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The importance and challenges of networking and knowledge sharing for attacking wicked problems have been aptly described by Weber and Khademan in their provocative *PAR* essay, “Wicked Problems, Knowledge Challenges, and Collaborative Capacity Builders in Network Settings” (March/April 2008). We argue in this essay, however, that a broader category of equally challenging but more commonplace “tangled” problems lies in a vast middle ground between routine and wicked problems. Think, for example, of the tangle of actors involved in operating a public school or a military base, or the tangle of programs that a social worker must navigate in order to help the families he or she serves. Success in coping with these kinds of challenges ultimately depends on finding ways to overcome the “need to know” default option in most organizations and moving to a “need to share” network culture.

One way to do so involves the creation of what we call “public sector knowledge networks” (PSKNs). Unlike other types of networks, PSKNs treat information and knowledge sharing across traditional organizational boundaries as a primary purpose as they try to address public needs that no single organization or jurisdiction can handle alone. PSKNs are sociotechnical systems in which human, organizational, and institutional considerations exist in a mutually influential relationship with processes, practices, software, and other information technologies. They have emerged in tandem with the adoption of advanced networking technologies and the development of e-government.

Examples of PSKNs include efforts to share geospatial information and expertise, such as the National Spatial Data Infrastructure initiative in the U.S. federal government; networks to support the sharing of public health data, such as the BioSense system supported by the Centers for Disease Control and Prevention and the U.S. Department of Health and Human Services; and networks to share environmental data, such as the Environmental Protection Agency's AirNow program. Other efforts support communities of practice with

information systems, communication tools, and data resources that improve professional practice. Such networks also gather, analyze, and share information about program performance among participating agencies in such fields as human services or establish monitoring and communications functions for public health, government financial management, or national security.

But building and nurturing PSKNs is no easy matter. In this essay, we draw on existing literature on collaboration and networking along with our own 15 years of action research and theory building involving public management projects in New York State and elsewhere. Our argument is threefold. First, while the problems of starting and sustaining PSKNs are formidable, they are not beyond the capabilities of astute, strategic, and tactically adept network builders. Second, a variety of lessons from our experiences can help in this endeavor. The upshot of these lessons is that it is misguided to conceive of information-intensive public management problems as mainly information technology (IT) problems, and therefore it is useless to focus on IT as a silver bullet. Instead, IT considerations must be appreciated as nested within a variety of organizational, sociological, ideological, and political contexts that all need considerable attention. Third, we argue that political leaders and public managers need to invest in developing as fundamental public management skills a broad and deep understanding of and capability for engaging with the *Realpolitik* of sharing knowledge and information in networks.

Public Sector Knowledge Networks in Analytical Perspective

PSKNs potentially offer substantial benefits. They constitute communication channels that give participants access to others' information and knowledge, with the expectation that better quality, more timely, and more complete information will be available to those who need it at the time that it is most useful. From an organizational learning perspective,

they provide a connection to others' knowledge and experiences (Galaskiewicz 1985; Hall 1999; Powell 1998), which can help public organizations improve their ability to react to uncertainty and complexity in the environment. In addition, interorganizational knowledge sharing is a major resource of professional and organizational innovation (Powell, Koput, and Smith-Doerr 1996).

Shared knowledge and information integration can help agencies better define and solve joint problems; coordinate programs, policies, and services; and prompt improvements in both IT infrastructure and information content (Dawes 1995). Sharing also facilitates integrated functions (Landsbergen and Wolken 2001) that provide citizens with convenient access to diverse information and services. Furthermore, positive sharing experiences can help government professionals build and reinforce professional networks and communities of practice, which can be valuable resources of information about programs, best practices, politics, and environmental conditions (Kraatz 1998; Powell 1998; Zucker et al. 1996).

Importantly, however, PSKNs are not all alike. One way to understand their variety is to see them as varying substantially across two salient dimensions: focus and extensiveness. As table 1 illustrates, two kinds of focus are prevalent: (1) a narrower focus that uses knowledge networking to help meet a specific need or solve a specific problem, and (2) a broader focus that aims to create systemic capacity to share knowledge and information whenever it is needed within a domain of action.

The narrower focus has the advantage of clarity: regardless of their organizational home or professional background, the actors involved are pursuing a particular goal that presumably has a desired endpoint. However, this type of focus lacks staying power. The knowledge and information-sharing network formed

to solve a specific problem generally is considered a temporary necessity rather than a permanent resource. By contrast, the broader focus offers more permanence and versatility. However, it is more difficult to design and implement, requires more fundamental capability, and faces different challenges to sustain its operations, including finding an appropriate and acceptable permanent organizational home for the network.

In terms of network extensiveness, three levels are common: (1) an intraorganizational network, where sharing takes place across different units of the same organization; (2) an interorganizational network that lies within a single government jurisdiction; and (3) an interorganizational network that crosses jurisdictions, sectors, or levels of government. Typically, more extensive and varied organizational networks have greater depth and breadth of knowledge to share, but the greater number and variety of stakeholders and contexts present more risks, costs, and barriers to overcome.

Thus, as we move from bottom to top and from left to right in table 1, the costs and risks increase, but arguably, so do the potential benefits and overall public value. Specific problem-oriented initiatives have the potential to meet a particular need and perhaps to generate learning that can be applied in similar settings at other times. By contrast, systemic initiatives have the potential to create ready capability to not only address current problems but tackle new problems as they emerge. These systemic knowledge- and information-sharing capabilities also can support ongoing innovation and value creation within their policy or problem domains.

Lessons from the Field: Challenges, Choices, and Opportunities

Prior research and our 15 years of action research in New York State suggest important lessons for those contemplating or trying to sustain PSKNs. We illustrate these lessons by referencing our experiences with six PSKNs that we worked with extensively in our research program. These PSKNs all involved information-intensive problems, including managing and evaluating homeless shelters and services; changing the basis for real property assessments; creating a geographic information coordination program; revitalizing the state central accounting system; enabling justice information sharing; and shifting from a regulatory to a service orientation in overseeing municipal finances. Details of each case are available in the longer e-version of this article on *PAR's* Theory to Practice Web site.

It suffices to note that the homeless services project is an example of an effort to share knowledge and work across many organizations and levels, all

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Table 1 Types of Public Sector Knowledge Networks

	Focus of knowledge networking	
	To address a specific need or solve a particular problem	To create systemic capacity to share knowledge and information within a domain
Extent of organizational network		
Across organizations in multiple jurisdictions, sectors, or levels of government	Annual reassessment Homeless services	GIS cooperative
Across organizations in the same jurisdiction	Statewide accounting system	Justice information sharing
Across units within the same organization	Municipal affairs	

focused on a specific need (see table 1, top-left cell). This project involved efforts to build a multiorganizational information-sharing system to consolidate information about homeless families and single adults, shelters, and related service programs across several dozen public and nonprofit organizations. In the real property assessment project, which was the same type, state and local participants held very different views of the definition of tax equity, the practices and processes of assessment, and the costs and benefits of relying on sales information instead of direct observation of real property characteristics to set assessments. The Geographic Information System (GIS) case aimed at building systemic capacity (Table 1, top-right) for a state-local coordination program, including a shared governance structure involving representatives of all stakeholder groups; a Web-based clearinghouse of metadata, data sets, and related information; and tools and policies intended to promote the sharing of spatial data sets.

The accounting case is an example of problem-oriented sharing within the same jurisdiction (Table 1, middle-left cell). The aging Central Accounting System, a legacy mainframe application, was the backbone of state government financial management. It needed replacement to allow the state to keep up with changing financial management standards with the help of modern information technologies. This redesign had implications for the accounting, budgeting, and financial management needs of every state agency, all municipalities, and hundreds of private organizations. In turn, the initial goal of the justice information-sharing initiative (Table 1, middle-right cell) was a systemic one involving a set of state-level justice agencies (including police, corrections, parole, and a central coordinating agency) in joint development of e-Justice New York, an interagency IT framework and portal meant to give users of criminal justice data and systems “one-stop” access to the information needed to accomplish their missions. Finally, the municipal affairs project (Table 1, bottom-left cell) sought to improve a particular kind of performance within one agency. This effort to generate consistent and readily shareable information and knowledge about local finances, local political and economic conditions, and state interventions in local government practices was part of a transition from a regulatory to a service-oriented strategy on the part of the state government.

The Tough News First

While public sector knowledge networks offer significant potential benefits for dealing with both wicked and tangled problems, our research suggests that they also face two sets of challenges that make them difficult to develop and sustain. One has to do with the nature of knowledge and the other with the complexities of the boundaries to be navigated. Taken together,

these knowledge and boundary challenges help explain why structured IT systems are often ineffective in transferring knowledge and information from one organization to another. Such systems rely on relatively rigid definitions and rules that are at odds with the dynamic flow and use of information in practice.

Lesson 1: The elusive nature of knowledge can cause considerable difficulty for PSKNs—it is dangerous to assume that meanings are clear, context is understood, and quality is acceptable to all participants.

Effective knowledge sharing depends on shared understandings, and these must be actively developed. That development almost always involves social interaction over time. Assuming that language is “clear” or that meanings are “obvious” usually leads to confusion, wasted effort, or costly errors. The social processes necessary to develop shared understandings and standard definitions of key terms and concepts require at least minimal levels of trust and support if open dialogue and compromise are to result.

The ease of knowledge sharing or the best ways to propagate it through a PSKN will depend on the nature of the knowledge itself. Some elements of knowledge are explicit, formal, and embodied in easily accessible media or artifacts, such as written policies, procedures, standards, and databases. This kind of knowledge is readily conveyed to others by language, images, or structured data and information systems. Other elements of knowledge are likely to be more tacit, embedded in social context and practices, and conveyed through “learning by doing” rather than through explicit means (Cohen and Bacdayan 1994; Wenger 1998). Knowledge also may be viewed as an organization-level phenomenon, embedded in organizational forms, expertise, and historical, social, material, and cultural contexts (Gherardi and Nicolini 2000).

Knowledge management studies also show that what is information to some is knowledge to others. Information forms the basis for knowledge development, on the one hand, and knowledge often is required to assimilate and interpret information, on the other (Davenport, DeLong, and Beers 1998). Finally, important aspects of knowledge sharing go beyond simple information or data exchange to focus on knowledge as *knowing*, implying the ability to use knowledge to accomplish some task or reach some level of performance (Brown and Duguid 2001). All of these kinds of knowledge are likely to coexist in any given setting, and the same sharing strategies will not work for all kinds.

Data quality is a further challenge. Quality most often is characterized as simple accuracy, but research shows

that high-quality data should be not only intrinsically good but also contextually appropriate for the task, clearly represented, and accessible to users. In other words, it needs to be “fit for use” (Wang and Strong 1996). The same information may be fit for some uses but completely inappropriate for others that have different temporal, security, granularity, or other requirements. Moreover, unrealistic assumptions about the quality and usability of information are common problems, including the common beliefs that information is objective, neutral, and readily available (Radin 2006).

In the annual reassessment project, for example, the basic argument for making annual statistical adjustments based on real property sales data presumed that there were enough sales in each town every year to compose a reasonable body of evidence for adjusting all property values in the town. When this assumption did not hold, assessors refused to even consider the new process. When the state argued that sales data from “similar” towns might be used instead, assessors rejected the idea as politically untenable.

Lesson 2: As a potentially sharable resource, knowledge varies in several essential respects—codifiability, embeddedness, and dynamics—and each variation demands substantially different treatment within a PSKN.

Variations in the nature of information and knowledge resources can be summarized in terms of three dimensions. One is codifiability—the ease with which knowledge is expressed in language, numbers, formal procedures, and explicit techniques. A second is practice embeddedness—the degree to which knowledge is situated in or generated by ongoing practice and learning by doing (Cohen and Bacdayan 1994). Information and knowledge are also very much embedded in changing temporal, physical, and programmatic contexts that need to be conveyed along with the information if someone working in a different context is to understand it. The third dimension is dynamics—the degree to which knowledge is constantly being recreated and transformed by use, including the development of new knowledge.

The GIS cooperative faced all of these challenges when it sought to make geospatial data sets widely available for sharing. Because this data had seldom been intended for use outside the programs for which it was collected, there was almost no metadata to help new users understand its context, how it had changed over time, its known weaknesses, or how key elements were defined and used in practice. Before the cooperative could become operational, significant investments had to be made in developing and adopting a common metadata standard to describe data resources in some detail. The logical first implementation focus, then, was to share the metadata, rather than the data itself.

Lesson 3: PSKNs are a form of cross-boundary exchange. The boundaries of organizations, jurisdictions, and sectors present the most obvious challenges, but more subtle boundaries related to ideology, professional norms, and institutional divisions can be equally problematic.

While networks of information systems may be relatively new to the public sector, the historical and institutional relationships among agencies are often many generations, even centuries, old. The American political system is designed to prevent the consolidation of power that can flow from information and knowledge sharing. Sharp lines of authority divide branches of government, as well as local, state, and federal levels. These may represent the most deeply embedded and pervasive boundaries to be crossed by PSKNs and thus constitute serious barriers to information and knowledge sharing. These barriers include widely different roles and functions at the federal, state, and local levels; enormous variation in local conditions and capabilities; inconsistent physical and technical infrastructure; and diverse and competing missions. These all contribute to misunderstandings and approaches that are ill suited to collaborative work (Dawes et al. 1997).

Here again, the annual reassessment case is instructive. Real property assessment is mainly a municipal function in New York. Assessments are conducted by more than 1,000 cities and towns ranging in size and sophistication from New York City, to diverse suburban areas, to towns of only a few hundred people. Accordingly, their ability to finance and manage the assessment process, handle the data management and analysis responsibilities, and interact with and educate the public varies in every possible way. Combine this diversity with the fact that state-level authority over this function is quite limited, and the prospects for a uniform statewide approach rapidly fade.

Boundaries typically occur in complex combinations. Policy and legal constraints on collaboration and knowledge sharing may involve program boundaries and goals (LaPorte and Metlay 1996; Milward and Rainey 1983), in addition to matters of cost allocation and authority across jurisdictions. Agencies also will have different policy agendas and competing priorities that flow from their different missions. Other boundary concerns include control of collaboration activities and rules about participation and decision making. Consider the knowledge exchanges necessary to establish new data-sharing relationships: Data policies and standards, timing and methods of data collection, and access to information can all vary widely across organizations (Landsbergen and Wolken 2001). Unless knowledge about these differences can be effectively shared, they cannot be reconciled. Once made explicit, however, issues of privacy, proprietary

content, and economic and political impacts can be taken into account in the kinds of sharing that are allowed. In the homeless services case, for instance, the state agency and homeless shelter providers worked for months to agree on policies and practices to protect the confidentiality of shelter residents. The agreement rested on hard-won common understanding about how to shield individual identity. All were surprised later by the objections of a late-joining domestic violence shelter director who pointed out that the location of the shelter, not the identity of the individual, was their overriding confidentiality concern.

Experience with and attitudes toward the kinds of collaboration needed for knowledge and data sharing may vary widely across organizational boundaries. Innovative capacity (Pardo et al. 2006), or the attitudes, resources, and skills necessary to organize and facilitate collaboration and knowledge sharing, may differ widely as well. Key elements of innovative and collaborative capacity building for PSKNs include managerial support and leadership (Eglene, Dawes, and Schneider 2007), facilitative skills (Bryson 2004), attitudes toward power and trust (Huxham 2003), and available resources and infrastructure. Innovative capacity also reflects a willingness to change attitudes and to master new managerial and technical tools, as well as a willingness to serve collective as well as individual agency missions and goals.

Crossing boundaries also means interaction with “alien” business processes and practices. As with information systems, the logic and full interpretation of a process may be poorly documented, causing, at best, a fragmented understanding of the complete process. The knowledge necessary to interpret many kinds of information is also intricately linked to the business processes from which it arises and in which it is used. Thus, effective data sharing and integration across boundaries often requires cross-boundary examination and understanding of diverse business processes and practices. In the justice case, an important requirement was to assure secure access to all the justice information systems to be connected through a single portal. A new joint management arrangement was needed to supersede multiple agency-based processes that issued and maintained user authentication and access permissions for thousands of workers. This affected not only the costs but also the long-standing internal business practices of each participating organization. The shift to a unified system required difficult negotiations, including crafting a formal interagency contract to deal with costs, processes, and authority relationships.

Organizational and professional cultures pose other kinds of boundaries. Knowledge often is embedded in these cultures and thus is not easily extracted or

transferred (DeLong and Fahey 2000). The way a police officer, say, interprets criminal history data likely will not be consistent with or easily transferred to someone without that particular training and experience. For information systems, the knowledge wrapper that holds the logic of data structures, definitions, collection methods, processes, and interpretive schemes is unique to the organizational setting in which it was created. This knowledge may be poorly documented and distributed in ways that make it difficult to aggregate and share. Without sharing this knowledge, however, the transfer of data across organizations is unlikely to produce meaningful results.

In the municipal affairs case, for example, regional staff used the general term “technical assistance” to mean a wide variety of activities under quite diverse circumstances. Only by actively engaging in comparisons and debates were they able to come to a common definition and set of services that could be deployed (and understood) consistently in every region. A similar process took place in the homeless services and annual reassessment cases, in which critical concepts such as “recidivism” and “tax equity” were understood differently by different actors and had to be explained, debated, and harmonized before the networks could really begin to work.

Simple physical distance poses a final boundary challenge. Despite great expectations for network technologies to allow remote collaboration, face-to-face contact is often important, even indispensable, for many forms of collaboration and knowledge sharing. This is especially true in the early stages of network exploration and formation. This necessary personal engagement, however, often is inhibited by the costs or complexity of travel or the lack of access to synchronous telecommunications, such as video conferencing, and incorrect assumptions about the nature and meaning of the knowledge and information to be shared. As is probably true in most states, there is a common expectation in New York that local and regional officials will come to the state capital to be involved in discussions of statewide programs. As a consequence, however, only those with enough discretionary money and full-time staff, or those in close proximity to the capital, actually participate. In five of our six cases, it was necessary to physically go out “on the road” in order to engage these critical stakeholders in an even-handed way.

Lesson 4: Trust, like knowledge, comes in different forms that work best under different conditions. Lack of sufficient trust—and lack of the right kind of trust—can be powerful inhibitors to PSKNs.

Trust influences how culture, values, and personal and organizational relations influence the processes and outcomes of knowledge sharing (Cresswell et al. 2006).

Trust is necessary in the face of the dynamic risks and interdependence inherent in knowledge sharing (Rousseau et al. 1998). When trust is low, transaction costs rise as a result of efforts to implement management and oversight controls that prevent exploitation (Jones, Hesterly, and Borgatti 1997).

Prior research and our experiences with PSKNs indicate that three kinds of trust are salient in knowledge networks. Calculus-based trust (Williamson 1993) rests on information-based, rational decisions about the organization or person to be trusted. Identity-based trust (Coleman 1990) stems from familiarity and repeated interactions among the participants. Identity-based trust also emerges from joint membership in a profession, a team, a work group, or a social group. Institution-based trust (Gulati 1995; Ring and Van de Ven 1992) rests on social structures and norms, such as laws and contracts, that define and limit acceptable behavior.

Importantly, different kinds of interactions demand different sorts of trust, and the lack of trust, as well as active distrust (Lewicki, McAllister, and Bies 1998), sharply limits what can be attempted and achieved. The sharing of codifiable information (e.g., the GIS cooperative) may need only calculus-based trust or some combination of institutional and calculated trust. However, sharing practice-embedded knowledge (e.g., among the assessors and shelter providers) requires at least some identity-based trust, and building this type of trust takes considerable time and interaction.

The quality of preexisting personal and professional relationships makes a big difference in reducing (or extending) how long it takes to build sufficient trust for new undertakings. In the homeless services case, the relationships between the state agency and the non-profit shelters had not always been smooth. However, they were consistently respectful. The shelter providers approached the project with a healthy skepticism, but they also had many past experiences of fair dealing that gave them some confidence to try new ways of working. By contrast, the annual reassessment project started from a basis of long mutual distrust across the state and local levels. It took longer to achieve less because past history had to be overcome. Many tentative steps were taken, withdrawn, and taken again as a long mutual adjustment process played out. Financial incentives, training programs, and grant-funded demonstrations all helped to encourage small but positive engagements that eventually moved the program forward.

Lesson 5: Risk is inevitable in PSKNs, and it is perceived and handled differently by different players.

Substantial risks inherent in knowledge sharing and collaboration can greatly interfere with effective

knowledge networks. Parties may not share the same understanding of risk and thus disagree over what may or may not be shared (Pardo et al. 2006). Common areas of disagreement include privacy, confidentiality, and security concerns; ambiguity about statutory authority to collect, share, or release information; and different degrees of openness to public access. In some contexts, information that is ordinarily public can pose unexpected risks, such as our earlier example of sharing the street address of a shelter for victims of domestic violence.

Moreover, agencies that compete for budget, control of scarce resources or infrastructure, or dominance in a policy domain may be reluctant to reveal any knowledge assets that may reduce or threaten their discretion and autonomy (Rourke 1978) or their ability to compete for power and influence (Provan and Sebastian 1996). Revealing information to outsiders also may pose a threat of embarrassment or sanction, or invite invidious comparisons of one agency or jurisdiction against another (Dawes 1995). Knowledge also may constitute highly valued organizational or personal assets. Loss of exclusive control of that knowledge can inhibit open dialogue and collaboration.

Even if there is no financial or tangible value at risk, some may resent another person or agency getting a “free ride” on their own hard-won knowledge. If the benefits of sharing are not clear, or if the exchange appears too one sided, barriers go up. Therefore, explicit strategies to address these perceptions of risk are critical to the success of knowledge-based collaboration. In the municipal affairs case, the regional staff initially were reluctant to share knowledge about how they advised local governments, fearing they would be criticized for giving bad advice. The agency’s leaders personally reassured them that the information gathered would not be used for personal evaluation and, in fact, that good regional practices would be highlighted and replicated. Putting these assurances into practice gradually built trust between management and staff.

But There Is Also Good News

Despite the tough problems they must face, prior research and especially our action research-based experiences with PSKNs also suggest that all is not lost for those seeking to develop, nurture, and sustain these information-sharing entities.

Lesson 6: The processes of PSKN engagement build professional networks, organizational connections, and reusable capabilities regardless of the level of substantive network success.

PSKN success is clearly not a unified concept. Our research suggests that substantive project success seems to depend on leadership and management practices, good quality data and appropriate infrastructure,

and a culture that provides incentives and rewards for knowledge and information sharing. In contrast, successful processes and relationships—what we call “networking success”—appear to rest on a combination of reputation, trust, competence, and supportive culture.

In all of the cases we studied, networking success was achieved more often and to a greater degree than substantive project success. All of the initiatives achieved greater success with organizational and individual networking than substantive achievement of their program or administrative goals. We conclude from this pattern that trusted networks among individuals and organizations are an explicit positive outcome as well as a precondition for eventual long-term substantive success. In addition, organizational and individual networking success can outlive a particular project and go on to strengthen and deepen working relationships in ways that can pay off in later projects. The homeless services project is a case in point. The project achieved a high level of networking success, yet it was not implemented because of a lack of political and financial support. Nevertheless, the project leaders from both the government and nonprofit shelter groups continued to work together successfully on new program initiatives.

It is important to recognize, however, that networking success is much less visible to external constituencies and political leaders than project success. It is a challenge to gain the time and support to work past early difficulties that are an inevitable part of the PSKN maturation process. However, persistence and focus on the ultimate goal can pay off. The GIS project, arguably the most substantively successful of the knowledge networks in our research, actually failed several times over nearly 10 years to garner political support and legal legitimacy before it eventually succeeded in achieving both its networking and substantive goals. Over this time, the professional GIS community persisted in building a case and demonstrating the practical value of its ideas until the political and managerial climate of state government was ripe for acceptance.

Lesson 7: Acquiring legal authority for a PSKN is a necessity, but there is no one-size-fits-all approach to structuring formal authority. Regardless of structure, mobilizing political support really helps.

Some legal basis for a knowledge network is necessary for legitimacy, but no particular structure of formal authority seems best. We have studied successful networks created specifically in law or by executive order, or formed under the general authority of an existing statute. None of the PSKNs we have studied over the years would have survived without this

legitimizing authority. In the annual reassessment project, for example, statutory authority was essential just to get started. Local government assessors are independently appointed or elected officials, and very few would consider a radically different way of working without a legal foundation to stand on when working with their own constituencies.

However, while formal legal authority appears to be necessary to launch a knowledge network, it may not be sufficient to sustain it through implementation. In the projects we worked with, legal authority bolstered by political support provided a more conducive environment for project development. These political linkages, usually associated with the explicit support of an elected official such as the governor or mayor, were especially useful in bringing reluctant parties to the table, clarifying leadership responsibilities, and negotiating powerful bureaucratic processes such as budget formulation. In the justice network, difficult negotiations over authority relationships and resource allocations depended on the direct and ongoing involvement of the governor’s criminal justice coordinator. In the municipal affairs project, internal agency conflicts could be confronted by the project leaders because they were carrying out their elected chief executive’s call to change the agency’s culture from one based on audits and compliance to one that emphasized prevention and assistance.

Lesson 8: Policy barriers are the greatest obstacles to substantive success in building PSKNs, but often they can be navigated by early intervention, focused action, and consistent attention.

Policy and legal barriers, especially the lack of formal support mechanisms, appear to present the greatest obstacles to achieving the expressed program or policy goals of these networks. These barriers are not so much restrictions on sharing as they are failures to support collaboration with appropriate resource allocations and policy mechanisms. In our research, general lack of legislative support, misallocated funding, and simple lack of funding were perceived as more severe barriers than laws that specifically restricted knowledge and information sharing. This is troubling because so much of the promise associated with public sector innovation depends on the ability of agencies to share information about clients and services and to share knowledge about their professions and practices. Without an enabling policy framework, the risk-averse culture of government is likely to dominate decisions and actions. The result is seen in missed opportunities and half measures that achieve little.

Astute PSKN leaders found ways to deal with these challenges. In the statewide accounting system case,

the project leader built a policy cabinet of “strategic partners” (representing both houses of the legislature, the state budget office, and the statewide IT agency) into the governance structure of the project. This ensured their ongoing attention, created a venue for policy discussions, and prevented surprises from derailing the effort. The GIS cooperative shows how formal policies can work to not only allow but also encourage information sharing. Through the creation of a formal standardized data-sharing agreement, the cooperative members established the rules, responsibilities, and benefits of sharing geospatial data across state and local government. The agreements assured access to data holdings, established primary data custodians for all data sets, and specified practices to enhance data use and quality for all members. By contrast, the annual assessment project was stymied by a lack of specific statutory and regulatory authorization to use market information to assess property values. The few local assessors who agreed to try it did so at their own political risk.

Lesson 9: Organizational barriers are serious, but amenable to innovation and creative management.

Organizational barriers negatively affect both substantive and networking success, but in our research, participants were resourceful in dealing effectively with many of them. Perceived barriers may reflect organizational realities that include diverse organizations with different missions and priorities, as well as organizational and individual resistance to change. Couple these difficulties with goals that often seem too ambitious or divergent, and it is not surprising that knowledge networking does not easily flourish. Our observations and interviews over the years, however, also reveal how certain managerial practices and individual initiatives can mitigate organizational barriers.

These practices include enduring relationships and close associations among key individuals with a shared vision, as was the case with the community of practice that advocated and eventually launched the GIS cooperative program. Professional commitments to innovative programs carried the annual reassessment project through a long period of negotiation and learning until it finally was adopted by a significant number of local governments. Likewise, long experience in working in and with certain organizations, and skills in negotiating familiar bureaucratic constraints, were instrumental in planning to replace the statewide accounting system. In that instance, veteran state officials designed the project in phases to coincide with budget and legislative cycles, ensuring that they would have the evidence necessary for decisions that would move the project forward and keep it visible to those with approval and budget authority.

Lesson 10: Multiple leadership behaviors are associated with success, including mission focus, emphasis on people and communication, willingness to experiment, and nurturing a culture of joint responsibility for success.

The leaders of knowledge networks need a repertoire of behaviors and skills that support collaboration and trust. In a multicase evaluation study (Zhang and Dawes 2006), we found that these personal qualities of leadership were much more important than the network leader’s expertise in the program or policy domain. Leaders who inspired trust, commitment, adaptation, and mutuality set a positive tone for behavior throughout the network. The most successful projects were led by people who emphasized the mission value of the effort and who focused first on the people involved rather than on the rules of engagement or the information content or material resources. They engaged in open communication with all players and used example and persuasion to convince participants of the collective and self-interest benefits of the effort. Successful leaders were candid and realistic about the costs and the risks to all concerned. We saw, for example, in the statewide accounting system and homeless services projects that leaders refrained from using the formal authority of their positions to compel participation by others. Instead, they sought practical solutions through wide consultation and experimentation. Moreover, they encouraged informal leaders to step forward and take responsibility for parts of the effort, especially when certain kinds of expertise or resources were needed.

Lesson 11: Early experience sets the tone and direction of cross-boundary relationships—unrealistic, incorrect, or misaligned expectations, processes, incentives, and assumptions are hard to change once set.

Unrealistic expectations and unexamined assumptions plague knowledge networking projects. To avoid serious mistakes and to control the risks of such undertakings, the early planning process needs to facilitate candid discussions that explicitly identify and engage stakeholders; fully describe benefits, barriers, and risks; and state underlying assumptions about the problem, the participants, and how they will make decisions and work together. Furthermore, the cases we have followed over the years highlight the importance of aligning goals and incentives through careful stakeholder analysis. This kind of analysis produces an early understanding of history, policy constraints, organizational capabilities, and technological limitations that can help participants plan projects wisely and manage interorganizational dynamics and implementation processes more effectively. In the justice project, for instance, participants initially thought they needed a common portal to link their information systems together. Through weeks of difficult and mostly

unproductive early discussion, however, they learned that their most pressing need was not for a technological tool but for a governance process to evaluate alternatives, consider divergent views, and make decisions about their joint responsibility for the justice enterprise.

Because different stakeholders perceive benefits and barriers differently, they need to be able to express their concerns directly. No one view is entirely complete or correct, but all are legitimate and need to be expressed and discussed openly from the start. Our findings indicate that in intergovernmental initiatives, higher levels of government tend to oversimplify and underestimate the needs of lower levels. In fact, local government stakeholders are considerably less optimistic about achieving goals and more concerned about a variety of organizational, technological, and financial barriers than their state-level counterparts. State officials often wanted to rely on their own assumptions about what “locals” think, need, and do, but when local official spoke for themselves, the picture of risks, benefits, and capabilities was much more accurate, diverse, and authentic.

Lesson 12: Learning and adaptation are essential to PSKN development and survival.

Knowledge networks are inherently learning organizations. They exist in a dynamic environment in which changing economic conditions, political priorities, and social trends have a strong effect on their status and operation. These conditions require not only learning but also ongoing adaptation. The interactions among individuals, organizations, and communities are the channels by which knowledge is exchanged, examined, and integrated. In the central accounting system project, for example, the lead agency staff thought they were well-versed in all of the uses made of accounting information. Thirteen stakeholder workshops later, they recognized how little they had appreciated the myriad cross-boundary business processes that linked their agency to all of the other government and private sector organizations that receive, handle, or disperse state funds. Therefore, the next steps in the system design process were refocused on detailing and accommodating these critical linking processes.

PSKN participants certainly should expect to adjust their sights based on learning and experience. In our research, when participants entered new projects, they generally had quite optimistic expectations about the possible benefits, giving all proposed benefits (such as better quality and more comprehensive information, improved infrastructure, and better accountability) good chances of being achieved. At the same time, they expected to face moderately severe barriers, including lack of funding, overly ambitious goals, and competing organizational priorities.

After acquiring substantial experience (typically about two years in our studies), participants reported that both benefits and barriers were lower than they initially had expected. Overall, none of the benefits were as great as they had expected, and none of the barriers were as formidable. In addition, the top benefits that participants believed had actually been achieved were somewhat different from their predictions at the beginning. The number-one predicted benefit was better quality information; the top achieved benefit was wider professional networks. The participants were very accurate, however, in predicting the top barriers. Lack of funding, overly ambitious goals, and different organizational priorities were the most expected—and the most commonly experienced—barriers.

Lesson 13: Technology is necessary but not sufficient for success.

Collectively, the preceding lessons lead to one simple yet essential final lesson: appropriate technology is a necessary but insufficient ingredient in the development, nurturing, and sustaining of PSKNs. In our view, in order for IT tools to be appropriate, they must be suited and scaled to the network structure and goals and be usable by all of the participants at reasonable cost and effort. However, participants often believe that having appropriate technology is the key to success. Their mistake comes in thinking that making different systems “talk” to each other is readily doable, and that once this is done, the knowledge-sharing problem will be solved. As we saw in the justice and annual reassessment cases, however, no information system—no matter how powerful, sophisticated, or intuitive—can solve political, organizational, or managerial problems, or problems associated with conflicting or competing goals or professional practices. In the municipal affairs case, the early effort to specify an information system was soon replaced by an effort to specify policies, business rules, and associated work processes that could be implemented in all the regional offices. With that done, the technology implementation to support the new practices was fairly straightforward. In short, information technology should be part of the effort to deal with these kinds of problems, but no particular method, and certainly no unexamined IT “solution,” will untangle them.

Conclusion

We have argued in this essay that public managers confront tangled problems every day across all policy domains and levels of government, and they need to be ready to deal with them through networked forms of engagement and action. Knowledge networking—the ability to create PSKNs suitable for addressing these problems—requires a certain set of skills and attitudes, as well as interpersonal and other kinds of trust. Network development processes that

emphasize early, open dialogue and examination of assumptions and expectations do better than those that rush forward with a fixed IT solution in mind. Those that adapt and learn from experience are more likely to succeed in achieving their substantive project and networking goals. Finally, to be sustainable as organizational forms, knowledge networks need some legal foundation, access to resources, supportive policies, and innovative forms of leadership.

Thus, the challenge for public managers is not so much a matter of successfully carrying out any particular networking project well. Rather, it is one of building institutional, managerial, and professional capabilities to engage cross-boundary, knowledge-intensive problems whenever they appear. As such, PSKNs work best when information- and knowledge-sharing capabilities are woven deliberately into the fabric of organizational and partnering work.

Prior research focusing on questions related to the effects of time and network purpose, scope, and leadership are all worthy of further investigation. While case studies have laid a foundation for understanding these organizational forms and their dynamics, surveys and a variety of modeling techniques hold promise for a deeper understanding of the ways in which these networks emerge, operate, and perform. A more detailed examination of what that research agenda should be is provided in the extended e-version of this article on the *PAR* Web site.

Clearly, sharing and integrating knowledge and information in multiorganizational settings involves complex sociotechnical interactions embodied in work processes, organizational forms, and institutional contexts. These are challenges of governance as well as issues for administration. They have implications for efficiency, performance, and public value that are ripe for multidisciplinary investigation, as well as for usefully linking research and practice. Sorting out these implications empirically affords a robust research agenda for the future. In the process, public administration schools and public agencies need to invest in developing as fundamental public management skills a broad and deep understanding of and capability for engaging in the *Realpolitik* of sharing knowledge and information in networks. The increasingly wicked and tangled problems of the future will require no less.

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