Yan Yang, Shuai Cao and Hongtao Yi*

Network Structure and Collaborative Performance Among Environmental NGOs in China

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Abstract: Although the significance of NGO cooperation has been recognized in various studies, little is known about how NGOs in authoritarian states engage in collaboration, and few studies examine the outcomes of NGO collaboration from a network perspective. This article utilizes a questionnaire-based method to gather data on 103 environmental NGOs (ENGOs) in China. First, we confirm the existence of collaborative networks among NGOs in 19 provinces and municipalities in China. Then, informed by the social capital theory, we investigate the impact of bridging and bonding structures on network outcomes. The results show that bridging network structures can promote the efficiency and effectiveness of environmental NGOs in collaboration. In contrast, while bonding structures can also improve cooperative efficiency, they are not always effective. Overall, this study highlights the crucial role of central actors in collaborative networks, enriching existing literature and providing valuable insights for policymakers and NGO managers.

Keywords: ENGO network; bridging structure; bonding structure; collaborative performance

1 Introduction

Non-governmental organizations (NGOs) are self-governing, voluntary, and nonprofit entities that are institutionally separate from the government (Anheier 2014). As third-party organizations, NGOs mainly serve the function of mobilizing social resources, providing public services, and engaging in social coordination and policy advocacy (Wang 2006). As the number of NGOs continues to rise and their influence expands,

***Corresponding author: Hongtao Yi**, School of Public Administration and Policy, Renmin University of China, Beijing, China; and Askew School of Public Administration and Policy, Florida State University, Tallahassee, FL, USA, E-mail: yihongtao@ruc.edu.cn
Yan Yang, School of Public Administration and Policy, Renmin University of China, Beijing, China; and Department of Public and International Affairs, City University of Hong Kong, Kowloon, Hong Kong, China
Shuai Cao, John Glenn College of Public Affairs, The Ohio State University, Columbus, OH, USA

more NGOs are involved in the process of policy advocacy. For instance, in the anti-seepage construction project of Yuanmingyuan in 2005, the environmental NGOs (ENGOs) represented by Friends of Nature urged the government to prioritize ecological protection and advocated that the public should be allowed to participate in the decision-making process of environmental policies. With the concerted advocacy of ENGOs, the government invited all parties to participate in a seminar on the ecological protection of Yuanmingyuan and ultimately decided to cancel the project. The government has gradually recognized the constructive roles of NGOs, started to transition from its initial mode of control, and shifted towards establishing a collaborative relationship with them (Jing and Gong 2012).

Scholars have also recognized the importance of collaborative relations for the development of NGOs, including cooperation between NGOs and governments (Gazley and Brudney 2007; Zhan and Tang 2016), between NGOs and enterprises (Moshtari and Vanpoucke 2021), and among NGOs (Arya and Lin 2007). The government can provide NGOs with the necessary financial resources and, more importantly, legitimacy (Hsu 2010). Organizations with good political ties to the government are more likely to maintain a higher level of funding stability (Zhan and Tang 2016). NGOs with close ties with the government also find it easier to gain legitimacy, which helps them seek funding from other donors (Johnson and Ni 2015). Therefore, NGOs actively build alliances with state agencies to obtain a stable supply of resources.

Enterprises are also important partners of NGOs. They provide NGOs with financial donations and in-kind support, such as expertise and technology, management systems, infrastructure construction, and human resource support (Moshtari and Vanpoucke 2021). However, collaborative partnerships can also limit institutional autonomy (Brinkerhoff 1999; Chaves, Stephens, and Galaskiewicz 2004; Guo and Saxton 2010; Onyx et al. 2010; Schmid, Bar, and Nirel 2008). For example, in policy advocacy activities, cooperation among NGOs helps them develop into more formal and professional organizations but, at the same time, restricts their autonomy of initiating or participating in political activities (Berry 2003; Hudson 2002; Onyx et al. 2010). To quest for autonomy, NGOs call for open communication and extensive linkages with each other. They use their efforts, experience, and resources through network activities to gain government attention, raise public awareness, and engage in the policy process (Umlas 1996).

Although scholars have begun to explore collaborative partnerships among NGOs, most research is mainly concerned with NGO-government collaboration and NGO-enterprise partnerships. Only 16 % of these articles emphasize the within-sector collaboration among nonprofit organizations (Gazley and Guo 2020). Human resource capacity, technological resources, gender representation at the leadership level, organizational scale, past collaborative ties, and past friendship relationships are some

of the key drivers that prompt NGOs to collaborate with each other (AbouAssi, Nadeen, and Page 2016; Gazley 2010; Kapucu and Demiroz 2015). Scholars have also found that organizational characteristics, partner attributes, and network structures can affect collaborative outcomes (Arya and Lin 2007; Chen and Graddy 2010).

However, the factors that facilitate or constrain the performance of inter-NGO cooperation are still rarely explored (Kareithi and Lund 2012). Network is one of the forms of collaborative actions NGOs engage in, and network structure is found to positively impact cooperative performance (Yi 2018; Yi, Yang, and Zhou 2021). However, few studies have analyzed the performance of NGO cooperation networks from the perspective of network structure. In addition, when it comes to analyzing collaborative relationships, social network analysis is less commonly employed, especially in exploring collaborative relationships (Gazley and Guo 2020). Therefore, to fill these gaps, this paper aims to explore the relationship between network structure and the performance of NGOs with survey questionnaires and the method of social network analysis. We intend to address the following research questions: Do NGOs engage in collaborative networks in China? Do NGOs that engage more with other NGOs achieve higher collaborative performance? In this study, collaborative performance refers to the efficiency and effectiveness of partnerships formed among organizations, particularly in contexts where multiple actors collaborate to achieve collective goals (AbouAssi, Wang, Huang 2021). This study aims to examine whether the structure of the collaboration network influences collaborative performance, specifically how bridging and bonding structures affect the efficiency and effectiveness of the environmental NGOs.

The next section is a literature review of the relationship between network structure and network performance. Informed by social capital theory, we formulate testable hypotheses to investigate the effect of different types of social capital on collaborative efficiency and substantive effects among 103 ENGOs in China. Then, we introduce our data collection process and elaborate on our research design, followed by results and discussion. The article concludes with theoretical contributions, practical implications, and directions for future research.

2 NGOs, Collaborative Network, and Network Outcomes

2.1 Rationales for NGO Collaboration

Resource dependence theory takes organizations as the unit of analysis for collaborative and social relationships. Organizations are not independent units but are

embedded in interdependent relationships with other organizations. To survive and thrive, organizations need to obtain resources from the external environment, such as funds, members, information, and identity (McCarthy and Zald 1977; Pfeffer and Salancik 2015). NGOs are dependent on the external environment, which can provide NGOs with sources of funding, legal status, and human resources (Tang and Zhan 2008). Merging, alliance-building, and co-opting are three strategies for organizations to obtain resources (Malatesta and Smith 2014). Scholars believe that engaging in a collaborative relationship can overcome external uncertainty and secure resources for the organization (Pfeffer and Salancik 1978; Provan 1984; Zuckerman and D'Aunno 1990). For instance, Zhan and Tang (2013) show that ENGOs in China with more connections to the party-state system are more likely to enhance their policy advocacy capacity. They also confirm that NGOs' connections with the government can help maintain the stability of the funds they receive. Stroup and Wong (2013) also demonstrate that NGOs can enhance their resource integration and organizational efficiency through alliances, cooperative relationships, and joint participation in projects. All these suggest that collaboration among NGOs can enhance their overall performance.

2.2 Partners of NGOs' Collaborative Networks

The positive correlation between collaboration and performance drives NGOs to choose networking as a management strategy (Mitchell, O'Leary, and Gerard 2015). Collaborative partnerships between NGOs and diverse stakeholders, including corporations, government agencies, and peer NGOs, are critical for improving organizational efficiency and achieving collective goals. In China, scholarly attention has predominantly focused on the cooperative relationships between the government and NGOs (Tang and Zhan 2008; Zhan and Tang 2016), while discussion on cooperative relationships among NGOs has been relatively neglected. Although Sullivan and Xie (2009) discussed how Chinese environmentalists established and expanded connections via the Internet, cooperative relationships through offline interactions require further exploration. Scholars have examined cooperative strategies among NGOs in various countries, for instance, Yabanci (2019) examined cooperative strategies among NGOs in Turkey; Sofronova, Holley, and Nagarajan (2014) studied cooperative network relationships among NGOs in Mexico; and Umlas (1996) explored cooperation among ENGOs in Russia. However, the formation of cooperative relationships among Chinese NGOs remains an underexplored area.

2.3 Impact of Collaboration on Performance

Research indicates that NGOs that actively engage in partnerships tend to attain enhanced performance outcomes (Clarke and Macdonald 2019; Mitchell, O'Leary, and Gerard 2015; Sanyal 2006; Schade, Wang, and van Prooijen 2022). An NGO collaborative network refers to a collection of loosely bridged or closely bonded NGOs that share resources and aim to achieve certain common strategic goals (Arya and Lin 2007). The literature on NGOs participating in collaborative networks underscores the importance of these partnerships for improving operational effectiveness and achieving remarkable collaborative outcomes. Whitehead (2014) examines NGO-business partnerships within the framework of corporate social responsibility (CSR) in China, emphasizing that the institutional dynamics surrounding such collaborations significantly shape their results. The study suggests that NGOs actively engaging with corporate partners can leverage these relationships to enhance visibility and resource mobilization, thereby strengthening their overall organizational performance.

In addition to NGO-firm collaborations, inter-NGO collaborative networks also have the potential to achieve overall effectiveness and efficiency. A network's effectiveness refers to the fact that each organization in the network can achieve outcomes that would not be possible by acting alone (Provan and Kenis 2008). Collaborative network efficiency denotes the ability of network members to achieve common objectives more quickly through collective action, thereby enhancing overall collaborative efficiency. Cooper and Shumate (2012) propose a network perspective for analyzing interorganizational collaboration. They illustrate this through a case study of gender-based violence NGOs in Zambia, demonstrating how inter-NGO collaboration can enhance effectiveness and efficiency. Hummel and Kusumasari (2024) also emphasize the advantages of collaboration among NGOs, including the opportunity to learn from one another's experiences and leverage existing networks, ultimately enhancing their capacity to achieve objectives more efficiently.

2.4 Determinants of Collaborative Network Performance

Recent research on performance determinants emphasizes organizational characteristics, inter-organizational relationships, and social capital (Guo and Acar 2005; Islam 2016; Sapat, Esnard, and Kolpakov 2019; Yi 2018; Yi, Yang, and Zhou 2021). Organizational characteristics within collaborative networks significantly influence network performance. Factors such as organizational size, resource availability, and prior collaborative experience affect NGOs' engagement effectiveness. For example,

larger NGOs may contribute more resources, while smaller organizations may offer unique local insights and connections (Graddy and Chen 2006; Guo and Acar 2005; Pfeffer and Salancik 2015). Guo and Acar (2005) emphasize that NGOs with diverse capacities and complementary strengths are better positioned for successful collaboration, as they can leverage shared resources to address complex challenges effectively. Interorganizational relationships are one of the crucial factors influencing collaborative network performance. Interorganizational trust fosters open communication, reduces transaction costs, and encourages the willingness to share resources and information. NGOs that cultivate trust-based relationships are more likely to achieve successful outcomes in collaborative endeavors (Sapat, Esnard, and Kolpakov 2019). Social capital is another critical determinant of collaborative network performance, which is defined as the synthesis of social resources, with which social members form connections and share the collective resources (Bourdieu 1986). Hillig and Connell (2018) elaborated that bonding social capital and bridging social capital were essential for effective collaboration.

However, scholars have identified that existing research on the determinants of NGO network outcomes remains underdeveloped (Kareithi and Lund 2012; Robinson et al. 2024; Yang and Cheong 2019). Based on previous research on the impact of social capital on collaborative network performance, this study aims to help advance understanding in this area by developing theoretical arguments grounded in social capital theory.

3 Influence of Network Structure on Network Outcomes

3.1 Social Capital, Network Structure, and Network Outcomes

Social capital links network structure to network outcomes. Burt (2001) proposes the concepts of network structural holes and closures as two forms of social capital. Structural holes occur when two or more individuals in a network are not directly connected because they lack a shared connection or intermediary who can link them together. In other words, a structural hole between two groups indicates that their connections are relatively loose. The transmission of information through brokerages is a method of bridging structural holes to strengthen communication between groups. The absence of direct connections between certain members of a network can create opportunities for others to bridge the gap and form connections across the network. In this sense, the structural hole can provide a competitive advantage for different groups (Burt 1992). In contrast, closure is a form in tightly

connected networks, which implies that individuals in the network are closely related. Collaboration within such dense networks can reduce risks for network participants (Burt 2001). Network closure imposes sanctions against members who do not observe the rules and thus it can enhance trust between members (Coleman 1988).

From the social network perspective, Burt (2005) argues that the presence of structural holes within a network can facilitate the formation of bridging social capital, while closures can facilitate the formation of bonding social capital among members of the network. Despite limited research on collaboration networks among NGOs, the role of bridging and bonding social capital in network performance has been further tested in other types of organizations, such as private enterprises and government departments. In terms of governance performance in government departments, using social network analysis, Yi (2018) examines the effect of overall bridging and bonding social capital on the state clean energy governance outcomes in the United States. Using a similar approach, Yi, Yang, and Zhou (2021) confirm the positive association between bridging and bonding network social capital structures and water resource governance performance in China. Similarly, concerning enterprise performance, Tan, Zhang, and Wang (2015) found that bridging social capital facilitates access to a broader range of resources, while bonding social capital enhances the efficiency of information sharing and resource flow. Both forms of social capital contribute positively to enhancing corporate innovation performance. According to previous studies, bridging social capital emphasizes an organization's external connections, thereby enhancing its external linkage channels. Instead, bonding social capital corresponds to internal cohesion, promoting efficiency in information sharing and communication. Prior research provides a foundation for this study to explore the relationship between network structure and network outcomes.

Different network structures have different impacts on network members. From the social capital theory, the network structures of structural holes and closure structures can bring positive network benefits, which will be the focus of our research.

3.2 Bridging Role of NGOs

Tang and Zhan (2008) divide NGOs in China into three categories: student groups, government-organized NGOs (GO-NGOs), and civic NGOs. These NGOs possess different characteristics, and they engage in different types of activities. GO-NGOs are organizations that "resemble something in between a governmental agency and a non-governmental organization (NGO)" (Wu 2003). Most GO-NGO members who come from government agencies keep close contact with the public sector. Due to the

convenient and direct channels they have with government departments, they are more likely to engage in communication with the government. For example, they would share responsibilities with the government for providing public services (Heurlin 2010). In comparison, civic NGOs are formed spontaneously by citizens, and enjoy a relatively high level of independence. They mainly exert pressure on the government through external forces, such as attracting public attention through the power of social media and trying to expand their influence through the power of public opinion. Student groups, on the other hand, are self-initiated by students and primarily focus on issues specific to universities and the student community. Due to constraints imposed by academic regulations and policies, their influence tends to be weaker than the former two types of NGOs. GO-NGOs are more inclined to work with government agencies, civic NGOs tend to work with the general public, while student groups form alliances with local universities, other domestic universities, and international university networks to expand their influence. Due to the distinct organizational characteristics, the links between different types of NGO members are relatively loose. Consequently, members who are not linked to each other form multiple structural holes in the NGO network.

NGOs mainly participate in the policy process, jointly provide public service to the government, and raise citizens' awareness of environmental protection (Heurlin 2010; Keck and Sikkink 2004). However, a single NGO has limited resources and influence, and most Chinese NGOs lack stable financial resources, making it hard to sustain their activities. In addition, Chinese ENGOs lack collective cohesion, because environmental NGOs have different organizational characteristics and missions, such as protecting rare species, promoting environmental protection in the community, or defending the blue sky (Tang and Zhan 2008). ENGOs are more likely to focus on achieving their own missions rather than forging collaborative relationships with others. Given the limited influence of one organization, they cannot gain a strong voice when negotiating with the government.

NGO leaders are the key coordinators and managers who can play a critical role in organizational development through their personal connections and capabilities. NGO leaders who maintain a good relationship with the government are more likely to secure funding stability, develop sound management systems, participate in policy advocacy, and expand the influence of environmental governance (Zhan and Tang 2016). NGO leaders can play a role as brokers in loosely connected NGO networks. That is, they occupy a structural position in the network as a bridge or a structural hole, facilitating communication between disjointed actors and bridging information transmission (Kwon et al. 2020). Therefore, NGO leaders can serve as brokers in the network. They can not only enhance the credibility of the organization and attract partners but also connect different organizations and facilitate the transfer of information and resources.

In loosely connected networks, there is less interaction between individual organizations, which often leads to structural holes (Burt 2001). Therefore, to achieve desirable outcomes, each organization is expected to build connections with other organizations. Collaboration among disconnected organizations can increase economies of scale in resource utilization by facilitating resource sharing (Lavie 2006). Brokers occupy a central position in the network, which gives them an information advantage over other actors (Burt and Soda 2021). Brokers play a crucial role in shaping network outcomes by facilitating information exchange and resource coordination. As they have direct contact with other members, brokers can provide access to resources and serve as bridges for other members to access first-hand information during the process of information diffusion. Moreover, brokers can link disconnected members and help them form collective beliefs and identities, which can lead to consensus-building and increased collective efficiency. Using a systematic review of 24 articles, Long, Cunningham, and Braithwaite (2013) conclude that brokers can exchange information between isolated groups and increase the efficiency of information transmission through their increased cooperation.

When the number of members connected by brokers is large enough, the actors have access to sufficient information and resources, which then enhances the efficiency of collective action compared to individual organizations collecting information and resources independently. In other words, if members establish numerous cooperative relationships with various partners, the speed of information flow will improve and the frequency of resource sharing will increase. Furthermore, brokers can integrate members' information and filter out overlapping and invalid information, which ensures more substantial results from collective action. Specifically, by forming multiple cooperative relationships, members can achieve optimal resource allocation and gain access to a broader range of information and resources beyond their individual capabilities. If multiple partners do not yield efficient and substantial results, partnerships may become burdensome for collective efforts, leading to resource waste. In the network, nodes represent actors, and edges represent the links between nodes (Bringmann et al. 2019). The degree centrality may be calculated by summing the number of edges each node owns directly (Freeman 1979; Wasserman and Faust 1994). For example, the out-degree centrality of actor A is the sum of all other actors to whom actor A is directly connected. A higher out-degree centrality indicates a greater number of direct connections with other organizations. Given this, we propose the following hypotheses:

Bridging hypothesis 1a: The bridging role of the NGO (measured by out-degree centrality) will be positively associated with collaborative network efficiency.

Bridging hypothesis 1b: The bridging role of the NGO (measured by out-degree centrality) will be positively associated with collaborative network effectiveness.

3.3 Bonding Role of NGOs

As opposed to structural holes, network closure is indicative of tightly-knit groups. Within closed network structures, nodes with strong interpersonal ties find it more conducive to establishing relationships grounded in trust and cooperation. NGOs could engage in partnerships with governments, businesses, and peer organizations. However, it is imperative for them to deliberate on the merits and drawbacks associated with collaborating with these distinct entities. Governments and NGOs can be considered as regulators and the regulated. Generally, formally registered NGOs tend to maintain strong relationships with the government (Ho 2001). However, regulations can create a power imbalance between the government and NGOs in collaborative partnerships, as NGOs are bound by government rules and regulations, and may face serious consequences for noncompliance. Enterprises are profit-seeking and may seek to enhance their reputation by collaborating with NGOs and promoting corporate social responsibility (Muller and Kraussl 2011). Enterprises' profit-seeking nature is often at odds with the non-profit nature of NGOs, which can make it challenging for them to form close alliances.

In contrast, NGOs share similar organizational characteristics, goals, and relationships, which can facilitate collaboration among them. NGOs are typically not driven by monetary profits, but instead focus on improving the environment or addressing social issues. Collaboration between enterprises and NGOs can sometimes lead to conflicts between divergent organizational goals, whereas cooperation between NGOs can avoid such conflicts. In terms of organizational relationships, the government and NGOs often play different roles, with the government serving as the regulator and NGOs as the regulated party. Such unequal status prevents NGOs from influencing government policies (Tang and Zhan 2008). As NGOs themselves have relatively equal status, they can reach consensus through frequent exchanges, gain influence collectively, and then facilitate effective engagement in the policy process.

In closed structures, tightly-knit collaborative relationships serve to avoid defection within the collaborative network. For example, financial funding plays a pivotal role in both the survival and advancement of NGOs and is likely to pose potential defection risks within NGO collaborative networks. Specifically, NGOs can obtain stable funding from governments and seek financial support from foundations (Zhan and Tang 2016). Nonetheless, external funding can potentially curtail an organization's autonomy, potentially leading to actions that deviate from the collective objectives in the pursuit of financial resources.

Network closure facilitates sanctions that reduce defection risks associated with network members, which can enhance the trust among them (Burt 2001). Compared

with the structural hole, members in the closure are more familiar with each other and more closely connected. In a closed structure, members with a high reputation are more likely to be accepted as partners. A high reputation means that the organization integrates its resources with other organizations in a consistent way to achieve its common goals (Provan and Milward 1995). In other words, the group with a high reputation prefers following, rather than defecting, the collective goals. Members within the closed structure communicate frequently. To maintain a close partnership, they seldom defect. They also have knowledge about which groups have a high degree of credibility and thus can be seen as reliable partners. Once a member defects, other members will no longer accept it as a group member.

Network closure enables frequent exchange of information and resources among members, leading to efficiency gains as organizations can save time and effort otherwise required to seek individual information channels. On the one hand, partners share common targets. Even if they encounter challenges in action, close connections can help solve the problem in time and achieve the collective goal more efficiently. On the other hand, the behavior of members is restricted by trust and credibility. Close connections between members and their eagerness to maintain a good reputation will motivate each member to work hard to achieve goals and substantive results. If close connections cannot effectively regulate members' behavior, collective actions may experience defection. Members might limit overall information flow by withholding their own informational resources and neglect their obligations in collective efforts, thereby hindering the attainment of collective goals. The clustering coefficient is a measure of the degree to which members (nodes) in a network tend to cluster together (Yi and Scholz 2016). The local clustering coefficient of a node is calculated as the proportion of connections among its neighbors over the number of all possible connections. A higher clustering coefficient indicates denser connections between nodes in the network. In a closed network, members feel a stronger sense of commitment. To maintain their credibility, they are unlikely to defect. Instead, they will work harder to achieve collective goals (Burt 2005; Granovetter 1985). Therefore, we propose the following hypotheses.

Bonding hypothesis 2a: The bonding role of the NGO (measured by clustering coefficient) will be positively associated with collaborative network efficiency.

Bonding hypothesis 2b: The bonding role of the NGO (measured by clustering coefficient) will be positively associated with collaborative network effectiveness.

4 Data Collection

As the unit of analysis in this study is the individual NGOs, we select the research object and methods accordingly. We first choose environmental NGOs (ENGOs) as the

research object for two primary reasons. Firstly, environmental governance is a multifaceted public issue that cannot be solved by a single entity. The only effective approach to environmental governance is to coordinate the efforts of multiple actors. Therefore, ENGOs are motivated to create collaborative networks. Second, previous research on the network of NGO collaboration focuses primarily on social services, such as the provision of HIV/AIDS care and treatment, human service, public health, arts, and cultural services (Arya and Lin 2007; Jang, Feiock, and Saitgalina 2016). In the area of environmental protection, Sullivan and Xie (2009) established a connection with online environmental activism in China. Although the NGO sector that has drawn the greatest attention from scholars is ENGO (Li, Lo, and Tang 2017; Sullivan and Xie 2009; Umlas 1996; Yang 2005; Zhan and Tang 2016), few research have focused on the likelihood of real world connections among ENGOs offline. To fill the research gap, we chose ENGOs as our research object.

A list of NGOs in China and related information are available on two websites.[1] The NGO2.0 map website serves as a platform for creating information connections between enterprises and NGOs. According to the NGO directory of the public welfare map, there are NGOs around the country that work in 22 different project areas, including environmental protection. We can obtain basic organizational information from the website, such as organization name, mission, service area, office address, registration type, registration time, establishment date, contact person and number, email, the person in charge, the number of full-time staff and part-time volunteers, the names of partners, project influence, governance status, financial funds, and other related information. The second website is the China Development Brief (CDB), which was created in 1996. It is a platform that provides NGOs with access to expert observation, research, and online support and services, covering 14 service fields, including environmental protection. Compared with the first website, this one contains less organizational information, only listing details such as the establishment date, work area, organization size, project area, contact email, introduction, talent recruitment, classified information, and organization news.

We employ a questionnaire approach to collecting data to fully understand the information of ENGOs and build network data. The questionnaire design includes five items: personal situation, organizational characteristics, collaborative relationship, policy participation, and policy outcomes. ENGOs are located in 31 provinces and municipalities across the country. We integrate ENGOs from all 31 provinces and municipalities in the sample selection to ensure the comprehensiveness of the data source. Yet our data collection procedure encounters three main challenges. First, the questionnaire was distributed in May 2021 during the COVID-19 period, which made it difficult for us to distribute the surveys as planned. This might

1 The two websites are http://www.ngo20map.com/and https://chinadevelopmentbrief.org/.

have impacted the representativeness of data as we were unable to contact several organizations. Secondly, the information on two websites was inaccurate. We encountered difficulty contacting the heads of some organizations due to missing or erroneous information like email addresses and phone numbers. Third, the organizations are constantly evolving. New ENGOs are launched and registered every day, while others changed their names or even ceased to exist.

Given these three limitations, we decided to distribute our questionnaires via email, with supplemental contact via phone and text messages. We conducted two rounds of surveys in response to the inconsistent information found on the two websites. The first round of questionnaires was delivered and collected from the ENGOs listed on the NGO2.0 map from May 2021 to January 2022. The second round of questionnaires was distributed to the ENGOs listed on CDB's website and was collected between January 2022 and May 2022. It is worth noting that both questionnaires have the same contents, and the only difference is the target respondents. The ENGO directories of these two websites overlap with each other. In addition to the 677 ENGOs on the NGO2.0 map, 142 new ENGOs from the respondents are still present in the CDB, making a total of 819 ENGOs. Among them, 253 organizations lacked sufficient contact details, so we selected a total of 566 cases after removing 253 missing observations. Then, in the two rounds of the survey, we received a total of 103 completed questionnaires, resulting in a response rate of 18.2 %. It should be noted that as the number of surveys and the demands imposed on NGOs increase, these organizations may reach a saturation point, potentially diminishing their responsiveness to new data collection requests (Dupuy and Prakash 2018). Scholars have also indicated that the challenges posed by a regulated political environment, along with the pressures resulting from the COVID-19 pandemic, may also constrain the responsiveness of NGOs (Noakes and Teets 2020; Wilke, Howard, and Pop 2020). Given the prevalent "survey fatigue" during the COVID-19, a response rate of 18.2 % is the best we could obtain, and it should serve as a reasonable response rate for statistical analysis. The minimum time to complete a questionnaire was 221 s (nearly 4 min), and the maximum was 761 s (about 13 min). All questionnaires were valid in terms of response time.

Table 1 presents the information on the recovery of questionnaires. Despite collecting 103 responses in total, we encountered abnormalities in some of the questionnaires. One questionnaire had an inaccurately filled-in section that would have caused biases in the original data, so we eliminated it. In addition, two questionnaires had operational issues, such as the data from the original questionnaire being overwritten, so we removed them from the analysis. As a result, the final sample for our analysis included a total of 100 responses. As presented in Table 1, apart from Chongqing municipality and Qinghai province, where complete questionnaires could not be collected in the two rounds of the survey, data from

Table 1: Questionnaire information statistics.

Province/Municipalities	Round1: NGO2.0 map	Round 2: CDB	Total
Beijing	6	8	14
Guangdong	3	5	8
Zhejiang	6	1	7
Gansu	6	0	6
Jiangsu	4	1	5
Shaanxi	4	1	5
Shanghai	1	3	4
Henan	4	0	4
Hubei	4	0	4
Shandong	2	2	4
Yunnan	1	3	4
Anhui	4	0	4
Liaoning	4	0	4
Hunan	3	0	3
Shanxi	3	0	3
Guangxi	3	0	3
Guizhou	3	0	3
Tianjin	2	0	2
Hebei	2	0	2
Fujian	2	0	2
Jiangxi	2	0	2
Inner Mongolia	2	0	2
Xinjiang	2	0	2
Hainan	0	1	1
Sichuan	1	0	1
Ningxia	1	0	1
Heilongjiang	1	0	1
Jilin	1	0	1
Tibet	1	0	1
Chongqing	0	0	0
Qinghai	0	0	0
Total	78	25	103

Tianjin city were excluded due to missing data. As a result, the data for these three provinces and municipalities are zero. We received only one questionnaire each from Hainan, Sichuan, Ningxia, Heilongjiang, Jilin, and Tibet. Thus, we could not construct a network for these provinces. In addition, while two questionnaires were received for Hebei, Jiangxi, and Inner Mongolia, respectively, only one respondent in each province provided information on the partnership, and neither respondent completed the collaborator information. Burgette et al. (2021) assert that in social network analysis, researchers require a minimum of three alters to develop a

preliminary social network model. As the number of alters increases, researchers can conduct a more detailed analysis of the positions as well as the interactive relationships among actors within the network. Therefore, we could not construct networks for these provinces either. Therefore, we use the remaining 19 provinces and municipalities to construct the collaboration networks.

5 Measurement

5.1 Dependent Variables

Collaborative performance is the primary dependent variable. Scholars have adopted perceived performance and conducted correlational research to validate its feasibility (Eaton 2003; Fitch 1970). To measure an organization's collaborative performance, we decided to directly ask respondents about their subjective evaluations of collaborative outcomes. Scholars mainly focus on efficiency and effectiveness as collaborative outcomes. For example, Zhan and Tang (2016) measured performance indicators in their questionnaire using three dimensions, namely fairness, efficiency, and substantive effects. Accordingly, we selected efficiency and effectiveness, which align with our research questions, as our measures. *"I think the process of cooperating with other NGOs is efficient"* and *"I think the cooperation with other organizations is truly effective"*. These two questions were measured using a 7-point Likert-scale with 1 representing "strongly disagree" and 7 "strongly agree". Based on the organization's collaboration outcomes, respondents provided their evaluations, and we used these judgments to estimate the level of collaboration in the network.

5.2 Independent Variables

The independent variables in this study are network structures. We focus on out-degree centrality and clustering coefficient. To calculate the network structure statistics, we first construct a network for the collaborative relations of 19 provinces and municipalities. In the third part of the questionnaire, we listed the ENGOs in the provinces and municipalities where the respondents were located. Then, we asked them how often they communicated with the ENGOs on the list of environmental protection. The options are set to *"no contact"*, *"daily"*, *"weekly"*, *"monthly"*, and *"yearly"*. The question also suggests that if the respondents do not make a choice, it means that there is no collaborative relationship between the two organizations. Because the respondents' answers are directed, the constructed network includes ego-sender and alter-receiver. For example, if A answers that there is cooperation

and communication with B, and if B responds that it does not have a collaborative relationship with A, then A and B have a one-way collaborative relationship with A as the ego-sender and B as the alter-receiver.

Regarding the out-degree centrality of an ENGO, it can be calculated by the number of collaborators selected by the respondents. For example, if A develops a collaborative relationship with B, C, and D, then A will have an out-degree centrality of 3. The clustering coefficient is calculated using the method proposed by Watts and Strogatz (1998). First, we need to determine the scope of the region. The region G is composed of a group of vertices V and a set of edges E, and an edge e_{ij} represents the link between the link between vertex v_i and vertex v_j. N_i is defined as the adjacency directly connected to vertex v_i, which can be described by the formula $N_i = \{ v_j : e_{ij} \in E \vee e_{ji} \in E \}$. Second, we need to calculate the local clustering coefficient (C_i), C_i is the proportion of the actual number of links between nodes in a given region to the number of possible links between them. In the case of directed connection, e_{ij} represents the unidirectional connection between vertex v_i and v_j, e_{ji} represents the unidirectional connection between vertex v_j and v_i. In region G, the number of vertices is defined as k_i, then the number of possible links between vertex is $k_i (k_i - 1)$. Then the local clustering coefficient is $C_i = \frac{|\{e_{jk} : v_j, v_k \in N_i, e_{jk} \in E\}|}{k_i (k_i - 1)}$.

5.3 Control Variables

Leadership has a significant impact on cooperation (De Cremer and Van Knippenberg 2002; Saul and Seidel 2011). Organizational leadership can facilitate information transfer, resource sharing, and group connection. Through the council, which is established for consultations, solicitation of opinions, and discussion of specific issues, organizations can forge stronger links with other organizations and create partnerships (Guo and Acar 2005). An organization can benefit from an effective leader and a full-time team. The board of directors serves as an important intermediary in an organization's response to an uncertain external environment (Heimovics and Herman 1990). A full-time team can also strive to obtain legal status for the organization and stimulate its efficient operation. Therefore, we utilized four items to measure ENGOs' leadership, namely *"My organization has established a board"*, *"My organization has a board of directors"*, *"My organization has established a committee"*, and *"My organization has a full-time team of leaders and managers"*.

Another significant factor influencing collaborative outcomes is ENGOs' relationship with the government. In China, the government formulates rules and regulations for the establishment and registration of associations. ENGOs under governmental supervision can be registered as legitimate organizations, which is

essential for gaining the trust of other organizations and developing collaborative relationships. Moreover, the government can provide support for ENGOs. Organizational leaders with strong relationships with the government can obtain more financial support for their organizations (Zhan and Tang 2016), which would attract other ENGOs to form relationships and further increase their effectiveness of collaboration. However, having close ties with the government can also limit organizational operations. To avoid government control and supervision, organizational leaders lacking government work experience tend to avoid working closely with the government (Hsu and Jiang 2015). They prefer to maintain a good relationship with other ENGOs and try to avoid government interference. Therefore, we used three items to measure the relationship between ENGOs and the government, namely *"My organization is supervised by the government"*, *"The leader of my organization has experience working in the public sector"*, and *"The leader of my organization has working contacts with government officials"*.

The answer options for all control variables are *"yes"* or *"no"*, so we treat all control variables as dummies. If the respondent answered "yes", we coded it as 1. Otherwise, it was coded as 0. Table 2 depicts measurement details of the dependent variables, independent variables, and control variables.

Table 2: Measurements of variables.

Variables	Measures	Predicted relationship
Dependent variable		
Efficiency	Seven-point Likert scale (1 = strongly agree, 7 = strongly disagree)	N/A
Substantive effect	Seven-point Likert scale (1 = strongly agree, 7 = strongly disagree)	N/A
Independent variables		
Out-degree centrality	Out-degree centrality in the collaborative network	+
Clustering coefficient	Clustering coefficient in the collaborative network	+
Control variables		
Board	Dummy = 1 if the organization has a board	Control
Council	Dummy = 1 if the organization has a council	Control
Committee	Dummy = 1 if the organization has a committee	Control
Full-time team	Dummy = 1 if the organization has a full-time team	Control
Supervised by government	Dummy = 1 if the organization accepts government regulation	Control
Leader working experience	Dummy = 1 if the organization leader has worked in the public sector	Control
Leader working contact	Dummy = 1 if the organization leader has working contact with a government official	Control

6 Methods

We employ ordinary least squares regression (OLS) to test our hypotheses. We utilize four models to estimate the relationship between independent variables and dependent variables. We specify the basic model as follows:

$$Y = a\boldsymbol{X} + b\boldsymbol{Z} + c + e$$

Where Y represents the dependent variables, including collaborative efficiency and effectiveness. $\boldsymbol{X}$ represents independent variables for the out-degree centrality and clustering coefficient. $\boldsymbol{Z}$ represents control variables, covering seven dummy variables. Lastly, a, b, and c are fitting parameters, and e is the error term.

In addition to regression analysis, we also complemented it with a detailed case study. Then, to further supplement the survey evidence, we incorporated a case of brokerage within the Beijing sub-network.

7 Results

Descriptive statistics are presented in Table 3. Our sample size is 100, but after removing missing data, the number of observations for the independent and dependent variables are 83 and 97, respectively. As shown in Table 3, the maximum value of out-degree centrality is 82, which indicates that the number of connected organizations can reach up to 82. In this study, the ENGO with the highest out-degree centrality is the Beijing Fuqun Environmental Research Institute, which has proactively established collaborative links with 82 local ENGOs in Beijing. The average

Table 3: Descriptive statistics.

Variables	Mean	SD	Min	Max	Obs
Efficiency	4.42	1.93	0	7	97
Substantial effect	4.51	2.02	0	7	97
Out degree centrality	13.07	14.46	0	82	83
Clustering coefficient	0.11	0.17	0	1	83
Board	0.12	0.33	0	1	100
Council	0.91	0.29	0	1	100
Committee	0.46	0.50	0	1	100
Full-time team	0.66	0.48	0	1	100
Supervised by government	0.97	0.17	0	1	100
Leader working experience	0.57	0.50	0	1	100
Leader working contact	0.08	0.27	0	1	100

values of the indicators on cooperation performance are 4.42 and 4.51, indicating that respondents' subjective evaluation of cooperation performance is relatively positive.

Table 4 presents the regression results of four OLS models. Model 1 and Model 2 take collaborative efficiency as the dependent variable. Model 1 is a baseline model, which is used to explore the relationship between the control variables and the dependent variable. Model 1 shows that the existence of the committee is positively associated with collaborative efficiency at the level of 0.05, meaning that the ENGOs with a committee have higher cooperation efficiency. However, there is a negative correlation between whether to be supervised by the government and cooperation efficiency, which indicates that ENGOs that are not supervised by the government have higher cooperation efficiency. In Model 2, the two core network structure variables, the out-degree centrality, and the clustering coefficient, are added. The out-degree centrality of the NGO is positively associated with cooperation network

Table 4: Regression results for network structure on collaborative performance.

	Collaborative efficiency as DV		Collaborative effect as DV	
Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Out degree centrality		0.03[c]		0.04[c]
		(0.02)		(0.02)
Clustering coefficient		2.75[c]		2.72
		(1.28)		(1.37)
Board	0.35	−0.19	0.31	−0.27
	(0.60)	(0.62)	(0.64)	(0.67)
Council	0.51	0.52	−0.01	0.07
	(0.73)	(0.76)	(0.77)	(0.81)
Committee	0.82[c]	0.84	0.64	0.54
	(0.40)	(0.44)	(0.43)	(0.47)
Full-time team	0.14	−0.01	0.40	0.25
	(0.45)	(0.48)	(0.48)	(0.52)
Supervised by government	−3.14[c]	−3.66[c]	−2.94	−3.54[c]
	(1.45)	(1.41)	(1.54)	(1.51)
Leader working experience	0.32	0.43	0.22	0.30
	(0.40)	(0.43)	(0.42)	(0.46)
Leader working contact	−0.19	0.48	−0.31	0.57
	(0.75)	(0.84)	(0.80)	(0.90)
Constant	6.53[a]	5.62[a]	6.99[a]	5.89[a]
	(1.62)	(1.62)	(1.73)	(1.74)
R^2	0.12	0.22	0.09	0.18
N	97	81	97	81

[a]$p \leq 0.001$; [b]$p \leq 0.01$; [c]$p \leq 0.05$, *standard errors are shown in parentheses*.

efficiency at the 0.05 level, and the clustering coefficient of the NGO is positively related to cooperation network efficiency at the 0.05 level, which supports H1a and H2a.

In the Beijing sub-network, the Beijing Fuqun Environmental Research Institute serves as a pivotal broker. Established in 1989, the institute initially focused on the Mount Everest Nature Reserve, supporting ecological protection and sustainable community development. Initially, its influence was limited, hindering the effective promotion of environmental activities. Over the years, the institute expanded its influence by forging continuous cooperative relationships with peers. Notable successful initiatives include the Pendeba Project and the Green Long March Project. The Pendeba Project features a visitor and training center in the Shigatse area, facilitating training for local communities and promoting sustainable development through collaborations with other ENGOs. Through the Pendeba Project, Fuqun has extended the societal impact of ENGOs within the local region. The Green Long March Project is China's largest youth environmental protection activity and another successful case of Fuqun. The project organizes and mobilizes student volunteers and other ENGOs to participate in environmental protection activities, facilitating effective dissemination of environmental awareness. Fuqun Environmental Research Institute has become a central actor in China's environmental protection field by gathering the strength of other ENGOs, enhancing the efficiency and effectiveness of collective actions.

The results for Model 3 and Model 4 take collaborative effectiveness as the dependent variable. As shown in Model 3, control variables and the collaborative effectiveness were not statistically correlated. After adding network structural indicators into model 4, the results became slightly different. The out-degree centrality of the NGOs is positively correlated with the effectiveness of network cooperation at the 0.05 level, which supports H1b. However, the clustering coefficient is not statistically associated with collaborative effectiveness. In terms of control variables, whether the NGOs are supervised by the government is negatively associated with the effectiveness of network cooperation at the 0.05 level.

8 Discussions

Our empirical findings partially support the hypothesis that bridging and bonding networks can enhance the efficiency and effectiveness of the ENGO collaborative network in China. We construct ENGO networks among 19 provinces and municipalities, and we find that bridging and bonding structures in ENGO networks are helpful in achieving efficient and substantive results.

ENGOs' out-degree centrality and collaborative efficiency are significantly correlated at the 0.05 level. Besides, the out-degree centrality of ENGOs has a significant positive correlation with the substantive effect of their cooperation. ENGOs with higher levels of out-degree centrality tend to establish collaborative relations with more organizations, suggesting that they are located in the central actor position within the network, which is conducive to information sharing and coordination. This aligns with findings from previous studies (Tan, Zhang, and Wang 2015; Yi 2018; Yi, Yang, and Zhou 2021). Out-degree centrality represents bridging social capital in collaborative networks. When organizations possess greater bridging capital and play a central role as critical actors within networks, they gain access to a broader range of information pathways. On the one hand, bridging social capital enhances the efficiency of information exchange within the network. Our study suggests that central actors integrate information and resources by engaging in active collaboration strategies. As opposed to individuals spending their time and energy searching for resources, central actors act as the hubs of the network and can gather information more easily. Thus, they can transmit information and resources more efficiently. On the other hand, bridging social capital facilitates achieving effectiveness within the network. Bridging social capital connects different types of NGOs, enhancing the collaborative network's problem-solving capabilities. By fostering cooperation and communication among internal members, central actors facilitate the network's ability to respond promptly to and resolve issues, thus driving the effectiveness.

Intriguingly, the effects of the clustering coefficient on collaborative efficiency and effectiveness are inconsistent. The clustering coefficient is significantly and positively associated with collaborative efficiency at the 0.05 level. However, the clustering coefficient does not exhibit a statistically significant correlation with the effectiveness of the collaborative network. Networks' clustering coefficients indicate the degree of connectivity among their members. It appears that although close cooperation between members can enhance information acquisition efficiency, it does not necessarily result in substantive improvements. It is possible that a close collaborative relationship requires mutual trust among members to reach a consensus, which may suggest that members must discard political ties with the government to reach a consensus. On the one hand, connections between ENGOs and the government can lead to more information being shared, regulation of freedoms, and economic improvement for organizations (Chen, Chen, and Huang 2013; Luo, Huang, and Wang 2012). On the other hand, maintaining good relationships with the government tends to lose NGO representation and limit their initial actions (Guo 2007; Zhan and Tang 2016). In China, the benefits of ENGO partnerships are not always superior to those of government partnerships. As a result, a close partnership between ENGOs may undermine the support of the

government, thereby affecting the effectiveness of the partnership. Hilderbrandt and Turner (2009) also argued that the government is concerned about the impact of ENGO's close collaborative links. Instead of forming a close partnership, the government would prefer that they engage in their work, which will also influence the effectiveness of the collaborative network. Therefore, even though the collaboration between ENGOs is close, the overall strength is relatively weak and insufficient to achieve substantial effects.

In terms of the influence of ENGOs' leadership, which refers to the internal structure of an ENGO, we find that organizations with committees are positively correlated with cooperation efficiency at the 0.05 level. This is consistent with the existing literature (Guo and Acar 2005), confirming that a well-established organizational structure is more conducive to achieving collaborative effects. Moreover, accepting government supervision and cooperative efficiency are negatively correlated at the level of 0.05. In other words, ENGOs that are not supervised by the government tend to produce more efficient cooperation. This corresponds to the previous statement of the negative consequences of government restrictions on ENGOs. Government involvement will limit the autonomy of ENGOs' activities, which can reduce exchanges and cooperation among members. ENGOs who are supervised by the government must consider the government's provisions, which can influence collaborative enthusiasm and efficiency.

9 Conclusions

NGOs in China are constantly growing in number, and they are playing an increasingly important role in various fields, including public service provision, policy advocacy, and the promotion of civic awareness of environmental protection and other social issues. They must gather their respective strengths to expand their overall influence. However, few studies have focused on whether Chinese NGOs form collaborative networks and what kinds of networks can produce better collaborative results. To fill these gaps, this article employs the questionnaire survey method to conduct an ENGO survey in 31 provinces and municipalities in China. Our findings confirm the existence of the ENGO network in China. Although Sullivan and Xie (2009) previously used a web crawler to find that Chinese environmentalists form connections online, real-world collaborative relationships have not been proven to exist. Additionally, our research reveals that while the bonding network structure can promote collaborative efficiency, it is not always effective. The bridging network structure, however, can produce better effectiveness and achieve higher collaborative efficiency.

Our research has several theoretical implications. First, we demonstrate that collaborative NGO networks are efficient, echoing the controversies raised by some researchers. Andreasen (1996) suggests that maintaining partnerships may consume the energy of individual NGOs, resulting in wasted resources and ineffective management. Babiak and Thibault (2009) also argue that NGO governance, roles, and responsibilities are complex and that partnerships are prone to ineffectiveness. However, we have shown that bridging and bonding structured networks can contribute to efficiency and yield substantive results. Ineffective management and resource waste may not be the result of cooperation. Cooperation should be promoted as an organizational development strategy within NGOs. The critical role of central actors is to facilitate NGOs in developing partnerships with other NGOs. NGOs can benefit from this by integrating information and filtering out duplicated information. For example, the Beijing Fuqun Social Service Center has established collaborative alliances with 82 Beijing-based NGOs, thus establishing itself as a central actor in Beijing's NGO collaborative network. By executing its central bridging role, the Beijing Fuqun Social Service Center facilitates the dissemination of environmental conservation information to other entities. As a result, the network of Beijing's NGOs can actively engage in environmental conservation activities, yielding substantive achievements. Also, NGOs can form a clustering relationship based on trust, and ambiguous roles and responsibilities can be alleviated through frequent exchanges. To accomplish common goals, clustering groups need to reach a consensus. However, NGOs should also consider whether sacrificing some political ties or other resources would compromise the effectiveness of their partnership.

We also contribute to the study of collaborative networks in NGO research. Previous literature examines the development of civil society in China from a state, market, and institutional perspective (Yang 2005). Instead, we analyze the evolution of civil society through a network perspective. Specifically, the development of civil society should also focus on its strengths and rely on the establishment of collaborative relationships among NGOs to increase its influence. This study introduces a novel perspective by focusing on inter-organizational cooperation among NGOs, thereby extending beyond traditional studies that typically examine collaboration with governmental and corporate entities. Existing literature on cooperation networks among environmental NGOs includes studies by Sofronova, Holley, and Nagarajan (2014) and Umlas (1996). The former examines local cooperation networks in Russia, while the latter focuses on similar networks in Mexico, both employing interview-based methods to explore cooperative relationships among environmental NGOs. In contrast, our study reveals cooperation networks among environmental NGOs in China, situated within the country's institutional context. Through quantitative analysis, we delineate network structures and interaction dynamics, contributing to a broader understanding of collaboration patterns among

NGOs in different environments and offering new empirical evidence and perspectives for cross-cultural research. Additionally, we combine resource dependence theory and social capital theory as the theoretical foundation to explain the NGO network and its logic of formation. Empirical evidence shows that the structural features of networks are closely related to the network outcomes, thus providing a new perspective for the study of the theoretical dimensions of network outcomes.

Our research also has practical implications for policymakers. To foster the development of civil society and increase the credibility of a service-oriented government, policymakers should consider the critical role of NGOs in social development. Indeed, NGOs can deliver services more easily to citizens. To improve the government's service delivery capacities and enhance the reputation of a service-oriented government, policymakers may choose to purchase public services from NGOs or collaborate with NGOs in the provision of public services (Heurlin 2010). Moreover, citizens and NGOs are important supervisors of government activities, supervising the implementation of local government policies to ensure that implementation follows the established goals and improves the efficiency of policy implementation (Zhan and Tang 2013). Our results suggest that government-regulated NGOs are less effective in collaborative networks and fail to achieve substantive results. Government regulations also limit the actions of NGOs and fail to stimulate their enthusiasm for collaboration. A sufficiently relaxed regulatory environment would improve effective collaborative outcomes for NGOs.

This research has several limitations. Due to the impact of COVID-19, many areas were in lockdown status when we distributed the questionnaires, which led to a relatively low response rate. Second, most NGOs were preoccupied with organizing service delivery activities and did not respond to our survey timely, which resulted in unsuccessful attempts to contact all listed organizations. Future research may devote more time to collecting more data and conducting follow-up studies with a stronger research design. We adopt a subjective cognitive measure to represent collaborative performance. Although it can somewhat represent the collaborative outcomes, its robustness should be verified with more objective data and measurements, such as defining more objective criteria for efficient and effective collaboration. Future studies might consider constructing objective measures of collaborative performance through changes in the influence of the organization, such as changes in public influence indexes such as the Weibo and WeChat public accounts, as well as changes in NGOs' sources of funding. Additionally, our research only examines the relationship between the network structure and collaborative outcomes. Yet researchers might be more concerned about the role of NGOs in policy advocacy, and future research can further connect network structure to policy advocacy. It would be interesting to examine whether the network structure may affect the capacity of NGOs to participate in the policy process, and what features of network structure

may motivate NGOs to engage in policy advocacy. Lastly, given the constraints of resources and geographical scope, we have only explored the collaborative networks of ENGOs within the province. Future research can construct collaborative networks of ENGOs both within and across provinces in the field of environmental protection, allowing for a more detailed comparison and analysis of the structural characteristics and performance differences between intra-provincial and inter-provincial networks.

References

AbouAssi, K., N. Makhlouf, and P. Whalen. 2016. "NGOs' Resource Capacity Antecedents for Partnerships." *Nonprofit Management and Leadership* 26 (4): 435–51.

AbouAssi, K., R. Wang, and K. Huang. 2021. "Snuggling Together or Exploring Options? A Multilevel Analysis of Nonprofit Partnership Formation and Evolution in an Unstable Institutional Context." *Nonprofit and Voluntary Sector Quarterly* 50 (1): 143–64.

Andreasen, A. R. 1996. "Profits for Nonprofits: Find a Corporate Partner." *Harvard Business Review* 74 (6): 47–59.

Anheier, H. K. 2014. *Nonprofit Organizations: Theory, Management, Policy*. London and New York: Routledge.

Arya, B., and Z. Lin. 2007. "Understanding Collaboration Outcomes from an Extended Resource-Based View Perspective: The Roles of Organizational Characteristics, Partner Attributes, and Network Structures." *Journal of Management* 33 (5): 697–723.

Babiak, K., and L. Thibault. 2009. "Challenges in Multiple Cross-Sector Partnerships." *Nonprofit and Voluntary Sector Quarterly* 38 (1): 117–43.

Berry, Jeffrey. M. 2003. *A Voice for Nonprofits*. Washington, DC: Brookings Institution.

Bourdieu, Pierre. 1986. "The Forms of Capital." In *Handbook of Theory and Research for the Sociology of Education*, edited by John Richardson, 241–58. New York: Greenwood Press.

Bringmann, L. F., T. Elmer, S. Epskamp, R. W. Krause, D. Schoch, M. Wichers, and E. Snippe. 2019. "What Do Centrality Measures Measure in Psychological Networks?" *Journal of Abnormal Psychology* 128 (8): 892.

Brinkerhoff, Derick W. 1999. "Exploring State–Civil Society Collaboration: Policy Partnerships in Developing Countries." *Nonprofit and Voluntary Sector Quarterly* 28 (Suppl. 1): 59–86.

Burgette, J. M., J. Rankine, A. J. Culyba, K. H. Chu, and K. M. Carley. 2021. "Best Practices for Modeling Egocentric Social Network Data and Health Outcomes." *HERD: Health Environments Research & Design Journal* 14 (4): 18–34.

Burt, Ronald S. 2005. *Brokerage and Closure: An Introduction to Social Capital*. Oxford, NY: Oxford University Press.

Burt, Ronald S. 1992. *Structural Holes*. Cambridge, MA: Harvard University Press.

Burt, Ronald S. 2001. "Structural Holes versus Network Closure as Social Capital." In *Social Capital: Theory and Research*, edited by Nan Lin, Karen S. Cook, and Ronald S. Burt. New Brunswick, NJ: Transaction Publishers.

Burt, R. S., and G. Soda. 2021. "Network Capabilities: Brokerage as a Bridge Between Network Theory and the Resource-Based View of the Firm." *Journal of Management* 47 (7): 1698–719.

Chavesc, M., L. Stephens, and J. Galaskiewicz. 2004. "Does Government Funding Suppress Nonprofits' Political Activity?" *American Sociological Review* 69 (2): 292–316.

Chen, B., and E. A. Graddy. 2010. "The Effectiveness of Nonprofit Lead-organization Networks for Social Service Delivery." *Nonprofit Management and Leadership* 20 (4): 405–22.
Chen, C. C., X. P. Chen, and S. Huang. 2013. "Chinese Guanxi: An Integrative Review and New Directions for Future Research." *Management and Organization Review* 9 (1): 167–207.
Clarke, A., and A. MacDonald. 2019. "Outcomes to Partners in Multi-Stakeholder Cross-Sector Partnerships: A Resource-Based View." *Business & Society* 58 (2): 298–332.
Coleman, James S. 1988. "Social Capital in the Creation of Human Capital." *American Journal of Sociology* 94: S95–120.
Cooper, K. R., and M. Shumate. 2012. "Interorganizational Collaboration Explored through the Bona Fide Network Perspective." *Management Communication Quarterly* 26 (4): 623–54.
De Cremer, D., and D. Van Knippenberg. 2002. "How Do Leaders Promote Cooperation? the Effects of Charisma and Procedural Fairness." *Journal of Applied Psychology* 87 (5): 858.
Dupuy, K., and A. Prakash. 2018. "Do Donors Reduce Bilateral Aid to Countries with Restrictive NGO Laws? A Panel Study, 1993–2012." *Nonprofit and Voluntary Sector Quarterly* 47 (1): 89–106.
Eaton, Susan C. 2003. "If You Can Use Them: Flexibility Policies, Organizational Commitment, and Perceived Performance." *Industrial Relations: A Journal of Economy and Society* 42 (2): 145–67.
Fitch, Gordon. 1970. "Effects of Self-Esteem, Perceived Performance, and Choice on Causal Attributions." *Journal of Personality and Social Psychology* 16 (2): 311.
Freeman, L. C. 1979. "Centrality in Social Networks Conceptual Clarification." *Social Networks* 1: 215–39.
Gazley, Beth. 2010. "Why Not Partner with Local Government? Nonprofit Managerial Perceptions of Collaborative Disadvantage." *Nonprofit and Voluntary Sector Quarterly* 39 (1): 51–76.
Gazley, B., and J. L. Brudney. 2007. "The Purpose (And Perils) of Government-Nonprofit Partnership." *Nonprofit and Voluntary Sector Quarterly* 36 (3): 389–415.
Gazley, B., and C. Guo. 2020. "What Do We Know about Nonprofit Collaboration? A Systematic Review of the Literature." *Nonprofit Management and Leadership* 31 (2): 211–32.
Graddy, E. A., and B. Chen. 2006. "Influences on the Size and Scope of Networks for Social Service Delivery." *Journal of Public Administration Research and Theory* 16 (4): 533–52.
Granovetter, Mark. 1985. "Economic Action and Social Structure." *American Journal of Sociology* 91 (3): 481–510.
Guo, Chao. 2007. "When Government Becomes the Principal Philanthropist: The Effects of Public Funding on Patterns of Nonprofit Governance." *Public Administration Review* 67 (3): 458–73.
Guo, C., and M. Acar. 2005. "Understanding Collaboration Among Nonprofit Organizations: Combining Resource Dependency, Institutional, and Network Perspectives." *Nonprofit and Voluntary Sector Quarterly* 34 (3): 340–61.
Guo, C., and G. D. Saxton. 2010. "Voice-In, Voice-Out: Constituent Participation and Nonprofit Advocacy." *Nonprofit Policy Forum* 1 (1): 1–25.
Heimovics, Richard D., and Robert D. Herman. 1990. "The Responsibility for Critical Incidents in Nonprofit Organizations." *Nonprofit and Voluntary Sector Quarterly* 19 (1): 59–72.
Heurlin, Christopher. 2010. "Governing Civil Society: The Political Logic of NGO–State Relations under Dictatorship." *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations* 21 (2): 220–39.
Hildebrandt, T., and J. L. Turner. 2009. "Green Activism? Reassessing the Role of Environmental NGOs in China." In *State and Society Responses to Social Welfare Needs in China*, edited by J. Schwartz, and S. Shieh, 89–110. Abingdon, England: Routledge.
Hillig, Z., and J. Connell. 2018. "Social Capital in a Crisis: NGO Responses to the 2015 Nepalese Earthquakes." *Asia Pacific Viewpoint* 59 (3): 309–22.
Ho, Peter. 2001. "Greening without Conflict? Environmentalism, NGOs and Civil Society in China." *Development and Change* 32 (5): 893–921.

Hsu, Carolyn. 2010. "Beyond Civil Society: An Organizational Perspective on State–NGO Relations in the People's Republic of China." *Journal of Civil Society* 6 (3): 259–77.

Hsu, C. L., and Y. Jiang. 2015. "An Institutional Approach to Chinese NGOs: State Alliance versus State Avoidance Resource Strategies." *The China Quarterly* 221: 100–22.

Hudson, Alan. 2002. "Advocacy by UK-Based Development NGOs." *Nonprofit and Voluntary Sector Quarterly* 31: 402–18.

Hummel, D., and B. Kusumasari. 2024. "Power Dynamics and Resource Dependence: NGO-government Collaboration in Yogyakarta, Indonesia." *Public Administration and Development* 44 (1): 32–42.

Islam, Carolyn A. (2016). Non-governmental Organization Vulnerabilities: Donors and Resource Dependence. CMC Senior Theses. Paper 1429.

Jang, H. S., R. C. Feiock, and M. Saitgalina. 2016. "Institutional Collective Action Issues in Nonprofit Self-Organized Collaboration." *Administration & Society* 48 (2): 163–89.

Jing, Y., and T. Gong. 2012. "Managed Social Innovation: The Case of Government-Sponsored Venture Philanthropy in Shanghai." *Australian Journal of Public Administration* 71 (2): 233–45.

Johnson, J. M., and N. Ni. 2015. "The Impact of Political Connections on Donations to Chinese NGOs." *International Public Management Journal* 18 (4): 514–35.

Kapucu, N., and F. Demiroz. 2015. "A Social Network Analysis Approach to Strengthening Nonprofit Collaboration." *Journal of Applied Management and Entrepreneurship* 20 (1): 87–101.

Kareithi, R. N., and C. Lund. 2012. "Review of NGO Performance Research Published in Academic Journals between 1996 and 2008." *South African Journal of Science* 108: 36–44.

Keck, M. E., and K. Sikkink. 2004. *Activists Beyond Borders: Advocacy Networks in International Politics*. New York: Cornell University Press.

Kwon, S. W., E. Rondi, D. Z. Levin, A. De Massis, and D. J. Brass. 2020. "Network Brokerage: An Integrative Review and Future Research Agenda." *Journal of Management* 46 (6): 1092–120.

Lavie, D. 2006. "The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View." *Academy of Management Review* 31 (3): 638–58.

Li, H., C. W. H. Lo, and S. Y. Tang. 2017. "Nonprofit Policy Advocacy under Authoritarianism." *Public Administration Review* 77 (1): 103–17.

Long, J. C., F. C. Cunningham, and J. Braithwaite. 2013. "Bridges, Brokers and Boundary Spanners in Collaborative Networks: A Systematic Review." *BMC Health Services Research* 13: 1–13.

Luo, Y., Y. Huang, and S. L. Wang. 2012. "Guanxi and Organizational Performance: A Meta-Analysis." *Management and Organization Review* 8 (1): 139–72.

Malatesta, D., and C. R. Smith. 2014. "Lessons from Resource Dependence Theory for Contemporary Public and Nonprofit Management." *Public Administration Review* 74 (1): 14–25.

McCarthy, J. D., and M. N. Zald. 1977. "Resource Mobilization and Social Movements: A Partial Theory." *The American Journal of Sociology* 82 (6): 1212–41.

Mitchell, G. E., R. O'Leary, and C. Gerard. 2015. "Collaboration and Performance: Perspectives from Public Managers and NGO Leaders." *Public Performance and Management Review* 38 (4): 684–716.

Moshtari, M., and E. Vanpoucke. 2021. "Building Successful NGO–Business Relationships: A Social Capital Perspective." *Journal of Supply Chain Management* 57 (3): 104–29.

Muller, A., and R. Kräussl. 2011. "Doing Good Deeds in Times of Need: A Strategic Perspective on Corporate Disaster Donations." *Strategic Management Journal* 32 (9): 911–29.

Noakes, S., and J. C. Teets. 2020. "Learning under Authoritarianism: Strategic Adaptations within International Foundations and NGOs in China." *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations* 31 (5): 1093–113.

Onyx, J., L. Armitage, B. Dalton, R. Melville, J. Casey, and R. Banks. 2010. "Advocacy with Gloves on: The "Manners" of Strategy Used by Some Third Sector Organizations Undertaking Advocacy in NSW and Queensland." *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations* 21 (1): 41–61.

Pfeffer, J., and G. Salancik. 2015. "External Control of Organizations – Resource Dependence Perspective." In *Organizational Behavior 2*, 373–88. London and New York: Routledge.

Pfeffer, J., and G. R. Salancik. 1978. *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper and Row.

Provan, Keith G. 1984. "Interorganizational Cooperation and Decision-Making Autonomy in a Consortium Multi-Hospital System." *Academy of Management Review* 9 (3): 494–504.

Provan, K. G., and P. Kenis. 2008. "Modes of Network Governance: Structure, Management, and Effectiveness." *Journal of Public Administration Research and Theory* 18 (2): 229–52.

Provan, K. G., and H. B. Milward. 1995. "A Preliminary Theory of Network Effectiveness: A Comparative Study of Four Community Mental Health Systems." *Administrative Science Quarterly* 40 (1): 1–33.

Robinson, R. S., J. N. Brass, A. Shermeyer, and N. Grossman. 2024. "Reported Effects of Non-governmental Organizations (NGOs) in Health and Education Service Provision: The Role of NGO–Government Relations and Other Factors." *Development Policy Review* 42 (1): e12737.

Sanyal, P. 2006. "Capacity Building through Partnership: Intermediary Nongovernmental Organizations as Local and Global Actors." *Nonprofit and Voluntary Sector Quarterly* 35 (1): 66–82.

Sapat, A., A. M. Esnard, and A. Kolpakov. 2019. "Understanding Collaboration in Disaster Assistance Networks: Organizational Homophily or Resource Dependency?" *The American Review of Public Administration* 49 (8): 957–72.

Saul, U., and C. Seidel. 2011. "Does Leadership Promote Cooperation in Climate Change Mitigation Policy?" *Climate Policy* 11 (2): 901–21.

Schade, J., Y. Wang, and A. M. van Prooijen. 2022. "Consumer Skepticism towards Corporate-NGO Partnerships: The Impact of CSR Motives, Message Frame and Fit." *Corporate Communications: An International Journal* 27 (5): 39–55.

Schmid, H., M. Bar, and R. Nirel. 2008. "Advocacy Activities in Nonprofit Human Service Organizations: Implications for Policy." *Nonprofit and Voluntary Sector Quarterly* 37 (4): 581–602.

Sofronova, E., C. Holley, and V. Nagarajan. 2014. "Environmental Non-governmental Organizations and Russian Environmental Governance: Accountability, Participation and Collaboration." *Transnational Environmental Law* 3 (2): 341–71.

Stroup, S. S., and W. Wong. 2013. "Come Together? Different Pathways to International NGO Centralization." *International Studies Review* 15 (2): 163–84.

Sullivan, J., and L. Xie. 2009. "Environmental Activism, Social Networks and the Internet." *The China Quarterly* 198: 422–32.

Tan, J., H. Zhang, and L. Wang. 2015. "Network Closure or Structural Hole? the Conditioning Effects of Network–Level Social Capital on Innovation Performance." *Entrepreneurship Theory and Practice* 39 (5): 1189–212.

Tang, S. Y., and X. Zhan. 2008. "Civic Environmental NGOs, Civil Society, and Democratisation in China." *The Journal of Development Studies* 44 (3): 425–48.

Umlas, Elizabeth Dora. 1996. *Environmental Non-Governmental Networks: The Mexican Case in Theory and Practice*. New Haven, CT: Yale University.

Wang, Ming. 2006. "The Social Function and Classification of Nonprofit Organizations." *Academic Monthly* 38 (9): 8–11.

Wasserman, S., and K. Faust. 1994. *Social Network Analysis: Methods and Applications*. Cambridge: Cambridge University Press.

Watts, D. J., and S. H. Strogatz. 1998. “Collective Dynamics of ‘small-World’networks.” *Nature* 393 (6684): 440–2.

Whitehead, D. 2014. “Chinese NGO-Firm Partnerships and CSR from an Institutional Perspective.” *Journal of Current Chinese Affairs* 43 (4): 41–74.

Wilke, N. G., A. H. Howard, and D. Pop. 2020. “Data-informed Recommendations for Services Providers Working with Vulnerable Children and Families during the COVID-19 Pandemic.” *Child Abuse & Neglect* 110: 104642.

Wu, Fengshi. 2003. “Environmental GONGO Autonomy: Unintended Consequences of State Strategies in China.” *The Good Society* 12 (1): 35–45.

Yabanci, Bilge. 2019. “Turkey’s Tamed Civil Society: Containment and Appropriation under a Competitive Authoritarian Regime.” *Journal of Civil Society* 15 (4): 285–306.

Yang, A., and P. H. Cheong. 2019. “Building a Cross-Sectoral Interorganizational Network to Advance Nonprofits: NGO Incubators as Relationship Brokers in China.” *Nonprofit and Voluntary Sector Quarterly* 48 (4): 784–813.

Yang, Guobin. 2005. “Environmental NGOs and Institutional Dynamics in China.” *The China Quarterly* 181: 46–66.

Yi, Hongtao. 2018. “Network Structure and Governance Performance: What Makes a Difference?” *Public Administration Review* 78 (2): 195–205.

Yi, Hongtao, and John. T. Scholz. 2016. “Policy Networks in Complex Governance Subsystems: Observing and Comparing Hyperlink, Media, and Partnership Networks.” *Policy Studies Journal* 44 (3): 248–79.

Yi, Hongtao, Y. Yang, and C. Zhou. 2021. “The Impact of Collaboration Network on Water Resource Governance Performance: Evidence from China’s Yangtze River Delta Region.” *International Journal of Environmental Research and Public Health* 18 (5): 2557.

Zhan, X., and S. Y. Tang. 2016. “Understanding the Implications of Government Ties for Nonprofit Operations and Functions.” *Public Administration Review* 76 (4): 589–600.

Zhan, X., and S. Y. Tang. 2013. “Political Opportunities, Resource Constraints and Policy Advocacy of Environmental NGOs in China.” *Public Administration* 91 (2): 381–99.

Zuckerman, H. S., and T. A. D’aunno. 1990. “Hospital Alliances: Collaborative Strategy in a Competitive Environment.” *Health Care Management Review*: 21–30.