2019

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This is an Accepted Manuscript of an article published by Routledge, an imprint of Taylor & Francis Group, in *Public Performance & Management Review* in 2019, available online at doi: 10.1080/15309576.2018.1562946

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Abstract

Current scholarship identifies benefits to both high quality partnerships and extensive networks when managing shared policy goals. However, with limited collaborative capacity, many public-sector agencies are faced with a decision of whether to pursue quality connections with specific organizations or more partnerships with an array of organizations. Using survey data from 72 local air agencies, findings indicate that quality of partnerships are better predictors of improved air quality than quantity of partnerships. Conclusions suggest building high quality partnerships is more important than having many partnerships when pursuing shared policy goals in a multi-dimensional environment.

Keywords: partnership, cross-sector collaboration, intergovernmental relations

Introduction

Inter-organizational partnerships are a key to achieving shared policy goals, especially when faced with complex problems (Andrews & Entwistle, 2010; O'Toole, 2015). Current scholarship identifies benefits of building both high quality partnerships and extensive networks of numerous organizations, which include resource sharing and transaction cost reduction. However, public-sector agencies have limited collaborative capacity (Provan & Lemaire, 2012). Therefore, many agencies are faced with a decision of whether to pursue quality connections with specific organizations or more partnerships with an array of organizations. There is little evidence to indicate how partnership "quality" and "quantity" should be balanced though. Additionally, faced with a multi-dimensional environment including both layered intergovernmental and cross-sectoral organizations involved in public service provision, there is limited research examining the types of organizations that are best suited for collaborative management of shared policy goals (Andrews & Entwistle, 2010; Berry & Brower, 2014). After literature on public-sector partnerships is reviewed, collaboration in U.S. air quality governance is discussed, where local air agencies are situated at the nexus of a diverse set of organizations (Fowler, 2018). Then, partnerships are examined using data from a sampling of 72 local air agencies, with findings indicating that partnership quality is a better predictor of air quality than partnership quantity. Conclusions suggest high quality partnerships are more important than many partnerships when pursuing shared policy goals in a multi-dimensional environment.

Partnerships

Policy governance relies largely on collaboration from a diverse group of public, private, and non-profit organizations (Fowler, 2018; Hill & Hupe, 2014; Lecy, Mergel, & Schmitz, 2014; O'Toole, 2000, 2015; Provan & Milward, 2001). As such, public administration research finds it increasingly important to understand how collaboration affects public service provision (O'Toole, 2000, 2015), and "an important component in almost every contemporary framework explaining implementation success and failure has to do with how inter-organizational relationships are managed" (Lundin, 2007, p. 631). While a substantial body of literature focuses on whether increasing partnerships results in better policy outcomes, "increasing partnerships" may be defined alternatively as organizational investment in collaborations (quality) or number of organizations partnered with (quantity) (Berry, et al., 2004; McGuire & Agranoff, 2011; McQuaid, 2010; O'Toole, 2015; Provan & Lemaire, 2012). In relation to quality, several scholars attempt to differentiate between collaboration and cooperation in formal partnership arrangements. Although these distinctions are not made here, collaboration tends to refer to higher-order forms of partnership while cooperation to lower-order forms, with each lending itself to different managerial strategies and tools (Keast, Brown, & Mandell, 2007; McNamara, 2012; Thomson & Perry, 2006). Others have focused on issues such as the size, scope, and density of networks as an important factor in defining managerial efforts (Graddy & Chen, 2006; Huang & Provan, 2007; Lee, Lee, & Feiock, 2012; O'Toole, 2015).

Given processing limitations though, both high quality and quantity in partnerships is impractical, and public-sector agencies are forced to make strategic choices (Smith & Larimer, 2009). Collaborations are faced with "operational, performance, or legal barriers that prevent the next action step… [and] face challenges in converting solutions into policy energy, assessing internal effectiveness, surmounting the inevitable process blockages, mission drift, and so on" (McGuire & Agranoff, 2011, p. 265). When successful, partnerships result in more effective outcomes as a result of: enhanced flexibility, innovation, and responsiveness; coordinated efforts; and, capacity and resource sharing (McQuaid, 2010; O'Toole, 2015; Provan & Lemaire, 2012). Importantly, both tangible (e.g., funding) and intangible (e.g., credibility) resources enhance organizational capacity, with intangible resources providing political capital to mitigate risk and conflict (Andrew, 2009; Feiock, Lee, Park, & Lee, 2010; Provan & Huang, 2012). Additionally, collaboration reduces transaction (i.e., managerial) costs of inter-organizational barriers by coordinating efforts and decreasing uncertainty via more knowledge and experience (Brown & Potoski, 2003; Clingermayer & Feiock, 1997). On the other hand, partnerships prove ineffective when there is a lack of trust, differing missions, deficient commitment to shared goals, or divergent cultures (Provan & Lemaire, 2012; Provan & Milward, 2001). Consequently, partnerships are driven by organizational desires to increase resources and reduce transaction costs in public service delivery, with partnerships waning as resources contract, costs increase, or distributions become inequitable (Fowler, 2018; Graddy & Chen, 2006; Lee, Lee, & Feiock, 2012; Park & Rethemeyer, 2014).

However, organizations risk decreased efficiency and effectiveness, via conflicts over goals, objectives, and resource sharing; loss of organizational autonomy; and, inter- organizational power dynamics (McQuaid, 2010; O'Toole, 2015; Provan & Lemaire, 2012). Therefore, balancing quality and quantity in partnership is a function of resource exchanges and transaction costs in coordinating organizations around shared policy goals. Furthermore, public- sector agencies "work [with] a variety of different kinds of actors...drawn from different organizational cultures, influenced by different sets of incentives, and directed toward different goals" (Hall & O'Toole, 2004, p. 190). As such, federal, state, local, nonprofit, and private organizations offer different advantages and disadvantages. For example, Andrews and Entwistle (2010), examining cross-sectoral partnerships in the United Kingdom, finds "public-public partnership is positively associated with effectiveness, efficiency, and equity, but that public-private partnership is negatively associated with effectiveness and equity. Public- nonprofit partnership is unrelated to performance" (p. 679). Additionally, these organizational differences lead to certain types of organizations being better suited for quality and others to quantity of ties, based on policy specific enterprises. For instance, in examining intergovernmental collaboration in Sweden, Lundin (2007) finds effectiveness is a function of policy complexity, and shared goals must be matched with advantages inherent in certain types of organizations. However, there are few assessments of how partnership quality and quantity with certain organizational types impact collaborative outcomes (Andrews & Entwistle, 2010; McQuaid, 2010; Scholtz, Berardo, & Kile, 2008).

Quality

While scholars may measure quality in partnership along numerous dimensions, in the most basic sense, it refers to levels of organizational investment in collaboration (i.e., dedication to collaboration). As partnership quality increases, organizations invest more of their organizational resources, capacities, and missions into collaborative arrangements, becoming more intertwined and reducing barriers that lead to inter-organizational transaction costs. Most assessments of partnership characteristics focus on qualitative aspects, such as strategic focus and leadership, trust, capacity, and/or outcome orientation, as essential qualities for successful partnerships (McGuire & Silvia, 2009; McQuaid, 2010; Provan & Lemaire, 2012). However, some scholars articulate levels or hierarchies of partnership quality, depth, or intensity. Sockett (1998) presents a four part quasi-hierarchical model where partnerships range from rudimentary to fully intertwined organizations: 1) support services; 2) resource exchanges; 3) joint planning and resource sharing; and, 4) full integration of functions. On the other hand, Waddock (1991) offers a slightly more sophisticated model in which partnerships are a function of organizational interdependence at administration, technical, and institutional levels. Common among these models is that levels of partnership are tied to how invested organizations are in collaborations, with arrangements creating more interdependence associated with higher degrees of quality (Hodge & Greve, 2007; Kemshall & Ross, 2000; Teisman & Klijn, 2002;).

While these typologies suggest quality engagement leads to better management of shared policy goals, increased quality also leads to increased opportunity costs, which may create new limitations to program effectiveness. Creating interdependence with one organizations reduces capacity to pursue similar arrangements with other organizations, creating substantial opportunity costs in an environment with a broad of array of potential partners offering different advantages (Hicklin, O'Toole, & Meier, 2008). Furthermore, there is significant risk associated with a loss of

organizational independence, with autonomy connected to key tools for successful policy governance such as flexibility and innovation capacity (Laven, et al., 2010; McQuaid, 2010; Robins, Bates, & Pattison, 2011). Additionally, intertwining organizations exacerbates classic problems associated with reduced accountability in collaborative arrangements, where it is difficult to hold individual actors responsible for their contributions to shared goals (Piatak, Romzek, LeRoux, & Johnston, 2018; Provan & Lemaire, 2012).

Quantity

As partnership quantity increases, new organizations offer access to new resources and reduce inter-organizational transaction costs; however, multiplexity increases with each new organization, multiplying ties and coordination costs. A significant body of network research suggests transaction costs of forming partnerships and managing shared policy goals are reduced as partners increase, with network experience and the number of available partners as significant predictors of partnerships (Brown & Potoski, 2003; Clingermayer & Feiock, 1997; Fowler, 2018; Graddy & Chen, 2006; Heranz, 2010). Additionally, each new partner brings with it more resources, and an expanded capacity for coordinating efforts, adding further benefit to network size. Thus, organizations seek more partners in networks to increase their access to resources and reduce their transaction costs. However, Provan and Milward (2001) contends that "after surpassing a certain size, any network will become less effective because of increasing coordination costs" (p. 418).

As networks expand, there is increased effort required to direct multiple autonomous organizations in concomitant tasks, resultant from increased complexity and decision-making layers. Essentially, partnerships replace transaction costs from inter-organizational barriers with those from coordinating organizations, which are intensified by both internal organizational and external network factors (Agranoff, 2007; Provan & Lemaire, 2012). When networks become overburdened by coordination costs, it leads to "overprocessing" and eventually "collaborative inertia" (McGuire & Agranoff, 2011; Provan & Lemaire, 2012). Furthermore, additional partners add further challenges to accountability, as more organizations contribute to a shared goal but provide unequal resources and efforts in the process (Provan & Lemaire, 2012). This is exacerbated by the number of organizations producing public goods and services in a multi- dimensional environmental, creating a very complex balance between resources and transaction costs for each additional partner (Hill & Hupe, 2014).

Multi-Dimensional Partnerships in Air Quality

Local air agencies sit at the nexus of a multi-dimensional environment of potential organizational partners with a shared policy goal of reducing air pollutants within specific geographic areas, presenting a ripe case to analyze partnerships. Although it is within a hierarchical intergovernmental arrangement, implementation of the U.S. Clean Air Act (CAA) of 1970 (amended in 1977 and 1990) functions more as a network with fluid membership and organizational independence (Fowler, 2018). Common in environmental legislation, the CAA relies on a federal-state partnership in which the Environmental Protection Agency (EPA) sets broad standards for six criteria pollutants (i.e., the National Ambient Air Quality Standards or NAAQS), and states develop implementation plans (i.e., State Implementation Plans or SIPs) and manage day-to-day operations (Belden, 2001; Fowler, 2016, 2018). However, roles of local governments in this arrangement fluctuate between states, with local agencies operating as either administrative sub-units of state agencies, with autonomy to pursue their own initiatives, or not at all (Fowler, 2016, 2018; Lester & Lombard, 1998; Woods & Potoski, 2010). Additionally, limited jurisdictions results in local agencies finding collaboration necessary to impact air quality outcomes (Fowler, 2016, 2018).

Due to the nature of air quality and governing legislation, intergovernmental (or public- public) partnerships tend to be preferred by local agencies. Since geographic and legal jurisdictions tend to be divided between many public-sector agencies, it is difficult for a single agency to effectively address complex policy problems that transect jurisdictions, such as air quality (Krause, 2011; Lee & Koski, 2015). As such, intergovernmental partnerships coordinate efforts across jurisdictions to better match shared goals with problem parameters, creating more effective outcomes (Andrews & Entwistle, 2010; Raab & Milward, 2003; Thurmaier & Wood, 2002). With both vertical (different levels government) and horizontal (same level of government) partnerships, coordination reduces inter-organizational barriers and managerial transaction costs via economies of scale, increased scales of operations, and by containing problems with a coordinated institutional arrangement (Andrews & Entwistle, 2010; Keast et al, 2004; O'Toole & Christensen, 2012; Thurmaier & Wood, 2002).

Vertical partners scale up efforts creating large opportunities for resource sharing and transaction cost reduction, but also encompass their partners. For local air agencies, partnering directly with state and federal agencies provides additional resources, but severely limits their autonomy to innovate and match policies to local needs (Lester & Lombard, 1998; Woods & Potoski, 2010). Since higher-level governments retain coercive power over lower-level counterparts within the federal system, vertical partnerships tend to be far less collaborative than partnerships with other types of organizations (Agranoff & McGuire, 1999; Scicchitano & Hedge, 1993; Zimmerman, 2009). As such, there are multiple examples in which local and/or state agencies were conscripted into serving as subunits of higher-level agencies (Lester & Lombard, 1998; Scicchitano & Hedge, 1993; Woods & Potoski, 2010). Furthermore, state and federal missions tend to be restrained to maintaining or achieving NAAQS compliance for geographic units (i.e., monitoring sites), and not universally improving air quality. Therefore, local areas that are unlikely to exceed standards get limited attention and resources from vertical partners. Local air agencies surveyed for this study reported vertical intergovernmental partners included environmental protection, transportation, and health agencies that deal with pollution issues at state- and federal-levels.

On the other hand, horizontal intergovernmental partnerships coordinate efforts across comparative jurisdictions. As such, inter-local partnerships are well poised to reduce transaction costs associated with problems that transects borders (Ling, 2002; Warner & Bel, 2008). In air quality, horizontal partnerships provide an opportunity "to coordinate projects and initiatives across regions and sectors to expand the impact of projects that would otherwise be too limited in scale to a have a substantive impact" (Fowler, 2016, p. 184). Nevertheless, other local agencies are direct competitors so replacing competition with collaboration carries risk as partners bargain and negotiate their relationship (Kwon & Feiock, 2010). As such, when benefit sharing becomes inequitable, partners stop complying and devolve to competitive behavior, resulting in a loss of efficiency and effectiveness (Bennett & Howe, 1998; Chen & Thurmaier, 2009). For local air agencies, cooperative relationships provide other localities competitive advantages in recruiting mobile citizens or businesses, or suffer from issues of shared accountability where other localities enjoy benefits without costs. Local air agencies surveyed for this study reported horizontal intergovernmental partners included environmental protection, transportation, and health agencies in neighboring jurisdictions.

While intergovernmental partnerships offer advantages in managing air pollutants, public-sector agencies are also constrained by economic and political realities, leaving certain limitations insurmountable. As such, cross-sectoral partnerships allow for coordination with both emissions producers and community advocates, enhancing capacity in new directions. Private organizations as purveyors of stationary source emissions are a key partner, with many working with public and nonprofit organizations at the local-level to reduce their environmental impact (NAC, 2017; NALGEP, 2017). In general, public-private partnerships provide public- sector agencies ready access to marketplace resources, which include funds, technical expertise, flexibility, shared risk, and innovation capacity (Andrews & Entwistle, 2010; Osborne & Gaebler, 1992). Additionally, private organizations have increased pressure for efficiency and access to resources that would otherwise be unavailable to public-sector organizations (Andrews & Entwistle, 2010; Cohen & Eimicke, 2008). Specifically for air quality, public-private partnerships allow local agencies to coordinate efforts directly with sources of air pollutants, making for more effective policy approaches than traditional regulations (Bemelmans-Videc, Rist, & Vedung, 2010). Local air agencies surveyed for this study reported private partners included local business and utilities as well as trade associations.

On the other hand, nonprofits are "particularly well placed to understand and voice the needs of disadvantaged, excluded, and underrepresented groups" (Andrews & Entwistle, 2010, p. 684). As such, nonprofits reduce transaction costs in creating equity and fairness, where local agencies are constrained by jurisdictions, politics, and economics (Andrews & Entwistle, 2010). Nevertheless, while most nonprofits focus on underrepresented populations, environmental nonprofits tend to focus on environment advocacy, rather than people (Nikolic & Koontz, 2008; Wallis & Dollery, 2006; Weisbrod, 1997). Additionally, environmental nonprofits play an important role in policymaking, but there is limited research on their roles in public service provisions (Nikolic & Koontz, 2008; Sharp, Daley, & Lynch, 2011). In air quality, nonprofit activities tend to supplement local initiatives, via advocacy and outreach campaigns, consulting with emission sources, and/or organizing regional cooperative networks. Local air agencies surveyed for this study reported nonprofit partners included environmental protection, health, and sustainability focused advocacy groups. However, cross-sectoral partnerships also suffer from conflicting missions, information asymmetries, and goal incongruity, leading to new transaction costs. Primary issues surround whether meaningful collaboration is possible or if missions are irreconcilable. This is exacerbated in environmental policy, where private-sector organizations are key sources of pollutants and nonprofits are chiefly focused on political advocacy. As such,

there are both successes and failures of cross-sectoral partnerships with differences usually explained by organizational-level capacity to manage incompatibilities and create accountability (Acar, Guo, & Yang, 2008; Gazley & Brudney, 2007; Hodge & Greve, 2007; Skelcher, 2005; Wang & Zhao, 2014).

Methods

Data

To collect data, the author surveyed managers of the 117 local government members of the National Association of Clean Air Agencies (NACAA). Of 81 total respondents (68.6%), 26 (32.1%) responded via mail and 55 (67.9%) responded digitally; however, only 72 (61.0%) completed enough of the survey to be usable for this analysis. Previous research indicates this is the most accurate list of local air agencies with dedicated air quality missions and that are engaged in air quality networks (Fowler, 2016, 2018; Woods & Potoski, 2010). Furthermore, the NACAA's mission is "to encourage the exchange of information, to enhance communication and cooperation among federal, state, and local regulatory agencies, and to promote good management of our air resources" (NACAA, 2017). As such, managers of member agencies should have some knowledge of partnership norms in air quality via interactions with NACAA, which may include education and training, conventions and symposium, and service to the association. Additionally, as respondents averaged approximately 23 years and 19 years working in the public sector and with air quality issues, respectively, they likely have significant personal experience and professional networks, which contribute to their expertise in this area.

Respondents are both diverse and representative of NACAA membership regionally and institutionally. NACAA local-level membership represents 26 states and the District of Columbia (D.C.), with 50% from the West region, 25.4% from the South, 4.2% from the Northeast, and 20.3 from the Midwest. In comparison, survey respondents represent 22 states and D.C., with 51.3% from the West, 22.5% from the South, 5.0% from the Northeast, and 21.3% from the Midwest. Additionally, NACAA membership is 21.2% city agencies, 32.2% county agencies, and 46.7% regional agencies (i.e., planning districts or consolidated city- counties). In comparison, survey respondents are 17.5% from city governments, 37.5% from county governments, and 45% from regional governments. Finally, respondents report a range of sizes for their agencies. In terms of employees, 39% report less than 10 employees, 18% between 11 and 20, 20% between 21 and 40, and 24% over 40. In terms of budget, 32% report less $1 million, 32% between $1 and 3 million, 12% between $3 and 5 million, and 25% over $5 million. Based on available data, the survey sample does not differ significantly from that of the NACAA membership as a whole.

Dependent Variable

The author models the dependent variable as annual median air quality index (AQI) for monitoring sites associated with local air agencies. It is assumed that local air agencies are organized around improving air quality in their respective monitoring sites, with existing air quality conditions serving as the best measure of agency effectiveness. AQI operates as a piecewise linear function of pollutant concentration to create a standardized, comparable measure of six criteria pollutants, measured on a scale from 0 to 500 (EPA, 2017b). AQI data were obtained from EPA's AirData system for each MSA and μSA (EPA, 2017a). Appendix A summarizes descriptive statistics for all variables.

Partnership Variables

Summarized in Table 1, the author measures partnership with two constructs (quality vs. quantity) along five categories (other local, state, federal, nonprofit, and private), with Likert scale responses ranging from strongly disagree to strongly agree. For models comparing cross- sectoral relationships, average of local, state, and federal categories creates an aggregate measure of intergovernmental partnership. The author phrased questions in broad terms to capture general perceptions of quality and quantity of working relationships across categories of partners, rather than the character of specific partnerships. For both items, binary (i.e., yes/no) response options enquire into simple existence of partnerships within categories of organizations. However, with Likert scale response options, items force respondents to provide a qualitative rating of partnerships, where one end of the spectrum represents high "quality" or "quantity" and the other end represents its inverse.

[Table 1 about here]

Since partnership quality may vary between organizational categories, partnership forms, agency cultures, or return on investment, weak partnerships for some may be substantive to others or vice versa. For example, if agencies are highly invested in partnerships but perceive an inequitable return on that investment, they are likely to judge overall quality as lower than an organization with similar returns but a lower investment. As such, the author phrased the quality item to elicit a qualitative judgment that balances both pros and cons of specific partnerships when formulating an ordinal rating. In other words, respondent perceptions consider both how invested their organizations are in partnerships and how that investment is balanced against issues such as opportunity costs and accountability. On the other hand, since air quality networks vary across geographic areas, organizations working on air quality in one area may not be doing so in other areas. As such, the author phrases the quantity item to focus judgement on number of partners when considering available partners. In other words, respondents provide an ordinal rating of how well their actual number of partners compare to their potential number of partners, with potential being defined by their own assessment of the service market place (i.e., are they working with everyone they could be?). After data collection, the author recoded the quantity item so an increased rating corresponded to an increase in perceived quantity.

Importantly, collaborative arrangements may not be interchangeable when working with a diverse set of partners with different jurisdictions, authorities, and missions (Berry & Brower, 2014). For instance, contracting is more likely for public-private partnerships and service agreements more likely for inter-local partnerships, which creates challenges for comparing quality and quantity. As such, objective measures of these complex concepts across a range of organizations in different service market places may not effectively capture the nuanced differences that exist. However, allowing respondents to use their qualitative judgments of the specific dynamics of their partnerships mitigates some of these challenges. Essentially, rather than attempt to create an objective "measuring stick" for quality and quantity that is universally applicable, this research design relies on survey respondents to identify the important aspects of their partnerships which define quality and quantity, and then apply a rating to it. Additionally, this approach also allows measurement with a simple ordinal rating that is comparable across a diverse set of organizational partnerships. Therefore, the quality and quantity measures are respondent perception of their partnerships based on subjective, qualitative interpretations within their specific context, which control for variations such as those that arise across localities, categories of organizations, and forms of partnership. While perceptions allow respondents to judge these complexities within individual contexts, analyses examine perceived quality and quantity and not objectively measured quality and quantity, creating limitations to the findings.

Based on these measures, if perceived partnership quality increases, then air quality will improve (i.e., AQI decreases) as a result of corresponding increases in coordinated efforts and resource sharing, and decreased transaction costs. On the other hand, if perceived partnership quantity increases, then air quality will not improve at a similar rate as a result of increased coordination costs that also occur. In other words, quality will have a stronger impact than quantity. These effects are a function of rates at which benefits of coordinated efforts, resource sharing, and reduced transaction costs increase compared to opportunity and coordination transaction costs. For partnership quality, benefits increase at a higher rate than costs. However, for quantity, additional organizations multiply costs of coordinating all organizations, and cause costs to increase at a rate similar to benefits. Consequently, costs and benefits of additional partners largely counterbalance each other, and improvements in program outcomes do not materialize (McGuire & Agranoff, 2011; Provan & Lemaire, 2012; Provan & Milward, 2001). Consequently, quality is more scalable than quantity, so increased quality will lead to more effective program outcomes while quantity will not. However, these effects will likely be highly dependent on the categories of partners involved, because costs and benefits are not equal when partners offer different advantages in managing air quality.

Control Variables

The author also uses three other independent variables to control for socio-economic and environmental factors that typically influence air quality. First, previous studies report that both economic development and political capital of industrial sectors affect environmental outcomes, and control for these effects by measuring comparative strength of industries producing pollutants or affected by relevant policy and/or managerial efforts (Fowler, 2016; Ringquist, 1993a, 1993b; Sapat, 2004). Since gross domestic product from industries that are primary stationary sources of air pollutants (i.e., manufacturing) is unavailable at the local-level, the author uses employee compensation for these industries instead. As such, this measure provides a point of economic comparison of manufacturing industries at the local-level (Fowler, 2016). Industry is measured as $1,000s of employee compensation from manufacturing industries per capita to control for these effects, with data from the U.S. Bureau of Economic Analysis (U.S. BEA, 2017). Second, as CAA implementation's core, state investment in air quality plays a central role in shaping outcomes. As such, state

environmental expenditures control for state capacity and resources (Fowler, 2016, 2018; Konisky & Woods, 2012; Potoski & Woods, 2002; Ringquist, 1993a, 1993b). The author obtained data from the U.S. Census Bureau, with expenditures measured in dollars per capita (U.S. Census, 2017). Finally, since air quality is contingent on previously existing conditions, annual median AQI for initial observation year controls for existing pollution levels and environmental differences (Bacot & Dawes, 1997; Fowler, 2012; Potoski & Woods, 2002; Sapat, 2004; Ringquist, 1993b).[1]

Analysis

First, the authors examine variation in quality and quantity across types of partners, using Spearman's Rho (Margolis, 2008). Then, Generalized Least Squares (GLS) regression tests effects on air quality outcomes. With a relatively small dataset and initial statistical diagnostics indicating heteroscedasticity, GLS is a better fit than Ordinary Least Squares (OLS) regression (Fox, 2008; Graddy & Wang, 2008). Further statistical diagnostics indicated no issues with the GLS models. To allow for time-delayed effects in air quality outcomes, data for the dependent variable are lagged three years and observed for 2016, while predicator variables are observed for 2013 (Fowler, 2012, 2016; Ringquist, 1993a, 1993b).[2] Three models test (intergovernmental, cross-sectoral, and multi-dimensional) both partnership quality and quantity effects.

Results

Table 2 displays correlation statistics within and between categories of partners. Inter- construct relationships are positive across partner categories with quality and quantity increasing together. Inter-construct relationships generally fall into the moderate range, with the strongest relationship for federal (.493) and weakest for local (.256). Intra-construct relationships are positive across partner categories as expected and generally range from weak to strong, with the strongest relationship for state-federal quantity (.699) and the weakest for local-nonprofit quantity (.174). Correlation analysis suggests two findings. First, while correlated, quality and quantity represent distinct constructs. Second, each construct is unique across categories of partner. In other words, quality is developed separately from quantity, and both are separately developed across intergovernmental and cross-sectoral dimensions.

[Table 2 about here]

Table 3 presents results for partnership effects on air quality outcomes when quality and quantity are separated into different models. Coefficients for local partnership in the intergovernmental and multi-dimensional models indicate that increased perceived partnership quality with local agencies is associated with better air quality outcomes (i.e., decreased median annual AQI). Additionally, coefficients for non-profit and private partnerships in the cross-sectoral model indicate that increased quality with private organizations is associated with better air quality outcomes, but increased quality with nonprofits has the opposite effect. Findings for federal, state, and aggregate intergovernmental partnership quality were not statistically significant in any models. On the other hand, coefficients for state partnerships in the intergovernmental and multi-dimensional models indicate that decreased perceived quantity of partnerships with state agencies is associated with better air quality outcomes. The coefficient for non-profit partnership in the multi-dimensional model indicates that decreased partnership quantity with nonprofits is associated with worse air quality outcomes. However, findings are not statistically significant in the cross-sectoral model. Findings for local, federal, aggregate intergovernmental, and private partnerships were not statistically significant in any model.

[Table 3 about here]

Table 4 presents results for partnership effects on air quality outcomes when quality and quantity are tested in combined models. Findings are similar to those presented in Table 3. Coefficients for local and private partnership indicate that increased perceived partnership quality is associated with better air quality outcomes. Additionally, coefficients for non-profit partnership indicate that decreased quality is associated with better air quality outcomes. However, findings for state and nonprofit partnership quantity were not statistically significant. Additionally, findings for state, federal, and aggregated intergovernmental quality, and local, federal, aggregated intergovernmental, and private quantity were not statistically significant. In general, coefficients and statistical significance between models were consistent, including those for industry, state expenditures, and median AQI, which suggests reliability of results. Pseudo- R^2 statistics indicate all models are moderately strong predictors of air quality.

[Table 4 about here]

Statistical analyses suggest three general findings. First, quality inter-local and public- private partnerships present the best options for improving air quality. This finding is similar to previous scholarship on cooperative benefits associated with inter-local agreements and public- private partnerships in general, and the need for local collaboration in air quality in particular (Chen & Thurmaier, 2009; Fowler, 2016; Hodge & Greve, 2007). Quality inter-local and public- private partnerships are likely effective as they most directly coordinate efforts around the nature of air quality by integrating both sources of emissions and geographic jurisdictions into management efforts. Second, there were either no statistically significant or mixed findings for partnerships with federal agencies and nonprofits, respectively. As most federal agencies are hands-off in dealing with local area specifics in environmental programs (unless there is a substantive violation of national standards), federal agencies provide few advantages in resources and transaction costs. Findings for nonprofits are a little more difficult to decipher though. It seems that more partnership in either aspect does not lead to better air quality outcomes. Nonprofits may be ill-suited for partnerships in air quality altogether, which may be due to the advocacy nature of environmental nonprofits. However, this finding needs to be further explored to better understand how public-nonprofit partnerships for environmental management function.

Finally, findings for state agencies were particularly interesting. While both low quality and quantity partnerships with state agencies are associated with better air outcomes, quantity was only statistically significant in models from Table 3, and quality was not significant in any model. However, states serve as the lynchpins in CAA implementation, which would suggest theoretically that they play an important role in air quality governance. One possible explanation for these findings is that there is significant risk for local agencies in partnering with states. As the CAA incentivizes states to focus efforts on NAAQS compliance, local agencies in areas less likely to be in violation receive fewer resources, which accounts for partnership quality's lack of effects. More importantly though, state-local partnerships decrease autonomy and accountability for local governments, resulting in less local capacity to innovate and responsibility for outcomes (Fowler 2016, 2018). In other words, if a primary source of local-level policy innovation loses independence, effectiveness decreases. On the other hand, local governments with fewer ties to state agencies are independent to develop new initiatives. Thus, fewer state-local ties may provide local agencies more room for innovation and accountability for program success, allowing programs to better adapt to the local context. In effect, these findings suggest that cooperation within the conventional federal hierarchy may not improve air quality.

Conclusions

Partnerships work to improve policy outcomes and public services by using collaboration to enhance capacities to manage wicked problems. However, these findings indicate that effectiveness is impacted by two dimensions: 1) quality versus quantity; and 2) type of partner. First, quality should be prioritized over quantity when managing shared policy goals. Findings indicate that increased quality is a much better predictor of improved air quality than increased quantity. Higher degrees of collaboration between organizations reduce barriers to resource sharing and that create inter-organizational transaction cost, with new costs increasing at modest levels compared to new benefits (Hicklin, O'Toole, & Meier, 2008). As a result, there are scalable benefits to partnership quality, so partnerships that work at any level of quality have a high ceiling for increasing effectiveness; although, there may be a point of diminishing returns. On the other hand, partnership quantity is less scalable, where new partners multiply coordination costs for all partners (McGuire & Agranoff, 2011; Provan & Lemaire, 2012). As a result, costs increase at a relatively high rate compared to benefits, and improved program outcomes are less likely to materialize. As partnerships require a balance between benefits and costs to be effective, quality provides a better avenue for striking that balance than quantity does, making it a better choice for organizations seeking to increase collaboration.

Second, partnerships should be well-matched for policy problems at hand, and offer the types of resources and transaction cost reductions necessary to improve outcomes. Findings indicate that inter-local and public-private partnerships produce better air quality outcomes. For managing air quality in metropolitan areas, localities need to coordinate efforts across adjacent geographies, and reduce transaction costs of working with industry. Partnerships with neighboring localities allow local agencies to better match resources with problem parameters, while public-private partnerships coordinate efforts with emission sources. On the other hand, vertical partnerships reduce local autonomy, and lead to duplications of existing efforts and constrain innovation. Specific to air quality, state-local relations tend to devolve to local agencies serving as administrative subunits of states, leading to overlapping rather than complementing efforts. As previous scholarship argues, the power of local governments in managing air quality comes from capacity to innovate and match policies with social, economic, and political needs (Fowler, 2016).

Findings for state partnership quantity provides some evidence to this point, where additional coordinating costs and reduced local autonomy had a negative impact on air quality (i.e., increased AQI). In sum, partnerships are only effective when organizations offer the right advantages for problems being managed.

While the findings here provide some interesting insights into how partnership quality and quantity affect program outcomes, the research design has two important limitations. First, there are several assumptions made about how respondents are interpreting survey items. Most importantly, the authors assume that respondents are appropriately interpreting the survey items and isolating the two distinct aspects of partnerships when responding to each item. Although these survey items were designed to capture quality and quantity as distinct analytical concepts, respondents may not have responded in the way that they were meant to, leading to potential measurement error. Additionally, the authors assumed that respondents have some expertise on the norms of air quality partnerships and considered those while responding. However, levels of expertise may vary and some respondents may be less aware of how their partnership behavior compares to others. Second, ordinal ratings do not allow statistical analyses to capture potential economies of scale or points of diminishing returns in quality or quantity of partnerships. As previous scholars argue, collaboration costs eventually outweigh benefits and overburden organizations, leading to decreased effectiveness (Hicklin, O'Toole, & Meier, 2008; Provan and Milward, 2001). While respondents may have considered this when rating their partnership, statistical analyses do not directly incorporate these issues, which limits inferences into the more sophisticated facets of these relationships.

Furthermore, additional research should consider how collaborative mechanisms associated with different types of organizations translate into program outcomes. Public-nonprofits partnerships highlight this, where findings for neither quality nor quantity were as predicted. However, these findings are consistent with previous research that indicates public-nonprofit partnerships affect public service delivery differently than intergovernmental or public-private partnerships (Andrews & Entwistle, 2010). As such, further research should focus on how quality or quantity impact partnerships with specific types of organizations (Andrews & Entwistle, 2010; Lundin, 2007). Additionally, in order to understand the scalability of these relationships, there should be further examination of how points of diminishing returns compare between quality and quantity. Finally, future research should explore other research designs that incorporate both qualitative and more sophisticated quantitative methodologies, such as time-series analyses, to examine how collaborative mechanisms unfold over time to impact outcomes and how network-level components translate into community-level outcomes. Understanding which directions to develop cooperative relationships is a key to building more effective public-sector collaborations.

Notes

1. In empirical models, this variable accounts for a majority of explained variance, as the strongest predictor of future conditions is usually past conditions. Consequently, analyses are limited in isolating individual effects of partnership variables. One possible solution to this problem is to use differences between initial and lagged AQI as the dependent variable to examine only changes that occur during the study timeframe. However, this method assumes that a one point change results from the same level of inputs if AQI is 10 or 100, but environmental remediation tends to become more costly as pollutants approach zero (Breyer, 1993). While this method may inaccurately estimate relationships, it does indicate strength of correlations during a set timeframe. To this end, GLS models use initial AQI to control for existing pollution levels and examine directional relationships of partnership variables. In supplement, Appendix B presents R^2 statistics for bivariate Ordinary Least Squares (OLS) regression models that use the difference approach to the dependent variable and indicate how strongly individual partnership variables and air quality change during the study timeframe are correlated. Consistent with other findings, these R^2 statistics indicate that partnership quality with local agencies and private organizations have the strongest correlations with AQI changes. On the other hand, partnership quantity has extremely weak relationships with AQI changes. In comparison to other findings presented here, these findings indicate that some partnership variables account for a notable portion of air quality outcomes, and pseudo-R^2 in GLS models are not entirely driven by control variables.

2. The authors tested multiple lag variations with results similar to those reported here, but diagnostic tests indicated the three-year lag is the best fit for the data

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Tables

Table 1. Measurement of Partnership Constructs and Categories

Construct	Categories	Responses
1. *Quality*: My office actively **cooperates or partners** with **[dimension]** working on air quality issues in my area. 2. *Quantity* (recoded): There are **[dimension]** working on air quality issues in my area that my office does **not cooperate or partner** with.	1. Other local agencies 2. State agencies 3. Federal agencies 4. Nonprofit organizations 5. Private organizations	1. Strongly Disagree 2. Somewhat Disagree 3. Neutral 4. Somewhat Agree 5. Strongly Agree

Table 2. Correlations of Constructs Across Categories

		Quality				Quantity			
	Quality/ Quantity	Local	State	Federal	Non-profit	Local	State	Federal	Non-profit
Local	.256*								
State	.314**	.281*				.553**			
Federal	.493**	.487**	.455**			.448**	.699**		
Non-profit	.257*	.263*	.344**	.465**		.174	.300*	.325**	
Private	.328**	.299*	.317**	.522**	.516**	.285*	.411**	.336**	.572**

N = 72. Note: *<.05, **<.01, ***<.001.

Table 3. GLS Results for Partnership Quality and Quantity in Separate Models

	Intergovernmental		Cross-Sectoral		Multi-Dimensional	
	Quality	Quantity	Quality	Quantity	Quality	Quantity
Local	-1.286 (.586)*	-.606 (.554)			-1.116 (.562)*	-.630 (.539)
State	.924 (.816)	1.015 (.587)$^{+}$			1.075 (.780)	1.018 (.585)$^{+}$
Federal	.275 (.517)	-.408 (.581)			.384 (.547)	-.177 (.574)
Intergovt.			.025 (.845)	.149 (.607)		
Nonprofit			1.232 (.632)$^{+}$	-.818 (.517)	1.084 (.620)$^{+}$	-.839 (.505)$^{+}$
Private			-1.022 (.503)*	.600 (.582)	-1.108 (.485)*	.491 (.568)
Industry	-.644 (.302)*	-.695 (.313)*	-.778 (.328)*	-.585 (.301)*	-.844 (.321)**	-.716 (.303)*
State Exp.	-.053 (.011)***	-.051 (.012)***	-.048 (.011)***	-.048 (.011)***	-.053 (.011)***	-.050 (.012)***
Med. AQI	.698 (.039)***	.676 (.038)***	.667 (.039)***	.661 (.039)***	.686 (.039)***	.659 (.038)***
Constant	16.640	17.562	16.791	17.552	15.571	17.926
Pseudo R^2	.251	.258	.263	.258	.274	.277
BIC	429.231	425.102	422.262	425.029	425.042	423.443
N	72	71	71	71	71	70

Note: +<.1, *<.05, **<.01, ***<.001.

Table 4. GLS Results for Partnership Quality and Quantity in Combined Models

	Intergovernmental		Cross-Sectoral	
	Quality	Quantity	Quality	Quantity
Local	-1.053 (.604)$^{+}$	-.647 (.551)		
State	1.035 (.824)	.843 (.682)		
Federal	.127 (.677)	-.469 (.570)		
Intergovernmental			.034 (.915)	.123 (.674)
Nonprofit			1.166 (.637)$^{+}$	-.632 (.536)
Private			-.876 (.526)$^{+}$	.454 (.570)
Industry	-.786 (.314)*		-.802 (.339)*	
State Expenditures	-.056 (.012)***		-.049 (.011)***	
Median AQI	.695 (.039)***		.656 (.040)***	
Constant	17.470		17.257	
Pseudo R^2	.266		.266	
BIC	433.688		433.524	
N	71		71	

Note: +<.1, *<.05, **<.01, ***<.001.

Appendices

Appendix A. Variable Descriptive Statistics

Variable	Description	Mean (or %)	Std. Dev.	Min	Max
Median AQI (Dependent Variable)	Annual median AQI, lagged three years behind predictor variables	46.49	9.86	20	77
Local (quality)	Likert scale response to quality survey item for local category	4.31	.87	1	5
State (quality)	Likert scale response to quality survey item for state category	4.64	.63	3	5
Federal (quality)	Likert scale response to quality survey item for federal category	4.07	1.04	1	5
Intergovernmental (quality)	Average of response to quality survey item for local, state, and federal categories	4.34	.63	3	5
Nonprofit (quality)	Likert scale response to quality survey item for nonprofit category	3.73	1.00	1	5
Private (quality)	Likert scale response to quality survey item for private category	3.32	1.14	1	5
Local (quantity)	Likert scale response to quantity survey item for local category	1.83	1.02	1	4
State (quantity)	Likert scale response to quantity survey item for state category	1.93	1.08	1	5
Federal (quantity)	Likert scale response to quantity survey item for federal category	1.99	1.05	1	4
Intergovernmental (quantity)	Average of response to quantity survey item for local, state, and federal categories	1.92	.85	1	4
Nonprofit (quantity)	Likert scale response to quantity survey item for nonprofit category	2.58	1.14	1	5
Private (quantity)	Likert scale response to quantity survey item for private category	2.45	1.05	1	5
Industry per capita	$1000s of employee compensation from manufacturing industries per capita	2.53	1.60	0	7.06
State expenditures	$1s of state environmental expenditures per capita	71.95	43.59	14.93	266.97
Median AQI	Annual median AQI for initial year of observation	50.81	12.38	24	97

Appendix B. R^2 from Bivariate Regression Models

	Quality	Quantity
Local	.085*	.022
State	.001	.002
Federal	.019	.0004
Intergovernmental	.041^{+}	.006
Nonprofit	.021	.0000
Private	.059*	.0003

Note: +<.1, *<.05, **<.01, ***<.001. Standard errors in parenthesis.