Sustaining Oregon's Cross-Sector Partnerships in STEM Education

By

Gretchen M. Becker

MPP Essay

Submitted to

Oregon State University

In partial fulfillment of

the requirements for

the degree of

Master of Public Policy

Presented December 2, 2016

Contents

Sustaining Oregon's Cross-Sector Partnerships in STEM Education

Gretchen Becker

Abstract

In recent years, state governments in the U.S. have promoted improvements to science, technology, engineering, and mathematics (STEM) education as a means to stimulate future economic growth and increase economic mobility into careers with higher earnings. Oregon's STEM Initiative includes the creation and development of strategic public-private partnerships which aim to anticipate regional STEM education needs, promote best-practices for reaching underserved populations, and build local STEM learning ecosystems to achieve "collective impact." Essential to the Initiative's success is demonstrating that these partnerships are effective cross-sector collaborations with the capacity to develop mutually-beneficial relationships and consolidate programmatic goals. Using an illustrative case study of the South Metro-Salem STEM Partnership, I find that affiliated organizations share in its vision and benefit from partnership through increased access to cross-sector knowledge and increased organizational capacity. However, an institutional environment of shared beliefs only results in the realization of those benefits when each organization has its expectations for participation met and when resources are available for continued partnership work, which has implications for Oregon's STEM Initiative.

Introduction

With support from the Oregon Chief Education office and the Oregon STEM Initiative, the South Metro-Salem STEM Partnership (SMSP) organized in 2012 to support student engagement and achievement in science, technology, engineering, and math. It consisted of a centralized leadership organization that would seek out potential partner organizations in the region interested in collaborating on changing student experiences with science, technology, engineering, and math (STEM) education. SMSP was built from a "collective impact" model which emphasized the important role leadership staff has in sustaining collective work beyond institutional and sector boundaries through the development of a shared vision and collaborative strategic planning (South Metro-Salem STEM Partnership, 2015). Little is known to what extent organizational mission or vision alignment is necessary for successful cross-sector partnerships between private industry and public educational institutions. Existing research is largely focused on partner's' motivations for initiating cross-sector collaborative relationships, and on the capacity and capability for the boundary-spanning organization and its leaders to effectively maintain these relationships (e.g. Austin, 2000; Edens & Gilsinan, 2005; Nowel & Foster-Fishman, 2010).

Instead, this research aims to understand the role private companies, community colleges, nonprofits, and educators have in sustaining partnerships from the perspective of their institutional constraints and capacities. Drawing from March and Olsen's (1984) New Institutionalism, I explore how the institutional environment including the partnerships' mode of governance, organizational structure, and shared beliefs affect partner commitment to collaboration, especially when partners face internal resource constraints. This illustrative case study of SMSP therefore contributes to scholarship on successful STEM educational partnerships

and STEM policy initiatives. In addition, it will contribute to the operationalization of the common agenda concept within the collective impact model.

Research Question

New Institutionalism's "logic of appropriateness" aims to explain organizational behaviors through an understanding of what actions are expected of an institution's members. These rules of behavior translate into action, "governed by a dominant institution that provides clear prescriptions and adequate resources, i.e. prescribes doable action in an unambiguous way," (March & Olsen, 2008, p. 7-8). Applied to SMSP, this framework would suggest that members will continue to participate in collaborative behavior unless that behavior is disrupted by institutional barriers. Therefore, the question guiding this research is "What institutional barriers exist, if any, that have the potential to hinder collaborative partnership with SMSP?"

Significance of the Study

The state of Oregon has built an innovative approach to STEM partnerships, signified in part by its recent selection for a nationwide STEM Ecosystems Initiative because of its "rigorous" and "effective" STEM instruction (STEM Ecosystems, 2016). To date, no academic research has been published on the success of Oregon's STEM network in the years since the Oregon STEM Initiative appropriated funding and agency support. More generally, there is a lack of published academic research on STEM strategic partnerships across the country, with the exception of Johnson (2012) and a recent doctoral dissertation (Walton, 2014).

Background

There are a broad range of public initiatives designated under the "STEM" educational framework. Stakeholders and decision-makers have recognized a related set of problems within education in each discipline, compelling broad policy interventions relying on the use of similar

mechanisms. If students do not have enough support to excel and persist in fields requiring science and math literacy, reform proponents advocate for the introduction of new curricula content, the replacement of lecture-driven pedagogical techniques with project-based learning opportunities, and the development of lasting student identities in those fields, among other recommendations. Second, one of the commonly stated goals is to integrate science, technology, engineering, and math disciplines so that students gain interdisciplinary knowledge and develop strategies for real-world problem solving (Honey, Pearson, & Schweingruber, 2014). However, because these initiatives cover diverse target populations and include stakeholders engaged in multi-level and cross-sector collaboration, "STEM" continues to be redefined to implicate a variety of perspectives and preferred policy outcomes.

Defining STEM Education

Even in the midst of educational reform, educators are likely to conceptualize STEM from their practical knowledge and experience from teaching the disciplines rather than adopting definitions constructed by institutional and political decision-makers within the reform movement. Breiner, Harkness, Johnson, and Koehler (2012) surveyed faculty at a public university as they implemented several STEM initiatives, including leading a regional STEM partnership. The researchers asked two qualitative, open-ended questions: 1) "What is STEM?" and 2) "How does STEM influence and/or impact your life?" and found that over 25% of respondents admitted a lack of understanding or knowledge of STEM. Of those who gave a definition, 57% identified the acronym as science, technology, engineering, and mathematics. In response to the second question, the majority of faculty described their personal perspectives from their daily lives; for example, some respondents within the humanities and arts departments with negative perceptions of STEM thought that the reform efforts were diminishing their

financial or professional standing within the university. Overall, Breiner, et al. (2012) found that faculty did not share a single definition or conceptualization of STEM, and that even a majority of faculty working in STEM fields discussed them in terms of siloed disciplines rather than using the integrated approach promoted within the university's initiatives. Breiner, et al.'s (2012) case study describes one potential barrier to STEM initiatives in their early stages; disagreement among stakeholders about what reform entails for their institution may slow paradigmatic change and result in differing expectations for their participation in that change.

Similarly, educators within K-12 schools disagree about how to best conceptualize STEM, and reform efforts have not yet brought about consensus. K-12 has historically taught science and math as distinct subject areas, slowing reform initiatives which aim for their integration (Honey, et al., 2014; Sanders, 2009). Roberts and Cantu (2012) reflected on three definitions of STEM implicit in the ways it is currently practiced: either as *siloed* subjects, as *embedded* applications of distinct subjects, or as *integrated* subjects taught as a single course. K-12 schools in the U.S. have also traditionally neglected technology and engineering, and educators are often unprepared to implement new curricula in these subjects (Brophy, Klein, Portsmore, & Rogers, 2008; Hew & Brush, 2007). However, some education researchers have promoted engineering education as the keystone to STEM integration across disciplines, since engineering activities involve the application of interdisciplinary STEM knowledge to problem solving and technology design while engaging students' creativity (Brophy, Klein, Portsmore, & Rogers, 2008).

Disagreement and ambiguity surrounding the conceptualization of STEM, therefore, is partially due to historical institutional norms about discipline divisions, and partially because educational reform takes time and educator training to adapt to new state and federal standards.

To complicate matters, the National Science Foundation originally used the acronym "SMET" before later deciding on "STEM," (Sanders, 2009). However, another reason for this ambiguity is that U.S. STEM initiatives are the result of differences in cross-sector motivations for reform across stakeholder groups (Edens & Gilsinan, 2005; Seitanidi et al, 2010). For school administrators and educators, STEM subject area integration is believed to benefit students' science and math literacy by reinforcing content knowledge in new contexts and by improving student engagement. For private industries, engaged students trained across discipline boundaries are more likely to persist to graduate with STEM degrees and build the labor market with creative problem-solvers with access to a broad base of content knowledge. Both stakeholder groups therefore benefit from integrated STEM instruction but rely on teachers to implement their particular curricula and pedagogical techniques for meeting this goal in the classroom.

Oregon's STEM Hub Network

SMSP is a public-private strategic partnership organization in Oregon with the expressed purpose of supporting regional efforts to improve K-16 education in science, technology, engineering, and math. It is a part of a collaborative network of eleven STEM "hubs" in Oregon, each with established partnership relationships with regional businesses, nonprofits, and school districts invested in improving diversity, student engagement, proficiency, and educational attainment in math and science. The network began in 2012 from a grant from Oregon's Department of Education (ODE) and Education Investment Board (OEIB, now the Chief Education Office), and its sustainability depends on recurring legislative funding and demonstrable progress towards statewide educational attainment goals. The network of STEM Hubs is a part of a growing STEM learning ecosystem which consolidates resources such as college credit opportunities, summer camps and research internships, in class or virtual

presentations from industry experts, and STEM project-based learning (PBL) curricula for educators. Combined, these resources are utilized to systematically improve students' access to STEM learning opportunities regardless of geography or socioeconomic circumstance. As for the state's political strategy, these partnerships help to build interdependent relationships between regional public schools with private industry to aid economic development. Private STEM partners provide resources and services to local schools and in turn are offered the legitimacy to shape the educational environment and curricula students are exposed to before entering the workforce (Abowitz, 2000; Edens & Gilsinan, 2005; Guthrie et al., 2008; Hoff, 2002). By joining a partnership and aligning their STEM mission with public initiatives, private partners may also experience increased political legitimacy and influence in state agencies and legislatures (Abowitz, 2000).

Literature Review

Educational Partnerships

Since the 1980s, the U.S. has placed considerable trust in educational relationships across sectors to facilitate educational reform initiatives at the state and local levels (Bainer, 1997). This is partially because there is academic consensus that school change is best achieved with community-wide involvement (Fullan, 2006; Johnson, 2012; Shirley, 2009; Warren, 2005). Additionally, since educational authority is largely delegated to state governments in the U.S., partnerships have emerged as a vehicle for efficiently translating policy goals into regional action while directly engaging stakeholders in decision-making (Darling-Hammond, 2010). This decentralized, community approach to education policy has led to a patchwork of diverse educational partnerships across the country with different collaborative goals, desired outcomes, and measurements for success (Darling-Hammond, 2010). Bainer (1997) argued that although

educational partnerships are highly situational, effective partnerships are characterized by dynamic engagement of partners on a mutual problem, parity among partners in the collaborative relationship, and a shared long-term commitment for reform. Notably, reform is brought about by the stability and nature of the relationship rather than directives from state agencies (Bainer, 1997; Sills et al., 1993).

According to Johnson (2012), educational partnerships aim to improve instruction or student achievement through meeting mutual goals, realizing organizational capacity for reform, and by aligning their organizational missions. For example, Oregon's South Metro-Salem STEM Partnership is organized around three core strategies for change: 1) connecting educators and students to community resources and expertise from STEM industries, 2) sharing best practices, and 3) expanding accelerated credit opportunities for students (South Metro-Salem STEM, 2015). The Partnership defines success in its ability to use these strategies to meet several long-term goals, such as increasing diversity in participation and achievement in STEM subjects, improving math and science proficiency, and increasing STEM college graduation and certification rates. Since these goals require partnership commitment for the next decade or more to ensure students are benefitting from community collaboration and investments in their achievement, educational partnerships such as SMSP rely on stable partnership models built on mutual agreement, successful conflict management, and capacity for organizational learning.

Motivation is essential for long-term partner engagement, and is closely tied to each partner's understanding of the value of collaborative work (Googins & Rochlin, 2000). Examining partner motives signifies their commitment to change and what Seitanidi et al. (2010) calls their "transformative intention," (p. 153). These motivations predictably differ for the parties involved—schools primarily seek resources from the private sector to meet student needs,

while businesses look to improve their standing in the community and invest in its social capital. In a case study analysis in secondary schools in Ontario, Hands (2009) learned that educators partnered to expand student access to community resources and programs, while administrators benefitted from district resources from the partnership. The participating schools' reputation also was improved in the local community. Bennett and Thompson's (2011) case study in a Southwestern U.S. metropolitan-area school district found that superintendents' motivation to improve district standing was a central factor in partnership development. In interviews with teachers participating in a high school partnership, Abowitz (2000) found that local corporate employers were willing to provide work opportunities for students, serving as a motivator for collaborative teacher-business relationships. From the perspective of private businesses, Hoff (2002) indicates that "building community goodwill" (p. 70) motivated partnership, which has also been identified in other case studies (Edens & Gilsinan, 2005; Seitanidi et al, 2010). Guthrie et al.'s (2008) analysis of national data demonstrated that corporate giving to schools was linked to tax incentives, but Hoff (2002) found that reducing tax obligation was a less important motivator than improving social capital and the businesses' public visibility. Because each sector's motivations for partnership differ, maintaining a motivation to collaborate over time depends on partners' expectations being met in a way that produces value, whether these expectations existed from the beginning or changed through institutional learning.

While standards for success in cross-sector collaboration are variably defined according to both context and motivations for reform, educational partnerships often encounter a range of challenges besides conflicts over shared goals (Achinstein, 2002). School-commercial partnerships are sometimes weakened when parity is disrupted, leading to the exploitation of financially dependent schools (Giroux, 1999). Lack of time and resources to continue

collaborative work is a common barrier, especially if the partnership work is voluntary and without a full-time, paid staff committed to partnership development and conflict management (Bainer, 1997; Kania & Kramer, 2011). School administrators may conflict over lost authority as partnership work directly with educators to influence student outcomes (Peterson-del Mar, 1994). Teachers may conflict with partnership expectations for reform if they do not agree with new professional practices and pedagogical techniques (Achinstein, 2002). And, even if partnering organizations have aligned missions and partners have access to sufficient resources, a lack of structured implementation guidelines can impede reform (Bainer, 1997; Bennet & Thompson, 2011; Googins & Rochlin, 2000).

Despite these challenges, U.S. K-12 schools have developed hundreds of thousands of effective partnerships with businesses and community organizations, suggesting this organizational model is often conducive for educational reform or for securing private resources for schools (Siegel, 2005). STEM partnerships are some of the most prevalent and wide-reaching, often involving businesses, state policymakers, K-16 educators, administrators, nonprofits, community colleges committed to student proficiency and success in STEM fields, with the realization that their common interests in STEM literacy benefit from mutually reinforcing efforts (Austin, 2000; NSTC, 2011).

STEM Partnerships

Although there have been considerable federal and state policy initiatives and investments in STEM reform through the development of strategic partnerships, little research exists on STEM partnership models and barriers to their success. However, in her 2014 doctoral dissertation, Janet Walton demonstrated that staff at a Southern U.S. STEM partnership were instrumental in coordinating stakeholder groups and in supporting the regional capacity for

meeting their strategic goals for change. In addition to facilitating dialogue between regional partners about resource needs, measurement objectives, and mission alignment, partnership staff also helped to coordinate programming such as job shadowing experiences for teachers at local businesses and organized teacher professional development. The staff's interdisciplinary background and networking skills provided important stability in cross-sector and boundary-spanning work which synergized with the organizational model. Two years after the partnership infrastructure was established, partners differed in their level of engagement in collaborative activities. However, stakeholders still communicated openly and worked towards a shared vision, remaining enthusiastic about the STEM hub's progress. Walton (2014) identified areas of weakness in interviews with partners which may affect the STEM partnership's sustainability, namely insufficient cross-sector social connections, the lack of a shared measurement system, and a lack of public understanding of the partnership's role in reform efforts. However, as Walton notes, some of these gaps may be expected given resource limitations and that the hub was in its early years of development.

Johnson (2012) conducted a case study of a Midwestern state's implementation of STEM policy over the first eighteen months of a regional STEM educational partnership. Initially, business partners were motivated to join to participate in local economic development and to improve community relations, while K-12 educators and administrators were motivated to join to gain access to regional resources, support, and innovative programming. Partners within higher education and community colleges were motivated by student learning and the promise of a higher quality education system overall. Together, partners successfully developed a shared vision guiding their work with the partnership, and while some progress was made towards shared outcomes, Johnson outlined several barriers which prevented effective collaborative work

and consistent engagement across parties. First, the partnership was organized at the same time as the development of a STEM school, distracting collaborative work and relationship building in other areas. Second, the partnership delayed establishing a strategic plan and a sustainability plan until the second year, limiting progress towards long-term goals during that time. Johnson (2012) concludes her analysis with a list of practices to follow in future programs targeting STEM education, including the development of shared vision and strategic plans for growth, identifying dedicated leaders for partnership work, and implementing an accountability structure to ensure partners are not side-tracked by individual interests (p. 55).

Collective Impact

In her 2014 doctoral dissertation, Janet Walton applied a framework known as "collective impact" to evaluate the success of a southern U.S. STEM Partnership. John Kania and Mark Kramer of consulting firm FSG, Inc. developed the "collective impact" organizational framework for partnerships convened for social change initiatives. They describe that partnerships organized under the collective impact model differ from other strategic partnership organizations in that they include the appointment of dedicated staff and the articulation of formalized steps toward achieving shared outcomes (Kania and Kramer, 2011). Altogether, collective impact organizations are defined by five characteristics: a common agenda, shared outcome measurement, continuous communication among partners, mutually reinforcing activities, and "backbone" support from committed staff (Kania and Kramer, 2011).

These characteristics, while operationalized outside of academia, are largely supported by Bryson et al.'s (2006) framework for cross-sector collaboration developed from a comprehensive literature review. Their review identified five non-linear categories of characteristics and barriers to collaboration often found in cross-sector partnerships: 1) the partnership's initial conditions,

such as preexisting relationship histories and the institutional environment, 2) process activities, including leadership, trust-building, strategic planning, and conflict management, 3) contextual structure and governance characteristics, 4) constraints or barriers, including partner power imbalances and competition, and 5) accountability and outcomes (Bryson et al., 2006).

The importance of mutually reinforcing activities and communication in the collective impact model derives from Bryson et al.'s (2006) structure and governance factors. Meeting partnership outcomes and maintaining partner accountability are important to Bryson et al.'s (2006) findings that connecting the two is important to cross-sector partnership success. Finally, collective impact theory's common agenda for change includes a mutual understanding of the social problem and agreement to address it through collaborative action (Kania & Kramer, 2011). This common agenda partially aligns with Bryson et al.'s (2006) process characteristics, wherein they argue that a shared vision emerges through organizational leadership: "To be effective, [leaders] need formal and informal authority, vision, long-term commitment to the collaboration, integrity, and relational and political skills" (p. 47).

Therefore, the collective impact model places its emphasis on the successful outcomes of Bryson et al.'s (2006) process, structure, and governance cross-sector partnership characteristics. The collective impact theory's distinguishing feature is the inclusion of a backbone leadership organization to coordinate governance activities beyond sector boundaries and their corresponding capacities and constituencies.

Oregon's STEM partnerships are built around the collective impact model, and state grant funding is indirectly contingent on satisfactorily meeting its five criteria (a common agenda, shared outcome measurement, continuous communication among partners, mutually reinforcing activities, and "backbone" support from committed staff). However, collective

impact's characteristics do not fully address conditions required for cross-sector collaboration between individual partners (Walton, 2014; Mattesich et al., 2001). Walton (2014) critiqued the model by concluding that collective impact's "continuous communication" theme "falls short of capturing the nuances of collaborative relationships" beyond considerations of trust and partner communication (p. 204). Walton (2014) suggests that there should be another theme added to the collective impact model that would better reflect partner engagement and collaboration (p. 204). Similarly, Bryson et al.'s (2006) analysis of the cross-sector collaboration literature attends more to organizational leadership, planning, maintaining trust, and partner agreement on process, structure, and governance practices than it attends to whether variation in partner capacities for engagement and changing partner commitment over time affects success in cross-sector collaboration.

Effective Cross-Sector Partnerships

Several prominent scholars of partnership organizations either emphasize the preconditions for partnership formation and public policy (Bryson, et al., 2006; Ebers, 1997; Seitanidi, Koufopoulos, & Palmer, 2010) or categorize partnerships into different typologies based on organizational structure or their approach to governance (Skelcher, 2007). Less academic attention has been paid to understanding the key features of effective partnership relationships across sectors *after* their initial establishment through public policy intervention. In this analysis I draw from existing theoretical concepts from both the governance and New Institutionalism literature and develop interdisciplinary propositions to explain the continued stability of the South Metro-Salem STEM Partnership in Oregon.

Cross-sector partnerships like STEM education partnerships often consist of governments, businesses, and community organizations, and may convene either voluntarily or

by legislative mandate to address social problems. Implicit in their structure is that these partnerships offer more institutional capacity acting together, through the support of mutually reinforcing work, than any sector alone could provide (Bryson, et al., 2006; Googins & Rochlin, 2000; Provan & Kenis, 2008). Coordinating public and private efforts across sectors brings several advantages, including improving the efficient use of resources and increased institutional capacity and learning (Huxham & Vangen, 2005). Googins and Rochlin (2000) describe several critical steps of a successful partnership process including defining partnership goals, establishing member commitment, assigning responsibilities, communicating regularly, sharing resources, and evaluating progress (p. 133). However, these steps build on an assumption that members understand the added value of a partnership relationship between members from different institutional cultures and with different values (Googins & Rochlin, 2000). Reed (1999) establishes a three-stage partnership relationship continuum which considers different levels of dependence required to produce value and influence mutual commitment among members. At the highest level of dependence is the "symbiotic value creation stage," wherein value is created through the exchange of effort, ideas, and resources, often appropriate for addressing complex social problems. In this stage, partners acknowledge that their mutual goals require joint commitment and problem-solving (Googins & Rochlin, 2000; Reed, 1999). Given the mutual dependency of sectors invested in educational reforms, therefore, STEM partnership members can be expected to demonstrate a persistent commitment to collaboration and recognize its value, conditional on the continuous exchange of effort and resources.

In a literature review on cross sector partnerships, Bryson et al. (2006) describe the conditions necessary for partnering, process, and meeting outcomes. Public policy to establish a cross-sector partnership is more likely to be implemented in instances of sector failure to solve a

public problem, which in the United States is often after market solutions prove insufficient (Bryson et al., 2006; Salamon, 1995). In this environment, a brokering organization or individual may step in to draw stakeholder attention to a public problem or appropriate resources (Gray, 1989). During these initial stages, partner members reach a general consensus about the problem definition and acknowledge their self-interest in collaboration (Bryson et al., 2006). During this process a formal agreement may be signed to designate partnership roles and to establish member accountability.

After the partnership is organized, Bryson et al. (2006) offer several propositions from the literature outlining the key features of a successful, sustainable collaborative relationship across sectors. First, a partnership is more likely to succeed if it has committed leaders in authority working to build both institutional and collaborative legitimacy. Cross sector relationships, the authors argue, are also sustained through trust-building activities, successful conflict management, and in relationships where power is distributed relatively equally among its members while remaining responsive to key stakeholders. A cross-sector partnership's organizational structure and approach to governance should also be sensitive to context and the partnership's strategic purpose. However, once these are negotiated and partners reach an agreement, a certain amount of dynamism should be embraced. Throughout an evolving partnership, Bryson et al. (2006) identify that member agreement on process structure, governance, and outcomes may be influenced by competition between institutional cultures and logics. Or, relationships may need to be reconfigured when policy change alters a member's access to resources. Bryson, et al. (2006) conclude that cross-sector collaborations operate most effectively when they can build on each sector's interests and strengths for mutual benefit while moderating or overcoming their weaknesses.

Though some flexibility in partnership governance is necessary, attaining positive outcomes across sectors through collaboration depends partially on the extent that the characteristics of network governance comport with its strategic purpose and its existing organizational structure (Provan & Kenis, 2008). In Keith Provan and Patrick Kenis' (2008) network governance typology, when one organization within a network has resources and legitimacy to lead the other members of the network, all network-level activities and decisions are facilitated through this organization and the network governance becomes both centralized and brokered. Given this description, and for the purposes of this essay, I will consider SMSP as a leading organization operating with a network mode of governance.

In this form of governance by a leading organization, Provan and Kenis (2008) identify key predictors of network effectiveness, defined as the ability to produce positive network outcomes that could not be attained by the network members acting alone. The authors propose that this type of governance will effectively achieve network outcomes when there is a moderate need for network-level competencies, when goal consensus is relatively low, and when trust is more centralized (Provan & Kenis, 2008, pg. 241). First, if a network's task or purpose requires organizations to be interdependent, governance by a lead organization may be preferred over decentralized, shared governance because the lead organization may provide skills other members may not have, such as grant writing, conflict resolution, and bridging activities such as seeking out new members or attracting external funding (Provan & Kenis, 2008). Additionally, lead organization network governance can be effective with relatively low goal consensus (Provan & Kenis, 2008). Whether it is attracting funding for the network or addressing community needs, an organization's goals may be individualistic or collaborative, network-level goals (Provan & Kenis, 2008; Van de Ven, 1976). While network goal consensus exists, network

members may be more likely to be committed to working together; however, this does not necessarily mean goals must be similar. “In fact,” Provan and Kenis (2008) describe, “similarity of purpose can result in difficulties in working together, especially when competitive pressures make network organizations reluctant to cooperate and share information” (p. 239). Regarding network sustainability in the long term, lead organization governance may require members to work in ways that complement network goals and remain committed to them, but in the short term the lead organization can support administration and member participation without complete goal consensus (Provan & Kenis, 2008).

Finally, compared with shared governance networks, a low density (or narrow distribution) of trust can be maintained throughout the network due to the centralized governance activities by the lead organization. Trust can be understood as members having positive expectations about other organization’s intentions within the network (McEvily, Perrone, & Zaheer, 2003, p. 92). Specifically, network governance by a lead organization can be effective when trust is centralized on the brokering organization (Provan & Kenis, 2008). Member trust in these organizations, otherwise known as “boundary spanners,” is a key characteristic of stable inter-organizational relationships. Webb (1991) states that “trust is pivotal to collaboration. Attitudes of mistrust and suspicion are a primary barrier to co-operation between organizations and professional boundaries: collaborative behavior is hardly conceivable where trusting attitudes are absent,” (p. 237). Trust is conceptualized several ways in the literature; sometimes, a model of inter-organizational trust refers to a willingness to take on risk, predictability in others’ collaborative behaviors, the existence of shared norms, or as a mechanism for coping with complexity (Bachmann, 2001; Ebers, 1997; Williams, 2002).

In addition to trust acting as a constant feature in collaborative relationships, Vangen and Huxham (1998) identify its dynamic role in ongoing relationships. First, partners take a risk and form expectations about the outcomes of collaboration, and trust is reinforced when these expectations are met in a cyclic process (Vangen & Huxham, 1998, p. 8). In surveys and interviews with boundary spanner members working in three policy areas in the UK, Williams (2002) found that trust, however defined, is key to building effective relationships at both the individual and organizational level. As Bryson, et al. (2006) writes, "Paradoxically, [trusting relationships] are both the lubricant and the glue—that is, they facilitate the work of collaboration and they hold the collaboration together," (p. 47). Since this case study relies on New Institutionalism as a theoretical framework for understanding partnership relationships, I define trust in its initial stages as an institutional decision for a partnering organization to shoulder risk due to the perceived presence of a shared vision. As the partnership matures, trust operates in the background as an institutional norm built on meeting collaborative expectations.

In Table 2, I synthesize many of the core features of successful cross-sector partnerships from the perspective of an institution making internal decisions whether to join or continue to collaborate with a lead partnership organization with a network mode of governance:

Table 2.

Pre-Partnership Formation	Partnership Agreement Signing	Partnership Delivery
1. Organization learns about the partnership from preexisting relationships with other sectors. 2. The organization recognizes that joining the partnership could further institutional or organizational *goals* for change. 3. *Expectations* about the *value* of partnership to the organization develop. 4. *Motivation* to collaborate emerges. 5. *Resources* are found from external sources or are reappropriated within the organization for partnership work. 6. Organizational *capacity* for partnership work develops.	*Vision* for change aligns and *goals* are redefined to meet network vision and *expectations*.	1. Network-level *capacities* emerge. 2. *Expectations* are recalibrated with new knowledge of network capacities for change, understanding of partnership *value* to the organization adjusts. 3. *Trust* emerges, centralized on the lead organization. 4. Organization fulfills obligations for partnership work according to their capacity. 5. *Resource* and *capacity* constraints are better understood. 6. Network-level outcomes are met, or not, organizational goals are advanced, or not. 7. *Expectations* recalibrate. 8. *Trust* in the lead organization and perceived *value* are built up or deteriorate. 9. *Motivation*, or commitment, to collaborate is maintained or recalibrated.

While variables such as trust, structure, and mode of governance influence partnership effectiveness, their salience varies over time depending on the tasks and needs within the partnership. Lowdnes and Skelcher (1998) found that these cross-sector relationships move through a four-stage partnership life cycle in their analysis of UK urban regeneration partnerships: pre-partnership collaboration, partnership creation and consolidation, partnership

program delivery, and partnership termination and succession (Lowdnes & Skelcher, 1998). The authors find that each stage is marked by a unique mode of governance and relationship type between stakeholders. Network governance, built on mutual benefit, reciprocity, and trust was most prominent in the pre-partnership stage as volunteers with a shared willingness to collaborate entered informal relationships between other stakeholders. Next, during the partnership creation and consolidation stage, partners begin formalizing their roles and rely on a more hierarchical mode of governance. As a partnership enters the program delivery stage, the authors describe a relative lack of cooperation as partners negotiate their access to resources. This stage is marked by market-like governance with emphasis on contractual agreements between stakeholders. Finally, the authors describe partnership relationships during a termination and succession stage, returning to a more informal network mode of governance in an environment of uncertainty and relying on interpersonal trust among stakeholders (Lowdnes & Skelcher, 1998). Throughout a partnership's life cycle, however, Lowdnes and Skelcher recognize that the network mode of governance is of continuing importance to "the sub-structure of successful partnerships," (1998, p. 320).

Theoretical Framework

Public policy that relies on cross-sector partnership organizations to implement a strategic purpose needs to pay particular attention to the institutional environment, especially when these partnership efforts are built through voluntary participation across public jurisdictions. According to Scott and Meyer (1991), institutional environments include the formal and informal rules and expectations an institution must meet in order to receive broader social support and legitimacy (p. 123). These may include expectations of organizational behavior drawn from generalized belief systems (Scott and Meyer, 1991). Drawing from an

analysis of school districts' expansion of administrative positions (Rowan, 1982), Scott and Meyer (1991) develop the proposition that, "Organizations in institutional sectors will succeed to the extent that they are able to acquire types of personnel and to develop structural arrangements and production processes that conform to the specifications of established norms and/or authorities within that sector," (p. 125). Expanded beyond sector boundaries, therefore, the "institutional environment" affecting an organization's collaborative behavior can be interpreted to respond first to the formal *intra*-sector pressures (such as allocating resources and meeting outcomes) and then to informal *cross*-sector expectations to believe in a shared vision and agree that collaboration is necessary to enact that vision.

Within New Institutionalism, these beliefs develop into a "logic of appropriateness" which impacts commitment to collaboration in beliefs and in practice, and becomes the foundation for trust built on mutual understanding (March & Olsen, 1994). Individual commitment is maintained, according to this framework, when the structure and institutional capacity of an organization allows; "Actors are limited by the complexities of the demands upon them and by the distribution and regulation of resources, competencies, and organizing capacities," March and Olsen (2008) explain, "that is, by the institutional capability for acting appropriately," (p. 10). To synthesize the literature for this analysis of a STEM partnership applied through the behavioral lens of the logic of appropriateness, I propose the following propositions:

1. Cross-sector STEM partnerships like SMSP rely on a network mode of governance rather than market- or hierarchy-based governance.

2. After their establishment, longer-term commitment to collaboration in STEM Education is built from the institutional environment provided by existing social relationships, legitimacy structures, and shared beliefs about STEM educational reform.
3. This commitment is sustained (via the "logic of appropriateness") so long as the social resource needs and organizational capacities are met and members maintain a consensus vision for STEM reform through cross-sector collaboration.

Methods

Sample

I chose Oregon's STEM Network for this illustrative case study because the state leads the nation as one of only a few states which has implemented a network of STEM education partnerships to support regional education policy. Specifically, the South Metro-Salem STEM Partnership (SMSP) is an example of a mature partnership working from institutional relationships since 2012. Another long-running partnership in the state is located in more uniformly urban school districts in Portland, covering a smaller geographic area. Therefore, selecting SMSP had the benefit of exploring barriers that rural and suburban school districts may experience in collaborating with community groups and industries across larger distances, often without an ability to attend regular meetings in person with the entire partnership.

Ten current South Metro-Salem STEM partners participated in telephone interviews during the Summer of 2016, representing nine partnering institutions. The Director of SMSP supplied the contact information from this public list of affiliated organizations and partner members. While the total population of current SMSP members is 60, I sent recruitment e-mails to 30 members to purposefully sample the most senior partners from nonprofit organizations, community colleges, STEM industries, and rural and suburban school districts. Ultimately, 9

partners agreed to participate from this list of 30, while one additional participant was recruited via a referral from a partner as someone directly informed of the partnership work and tasked with attending regular meetings but not listed as an official partner. Table 1 summarizes the types of organizations and participants included in this study. Since my analysis depends in part on the particular resource needs, institutional norms, and goals faced by nonprofit, education, and industry sectors, I connect each partner with their organizational type. And, to further preserve participant confidentiality in this small population of partners, I did not refer to any organization or participant by name or by job title. Instead, I use a name selected at random and assigned regardless of the participant's gender.

Table 1. Study Participants by Organization Type

Type of Organization	*# of Participants*
Rural School District	1
Suburban School District	3
Community College	1
Nonprofit Organization	2
STEM Industry	3

Method of Analysis

I chose a semi-structured interview protocol (see Figure 1) to evoke each participant's experiences with the partnership in a way that allowed making comparisons across sectors. Each respondent elected to participate in a telephone interview when provided the option to either participate in the interview in-person or by telephone. Every interview was conducted during approximately 30 minute sessions and recorded with the participant's knowledge. I asked the participants a series of nine broad questions as summarized in Figure 1 and several probing

follow-up questions for additional details to either clarify or expound on their experiences during their partnership work.

Figure 1. Semi-structured Interview Protocol

1. How familiar are you with the work of the South Metro-Salem STEM Partnership?
2. What was your organization's initial motivation for becoming a SMSP partner?
3. What are some benefits of working with SMSP to your organization?
4. What are some challenges of this work with SMSP? Or, what would you like to see changed?
5. Is there any additional support you would expect for this partnership work?
6. In your opinion, what is the purpose of a STEM Hub?
7. What are some of the most important priorities regarding changes to how STEM is taught in this area's school districts?
8. How have your perspectives on STEM education shifted since you have started working with SMSP, if at all?
9. What are your organization's goals in STEM education, and how are you measuring your progress towards those goals?

I first asked about the participant's experiences with SMSP directly, however, I also invited participants to speak more generally about the organization they represented if they preferred. This was done to provide respondents with an additional layer of confidentiality or to provide flexibility for them to share how their personal experiences or perspectives compared with those of their organization. This flexibility also helped me identify any differentiation between the institution and the individual, and whether or not the partnership experiences could be explained through the influence of a "logic of appropriateness" about issues in STEM education and collaborative work.

The recordings from these telephone interviews were then transcribed and coded using Word and Excel software by Microsoft Office. The first round of coding identified responses related to the interview protocol's central concepts: *knowledge* about SMSP's work, *benefits* and *barriers* of partnership with SMSP, the respondent's *vision* for STEM education reform through the partnership, and their organization's *goals* for impacting STEM education, in addition to demographic information about the type of organization the participant represented as discussed in Table 1. The types of responses for each concept were then coded into distinct categories to represent the full range of experiences related to the general concept, guided by themes from the literature. For example, a response to a question about the benefits of partnership could include references to the *structure* or *mode of governance* of SMSP, and changes to an organization's potential *geographic impact* in STEM education. The contextual details of each category and how they related to one another were then explored using axial coding.

Results

In the following presentation of the findings from this case study, I will explore the benefits and challenges SMSP's partners experience with their work, the ways their shared vision for STEM educational reform is met through their partnership relationships, and their perspectives on the networked, regional approach to partnership collaboration. Together, these findings demonstrate that SMSP's ability to sustain partner commitment over time is largely due to sufficiently embedded norms, beliefs, and trust which are tied to a shared vision for STEM reform.

Benefits and Barriers to Partnership

Out of the 10 interviews with partners, nine could identify ways their organization directly benefitted from SMSP's partnership work. Across sectors, partners recognized the work

by SMSP to help coordinate STEM professional development opportunities for educators across districts and grade levels, guided in part by state and federal educational standards for reform. Partners benefitted from sharing educator expertise and best practices across the region through the network. As one suburban district superintendent "Julia" described,

> *We have been able to have a number of our teachers participate in these collaborative teams of folks that have engaged in professional development over the course of the year. We've really seen the benefit of that, not only because they've brought that expertise back into their schools, but we utilize those people to be a part of their district STEM committee, so they had a big voice in putting together our first district-wide STEM plan that looked out five years and really started to build that vision. The partnership helped to create that traction for us, because we were able to access that expertise with the deeper level of knowledge and leverage that knowledge to put that plan together.*

"Michael", a suburban district's STEM coordinator agreed:

> *There's so much benefit even in just talking about what's happening in another district or somebody else's classroom… teacher networking is a* huge *benefit.*

A suburban teacher "Rebecca" said that the number one benefit of the partnership was the increased capacity teachers gained from working with educators in other districts. This capacity was tied with increased awareness of STEM as an integrated subject as well as helping teachers lead other teachers in building STEM lessons and units. "Emily," an industry partner, said that her company benefitted by networking with stakeholders in the region, and appreciated learning about educator's roles in facilitating student engagement in STEM:

> *We get an opportunity to know what community-based organizations are in the STEM realm, and it helps us see best practices.*

Another industry partner admitted that his company did not directly benefit from the partnership work, but that partnership was an important expression of "community goodwill." And a partner from a nonprofit organization specifically mentioned that their regional efforts to engage students in STEM were "reinforced" by others in the network.

In addition to sharing knowledge and building teacher capacity, educators felt that partnerships had the potential to benefit their access to financial resources. One rural and one suburban partner within the school districts attributed their success in receiving grants to collaboration with other districts working on improving STEM. However, all of the education partners said that more money needed to be available to increase teacher participation in partnership work and professional development, and that small, rural districts could not always step in to pay for teachers' increased workload. Rebecca, who is from a mid-sized suburban school district, said that,

> *We get money for professional development, but it's not enough for all of the STEM work. When we start talking about all the hours teachers need to develop an advanced credit class, if we're talking about supporting teachers by paying for their time when they articulate a course, the district has to give more funding for that…. That could potentially be a problem in the future if we're not as well funded from the district—it may hamper our ability to partner.*

Julia, a superintendent, valued SMSP's contributions so far, but predicted that partnership work would most likely be hindered because of financial constraints associated with growth:

> *I think all of my focus for about how the partnership can be effective is about scale, not about the quality or about what they're doing.*

In one interview, Michael said that limited resources for partnership work was a source of conflict when some districts contributed more than others and there was differential commitment among educators and administrators:

> *I would say there has to be buy-in by all the partner districts because it actually hurts the partnership to pay lip service to their commitment but not follow through with active participation because then you're kind of—I'm going to use a nasty phrase here and I don't mean it to sound so bad—then you're just kind of dead weight that the rest of the partnership pulls along…There would be districts that just didn't hold teachers accountable to show up, and so resources are being pulled away from folks that are actively participating to people from districts that aren't showing up. So buy-in is a big piece. Part of that buy-in is that it has to be built in to the priorities and strategies of all the partner districts.*

Later in the interview, Michael added that the number of districts served by the partnership placed additional strain on smaller districts,

> *One of the difficult things about a Hub that is 14, 15, 16 districts large is that it is really difficult to find a one-size fits all model that's going to hit everybody's needs… Our needs are going to be different than [a district] that is eight times our size and we just can't compete resource-wise with what they have going on.*

Michael's knowledge that school districts with a lack of resources were less engaged in meetings and in partnership work was validated with my interviews with other school district

administrators. One administrator noted they were hesitant to call me to participate in an interview because they were less familiar with the partnership's current efforts, as their district did not always fund participation. All of the other partners said that they were either "pretty familiar" or "very familiar" with the partnership and attended regular meetings or worked with another administrator who did. Unlike partners from the school districts and a community college, industry and nonprofit partners required less financial support for their partnership work, and instead discussed ways they could give resources to students and educators, such as access to after school opportunities, tours of industry factories, and networking opportunities with STEM industry professionals.

Overall, partners agreed that Oregon's network of regional STEM Hubs provides an important benefit in facilitating cross-sector relationships beyond those that existed before the STEM Initiative. On two separate occasions, however, confining their collaborative work through these regional boundaries made geographically aligning services difficult for a nonprofit partner and "Tim" from a community college. Tim mentioned in our conversation that,

> *I think the regional concept is the better way to go than statewide, but those STEM regions don't necessarily line up with our workforce development regions… If they did line up that would be more powerful, in that sense, as far as getting more stuff done.*

To summarize, partners saw benefit in the ability to network and share resources and knowledge across and within the partnerships' different sectors, which school administrators found increased teacher capacity to engage students in STEM. According to Googins and Rochlin (2000), when organizations' expectations for collaboration are met and they find value in collaborative work, then their motivation for partnership is sustained. This feature was confirmed in the partner interviews; each member of SMSP that could articulate benefits of

partnership were optimistic about continued collaboration. While partners outside of the schools and the community college did not encounter financial barriers to partnership, this was a reoccurring challenge faced by districts and would likely affect scaling up partnership efforts to include more teachers and administrators. The regional focus of SMSP provided a central benefit for most partners to develop new meaningful relationships, but these boundaries sometimes prevented an organization from efficiently collaborating with SMSP and from reinforcing other partners' regional efforts.

STEM Vision

The network-level vision for STEM educational reform is based on two central beliefs: 1) mutual understanding of the improvements necessary in STEM education, such as integrated curricula, project-based learning activities for students, developing student identities in STEM, increasing diversity in STEM fields, and expanding opportunities for students outside of the classroom, among others; and, 2) cross-sector collaboration is necessary to enact these reforms. The partners interviewed agreed that SMSP's multiple-strategy approach was both clearly articulated and necessary for increasing student's interest and literacy in science, technology, engineering, and math. There was also consensus that these subjects would ideally be taught as an integrated whole to improve real-world relevancy and to increase student engagement and achievement in related fields. As the superintendent Julia reflected on the partnership's development, she said,

> *One strength of South Metro is that there is a clear set of guiding values or vision if you will, and I think it will be important that if the opportunity does come to grow the partnership those early fundamental priorities and values remain at the forefront, that you remember what it was that made you successful in the first place.*

However, the partners' organizational type affected what aspects of this vision they found most salient, whether it was helping students access accelerated credit opportunities, improving access to STEM careers, or sharing educator best practices. For industry partners, their vision was discussed in more abstract terms:

> *As far as [our company's] connection, we're a high-tech company, we have a large group of engineers so philosophically the STEM program is really important to the future of our company.* –Eric

> *I think the STEM Hub has a role convening the community organizations and the educators to make 21st century career readiness goals happen.* –Emily

Educators, on the other hand, focused more attention towards the near-term, describing a vision of educators implementing new, integrated STEM curricula through knowledge gained from networking with each other and industry partners. Julia offered her vision for the partnership work:

> *I think what the vision is all about is really creating those opportunities to share best practices and to provide opportunities for staff members that may not be available in their home district.*

Educators' focus on the short-term aspects of STEM reform was linked to their proximity to the problem, resource constraints, and a recognition that training teachers is one of the first tangible steps towards network-wide partnership goals. By contrast, private industry partners discussed long-term benefits of reform, such as building a workforce with "21st century skills," due to their sector's stated goals of partnership work.

Out of the seven partners that were aware of their organization's initial motivation for joining the partnership, each was linked to their perspectives on the purpose of a STEM Hub and this network-wide vision for reform. This overlap between an organization's initial motivation and its long-term plans suggests that partner's expectations for the partnership have remained consistent since the earliest stages of its development, and that partners have continued to feel that SMSP is integral to their vision being realized in the region. For two partners, these early stages affected their later success;

> *A lot was done right from the get go very intentionally, with the stakeholders that came to the table to have that really broad set of representation and then to be really intentional about creating those connections.* –Julia, suburban school district superintendent

Because of the stakeholders' intentional development of a shared vision for cross-sector collaboration in STEM from its earliest stage, SMSP successfully developed mutual understanding about the role of a STEM Hub, which later became a stable foundation on which to grow longer-term engagement with reform efforts.

Network Governance

To understand SMSP's effectiveness as a cross-sector partnership beyond each organization's individual needs, challenges, and internal goals, I next turn to partner's experiences with their collaborative relationships at the network level. Six partners recounted that joining SMSP has shifted their understanding of STEM education, with the exception of one education partner, both nonprofits, and the community college. These partners discussed their history working on STEM reform from within their institutions, and their familiarity with the Partnership's strategic aims like increasing access to CTE or improving project-based learning

opportunities in the classroom before joining the partnership. With the partners that recognized that joining SMSP changed their perspectives, they made references to approaching the content of STEM education differently in the classroom and a recognition of the organizations' dependence on other sectors' work and SMSP's leadership. In the interviews, partners discussed how SMSP was essential to forming relationships with the other sectors, which in turn helped partners learn from each other. District STEM coordinator Michael appreciated SMSP's leadership and network capacity-building work to the extent that it provided partners with access to cross-sector knowledge:

> *Some really smart person once told me is what makes us dangerous is not knowing what we don't know… There's so much that's tied into the concept of a Hub…looking at how these organizations are working for the collective good, you know, you've got K-12 and industry partners and higher education and state and government agencies, all those organizations have often times a very limited focus and if you want to bring them together around a common agenda I think it helps us know what we don't know… We get too close to the work.*

Industry partner Emily remarked that she now better understands how some students' only experiences with STEM and STEM fields comes through their experience with educators, and how those experiences are not evenly shared across the districts. Reflecting more generally on the importance of the cross-sector networking work, she said,

> *I think the best reason for having a STEM Hub is to help all facets of this work come together and see and know and understand what the others are doing to advance the work.*

Michael also described how his perspectives about STEM organizations' interdependency changed,

> *For me personally, it's been an education in the power of community and it's been an education in all the different facets that have to come together to make it work.*

Beyond the spread of this knowledge about how to collaborate in STEM, three partners recognized that long-term partnership work could be sustained if the "right people" saw the value of being "at the table" and participating in quarterly meetings, where partners would communicate their needs, progress, and goals, and how they might collaborate on upcoming activities. While these partners indicated that their organization did value regular meetings, they communicated that not all of the partners may feel the same. This was demonstrated in an interview with a suburban educator, who thought that the accelerated credit work group meetings were not as productive as she would have liked, suggesting that innovation in this area was slow work, and that they may have benefitted from the early inclusion of more high school counselors. Two of the industry partners hope to see more business representation at meetings, and are looking to find other ways to tailor their interactions with SMSP to make sure their attendance remains valuable. Eric remarked that many of the meetings he attends are rightly focused on educators, but that he saw more value in attending industry breakout sessions with other regional partners.

Beth, a nonprofit partner, said that SMSP needed to expand their support for young people in STEM beyond the classroom for the partnership work to be beneficial to their organization. Currently, Beth feels that the partnership meetings do not involve their organization enough, leading her to question their value to the nonprofit,

> *Their projects that they're doing don't really involve us… Currently it does not feel like a partnership where we are mutually doing things together, communicating what you're doing with each other, and inviting each other into your living rooms. Rather than that, the STEM center applies for what they want to do and then do it, and say 'Would you mind signing on?'*

In my interview with Beth, she communicated that her expectations were not fully met by SMSP, and this signaled a slight breakdown of trust in its leadership's decision making and in her commitment to collaboration with the Partnership.

Despite these barriers to creating mutual value for two partners, most partners across sectors commented positively about their interactions with SMSP's regional structure and its leadership, and that they do see value in their participation:

> *I would say that all the Hubs are doing a phenomenal job sustaining the work, and the relationship is going well.* –Emily, industry partner

> *I think it's a mutual effort, we've been engaged more for collective benefit than just individually for our district.* –Rebecca, suburban educator

> *From a collaborative standpoint, I think that our group and South Metro STEM Partnership works extremely well together, very collegial, very supportive of each other… There's things that we can't do for ourselves that we have been able to do through the partnership.* –Julia, suburban school district superintendent

> *I think [SMSP Director] has done a fantastic job and has moved everything forward more than we expected.* –Tim, community college partner

Three partners described that the Hub network structure across the state was particularly valuable and benefitted their ability to coordinate activities; as an industry partner Eric described,

> *It seems to me that the STEM Hub is a way to have a geographical organization and putting some structure in there so that there is a point of contact for people to come to, so that's really valuable, I mean, when programs get too large on the state level it might be a little harder to interact… Having it right here it's really easy for us, [SMSP] is right in our community and it's convenient for when we do have an interaction.*

Overall, partners cited SMSP's organizational leadership and its networked approach in coordinating relationships across sectors as reasons partners have confidence that the Hub has offered increased institutional capacity for reform. While each sectors' individual goals for impacting STEM depend on the partnering organization's internal incentives, they agree about what is needed for STEM reform, and that SMSP and other STEM Hubs have met their expectations by providing the opportunity for collaboration, the infrastructure for spreading knowledge, and building network-wide capacity greater than education, industry, and nonprofit sectors would have working alone. This agreement on governance approach and process activities also contributes to SMSP partner's continued commitment to collaboration, as suggested by Bryson, et al. (2006).

Discussion

As with Walton's evaluation (2014) of a regional STEM Partnership from the perspective of educational reform, my interviews with South Metro-Salem STEM partners (SMSP) found that the leading organizational infrastructure was central to sustaining relationships across sectors and increasing their institutional capacity to impact STEM education compared with acting alone. Four years later, SMSP is still successfully growing their regional relationships,

coordinating effective teacher professional development opportunities, advancing accelerated credit course offerings in their school districts, and developing an online platform which, in its early stages, is already connecting educators with STEM industry professionals among other initiatives. Consistent with Walton's (2014) findings, partners maintained a different level of engagement in partnership meetings and activities depending on their organization's sector and its amount of dedicated resources for partnership work, but continued to communicate with SMSP and shared the partnership's vision for engaging students with integrated STEM educational experiences.

Encouragingly, SMSP did not share weaknesses as a partnership with Johnson's (2012) or Walton's (2014) evaluation of STEM Partnerships in their earliest stages of development, such as a lack of sufficient social bridging capital or of a strategic plan to help guide long-term goals. This may be due to several factors, including the additional years with experience in partnership work, awareness within SMSP and in government agencies of these weaknesses other partnerships have experienced, and/or from effective leadership by SMSP's Director.

These interviews demonstrated general consensus in SMSP's vision for collaboration in STEM which serves as the foundational belief system unifying SMSP's institutional environment (Scott and Meyer, 1991). This environment was built in part through state-level government investment in the STEM Initiative and agency support of the statewide STEM Network infrastructure, but SMSP worked early on to build a common agenda between each sector through leadership and communicating the value of building new relationships with other potential partners. Over time, the partners that said their perspectives on how to reform STEM education changed after they joined the partnership also agreed that they learned more about the

value of collaboration across sectors, particularly with how SMSP coordinated activities that could reinforce work from other sectors.

Consistent with Scott and Meyer's (1991) proposition that successful organizations have personnel and structural arrangements that conform to the institutional environment, SMSP's partners participate in collaborative work to the extent their affiliated organizations are willing to commit the necessary extra resources. In interviews with partners facing organizational barriers to full participation in SMSP, they either described a lack of received benefit they expected from partnership or intra-sector financial competition. Both of these barriers could be considered intra-sector pressures which threatened to overcome the embedded cross-sector "logic of appropriateness." When partner's expectations for collaboration met these barriers in practice it affected their commitment to their current level of partnership work with SMSP. With the nonprofit partner who expressed doubt in the value of partnership, it centered around the lack of perceived benefit in attending day-to-day partnership meetings and current programmatic emphasis on K-12 educators. For school administrators like Michael, intra-sector inequality in the current distribution of resources between the districts generated competitive tension between districts of different sizes and eroded trust in others' contributions to collaborative work. For partners not experiencing these barriers, trust in SMSP's leadership quietly operated in the background. However, none of the partners that responded to a request for an interview demonstrated a break-down in a collective vision for reform more broadly, even when those partners' motivation to collaborate and their level of engagement waned slightly.

Several years into the partnership's work, SMSP fits into Lowdnes and Skelcher's (1998) partnership delivery stage. However, it quickly became evident during the interviews that organizations were not facing cross-sector competition or other characteristics of a market mode

of governance (Lowdnes & Skelcher, 1998). Instead, SMSP continued to demonstrate networked governance; communication between the partner and SMSP were more relational than formal, the partners shared a high level of commitment to a collaborative vision, and the tone of their interaction with SMSP was one that recognized that association with the partnership brought mutual benefit and an understanding that sectors depended on one another to reach that vision. Given the complexity of reforming STEM education, this network mode of governance is appropriate for the strategic purpose of Oregon's STEM Initiative and collective impact model's centralized leadership structure.

This brings the discussion to the limits of the collective impact model for evaluating a cross-sector partnership's long-term sustainability. The model's five components (a common agenda, shared outcome measurement, continuous communication among partners, mutually reinforcing activities, and "backbone" support from committed staff) are largely static criteria that limit insight that could be gained from deeper investigation; partners recognized that these criteria were met, but that the barriers to collaboration they experienced emerged from intra-sector or intra-organizational priorities or resource constraints. Since interviews with SMSP have demonstrated that these criteria are already embedded into the organizational structure and established relationships with the leadership organization, long-term barriers to collaboration could be overlooked. However, this literature review and case study reveal that new institutional barriers may arise, trust may wane, and expectations may be renegotiated—affecting partners' commitment to collaboration despite a shared strategic vision in STEM.

Therefore, these interviews confirmed each of my propositions built from the academic literature regarding SMSP's effective cross-sector collaboration: 1) SMSP relies on a network mode of governance built on mutual commitment and shared beliefs, 2) Longer-term

commitment to collaboration emerges from the intuitional environment created by SMSP's leadership and its ability to meet partner expectations in STEM education, and 3) this commitment is sustainable, though contingent first on resource needs and whether organizational capacities for participation are met.

Conclusion

As an illustrative case study, SMSP and Oregon's STEM partnership network stands out as a successful and sustainable example of cross-sector partnership, bringing together existing resources and services across a region of the state to engage students in STEM fields. Interviews with partners demonstrated that the early barriers to STEM partnership work articulated in Johnson (2012) and Walton (2014) do not necessarily apply to more established partnerships, especially those with committed leadership, intra-sector organizational capacity to meet each sector's needs, and a consensus vision built into the cross-sector organizational environment. This analysis, however, does have some caveats. While each sector was represented in the sample, the sample was narrow and therefore limited the number of conclusions that could be drawn about sector-specific barriers and motivations for partnership. Further research could compare outcomes reached and institutional environments faced by each of the six statewide STEM Hubs in the network in subsequent years. This research also focused on the use of cross-sector partnership organizations from the perspective of public policy and public administration rather than past analyses of STEM Partnerships by researchers in education (Johnson, 2012; Walton, 2014).

The partner experiences through SMSP may have implications for public policy and strategic partnership theories. First, lessons about the importance of cross-sector inclusion,

centralized institutional capacity, and a shared vision for change from the first four years of SMSP's successful relationships can be translated to other early STEM partnerships, which may benefit their long-term sustainability. Other forms of educational partnerships working from this STEM model may benefit from SMSP's multi-strategy and multi-sector approach. Finally, this case study may demonstrate to policymakers that sustaining partnerships requires long-term state leadership and commitment, ensuring that each sector maintains their institutional and financial capacity to participate in regional partnership activities.

References

Abowitz, K.K. (2000). Democratic communities and business/education "partnerships" in secondary education. *The Urban Review 32*(4), 313-341.

Achinstein, B. (2002). *Community, Diversity, and Conflict Among Schoolteachers: The Ties that Bind*. New York, NY: Teachers College Press.

Austin, J. E. (2000). *The collaboration challenge: How nonprofits and businesses succeed through strategic alliances.* San Francisco, CA: Jossey-Bass.

Bachmann, R. (2001). Trust, power, and control in trans-organizational relations. *Organizational Studies* 22(2): 337-365.

Bainer, D. L. (1997). A comparison of four models of group efforts and their implications for establishing educational partnerships. *Journal of Research in Rural Education 13*(3): 143-152.

Bennett, J.V., & Thompson, H.C. (2011). Changing district priorities for school-business collaboration: Superintendent agency and capacity for institutionalization. *Educational Administration Quarterly 47*(5), 826-868.

Brophy, S., Klein, S., Portsmore, M., & Rogers, C. (2008). Advancing engineering education in P-12 classrooms. *Journal of Engineering Education* 97(3): 369-387.

Bryson, J. M., Crosby, B. C., & Middelton Stone, M. (2006). The design and implementation of cross-sector collaborations: Propositions from the literature. *Public Administration Review 66*: 44-55.

Darling-Hammond, L. (2010). *The Flat World and Education: How America's Commitment to Equity Will Determine Our Future.* New York, NY: Teachers College Press.

Ebers, M. (1997). Explaining inter-organizational network formation. In M. Ebers (ed.), *The formation of interorganizational networks*. Oxford: Oxford University Press.

Edens, R., & Gilsinan, J. E. (2005). Rethinking school partnerships. *Education & Urban Society, 37(2),* 123-138.

Fullan, M. (2006). Change theory: A force for school improvement. In J. M. Burger, C. F. Webber, & P. Klinck (Eds.), *Intelligent leadership: Constructs for thinking education leaders* (pp. 27-39). Dordrecht, The Netherlands: Springer.

Giroux, H. A. (1999). Schools for sale: Public education, corporate culture, and the citizen-consumer. *The Educational Forum* 63(2): 140-149.

Googins, B. K. & Rochlin, S. A. (2000). Creating the partnership society: Understanding the rhetoric and reality of cross-sectoral partnerships. *Business and Society Review 105*(1): 127-144.

Gray, B. (1989). *Collaborating: Finding Common Ground for Multiparty Problems*. San Francisco: Jossey-Bass.

Googins, B. K., & Rochlin, S. A. (2000). Creating the partnership society: understanding the rhetoric and reality of cross-sectoral partnerships. *Business and Society Review 105*(1), 127-145.

Guthrie, D., et al. (2008). Giving to local schools: Corporate philanthropy, tax incentives, and the ecology of need. *Social Science Research, 37*(3): 856-873.

Hands, C. M. (2005). It's who you know and what you know: The process of creating partnerships between schools and communities. *School Community Journal, 15*(3), 63-84.

Hands, C. M. (2009). Why collaborate? The differing reasons for secondary school educators' establishment of school-community partnerships. *School Effectiveness and School Improvement, 21*(2), 189-207.

Hoff, D. L. (2002). School-business partnerships: It's the schools' turn to raise the grade! *School Community Journal 12*(2), 63-78.

Honey, M., Pearson, G., & Schweingruber, H. (Eds.). (2014). *STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research*. Washington, D.C.: National Academies Press.

Huxham, C. & Vangen, S. (1998). The role of trust in the achievement of collaborative advantage. Paper presented at the 14th EGOS Colloquium, Maastricht.

Huxham, C. & Vangen, S. (2005). *Managing to Collaborate*. London: Routledge.

Kania, J., & Kramer, M. (2011). Collective impact. *Stanford Social Innovation Review, 1*(9), 36-41.

Johnson, C. C**.** (2012). Implementation of STEM education policy: Challenges, progress, and lessons learned. *School Science and Mathematics*, *112*(1), 45-55.

Lowdnes, V. & Skelcher, C. (1998). The dynamics of multi-organizational partnerships: an analysis of changing modes of governance. *Public Administration* 76(2): 313-333.

March, J. G. (1994). *A Primer on Decision Making: How Decisions Happen*. New York: Free Press.

March, J. G. & Olsen, J. P. (2008). The Logic of Appropriateness. In M. Moran, M. Rein, & R. E. Goodin (Eds.), *Oxford Handbook of Public Policy*. Oxford: Oxford University Press.

Mattessich, P. W., Murray-Close, M., & Monsey, B. R. (2001). *Collaboration--what makes it work* (2nd ed.). St. Paul, MN: Amherst H. Wilder Foundation.

McEvily, B., Perrone, V., & Zaheer, A. (2003). Free to be trusted? Organizational constraints on trust at the boundaries. *Organization Science* 14(4): 422-439.

National Science and Technology Council. (December, 2011). *The Federal Science, Technology, Engineering, and Mathematics (STEM) Education Portfolio.* Retrieved from: https://www.whitehouse.gov/sites/default/files/microsites/ostp/costem__federal_stem_education_portfolio_report.pdf

Peterson-del Mar, D. (1994). School-site councils: The hard work of achieving grassroots democracy. *Oregon School Study Council* 37(6).

Provan, K. G. & Kenis, P. (2008). Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory* 18(2): 229-252.

Reed, B. (1999). *A path for evolving business/non-profit relationships: Expanding the value exchange.* Presentation before Boston College Center for Corporate Community Relations Dialogue on Cross-Sector Partnerships, February 1999.

Rowan, B. (1982). Organizational structure and the institutional environment: The case of public schools. *Administrative Science Quarterly* 27(2): 259-279.

Salamon, L. M. (1995). *Partners in Public Service: Government-Nonprofit Relations in the Modern Welfare State.* Baltimore: Johns Hopkins University Press.

Sanders, M. (2009). STEM, STEM education, STEM mania. *Technology Teacher* 68(4): 20-26.

Scott, W. R. & Meyer, J. W. (1991). The organization of societal sectors: Propositions and early evidence. In W. W. Powell & P. J. DiMaggio (Eds.) *The New Institutionalism in Organizational Analysis* (108-140), Chicago: University of Chicago Press.

Seitanidi, M. M, Koufopoulos, D. N., & Palmer, P. (2010). Partnership formation for change: Indicators for transformative potential in cross-sector social partnerships. *Journal of Business Ethics* 94: 139-162.

Shirley, D. (2009). Community organizing and educational change: A reconnaissance. *Journal of Educational Change, 10*(2), 229-237.

Siegel, D. S. (2005). Analyzing the effectiveness of university technology transfer: Implications for entrepreneurship education. *University Entrepreneurship and Technology Transfer: Process, Design, and Intellectual Property Advances in the Study of Entrepreneurship, Innovation, and Economic Growth* 16: 1-38.

Siegel, D. J. (2010). *Organizing for social partnership: Higher education in cross-sector collaboration.* New York, NY: Routledge.

Sills, B. A., Barron, P., & Heath, P. (1993). School reform through partnerships. In *Report of the Synergy Conference: Industry's role in the reform of mathematics, science, and technology education* (68-71). Leesburg, VA: Triangle Coalition.

Skelcher, C. (2007). Public-private partnerships and hybridity. In E. Ferlie, L. E. Lynn Jr., & C. Pollitt (Eds.), *The Oxford Handbook of Public Management* (347-370). Oxford: Oxford University Press.

South Metro-Salem STEM Partnership (2015). Memorandum of agreement between each partner organization as a member of the South Metro-Salem STEM Partnership. Retrieved from http://www.oit.edu/docs/default-source/strategic-partnerships-and-government-relations/south-metro-salem-stem-partnership/sms-stem-partnership-agreement_amended-oct2015.pdf?sfvrsn=2.

STEM Ecosystems. (2016). Community of practice. Retrieved from: www.stemecosystems.org/first-community-of-practice/.

Walton, J. (2014). *Partners for Change: A Mixed Methods Case Study of an Intermediary-led Partnership for STEM Education Reform*. (Doctoral dissertation). University of Cincinnati: Cincinnati.

Warren, M. R. (2005). Communities and Schools: A New View of Urban Education Reform. *Harvard Educational Review*, 75(2), 133-173.

Webb, A. (1991). Co-ordination: a problem in public sector management. *Policy and Politics* 19(4): 229-41.

Williams, P. (2002). The competent boundary spanner. *Public Administration* 80(1): 103-124.