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# A matter of information – The influence of international bureaucracies in global climate governance networks

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## Abstract

International bureaucracies, also called International Public Administrations (IPAs), have been identified as potentially influential actors within the global climate change regime complex. To assess how these organizations exert influence, scholars have predominantly relied on case studies, interviews and descriptive (network) statistics. This article aims to contribute to this literature with a systematic analysis that is not limited to an organization, issue or region, but applies exponential random graph models (ERGMs) to data from an original large-N survey (n=342) of participants of global climate negotiations. Our findings indicate that IPAs have a considerable potential to influence global climate policy outputs. This potential influence is associated with the information they provide to regime stakeholders.

**Key words:** climate change, international organizations, International Public Administrations, UNFCCC, exponential random graph models (ERGMs), egocentrically sampled network data.

## Highlights

- International bureaucracies exert influence in the global climate governance network
- IPAs' influence in the network is strongly associated with the information they provide to other actors in the global climate change regime complex.
- ERGMs based on egocentrically sampled data are a useful technique to examine the influence of IPAs

## **Introduction**

Multilateral negotiations between states lie at the centre of the global climate policy regime, but over the last decade a diverse set of non-Party stakeholders (NPS), that is, institutions and actors, operating at different levels and across various geographical areas and sectors, have become involved in the governance of climate change (Keohane and Victor 2011; Abbott 2012; Jordan et al. 2015). Thus, the multilateral negotiations under the United Nations Framework on Climate Change (UNFCCC) are now embedded in a broader climate governance architecture that comprises “state and non-state actors, transnational networks, intergovernmental institutions and regime complexes” (Biermann and Kim 2020). The defining characteristic of this new governance architecture is the network-like relations between the different actors and institutions (Bulkeley et al. 2012; Cao and Ward 2017; Kalfagianni, Partzsch, and Widerberg 2020).

Within this context, the secretariats of International Organizations (IOs), also referred to as International Public Administrations (IPAs) or international bureaucracies, have long been ignored in their role as autonomous political actors. Since the late 1990s, however, IPAs have received increasing scholarly attention (Eckhard and Ege 2016; Trondal 2016; Bauer, Knill, and Eckhard 2017). Whereas an IO can be defined as “an institutional arrangement that combines a normative framework, member states, and a bureaucracy” (Biermann et al. 2009b: 39), IPAs are the bureaucratic core of IOs or, in other words, “the hierarchically organized administrative units [of IOs] composed of a multinational staff with competing national and international loyalties” (Biermann 2017: 247). Although they are an integral part of IOs, IPAs have been identified as political actors in their own right (Jinnah 2014: 21) and as autonomous and influential players within the field of environmental and climate governance (Biermann and Siebenhüner 2009; Busch 2009; Jinnah 2011; Jörgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017; Michaelowa and Michaelowa 2017; Saerbeck et al. 2020).

The IPA that lies at the center of the global climate governance network is the UNFCCC secretariat. The United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) are other IPAs that have been found to be central actors within this network (Saerbeck et al. 2020). Occupying central positions in networks is commonly associated with a high potential for exerting influence over the network (Freeman 1977). IPAs are thus increasingly recognized as important actors within global climate policy

– however, much of the empirical evidence on the ways in which IPAs exert influence is derived from qualitative case studies, using interviews or document analysis.

In this research, the information provided by IPAs to other stakeholders has been identified as the primary mechanism through which IPAs can impact global policymaking processes (Barnett and Finnemore 2004; Biermann and Siebenhüner 2009; Eckhard and Ege 2016; Jörgens, Kolleck, and Saerbeck 2016; Busch and Liese 2017). Their expertise is used by other actors to inform policymaking processes, to legitimize certain policy decisions, or to substantiate policy positions (Barnett and Finnemore 2004; Littoz-Monnet 2017). Unique bureaucratic knowledge is thus assumed to constitute one of the main resources through which IPAs can exert influence within global governance networks (Hirschmann 2012; Johnson and Urpelainen 2014). Building on Resource Dependency Theory (Pfeffer and Salancik 1978), which posits that actors engage in collaboration to secure external resources, we argue that information is the main resource that IPAs can provide to other stakeholders in the regime. Consequently, we test whether the potential influence of IPAs in global climate governance networks is associated with the policy-specific information they provide.

This article adds to the literature in several ways. On the one hand, previous research has relied mainly on document analyses, interviews and descriptive (network) statistics to identify whether and how IPAs exert influence within the climate change regime (Busch 2009; Jinnah 2014; Jörgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017; Saerbeck et al. 2020). Moreover, most of this research focused on one organization (usually the UNFCCC secretariat), one geographical region or a specific issue area within the climate change regime. Hence, there is a lack of comprehensive empirical research on how IPAs as a distinct category of actors exert influence within the global climate governance network. To address this lacuna, we use an inferential network analytical approach to study the role of information within the climate regime.

A major challenge for inferential network analyses on a global scale is that these usually require complete or almost complete network data. We aim to overcome this issue by using an approach developed by Krivitsky and Morris (2017) that allows the use of egocentrically sampled data for exponential random graph models (ERGMs). Our aim, therefore, is to apply a methodological innovation from the SNA field to the field of global climate governance and international public administration, where SNA studies are still rare. Our analysis is based on a data set that was generated through a large-N survey (N=342) with participants as well as NPS of the annual climate change negotiation in 2015, the 21<sup>st</sup> Conference of the Parties (COP21).

Based on the survey responses, we obtained a collaboration and an information network, which form the base of our analysis.

The remainder of this article is structured as follows. In the next section, we briefly describe the evolution of the global climate governance network and the role of international bureaucracies within the regime. We then discuss how information can be used as a resource to gain influence. In section four, we describe our data set based on a large-N survey and our methodological approach. This is followed by the result of our ERGMs. The article concludes with a discussion of our findings, limitations, and directions for future research.

### **International bureaucracies in global (climate) governance**

There is little doubt that policies to tackle climate change must go beyond action at the national level (Stavins 1997; Aldy and Stavins 2009). Global collaboration between actors is considered crucial for an effective response to climate change (Keohane and Victor 2016). Over the last decades, the global climate change regime has undergone important changes (Andonova, Betsill, and Bulkeley 2009), making its collaboration patterns more complex.

The regime has evolved from a multilateral system, centered on nation states, to one that includes a wide range of NPS, such as businesses, multilateral banks, civil society organizations, international organizations and their bureaucracies as well as cities and regions (Biermann et al. 2009a; Keohane and Victor 2011; Abbott 2012). Due to the growing involvement of NPS, the climate regime has been characterized as a transnational, rather than intergovernmental, regime complex (Abbott 2012; Bulkeley et al. 2012). However, this transnational aspect of the climate regime is not completely detached from the intergovernmental one under the UNFCCC (Betsill et al. 2015; Lövbrand, Hjerpe, and Linnér 2017). The Paris Agreement, for example, links the two spheres by welcoming actions from NPS (UNFCCC 2015). Due to the multiplicity of actors and its non-hierarchical structure, the climate regime complex is often described as a network (Andonova, Bulkeley, and Betsill 2007; Pattberg and Stripple 2008; Bulkeley et al. 2012; Cao and Ward 2017; Tosun and Schoenefeld 2017). In this network, state actors, NGOs, businesses, research organizations, international organizations/bureaucracies, etc. represent the nodes while the collaboration that occurs among them can be conceived of as the network's ties.

Only recently have scholars focused on the role of IPAs within the climate policy network and their influence on the formulation and implementation of strategies to tackle climate change (Depledge 2007; Busch 2009; Jörgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017; Hickmann et al. 2021). Studies in the fields of International Relations and Public Administration (PA) found that IPAs can exert an autonomous influence on global policymaking and need to be taken into account in order to properly understand global policymaking (Barnett and Finnemore 2004; Yi-Chong and Weller 2008; Biermann and Siebenhüner 2009; Trondal 2011; Busch 2014; Widerberg and van Laerhoven 2014; Eckhard and Ege 2016; Bauer, Knill, and Eckhard 2017). In contrast to the ‘traditional’ IR literature which conceptualized IPAs as servants of nation states, IPA scholars argue that by influencing the broader normative environment in which states operate, IPAs can affect state interests and identities (Biermann 2017: 256). Moreover, they develop their own policy preferences and act strategically to influence global policy outputs in line with these preferences (Ness and Brechin 1988; Jinnah 2014; Kolleck et al. 2017). Prior to this “organizational turn” in international relations theory (Ellis 2010), the potential influence of international bureaucracies in global policymaking had been neglected or conceived of as merely an administrative one that involved “distributing documents, organizing conferences or maintaining websites” (Jinnah 2014: 21).

From an institutionalist perspective, IOs and their bureaucracies can enhance collaboration within regimes (Keohane 1984). More recently, they have been described as the “institutional grid in global governance” (Ege 2020, 577). They facilitate the negotiation and domestic implementation of international agreements by reducing transaction costs, improving access to information, and monitoring behavior (Keohane 1984; Abbott and Snidal 1998). The growing complexity of the global climate regime and its transnationalization has made their tasks and roles even more multifaceted.

IOs and their bureaucracies are now frequently referred to as “orchestrators” that support transnational organizations by steering them through soft modes of governance, such as incentives or persuasion towards a governance goal (Abbott 2012: 587; Hickmann et al. 2021). Among the most prominent examples in global climate policy, the UNFCCC secretariat has been conceptualized as an orchestrator of climate action as it strategically interacts with national governments and NPS to raise the level of ambition of national climate policies (Hickmann et al. 2019, 3). As orchestrators, IPAs can integrate non-state actors into the multilateral negotiation process, which makes them important collaboration partners for NPS. In addition, they still assist nation states with various matters regarding the negotiations. Therefore,

international bureaucracies are the point of reference for many (state and non-state) actors in the regime, which makes them a preferred source of policy-relevant information for these actors.

Based on this global climate governance and public administration literature, we derive our first hypothesis:

**Hypothesis 1:** Within the global climate governance network, which is comprised of various types of actors, IPAs are more likely than other actor types to be part of a dyad.

### **Information as a resource**

Many factors can help explain an IPA's influence on global policymaking. IPA scholars identified various external and internal determinants. The most important external factors are the policy domain in which an IPA operates and the capability of nation states to control the actions of international bureaucracies (Eckhard and Ege 2016). In highly politicized policy areas (as opposed to more technical ones), it is more difficult for IPAs to exert autonomous influence on policy outputs (see, Copelovitch 2010; Hanrieder 2014). Strong control mechanisms put in place by nation states are also associated with less influence of international bureaucracies (Best 2012; da Conceição-Heldt 2013). Thus, as the field of global climate change became increasingly politicized during the negotiations of the Paris Agreement in 2015, IPA influence became less likely. Moreover, the climate change secretariat, which is the most important IPA within the climate regime, has quite a narrow mandate (Busch 2009; Hickmann et al. 2021). These external determinants would suggest that IPAs have rather limited influence within the climate change domain.

On the other hand, studies have shown that internal characteristics of international bureaucracies, such as senior leadership and the level of expertise and authority, also affect an IPA's potential to exert influence (Barnett and Finnemore 2004; Biermann et al. 2009b; Busch and Liese 2017; Littoz-Monnet 2017). Barnett and Finnemore (2004) argue that the ability to produce and control knowledge is one of the great resources of international bureaucracies. Using several case studies of international environmental bureaucracies, Biermann and Siebenhüner (2009) also find that knowledge plays a crucial role in how IPAs exert influence.

The information IPAs provide can take on different forms. On the one hand, they possess deep knowledge about the institutional processes within "their" multilateral treaty system and can

therefore be considered its institutional memory (Bauer 2006). On the other hand, their longstanding issue-specific technical and legal expertise constitutes an authoritative source of information within the regime (Barnett and Finnemore 2004; Derlien, Böhme, and Heindl 2011). By sharing information and expertise with various stakeholder groups, IPAs can help these actors to get access to the negotiation process. In a recent study of the UNFCCC secretariat, Hickmann et al. (2021) refer to this as facilitative orchestration. This type of orchestration is softer than other orchestration and relies on governance mechanisms such as knowledge production and the diffusion of relevant information (Abbott 2009). For example, by providing information about the timing and the agenda of intergovernmental negotiations to environmental NGOs, IPAs can help these NGOs to develop better and more targeted advocacy strategies. This can be considered an indirect influence of IPAs by enabling other actors to engage in the process. Moreover, IPAs have considerable experience and can provide technical and scientific information, as for example UNEP provides with their “Emissions Gap Reports”, where they review the emissions reduction progress. With these reports, IPAs can influence how the problem itself, its urgency and the range of potential solutions are perceived by other stakeholders, thereby stimulating new discourses and new actions.

A combination of the literature on information-based orchestration and resource dependency theory (RDT) (Pfeffer and Salancik 1978) can help us develop a better theoretical understanding of why organizations in the global climate policy regime cooperate with each other. According to RDT, actors engage in collaboration with those actors which they perceive to have important political resources. They do so in order to maximize their own access to these resources (Henry 2011). From an RDT perspective, an IPA’s issue-specific expert knowledge is an immaterial resource that can increase other actors’ willingness to cooperate with this organization (Biermann and Harsch 2017; Biermann and Koops 2017). In line with recent empirical research on IPAs, we thus expect that it is the issue-specific expert knowledge of IPAs in the climate change regime that increases their attractiveness as collaboration partners for other types of actors (Yi-Chong and Weller 2008; Biermann and Siebenhüner 2009; Johnson and Urpelainen 2014; Littoz-Monnet 2017).

Our second hypothesis therefore aims to test whether information provision is the mechanism through which IPAs can exert influence in the climate governance network.

**Hypothesis 2:** The less actors value the information provided by other actors, the less likely they are to be part of a dyad in the collaboration network.



This second hypothesis suggests that it is not only the actor type that determines an organization's centrality in the collaboration network, but also the degree to which other actors regard the information provided by an organization as useful and trustworthy. If many others perceive information from an actor as useful, this can create a prestige effect that increases the likelihood that organizations will work with that actor (e.g. Gest and Grigorescu 2010).

Scholars thus far have predominantly relied on qualitative methods, based on interview data, document analysis and participant observations, or on descriptive (network) statistics to explore how IPAs influence international climate policies. We aim to contribute to this emerging literature by testing whether IPAs' influence within networks can be explained through their unique bureaucratic knowledge, using an inferential network analysis approach.

## **Data and methodological approach**

### **Data**

Data for this study were obtained from an original survey with participants of COPs. Although COPs are not the only venue where stakeholders of the global climate governance regime meet, they can be considered the most important annual events in this context. Moreover, stakeholders participating in other events, such as the climate week, G20 meetings, etc., are also likely to take part in the annual COPs. Hence, the COP participant lists offer the most comprehensive account of stakeholders in the global climate change regime. Important stakeholders were thus identified using the participant lists and through a follow-up one-wave snowball sampling with actors who were named by respondents during the first round. In total, the online survey was sent to 2,474 stakeholders, 342 (13.8 per cent) of whom answered the subsequent questions. Respondents could access the survey from October 2015 to March 2016 (for more details see, Saerbeck et al. 2020; Saerbeck et al. forthcoming).

Our analysis is based on the following two survey questions:

- Which organizations did you cooperate closely with regarding topics discussed under the UNFCCC during the last 12 months?
- Which organizations did you receive trustworthy information from during the last 12 months?

These questions were used to obtain a network on collaboration and another on information exchange. Our aim is to test whether actors' popularity in the information network (measured

through indegree centrality) can help explain patterns of the collaboration network because we expect information to be the main resource that makes IPAs important collaboration partners. Whereas the information network is directed, we consider the collaboration network to be undirected since “collaboration as a social fact is, per se, undirected” (Ingold and Leifeld 2014: 13). If the research interest is to identify differences in perceived collaboration intensity by two actors, collaboration can also be considered as directed. In this study, we are more interested in collaboration patterns without further qualification of the kind of collaboration and therefore treated the ties as undirected. We added the term “closely” to obtain only those collaboration ties that the respondents perceived to be most relevant for their work. For each question, respondents were able to provide the names of up to six organizations that were not suggested by the researchers. Since inter-organizational relations are our focus of analysis, self-related ties (loops), for example, when Greenpeace Germany names Greenpeace US, were excluded from the analysis. The same applied to duplicates, i.e., when one organization named another organization twice. We ended up with 342 egos for the collaboration network and 296 egos for the information network. In total, the collaboration network contains 918 nodes and 1411 ties.

At the start of the survey, the participants were asked to specify the kind of organization to which they belonged. The possible categories were: 1) Business association, 2) Government (national/subnational), 3) Intergovernmental organization (here IPAs), 4) Non-governmental organization, 5) Research institutions or 6) Other. As mentioned in the beginning, this study focuses on the international bureaucracies, which are the administrative parts of intergovernmental organizations. However, respondents rarely differentiated between the IO and the IPA. Only some differentiated between the UNFCCC and the UNFCCC secretariat. Hence, when respondents named IOs such as UNEP, UNDP, or the UNFCCC as collaboration partners or information sources, we assumed that they meant the IPA, that is, the administrative part of the organization and its permanent staff, as the partner. Organizations that were named by survey respondents but did not participate themselves in the survey were assigned an actor type by the authors and research assistants based on their online public profiles. The respondents were coded into different regions, using seven categories: 1) Africa, 2) Asia, 3) Australia/Oceania, 4) Europe, 5) Global, 6) North America, and 7) South America. The distribution of respondents regarding organization types and regions is depicted in Figure 1 and Figure 2, respectively. The numbers match the general patterns of organizations represented at global climate conferences (UNFCCC 2012, 2014)

## Method

### Exponential random graph models

To analyze the global climate governance network and the role of IPAs within them, we use a subclass of exponential-family random graph models (ERGMs) or  $p^*$  class models (Wasserman and Pattison 1996; Robins et al. 2007). These models have gained increasing popularity among networks scholars within the last decade (Cranmer et al. 2017). The idea behind this type of model is to approximate the data generating process of the observed network by using exogenous covariates as well as endogenous network statistics (Morris, Handcock, and Hunter 2008). The extent to which the observed network differs significantly from any other random networks that could have been observed can thus be tested.

One caveat of the application of ERGMs is the need for (almost) complete networks in which all nodes (individuals, organizations, etc.) as well as the ties (collaboration, information exchange or other relationships) between them can be observed. However, gathering complete network data is extremely difficult in some contexts, for example when networks span over numerous organizations and geographical areas (Wellman 2007). This is also the case for the global climate governance network which is the focus herein. As described above, the network has become increasingly diverse in terms of actor groups and covers actors working on multiple levels (e.g., local, national, global). Hence, we gathered data based on COP participant lists and used a one-wave snowball sampling (Robins et al. 2007; Marsden 2011). This type of network data represents the network from the perspective of one focal actor (ego) to its connections (alter).

Building on previous reflections about the development of ego-centered models (Robins 2014), Krivitsky and Morris (2017) have developed an approach that allows the use of ERGMs with egocentrically sampled data for which the population is larger or unknown as is the case in our study. The approach is based on the assumptions that if the egos are a random sample of the population, and the observed network statistics scale up with network size, it is possible to adjust for this estimation through an offset term which preserves the mean degree (Krivitsky, Handcock, and Morris 2011). Krivitsky and others argue that “social processes that produce networks of human social relationships are primarily local in nature” (ibid., 322) and therefore networks of different sizes can be constructed using egocentrically sampled data (Krivitsky, Handcock, and Morris 2011). Studies indicate that this approach makes it possible to represent

features of complete networks based on egocentric network samples (Smith 2012; Krivitsky and Morris 2017; Krivitsky, Morris, and Bojanowski 2021).<sup>1</sup>

We conducted our analysis in the integrated development environment RStudio (R Core Team 2019). The packages we used for the analysis are part of the Statnet suite of packages: *ergm* (Handcock et al. 2018) and the wrapper *ergm.ego* (Krivitsky 2021) to fit the ERGM to egocentrically sampled data.

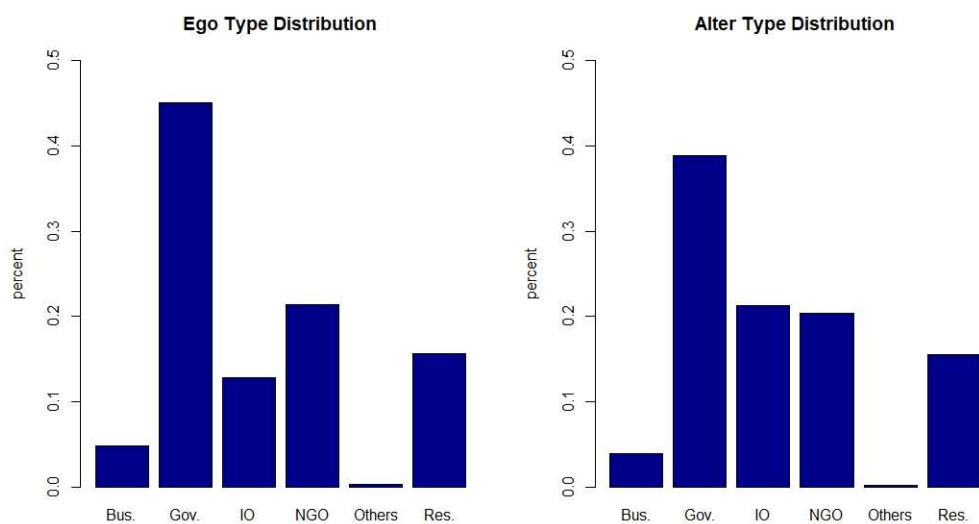


Figure 1. Distribution by actor type

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<sup>1</sup> For more detailed technical information on this approach, see Krivitsky and Morris (2017).

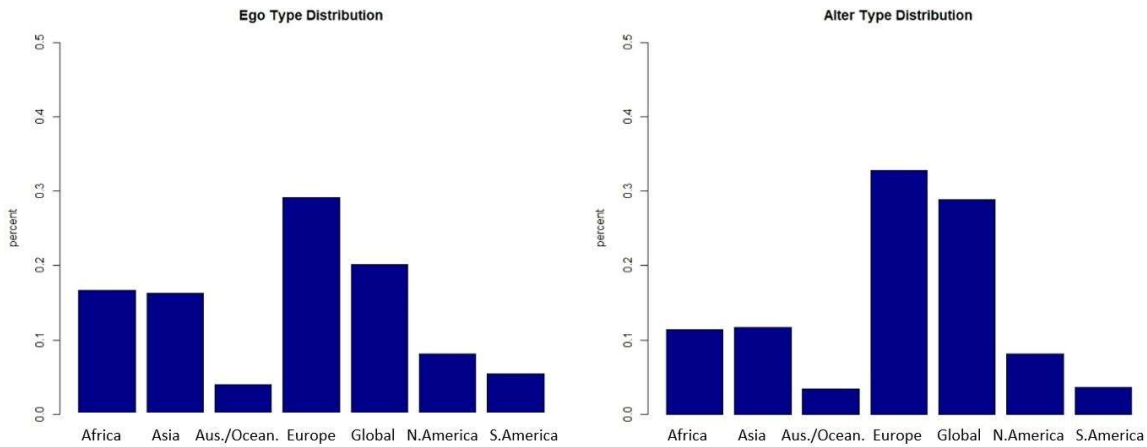


Figure 2. Distribution by region

### Model specification

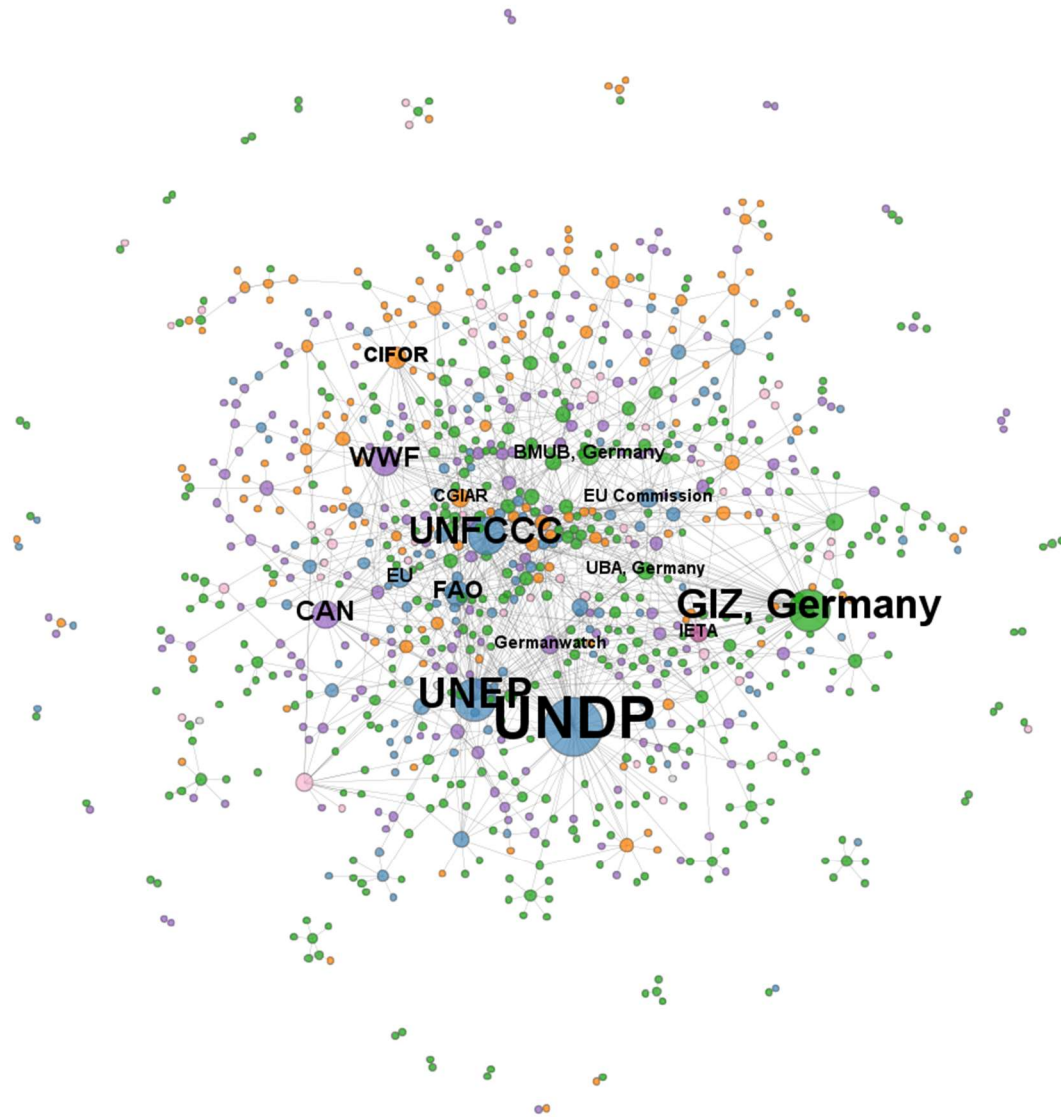
We created two models to address our research question of how international bureaucracies influence global climate policymaking. Whereas the first model only includes parameters of the cooperation network, the second model also includes one parameter of the information network (for descriptive statistics on the information network see Annex 3 and 4). The main variable of interest for our analysis is the actor type. We included a covariate on a nodal level and a dyad-level term to account for the homophily of different types of actors. Additionally, we added a covariate that captures the tendency of actors to form ties with organizations that work within the same region. Although climate change is a global issue, actors that are based and work within the same geographical areas might face the same challenges when it comes to climate change impacts and/or are more likely to meet each other. We expect collaboration between them to be more likely. The regional focus of an organization was determined by researching the offices of the organizations. If an organization only has offices within South America, for example, it was categorized as a South American organization. However, if an organization has several offices in different continents, it was categorized as “Global”. Moreover, both models contain an edges term to account for the density of the network. To increase the model fit, we also included degree-based measures as dyad dependent terms. We scaled the results to a pseudo-population of 2.500 given the identified population through COP participant lists. The overall network size of the global climate collaboration network is unknown because not all organizations participate at the COP. However, we assume that the most important organizations in global climate policymaking are represented at the COP.

The above-mentioned specifications are the same for both models. In addition to these variables, in the second model we included a covariate that is derived from the information network, which was also obtained through the survey. We added the indegree scores, i.e., the number of times an organization was named as source of information, as a node level attribute in the collaboration network to test our argument that the influence of IPAs within the climate governance network is associated with their expertise and the information they provide. If the organization was not named in the information network, they received a score of 0.<sup>2</sup>

*Figure 3. Collaboration Network*

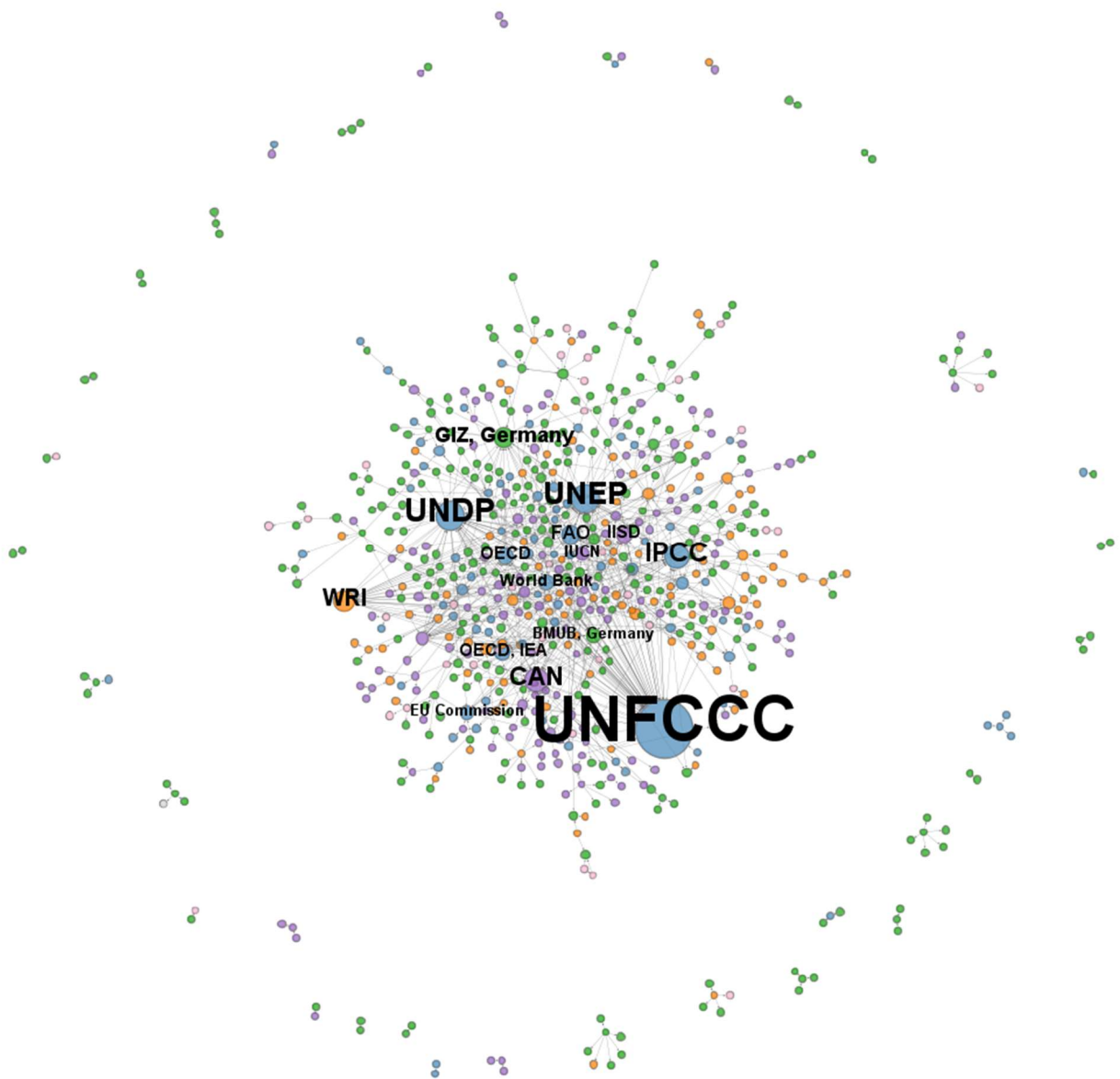
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<sup>2</sup> The indegree score should be interpreted with caution due to potential unsystematic unit nonresponse.



**Note:** This network was produced with Gephi. The size of the nodes indicates their degree scores. The 15 actors with the highest degree scores were labelled. The colors refer to the different types of actors (blue = IO/IPA, purple = NGO, orange = Research, green = Government, pink = Business, grey = Others).

*Figure 4. Information Network*



**Note:** This network was produced with Gephi. The size of the nodes indicates their indegree scores. The 15 actors with the highest indegree score were labelled. The colors refer to the different types of actors (blue = IO/IPA, purple = NGO, orange = Research, green = Government, pink = Business, grey = Others).

## Results

The results of the egocentric ERGMs are presented in Table 1. The goodness of fit diagnostics for both models were obtained according to Hunter, Goodreau, and Handcock (2008) and can be found in the Appendix. Moreover, we checked the model for multicollinearity by examining the variance inflation factors (Duxbury 2018) and found no issue with any parameter. As described above, our first model included actor types as a node level attribute, and on a dyadic level as homophily effect between actor types. The results indicate that IPAs are part of a dyad



within the collaboration network significantly more often than any other actor type. Even the reference category, governmental actors, is less likely to be part of the collaboration network than IPAs. This result lends support to our first hypothesis that IPAs are more likely than any other actor type to form part of a dyad within the climate governance network. Moreover, we can observe some general homophily effects for business actors, NGOs and research organizations. This indicates that these actor types are more likely to form ties with each other, a tendency that cannot be observed for IPAs. Due to the expectation of strong regional collaboration networks, we controlled for this effect by accounting for the regional focus of the actors. The reference category for this covariate is Europe. African, Asian as well as Australian and Oceanic organizations have a significant negative effect, whereas global organizations a significant positive one. Global organizations are thus the only ones, significantly more likely to be part of a collaboration tie than European organizations.

	<b>Collaboration 1</b>		<b>Collaboration 2</b>	
	Estimate	SE	Estimate	SE
Network size adj.	-7.78***		-7.78***	
edges	1.52***	0.25	1.06***	0.24
<i>degree1</i>	2.19***	0.33	1.53***	0.26
<i>degree2</i>	0.78**	0.27	0.25	0.22
<i>Actor type (ref= Government)</i>				
<b>Business</b>	-0.56**	0.18	-0.36	0.19
<b>IO/IPA</b>	0.33**	0.12	-0.02	0.14
<b>NGO</b>	-0.54***	0.12	-0.46***	0.13
<b>Research</b>	-0.42***	0.14	-0.43**	0.27
<i>Actor type homophily</i>				
<b>Business</b>	1.56***	0.46	1.53**	0.46
<b>Government</b>	0.14	0.17	0.12	0.17
<b>IO/IPA</b>	0.15	0.24	0.21	0.27
<b>NGO</b>	1.40***	0.21	1.41***	0.21
<b>Research</b>	1.05***	0.26	1.07***	0.27
<i>Region (ref= Europe)</i>				
<b>Africa</b>	-0.52***	0.15	-0.42*	0.17
<b>Asia</b>	-0.36*	0.14	-0.31*	0.14
<b>Australia/Oceania</b>	-0.51**	0.19	-0.45*	0.21
<b>Global</b>	0.90***	0.11	0.53**	0.19
<b>North America</b>	0.01	0.12	0.08	0.14
<b>South America</b>	-0.06	0.16	0.08	0.18
<i>Regional homophily</i>				

<b>Africa</b>	2.51***	0.31	2.52***	0.31
<b>Asia</b>	2.18***	0.28	2.19***	0.27
<b>Australia/Oceania</b>	3.64***	0.36	3.65***	0.38
<b>Europe</b>	0.81***	0.20	0.81***	0.20
<b>Global</b>	-0.52*	0.19	-0.42*	0.17
<b>North America</b>	2.01***	0.31	1.99***	0.30
<b>South America</b>	3.10***	0.44	3.08***	0.47
<i>Information network</i>				
<b>Indegree of info. source</b>			0.08***	0.00

Note: Significance levels: \*\*\*p< 0.001; \*\*p<0.01; \*p<0.05.

Table 1. Results of the ERGMs for the global climate change collaboration network

As expected, the estimates for regional homophily are significantly positive for all continents. Global organizations are however less likely to cooperate with each other. Overall, this first model shows that IPAs are significantly more likely to be part of a collaboration tie, indicating their influence within the global climate governance network.

In the second model, we test whether these results change when we include the indegree scores of the information network. This is the covariate that allows us to assess whether the information provided by IPAs is associated with their influence in the global climate collaboration network. When we include this covariate, we observe that the results for IPAs do indeed change. The estimate becomes negative and insignificant, meaning that IPAs are no longer more likely to be part of a dyad within the collaboration network when accounting for the organizations' indegree in the information network. The estimate of the indegree of the information provider is positive and significant. This leads to the suggestion that an organization that is popular in the information network (measured through indegree scores) is also more likely to be part of the collaboration network. All other results are very similar to the first model.

## Discussion and conclusion

This study focuses on the potential influence of international bureaucracies in the global climate governance network. The growing complexity of collaboration patterns due to the involvement of a wide variety of actors across different sectors and geographical areas (Andonova, Betsill, and Bulkeley 2009; Abbott 2012; Chan et al. 2016) raises the question of who exerts influence

in these governance networks. Scholars have identified international secretariats, which have long been neglected in the International Relations literature, as influential actors in the global climate governance network, with the UNFCCC secretariat being the most prominent example (Busch 2009; Jinnah 2011; Jörgens, Kolleck, and Saerbeck 2016; Kolleck et al. 2017). Hence, the question this article set out to answer is: How do IPAs exert influence on global climate policy making?

There are different ways to do so. Some actors, such as governments, have the legal power to design and implement policies. But the influence of international bureaucracies is less obvious and hence more difficult to detect, due to their limited formal mandates. One of the main aims of IPA scholars is thus to find the determinants of their influence (Barnett and Finnemore 2004; Biermann and Siebenhüner 2009; Busch 2014; Eckhard and Ege 2016). Information and knowledge provided by IPAs have been identified as playing a central role (Busch and Liese 2017; Littoz-Monnet 2017).

In this study, we applied a systematic approach using ERGMs based on a large-N survey (N=342) to test whether the findings from case studies can also be observed at the larger scale of the global climate policy network. The results of our analysis lend support to our argument that the prominence of IPAs in the global climate collaboration network is associated with their perceived expertise in this issue area or, in other words, with their prominence in the information network. Once we account for the popularity of actors within the information network, IPAs are not significantly more likely than government actors to be part of the global climate collaboration network anymore. Hence, their previously prominent role in the collaboration network disappears. This change is in line with our hypotheses. Information provided by IPAs is significantly associated with their prominence in the collaboration network and thus their potential for influence.

With respect to the interpretation of our results, it is important to consider the period of data collection. Information might have been an especially crucial resource at that time in the international negotiations. During COP21 in Paris, a new global agreement was adopted and nation states had had to submit their climate pledges (the so-called Nationally Determined Contributions, NDCs) beforehand. As this was a new situation, nation states and other stakeholders were dependent on the UNFCCC secretariat, the central IPA in the global climate regime, to provide information on the process. The need for information could have been particularly strong at that time. This would imply that the UNFCCC secretariat, the IPA at the

core of the international regime, was particularly central and influential. However, as figure 3 and 4 show, other IPAs were also central in the network.

Another potential limitation of our study addresses our theoretical assumptions. In the present article, we theorize that the information IPAs possess and disseminate leads to their influence in the climate collaboration network. However, reverse causality might apply in this case. In other words, IPAs might be perceived as influential and therefore could be used as trustworthy information providers. Leifeld and Schneider (2012), for example, state that “perceived influence of a potential alter is a sign of high quality, either in terms of its information potential or as a powerful ally” (Leifeld and Schneider 2012, 733). Due to the cross-sectional and egocentric nature of the data, we are not able to further investigate a clear causal direction. Moreover, a more dynamic model might be the closest to the actual underlying mechanisms, where information and influence mutually reinforce each other.

Our data collection process through snowball sampling might also provide a limitation since this is not the sampling method the egocentric ERGM approach was designed for (Krivitsky and Morris 2017). Nevertheless, we believe that this was the most appropriate approach given our research question and population. It was only through this sampling strategy that we were able to gather as much information as possible and map the network as well as possible with little bias. In addition, other studies have successfully used this combination of data collection and analysis before (Hermans et al. 2017). An additional methodological issue to consider is the egocentric nature of the data which does not allow endogenous network statistics to be accounted for. Therefore, higher-order network effects, such as triadic closure, could not be considered. However, they might still influence the network structure.

A mediation analysis could also have been used to identify whether the popularity in the information network significantly influences the IPAs’ effect within the collaboration network. Although mediation analysis for ERGMs is being developed (Duxbury, Desmarais, and Leifeld 2019), it is not yet applicable to egocentric network data. Future research could test whether our two models differ significantly from each other.

Overall, our results substantiate previous research. Saerbeck et al. (2020), for example, found that the UNFCCC secretariat provides various types of information. Although all stakeholder groups indicated that they received primarily procedural information from the secretariat, a large amount of information on policy options as well as technical and scientific aspects of climate change was also disseminated by the secretariat. These results could also be transferable to other IPAs within the regime. Since IPAs can provide various kinds of information and thus

reach numerous stakeholders, they are more likely to exert influence on the climate change governance regime. They can thus be considered information hubs of the regime (Saerbeck et al. 2020).

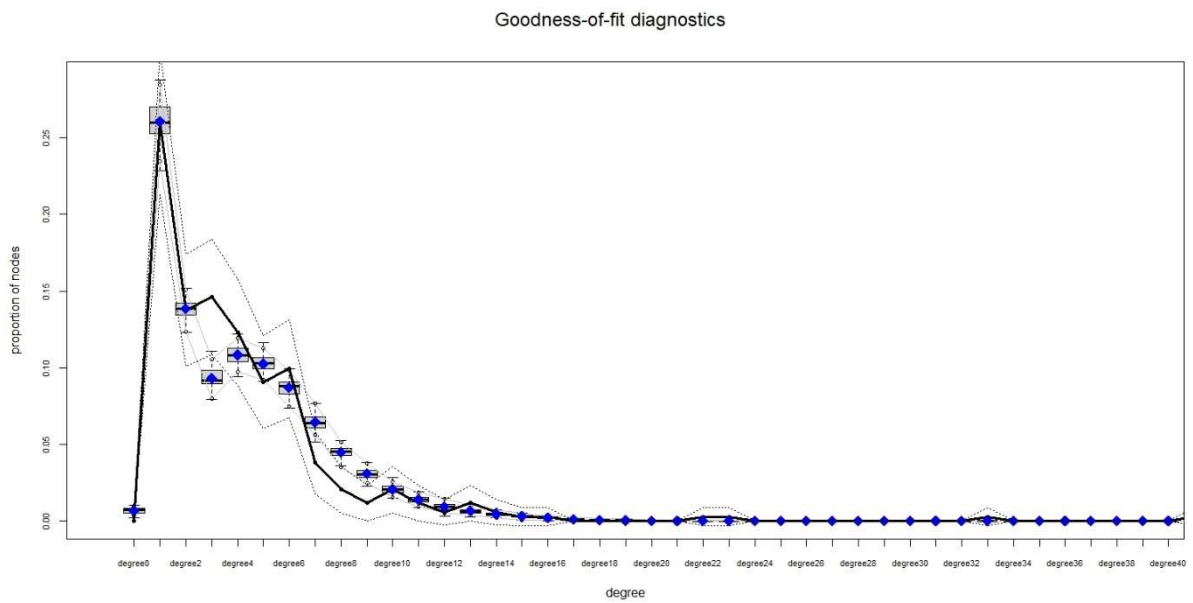
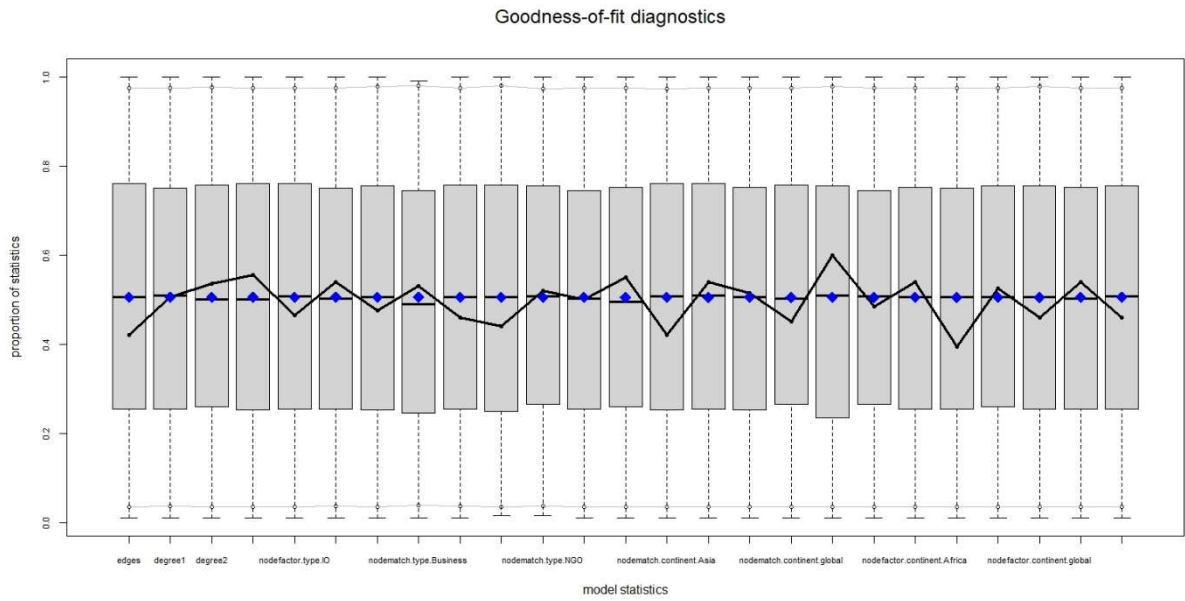
On a more political level, our results help explain how it was possible to achieve the historical Paris Agreement. Much of the focus around COP21 and the multilateral agreement has been on the French diplomacy, support from two of the major emitters (China and the United States) and the bottom-up action by NPS (Dimitrov 2016; Falkner 2016). Little attention has been given to the IPAs, other than the leadership of the Executive Secretary of the UNFCCC, within the climate regime complex and the role they played in the success of the negotiations (Hickmann et al. 2021). Thus, our findings can provide insights for scholars in IR as well as in climate change or environmental politics that underestimate the role of international bureaucracies in the success or failure of international agreements.

Despite the aforementioned potential limitations due to our data structure and the possibility of reverse causality, our results form a solid basis for future analysis. Although it is extremely difficult to gather longitudinal data with a global scope, future studies could add to this research by collecting network data during various time periods. This would support a better understanding of the causal mechanisms or the dynamic process behind information flow and influence. In addition, the approach presented in this article could be applied to other issue areas to further examine whether the importance of information differs across issue areas. Overall, the analysis of the influence of international political actors remains an exciting field of research with many unanswered questions, in which (inferential) Social Network Analysis promises interesting insights.

## Appendix

### Appendix 1. Goodness of fit diagnostics for the first collaboration model

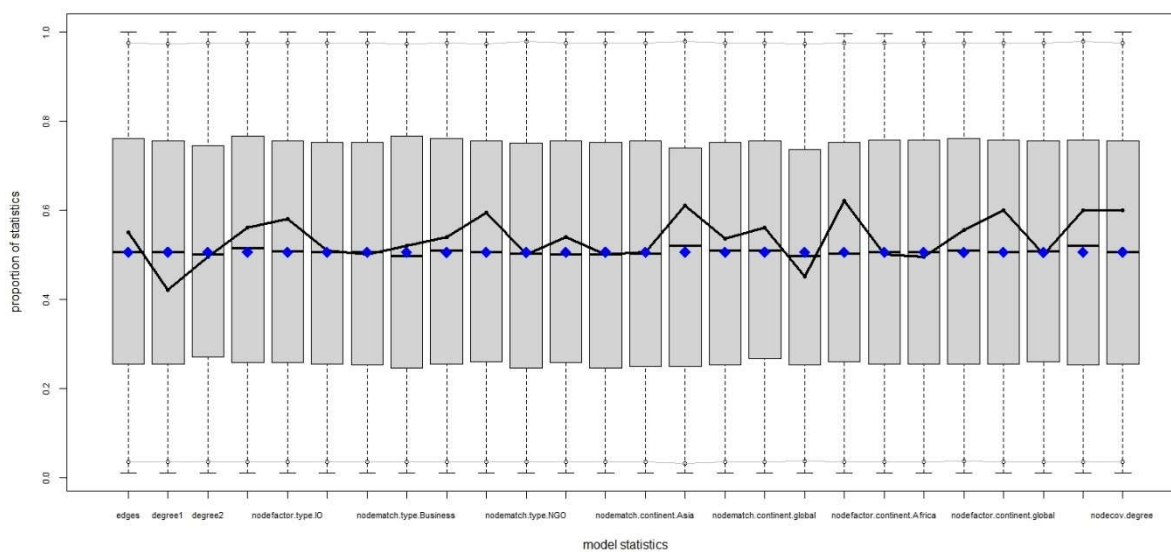
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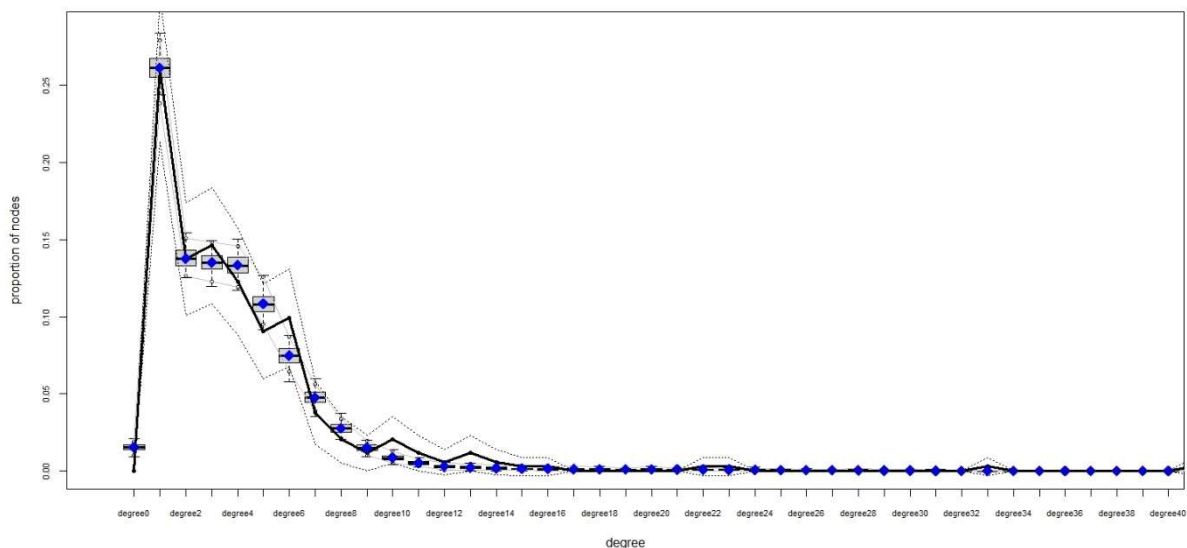
### Appendix 2. Goodness of fit diagnostics for the second collaboration model

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Goodness-of-fit diagnostics



Goodness-of-fit diagnostics



Appendix 3. Degree centralities of organization types in the information network

Type	Indegree	Outdegree	Degree
Business	18	61	79
Government	333	378	711
IO	346	137	483
NGO	203	220	423
Research	126	231	357

Appendix 4. Top 15 actors based on indegree in the information network

Organization	Type	Indegree	Outdegree	Degree
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UNFCCC	IO	74	0	74
UNDP	IO	32	28	60
UNEP	IO	31	12	43
IPCC	IO	26	3	29
CAN	NGO	24	1	25
WRI	Research	21	4	25
GIZ, Germany	Government	19	10	29
FAO	IO	17	4	21
IEA	IO	14	1	15
OECD	IO	13	3	16
IISD	NGO	13	0	13
World Bank	IO	12	0	12
BMUB, Germany	Government	11	0	11
IUCN	NGO	10	3	13
EU Commission	IO	10	0	10

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