The second motivating question of our study concerns how the network is governed. The findings of our network analysis seem to suggest that the Climate Action Plan's implementation network most closely resembles the lead agency governance model described by Provan and Kenis (2008), with the Department of Communications, Climate Action and Environment (which drew up the plan) acting as the network's lead organization. The Department is responsible or co-responsible for more actions than any other actor and acts as an intermediary between more otherwise unconnected actors than any other actor.

However, looks can deceive. As noted above, as part of the governance reforms introduced by the Climate Action Plan, a Climate Action Delivery Board has been established within the Department of the Taoiseach. The stated role of this body is to 'hold each department and public body accountable for the delivery of actions set out in the Climate Action Plan' (DCCA, 2019, p. 37). To fulfil this role, a new Climate Action Unit was established within the Department of the Taoiseach in summer 2019 in support of the Delivery Board

TABLE 3 Actors responsible for the most actions

	No. of actions	Sector	Level
1. Dept. of Communications, Climate Action and Environment	110	Environmental protection	National
2. Sustainable Energy Authority of Ireland	67	Environmental protection	National
3. Dept. of Agriculture, Food and the Marine	44	Agriculture, fisheries and forestry	National
4. Dept. of Housing, Planning and Local Government	43	Housing and community amenities	National
5. Teagasc	28	Agriculture, fisheries and forestry	National
6. Dept. of Transport, Tourism, and Sport	25	Transport	National
7. Dept. of Business, Enterprise and Innovation	23	Enterprise and economic development	National
8. Dept. of Public Expenditure and Reform	22	General public services	National
9. Local Authorities	21	General public services	Local
10. Commission for Regulation of Utilities	20	General public services	National

TABLE 4 Sectors of network actors

Agriculture, fisheries and forestry	8	7%
Education and training	17	16%
Enterprise and economic development	30	28%
Environmental protection	9	8%
General public services	21	19%
Health	1	1%
Housing and community amenities	5	5%
Public order and safety	4	3%
Recreation, culture, religion	2	2%
Science and technology	3	3%
Social protection	3	3%
Transport	7	6%

(Government of Ireland, 2020). This unit plays a central role in monitoring and driving implementation of the actions set out in the Climate Action Plan. This task is carried out through quarterly reporting under which the responsible lead department over each action is required to provide an update on delivery and/or report on any delays. Under the system developed, responsible lead departments are required to provide regular indications of progress throughout the quarter, anticipating any challenges to timely implementation. This is followed by ongoing interaction between the Department of the Taoiseach's Climate Action Unit and the relevant lead department until the end of the quarter and the escalation of issues through relevant government structures (including the Climate Action Delivery Board and the relevant Cabinet Committee) in a bid to unblock any implementation challenges experienced. The Climate Action Unit is responsible for collating updates and publishing the quarterly implementation reports (Department of the Taoiseach, 2019).

Because of the central role of the Department of the Taoiseach in driving implementation through monitoring, reporting, and facilitation, we characterize the network structure not as a lead agency governance model but rather as a network administrative organisation (NAO) model. As discussed above, the NAO model is similar to the

lead agency model, the main difference being that the NAO is not a key member of the network that they manage. This captures well the role that the Department of the Taoiseach plays in seeing the plan implemented. It is responsible for very few actions in the Climate Action Plan, the majority of which concern how the plan is governed. For example, Action 2—the establishment of the Climate Action Delivery Board—is central to the governance of the policy implementation network.

6 | DISCUSSION

Since the adoption of the 2015 Paris Climate Accord, nation states have become the key arena where actions to reduce global greenhouse gas emissions are devised and taken. Under the agreement, signatory countries are obliged to set out their nationally determined contributions to reducing global GHG emissions. To meet the multi-level and cross-sectoral climate governance challenge (Gupta, 2007), national governments will need to involve public, private and third sectors actors in the integration of climate policies into the sectors in which they operate (van Asselt et al., 2015). Where a network has been formed to implement national climate policies, the characteristics of the members of that network, the nature of the relationships among the network actors, and how their actions and interactions are governed will shape how the network functions and how it performs (Sandström & Carlsson, 2008).

The network literature usually argues that successful collective action is more likely when network density is higher. This is because when actors have more ties to others, it is assumed that they are more likely to stay engaged in resolving whatever problems that they are jointly addressing (Goldsmith & Eggers, 2004). However, in a network where the number of interactions among actors is low, such as that which is analysed here, the presence of a central actor with the responsibility for network management, such as the Department of the Taoiseach in the NAO role, can reduce opportunistic behaviour while also combatting apathy and fatigue by monitoring and coordinating the activities of actors (Emerson et al., 2012; Provan &

**TABLE 5** Ten most central actors (co-responsibility)

Actor	Co-responsible	Sector	Level
1. Dept. of Communications, Climate Action and Environment	87	Environmental protection	National
2. Sustainable Energy Authority of Ireland	85	Environmental protection	National
3. Dept. of Housing, Planning and Local Government	60	Housing and community amenities	National
4. Dept. of Agriculture, Food and the Marine	59	Agriculture, fisheries and forestry	National
5. Environmental Protection Agency	48	Environmental protection	National
6. Dept. of Business, Enterprise and Innovation	48	Enterprise and economic development	National
7. Local Authorities	45	General public services	Local
8. Dept. of Transport, Tourism, and Sport	37	Transport	National
9. Teagasc	36	Agriculture, fisheries and forestry	National
10. Enterprise Ireland	36	Enterprise and economic development	National

Note: The number of other actors with which they share responsibility for implementing an action. Multiple actors can be responsible for an action. Nine in the case of Action 38.

TABLE 6 Ten most central actors (normalized betweenness centralized)

Actor	Betweenness	Sector	Level
1. Dept. of Communications, Climate Action and Environment	0.254	Environmental protection	National
2. Sustainable Energy Authority of Ireland	0.195	Environmental protection	National
3. Dept. of Agriculture, Food and the Marine	0.085	Agriculture, fisheries and forestry	National
4. Dept. of Housing, Planning and Local Government	0.073	Housing and community amenities	National
5. Dept. of Transport, Tourism, and Sport	0.050	Transport	National
6. Local Authorities	0.040	General public services	Local
7. Dept. of Business, Enterprise and Innovation	0.039	Enterprise and economic development	National
8. Environmental Protection Agency	0.036	Environmental protection	National
9. Teagasc	0.032	Agriculture, fisheries and forestry	National
10. National Transport Authority	0.026	Transport	National

Kenis, 2008). Indeed, networks can be more effective at meeting their objectives when they are centralized and not densely connected (Provan & Milward, 1995). This is because densely connected networks that are also highly centralized can be inefficient because of the amount of time, effort, and resources that are used to build and maintain redundant connections. That said, a highly centralized network that in theory is conducive to efficient coordination might still fail to address the policy problem for which it was constituted if the network manager shows little interest in doing a good job (Bodin, 2017).

Figure 7 shows the governance level of the actors involved in the implementation of the actions outlined in each of the plan's 13 policy areas. The Agriculture, Forestry and Land Use section of the plan is the only area where actors from all governance levels are involved. The actions in the Citizen Engagement section of the plan involve both the most local and the most regional actors, while the actions in the Built Environment section of the plan involves the most national level actors. There are three sections where only national level actors are involved: Where We Stand; Governance of the Challenge; and International Action.

Our analysis shows that actors in the network tend to have more within-level than cross-level ties. These results are similar to those of studies that have analysed the structure of environmental governance networks (Hamilton et al., 2018, 2020). When actors primarily engage with other actors that operate at the same governance level as themselves, they can focus on the issues that are more salient than the issues being addressed at higher or lower levels (Hamilton et al., 2018). This also contributes to the creation of the bonding ties that generate the social capital that is crucial for successful collective action (Berardo, 2014). While cross-level collaboration is a necessary condition for effective multi-level governance, it is not sufficient. Fruitful cooperation between actors operating at different governance levels is also necessary. Networks with structures that create both bridging and bonding social capital have been found to better enable collective action (Agnitsch et al., 2006). Actors that connect across levels by circulating or distributing knowledge and material resources throughout the network play a crucial role in how well a network functions (Cash et al., 2003; Di Gregorio et al., 2019; Lemos & Morehouse, 2005). Two national level organizations—the Sustainable

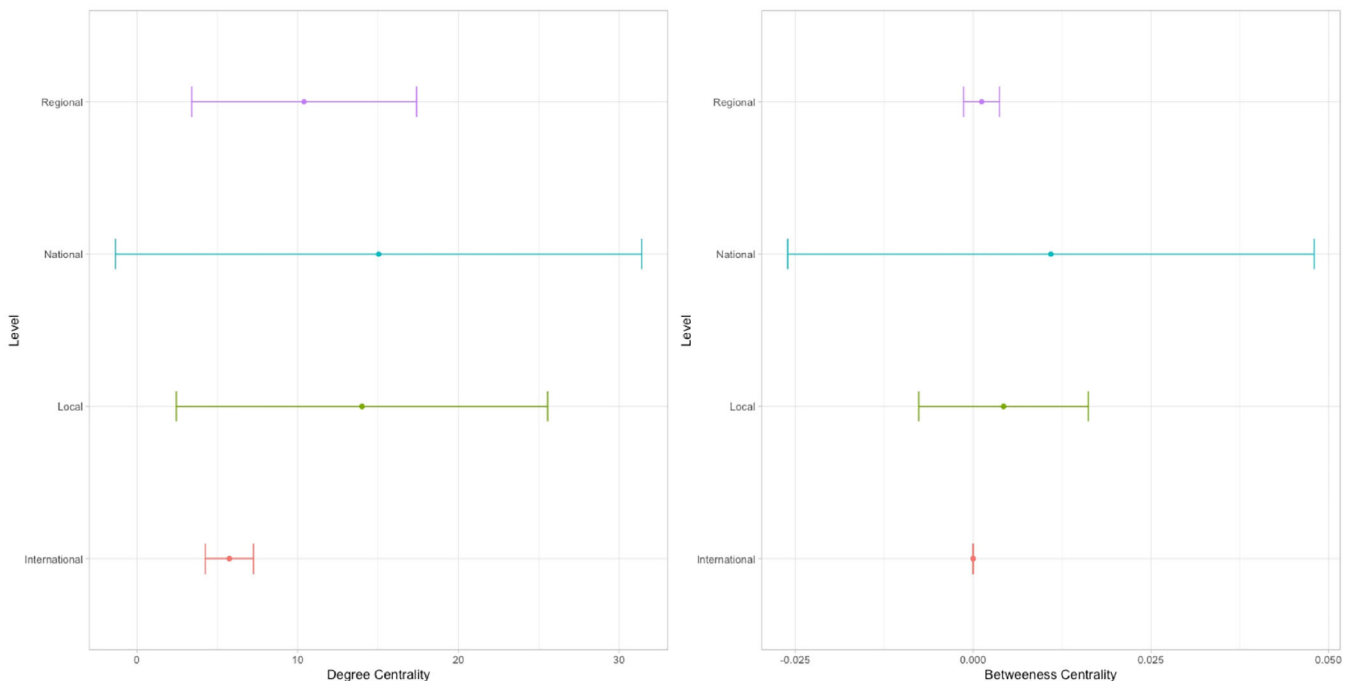


FIGURE 3 Mean and standard deviation of centrality by governance level [Color figure can be viewed at wileyonlinelibrary.com]

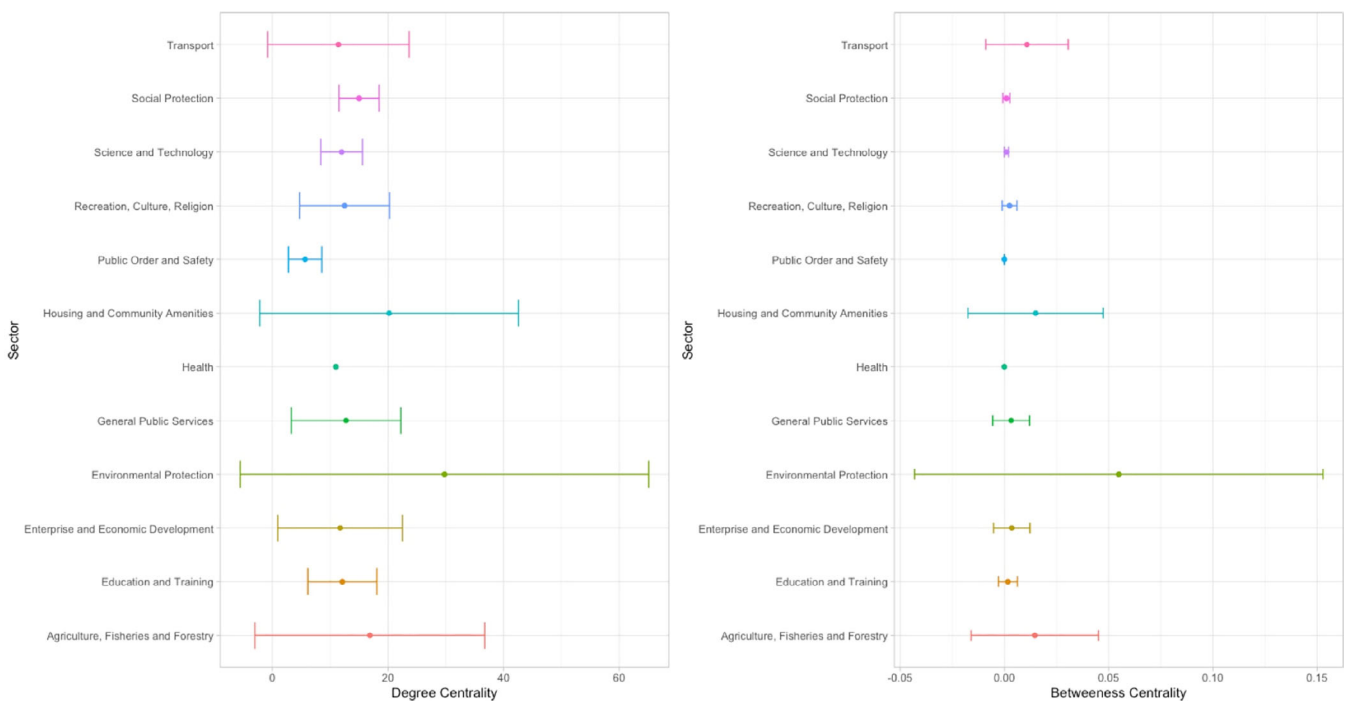


FIGURE 4 Mean and standard deviation of centrality measures by sector [Color figure can be viewed at wileyonlinelibrary.com]

Energy Authority of Ireland and the Department of Communications, Climate Action and Environment—are most often in the position of being a bridge between pairs of actors at different governance levels, filling what are known as structural holes in network theory (Burt, 1992). As such, these two actors play a pivotal role in circulating resources throughout the network and in communicating knowledge

learned during policy implementation to the NAO. Due to their network position, the learning that they engage in, and which they facilitate, can contribute positively to helping the network achieve its objectives. The two actors can play a key role in building trust (Luo, 2005), in managing conflict (Sabatier & Jenkins-Smith, 1993), and in ensuring that actors keep working together towards achieving the network's goals.

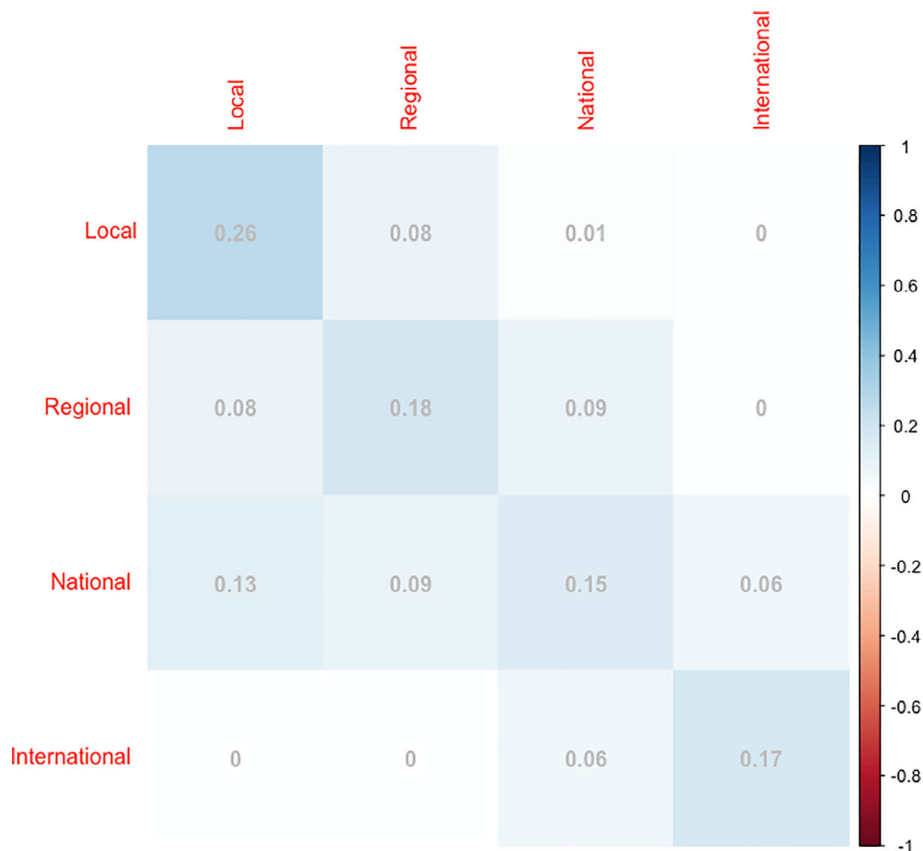


FIGURE 5 Density of ties between actors at different governance levels (ANOVA density model results are not significant for any pair of governance levels) [Color figure can be viewed at wileyonlinelibrary.com]

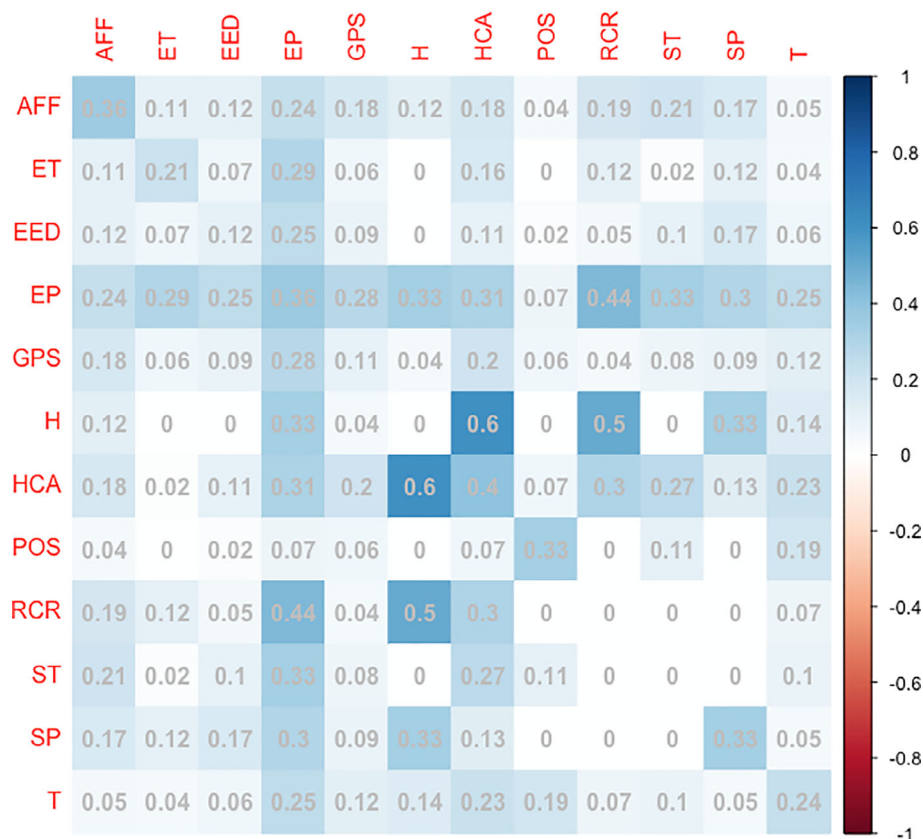


FIGURE 6 Density of ties between actors by sectors (ANOVA density model results are not significant for any pair of governance levels). AFF, agriculture, fisheries and forestry; EED, enterprise and economic development; EP, environmental protection; ET, education and training; GPS, general public services; H, health; HCA, housing and community amenities; POS, public order and safety; RCR, recreation, culture, religion; S&T, science and technology; SP, social protection; T, transport [Color figure can be viewed at wileyonlinelibrary.com]

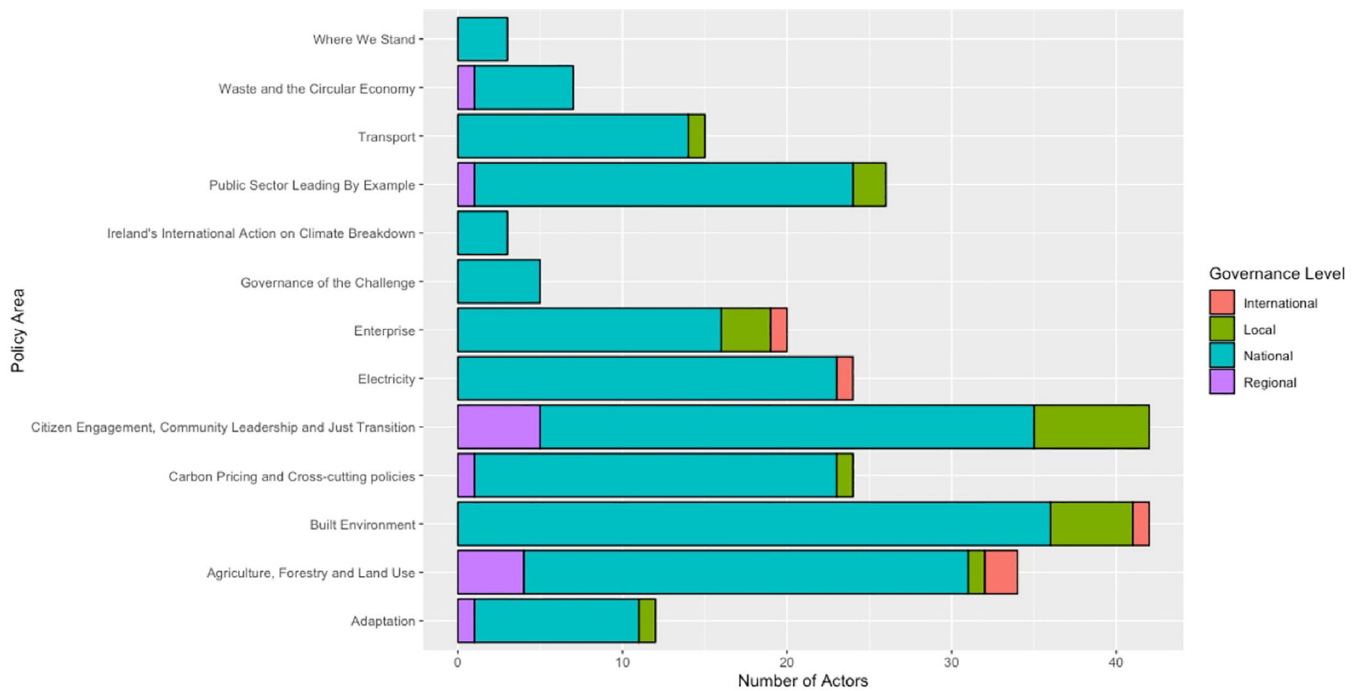


FIGURE 7 Policy sector of actions and the governance level of the actors involved in their implementation [Color figure can be viewed at wileyonlinelibrary.com]

Tackling tough problems like climate change in a way that achieves beneficial community outcomes often requires that actors from multiple sectors collaborate with one another (Bryson et al., 2006; Rethemeyer, 2005). However, cross-sectoral collaboration does not guarantee success (Andrews & Entwistle, 2010) and organizations from different sectors are usually better off only engaging in collaborative behaviour when it enables them to achieve some outcome that could not be achieved by working alone (Bryson et al., 2015). In the network analysed in this study, there is not more cross-sectoral responsibility for actions in the plan than would occur by chance. There is also no set of actors from any two sectors that are more often responsible for the same actions than there are from any other two sectors. Notwithstanding these observations, 82% of all the actions in the plan do involve actors from at least two different sectors (Figure 8). Actions related to the Built Environment involve actors from the greatest number of sectors—all except Public Order and Safety. The implementation of Built Environment actions also involves the joint largest number of actors, alongside the Citizen Engagement policy area, which involves actors from eight different sectors. Four other policy areas involve actors from eight different sectors: Adaptation; Agriculture, Forestry and Land Use; Carbon Pricing and Cross-cutting Policies; and Electricity. Actions related to Where We Stand and to Ireland's International Action on Climate Breakdown involve the fewest number of actors, while actions related to Where We Stand and to the Governance of the Challenge involve actors from the fewest number of different sectors.

Cross-sectoral collaboration is more likely to be successful when individual actors are tied to one another through multiple linking mechanisms (Bryson et al., 2006), such as bridging actors and having a

shared responsibility for specific tasks (Logsdon, 1991). Conversely, success is much less likely when there is no agreement on task allocation or a shared understanding of the purpose of collaboration (Huxham & Vangen, 2005). The Climate Action Plan assigns responsibility for specific actions in the plan to specific actors, which favours the likelihood of successful instances of cross-sectoral collaboration. The two bridging actors in the network, identified above, come from the Environmental Protection sector. The interests of this sector are often portrayed as being at odds with those of actors from the industrial, agricultural or transport sectors. As such, how successfully actions that require cross-sectoral collaboration will depend to some degree on how well these two bridging actors can contribute towards building trust among actors from sectors that may not trust one another (Human & Provan, 2000) and in helping actors understand that successful implementation of the plan is in both their and the public's interest (Bryson et al., 2015).

That the Climate Action Plan is dominated by national level actors is not surprising given that Ireland is one of the most centralized states in Europe, with local or regional actors having few responsibilities or resources. A policy developed to address climate change needs to take seriously the multi-level nature of the problem (Hanssen et al., 2013). A policy implementation network dominated by national level actors gives disproportionately less power to local actors, distances those responsible for action from local communities, makes it more difficult for those geographically distant from the centre of power to hold accountable those in charge and is less likely to be able to address the heterogeneous preferences of citizens. Policymakers might consider how having so few non-national level actors involved in the plan impacts on its proposal to substantially increase public

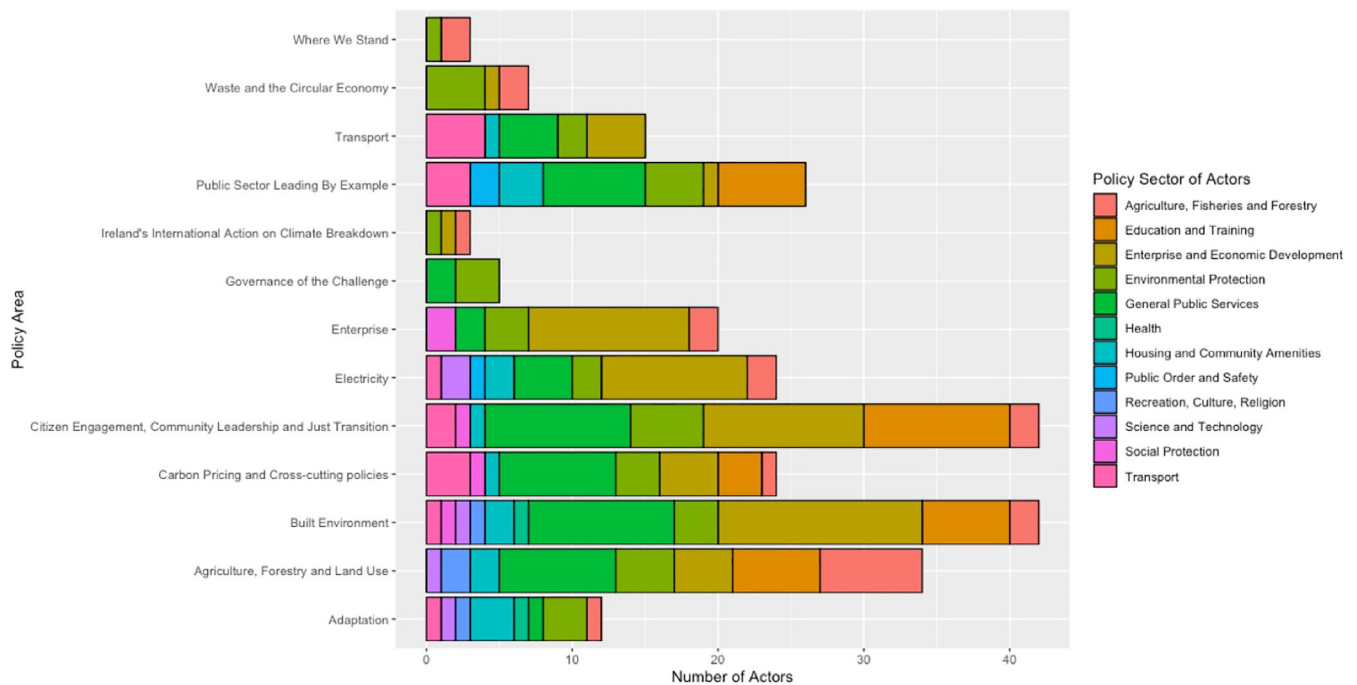


FIGURE 8 Policy sector of actions and the sector of the actors involved in their implementation [Color figure can be viewed at wileyonlinelibrary.com]

engagement with climate change, particularly, in relation to its plan to establish initiatives to educate, engage, motivate, and empower people to take climate action. That there are not more interactions between actors from different sectors than would occur by chance is perhaps less of a problem, especially when we consider that nearly of all the actions in the plan do involve actors from at least two sectors. If not the case already, it might make sense to re-examine all the actions in the plan to determine if there are any that could be more effectively implemented if actors from sectors not already involved in their implementation were brought on board.

7 | CONCLUSION

This paper analysed the Irish Climate Action Plan as a policy implementation network to develop our understanding of the multi-level and cross-sectoral nature of these types of networks. It approached this task by asking: (i) What are the characteristics of the members of the network and how are the relationships among them structured? (ii) How is it governed? We applied network methods to ascertain the extent to which the plan is an exercise in multi-level and cross-sectoral policy implementation and to uncover the governance levels and sectors from which the most central actors in the network operate. With this understanding of the network's structure, we then considered which mode of governance (Provan & Kenis, 2008) best describes how the network is governed, concluding that it is governed by network administrative organisation (NAO). We acknowledge that understanding a policy implementation network involves more than just mapping and analysing the relationships among the actors

involved in the plan. Nevertheless, we contend that analysing these relations is an important first step for understanding a network's structure and for determining how the activities of participating actors might be monitored, coordinated and managed. It also allows us to reflect on the likelihood of the plan successfully meeting its stated objectives.

This paper's most significant contribution to the literature on environmental governance is its conceptualization and analysis of a policy implementation network as a multi-level and cross-sectoral phenomenon. We argue that taking this perspective better equips us to understand inter-actor power relations and how these affect the responsibilities, challenges and opportunities of the actors involved in the implementation of a public policy.

The literature on policy implementation networks offers some hints about the likely performance of a network constituted and governed as the one analysed here. The stable structure of NAO-governed networks makes them the most effective for guiding the behaviour of network actors and for limiting the extent to which actors pursue their own interests, thereby improving the chances that it achieves its goals (Provan & Kenis, 2008; Rodriguez et al., 2007; Røiseland, 2011). These networks are also best placed for managing the tensions of internal/external legitimacy and efficiency/inclusiveness (Provan & Kenis, 2008). NAOs can strike a balance between the tension between internal and external legitimacy by organizing and overseeing the actions and interactions among network actors, while simultaneously taking on the role as the public face or representative of the network. The NAO (Department of the Taoiseach) responsible for governing the Climate Action Plan is therefore more likely to see the plan achieve its objectives if it can obtain the support and

approval of both the public and the network actors. NAO-governed networks are also best suited for managing the tension between the need for both network diversity and unity, which it can achieve by integrating and coordinating the actions of network members (Saz-Carranza & Ospina, 2011). By occupying the NAO role, The Department of the Taoiseach is using its position and authority to instigate a new level of climate policy integration in Ireland (van Asselt et al., 2015). It is overseeing changes in organizational behaviours through administrative coordination and is pushing for the successful implementation of the plan by managing the publication of quarterly progress reports. It is noteworthy in this regard that the NAO in this case is the Department of the Taoiseach rather than the Department of Environment, Climate and Communications. As a more central and powerful actor, the Department of the Taoiseach is arguably better placed to undertake this NAO role, which may lead to a stronger version of climate policy integration. It is not possible on the basis of our analysis to reach such a conclusion, but this topic is worthy of further investigation.

Perhaps the most notable limitation of this study is that the relationships between actors in the implementation network are conceptualized and measured as binary phenomena, that is, they are either present or absent. As a result, similarly to other studies that analyse network ties as being binary, we do not consider the qualitative differences in the nature of the relationships between different pairs of actors. However, the nature of the relationship between any pair of actors in the network can be understood by consulting the Climate Action Plan, where the reason for the relationship between each pair of actors is described in detail.

The nature of our study—being a single case study—means that any attempt at generalizing from our findings should be undertaken with caution. Indeed, Ireland is distinctive in several important respects. As noted above, Ireland is a highly centralized state with comparatively weak structures for local government (Dekker, 2020). In a climate change context, Ireland's GHG emissions profile is also highly unusual, with agriculture accounting for 35% of total emissions in 2019 (EPA, 2020). New Zealand is the only other developed country with such a high share of GHG from agriculture. For historical and cultural reasons including stemming from Ireland's late industrialization, the agricultural sector wields political clout arguably disproportionate to its importance to the contemporary economy. These factors combine to create particularly challenge context for the governance of climate change.

In order to overcome the limitations of a single country case study, future research could compare several countries to investigate whether certain kinds of climate policy implementation structures produce more successful policy outcomes than others. To the extent that these structures consist of policy implementation networks, the combination of the network methods and theoretical insights on the cross-sectoral and multi-level nature of these networks we have developed in this paper can be used in such studies. While comparative studies on networks involved in formulating national climate change policies do exist (Kammerer et al., 2021; Ylä-Anttila et al., 2018), we are not aware of

comparative research on networks involved specifically in climate policy implementation. Undertaking such research would help in assessing whether the network properties we found in Ireland (dominance of the national level, relatively low cross-sector collaboration, NAO leadership) are a product of the specificities of the Irish context (e.g., the centralized nature of the institutional structure there) or whether they characterize climate policy implementation networks more generally.

In June 2020, a new Irish government was formed, with the leader of the Green Party, Eamon Ryan, being appointed as Minister for the Environment, Climate and Communications. In late March 2021, his department published a Climate Action Bill that commits Ireland to a 51% reduction in emissions by 2030 and to carbon neutrality by 2050. Alongside this, a public consultation was launched to prepare a new Climate Action Plan, which will set out the actions to be taken to meet the emissions reductions targets. Those responsible for developing the new plan should consider how the structure of the cross-sectoral and cross-level ties in the network can contribute to meeting the NAO's governance challenge of managing and improving climate policy integration in Ireland.

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ENDNOTES

- ¹ There are actions in the plan where all the country's local authorities are named as being responsible for their implementation. As such, we treat local authorities as one single actor in cases where they are not named individually.
- ² In the Irish State Administration Database, they are referred to as policy domains. We refer to them here as sectors to differentiate them from the climate policy domain, which encompasses all these domains to some degree.

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