Lessons Learned about Planning and Implementing Statewide Systemic Initiatives in Mathematics and Science Education[1]

Daniel J. Heck and Iris R. Weiss
Horizon Research, Inc.[2]

Sally Boyd and Michael Howard
Independent Consultants

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Introduction

When the National Science Foundation launched its commitment to systemic reform with the Statewide Systemic Initiative (SSI) Program, the foundation recognized that no single approach would be appropriate for undertaking systemic reform across the wide variety of state contexts in the nation (National Science Foundation, 1990). Accordingly, NSF gave great latitude to the states in their approaches to reform.

States engaging in systemic reform encountered a substantial challenge to design programs that both addressed statewide reform, and undertook the task of reforming entire systems of education. Systemic reform required strategic thinking about the technical aspects of reforming mathematics and science teaching and learning, planning to go to scale within a state, and planning to sustain reforms over time. Delivering needed services to districts, schools, teachers, and students was at the same time far too much to attempt, and insufficient even if an SSI could have done it all.

The SSIs had to balance attention to direct services with attention to building infrastructure and capacity, and reforming state policy systems that would support changes in teaching and learning. Moreover, whether delivering services, building infrastructure and capacity, or working in the policy arena, the SSIs required keen political strategizing in order to make systemic reform work.

This presentation is grounded in research on the strategic thinking of all of the SSIs that completed the initial five-year phase of funding. Proposals and reports from all SSIs and semi-structured interviews with leaders in 13 of the SSIs are the data sources. Results

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[2] The authors can be contacted by mail at Horizon Research, Inc., 326 Cloister Court, Chapel Hill, NC 27514; by phone at 919-489-1725; or by email at dheck@horizon-research.com and iweiss@horizon-research.com.

focus on examples of how SSIs: 1) operated within the formal and informal education system; 2) cooperated with existing reform efforts; 3) sequenced and balanced interventions; and 4) gained public, political, and professional support for system reform. Strategic thinking about the technical design of interventions, the implementation of interventions, and the political factors involved in systemic reform is hypothesized to lead to an initiative characterized by high quality interventions that are sustained as part of a comprehensive program of continuous improvement.

Strategic Thinking in Systemic Reform

Those who undertake systemic reform seek to change education systems on an unprecedented scale (e.g., whole states or districts, including all schools, teachers, and students) and scope (e.g., policy, management, infrastructure, instruction, student outcomes) (Webb, Century, Davila, Heck, & Osthoff, in preparation). The challenge of designing and carrying out a such an ambitious reform demands conceiving and enacting a plan that includes effective activities for making changes on the required scale and of the needed scope; a feasible means for putting those activities into place in a timely and coordinated manner; and attention to the interests and influence of a wide range of stakeholders within the state and within the initiative. We have characterized the processes by which the leaders of systemic reform address these demands as the ***strategic thinking*** of the initiative.

The kind of strategic thinking we envision occurring in systemic initiatives is similar to what researchers of international development, public and non-profit organizations, and business have described for organizations they study. For example, Goldsmith (1996) delineated three aspects of organizations in international development that practice strategic thinking. First, the organization knows both its capabilities and its markets. Second, it has to scrutinize all aspects of its context—technological, economic, political, and social—that affect the organization's ability to achieve its goals. Third, the organization has to establish and maintain a fit among those external factors and its own position, services or products, and goals.

Designing and enacting systemic reform in education involves similar strategic thinking. Leaders of systemic initiatives must consider in their planning questions about technical aspects of reform (areas of need, capacities to address needs, actions likely to produce desired results) and political aspects of reform (involving key players and addressing their interests, communicating with stakeholders, positioning the initiative). During implementation new demands emerge both in technical aspects of reform (sequencing activities, taking advantage of emerging opportunities, maintaining quality control) and in political aspects of reform (gaining broad support, establishing credibility). Simultaneous and deliberate consideration of the demands in each of these areas while planning and implementing a systemic initiative defines strategic thinking in systemic reform.

Horizon Research, Inc. (HRI) served as an evaluator or evaluation consultant for several of the SSIs throughout the 1990s and currently conducts the national Core Evaluation of the Local Systemic Change through Teacher Enhancement (LSC) program for NSF (Contract Nos. RED-9255369, REC-9912485). In these roles, and in the current project with the Wisconsin Center for Education Research, HRI has had the opportunity not only

to take a critical look at systemic reform initiatives within states and localities, but also to look across states and localities to understand how systemic reform has been tailored to a variety of contexts. As a part of this work, HRI has investigated strategic thinking in systemic reform in the context of the SSIs. The term "strategic thinking" is intended to include the deliberations and decision-making that occur in the planning stages for systemic reform and for specific activities of the systemic initiative, and the adjustments, redirections, and mid-course corrections that occur as the initiative is implemented. Strategic thinking involves deliberations and decisions about both the technical aspects of reform and the political dimensions of reform.

Technical Strategy

The choices SSI leaders made about which elements of the education system the initiative would target and how those elements would be addressed constitute the initiative's ***technical strategy***. Common elements of the system the technical strategy might address include teacher capacity, infrastructure for delivering assistance to schools and teachers, and policies such as curriculum standards, instructional materials adoption, and student assessment. Regardless of which elements the initiative chooses to address, a sound technical strategy is likely to be reflected in a plan that target elements of the system which:

a) Represent important areas of need within the state;
b) Are not being addressed well or comprehensively within the state;
c) Complement existing efforts in the state targeting other elements; and
d) Can be positively affected within the resources, capacity, and design of the initiative.

The technical strategy for systemic reform is not confined solely to the planning phase. Which elements of the system are being targeted for reform and which activities of the initiative target each element must be coupled with decisions about how the activities of the initiative will be put into place. Moreover, the targeted elements and the initiative's activities are likely to change over time. Some sequencing of targets and activities may be planned in advance, but alterations and mid-course corrections to the technical strategy that were unforeseen in the initial planning phase seem almost inevitable in the implementation phase. The technical strategy during the implementation phase may be reflected in:

a) A sequence of activities that build on one another;
b) Deliberate work on elements that provide widespread guidance and powerful influence to support more specialized or localized work undertaken simultaneously or at a later time;
c) Targeting additional elements of the system as opportunities emerge in the context; and
d) Appropriate quality control mechanisms to assure that the implementation of the plan matches the standards of the plan.

Political Strategy

A clear lesson that has emerged from the SSI program is that systemic reform is as much a political challenge as it is a technical challenge. Many leaders of the SSIs found themselves devoting as much time and effort attending to state and local politics as they did attending to issues of teaching and learning. As the SSIs formed the broad and inclusive partnerships that the program demanded, and as they partnered with NSF in the cooperative agreements that governed the SSI awards, differing interests and agendas surfaced which complicated the work of designing initiatives for systemic reform. Each initiative had to make key decisions about how the SSI would position itself to reform long-standing mathematics and science education systems, which partners to include in the initiative and how each partner's interests could be made to fit within the SSI, and what to do about interests that did not fit well within the SSI. These decisions constitute the ***political strategy*** of the planning of the initiative. A sound political strategy is likely to be reflected in a plan that includes some combination of the following:

a) Involvement of important and influential individuals, groups, and organizations within the state mathematics and science education system and context;
b) Communications that allow the initiative to monitor the state context, disseminate information to key stakeholders, and to obtain timely input; and
c) A plan to position the initiative as the "voice" for science and mathematics reform within the state.

The political strategies of the SSIs rolled out in parallel with the technical strategies during implementation. Some SSIs had planned strategies for gaining and maintaining political, professional, and public backing. Others developed these strategies along the way as they tried to deal with the issues that arose during implementation. In all cases, a sound political strategy required building momentum and support for the initiative over time, keeping up with the ebbs and flows of shifting opinions and interests, and in many cases responding to more substantial changes in the political landscape that accompanied changes in the governor's office, the legislature, and/or leadership in state education administration. Aspects of the political strategy that developed or became evident in the implementation phase included:

a) Providing incentives for involvement of districts, schools, teachers, and organizations;
b) Creating and using "existence proofs," or "proofs of concept," to establish the credibility, effectiveness, and impact of the technical strategy on a small scale as a precedent for large scale implementation;
c) Creating healthy redundancies to prevent obstacles facing one activity from blocking attainment of important goals; and/or
d) Isolating pieces of the initiative enough to prevent lack of progress on one activity from stifling the entire initiative.

Examples of Strategic Thinking in Systemic Reform

The distinctions between technical strategy and political strategy for description and analysis have served the research team well. However, for the SSIs, technical and

political strategies and decision-making were, by the very nature of systemic reform, intertwined. Although it was the case that some technical and political decisions were undertaken somewhat separately, every technical decision had political implications and vice versa. In some cases, the technical and political needs and implications were considered together. In fact, the definition offered earlier in this paper of strategic thinking in systemic reform—simultaneous and deliberate consideration of the demands in technical and political arenas while planning and implementing a systemic initiative—incorporates the integrated nature of the type of thinking we propose must provide a foundation for systemic reform.

We offer below some examples of how SSI leaders thought about the technical and political demands, considerations, and implications of systemic reform in the planning of a systemic initiative, in the implementation of a systemic initiative, and in sustaining pieces of a systemic initiative. These examples describe only parts of these SSIs, with enough context to elucidate the constraints and opportunities of the initiatives' technical and political strategies. We note as a caveat that the leaders of the SSIs represent some of the primary contributors to our understanding of what systemic reform is and how systemic reform works. When they undertook statewide systemic reform in the early 1990s they had little, if any, theory upon which to build and no examples of systemic reform on a comparable scale on which they could draw. Our critique should be seen as descriptive and critical within our framework, but not evaluative.

Planning the Michigan Statewide Systemic Initiative (MSSI)[3]

The case of the Michigan Statewide Systemic Initiative provides a useful example for examining how political strategies emerged in the planning phase for the SSI. Of particular interest are the ways that attending to the political demands of planning the SSI altered the technical strategies of the initiative.

In Michigan, the SSI was faced with finding a niche and consolidating forces within a state in which many elements that could play a part in systemic reform were developing concurrently. By 1989, mathematics educators had developed and pushed for the adoption of "Curriculum Outcomes and Essential Goals;" similar guidelines were adopted for science in 1991. Both the science and mathematics "Essential Goals" documents reflected national standards, and provided the basis for revisions to the Michigan Educational Assessment Program (MEAP)—the statewide assessment system in science, mathematics, and reading. At the time the MSSI was funded in 1992, Michigan was also in the process of developing state standards in mathematics and science, based on the "Essential Goals" documents. A highly influential policy, Public Act 25, enacted in 1990, was driving a redistribution of power in Michigan, with the local districts assuming a much larger share of once centralized state decision-making. With decision-making came accountability, closely tied to the MEAP. Said one former MSSI staff person: "The pressure is immense. Public attention is great. Principals and others live in fear of bad scores being broadcast on TV." The most "at-risk" districts were those most "terrified by the MEAP and accreditation process." The state had begun to provide an infrastructure for supporting districts facing new requirements with heightened

[3] Sally Boyd is the project's principal researcher on MSSI. This example is taken from a draft case report that she authored.

accountability. In particular, the legislature's Mathematics and Science Challenge Grant Program established regional Mathematics and Science Centers to support districts and schools to improve their programs in mathematics and science. A wide array of professional development programs was also underway, but these programs were not coordinated within the state.

Within this state context, the MSSI envisioned clear roles for itself. Technical strategies for achieving reform would bring coherence to the system, and address critical areas currently neglected by other forces in the state. For example, with the state continuing to fund the Mathematics and Science Centers, and the U. S. Department of Education providing support for the development of curriculum frameworks, the MSSI chose to direct their attention elsewhere, viewing these existing pieces as "tools" for reform.

Although the state provided guidance on curriculum, instruction, and assessment, there was little consensus on the overall direction needed to achieve systemic reform in science and mathematics education. The MSSI planned to articulate this vision. Initially, the plan for MSSI focused heavily on professional development around the state's emerging standards. The proposal submitted by the MSSI in the first round of the competition for SSIs was not funded, with NSF citing a need to expand the mission and show evidence of commitment by high-level stakeholders. In essence, MSSI was asked to merge a political strategy with its technical strategy.

MSSI planners then convened over 100 stakeholders in mathematics and science education to reflect on the needs and gaps in the system. A draft position paper entitled "Scientific Literacy and Mathematical Power for All" helped generate dialogue and build consensus among this group. Discussions were intended not only to inform policymakers, district administrators, professional development providers, university faculty, and others, but also to engage them in decision-making about how to proceed. In convening important stakeholders in mathematics and science education throughout the state to address a political need, MSSI reconsidered its technical strategy. For example, there was broad consensus among MSSI planners that teacher education reform was a pressing need, and there were no statewide efforts in place "to take it on." One of the MSSI evaluators recalled:

> *The MSSI provided a way to convene people, which hadn't been happening. There were all these pieces out there, but no entity to convene the players. So they got people together and got them talking in the same ways and the vision emerged from that work. And in the process, the MSSI was trying to build the capacity of the various players—not just individual capacity, but also organizational and structural capacities that hadn't existed before.*

"Scientific Literacy and Mathematical Power for All" was an umbrella document designed to encompass broad interests and activities around science and mathematics. Ultimately, the MSSI would submit the position paper for review, revision, and adoption by the Governor, the State Board of Education, the legislature, and presidents of universities and colleges. Once adopted, the document would guide systemic reform in the state, and serve as the official position statement on mathematics and science

education. MSSI had begun to develop itself as an important voice for mathematics and science education through political strategizing, but a somewhat different technical plan emerged as a result. The four areas where MSSI focused its attention in the initiative that was awarded in the second round of SSI funding from NSF reflected a different emphasis than the original plan of a year earlier. Professional development was situated alongside policy review and teacher education reform. A redoubled emphasis on the lowest achieving districts in the state was also put in the forefront. Much of the difference could be attributed to the broad and inclusive planning process that MSSI leaders undertook between submission of the first and second proposals.

Implementing the Vermont Institute for Science, Mathematics, and Technology (VISMT)[4]

The Vermont Institute for Science, Mathematics, and Technology offers an informative example of strategic thinking in technical and political aspects of reform during implementation of the initiative. At several critical junctures in the implementation phase, the SSI evolved in its technical and political strategies as the initiative achieved successes in some areas upon which it could build further reforms, and reconsidered its interventions in areas where intended progress was not accomplished.

VISMT was initially funded in the second cohort of NSF funding for SSIs, and was funded by NSF for continuation in Phase II five years later. In general terms, many of the past and current activities of VISMT can be tied to what was originally planned for the SSI in the early 1990s. However, the SSI in Vermont has played out in ways that were not anticipated in the planning stages. The implementation and retooling of the SSI in Vermont demonstrates strategic thinking about choosing to address elements of the system that send strong messages across the system, paying careful attention to signals from important stakeholding groups, sequencing activities to build on one another, providing incentives for participation at the local level, and maintaining sufficient flexibility and quality control to ensure that the initiative's more decentralized work both responded to local needs and concerns, and also maintained alignment with a statewide vision for mathematics, science, and technology education.

In its initial plan, VISMT identified policy work in standards, frameworks, and assessments, and capacity building and direct service work in professional development as important activities of the initiative. VISMT has remained active in all of these areas over the last decade. However, within each of these areas, VISMT has deviated considerably from what was designed in the early 1990s, and perhaps even more in how these areas have been used as mutually reinforcing components of statewide systemic reform.

Vermont's Commissioner of Education in the early 1990s, Richard Mills, was pushing the state toward greater centralized guidance. The state had adopted a *Common Core of Learning* that established a basis for developing teaching and learning goals statewide. A voluntary state portfolio assessment in reading and mathematics was also in its infancy. Commissioner Mills had laid out a plan for providing educational guidance to the locally

[4] Michael Howard is the project's principal researcher on VISMT. This example is taken from a draft case report that he authored.

controlled districts through development of standards, frameworks, and assessments. The Department of Education, however, was severely understaffed to accomplish the requisite work of research and development of the policy instruments and of providing support for districts to implement reforms.

The SSI's first step was to involve itself heavily in the development of standards and frameworks that the Commissioner and the SSI's leaders envisioned would provide guidance for the development of local curricula in mathematics, science, and technology. VISMT became a natural partner for the Department of Education in this effort, because it represented resources that the Department did not have at its disposal, and because, in its planning process, VISMT had positioned itself to be a convener of the kind of inclusive and collaborative process that standards and framework development would require for credibility and acceptability across the state. In retrospect, one of the project planners described the importance of this approach:

> *VISMT made a conscious decision to be an active partner in development of the statewide frameworks. That was very important, because they became the foundation for other work in the state. And through that process VISMT was able to build some real credibility for its capacity in math and science.*

VISMT was given the role on the commission for the standards and frameworks document to lead development of an integrated mathematics, science, and technology section. However, translating the interdisciplinary vision espoused by VISMT (and the Department of Education) into a concrete framework proved to be politically difficult. The commitment to an integrated approach was not broadly shared. Early drafts of the frameworks were criticized from several quarters. Scientists noted the absence of what they felt were important concepts; mathematicians were concerned that mathematics was losing its identity, in part because some topics could not be addressed in an integrated manner; educators worried that the Framework would require large changes in their accustomed local curriculum. NSF, too, voiced concerns about the shape that the framework was taking.

The VISMT staff leading the Framework development tried to steer a course that maintained the commitment to an integrated vision while being politically sensitive to the many concerns that arose. A review of the draft Framework was commissioned and was used with additional public comments to revise the Framework document. In the final draft, released in late 1995, science and mathematics were given greater independent treatment, with standards derived from their respective national standards documents. The interdisciplinary flavor was retained, but was very much in the background. The State Board of Education adopted the resulting *Framework of Standards* in January 1996. Interestingly, what had originally been viewed as a leading element of the reform had not been realized until almost the end of the original SSI funding period.

As VISMT looked toward its future, the adoption of the Framework and parallel work in portfolio and standardized assessment provided a new focus upon which the initiative built its local support activities. Through most of Phase I, VISMT had advocated for inquiry-based teaching as generally the "right thing to do." With the Framework in place and aligned assessments in development, VISMT could now emphasize curriculum and

instruction based on the state's new standards. However, the SSI also questioned the capacity of its existing support structures and activities to provide what was needed to reform mathematics and science instruction across the state.

VISMT's evolution in professional development support for districts was based both on the initiative's internal awareness of when changes were needed and on an ability to recognize and build upon opportunities in the changing state education environment.

As originally planned, VISMT professional development was built around centralized, two-week summer institutes for teams of teachers and administrators. Participants responded well to the institutes, but participation in follow-up and school-site support activities was not as strong as expected. Moreover, because the state standards at the time were still under development, the institutes focused on national standards, and participants sometimes found it difficult to make links to local curricula. Beginning in the fourth year of the initiative the institutes were moved to regional sites (school districts, higher education institutions, informal science organizations) as five-day Regional Professional Development Institutes, which reached another level of participants and increased VISMT's visibility at the local level.

At the same time that the institutes were being moved to regional sites, another strategy was being implemented by VISMT. VISMT leadership was concerned that the bulk of the VISMT professional development activity was taking place away from the school site, and was therefore disconnected from what was happening in the schools. Furthermore, although the summer institutes were intended as leadership development experiences, teachers going back to their classrooms found it difficult to function effectively as reform leaders.

The decision was made to begin the VISMT Teacher Associates program. Outstanding classroom teachers were recruited to work on a regional basis as Teacher Associates, providing on-site technical assistance to participating schools. The Teacher Associates' primary purpose initially was to provide consulting and assistance to teachers in their classrooms and to assist school teams in working on professional development plans that better reflected local needs. As the state standards were nearing completion, the VISMT leadership saw another role for the Teacher Associates, namely to assist schools in examining their mathematics and science curricula in light of the standards. A member of the VISMT staff explained:

> *One of the most important things the Teacher Associates learned was how to work with the science committee in the school, get them to meet effectively on a regular basis and continue to pursue changing science education in that building. That was an important element to making change in the building, and drew more people in than we ever had before. … At the institutes, people would get excited, but if there was no leadership back in the school, it would be gone in six or seven weeks after the summer was over.*

VISMT began with four full-time Teacher Associates in 1995, then expanded to twelve full-time positions. Although the original intent was that a Teacher Associate would be

released for one year, many worked with VISMT for two years before returning to their classrooms to provide local leadership. The Teacher Associate model is still in use in VISMT, although it has been scaled back somewhat and the job description for Teacher Associates has taken on greater flexibility. The current Executive Director explained:

> *In the early days, we were able to go out and almost hand-pick the best candidates for the positions. What we found over time was that there were good people interested in this kind of work, but not all of them are in a position to take a year to come work full time in the Teacher Associate model. We started looking at how to build the model around the people, keeping the parameters that were important to us but giving some flexibility in what the model would look like.*

Moving from the centralized summer institutes to a regional format built around shorter, targeted conferences and on-site assistance from Teacher Associates has been key in VISMT's efforts to impact schools. Furthermore, the shift from working generally on inquiry and standards-based teaching to a specific effort to translate the Framework into local curriculum provided a political incentive and a specific purpose for sustained VISMT presence in its participating schools.

Sustaining the Maine Mathematics and Science Alliance (MMSA)[5]

The Maine Mathematics and Science Alliance affords an example of an SSI that put technical strategies into place early in the initiative that were not well matched with political realities that emerged in the state and in the SSI program. Sustaining systemic reform in Maine involved revamping technical strategies in light of the political successes and failures of the initiative. In particular, MMSA had to be alert to opportunities that existed when the SSI funding from NSF came to completion.

The SSI in Maine was most visible in the state in its creation of Beacon Schools, which were intended to be "living laboratories" for creating and demonstrating standards-based instruction in mathematics and science education. The Beacon Schools were selected from different regions of the state and represented different levels of capacity and progress toward a standards-based system even from the start of the initiative. As originally designed, a single Beacon School would have been chosen in the first year of the project, as a test site to work out the "bugs," before an additional six sites were chosen for the duration of the project. As one of the planners of the original design described:

> *We used the word "Beacon" School … the image was supposed to be the lighthouse. There were these Beacons, wonderful places where something really exciting is going on, and so that the school district next door would say, "You know something interesting going on there, let's go over there and let's talk to them." Or more than that that the people in the Beacon Schools, one of the charges want to go out and spread the word through the various*

[5] Daniel Heck is the project's principal researcher on MMSA. This example is taken from a draft case report that he authored.

mechanism that were set up, such as the institutes during the summer. … One of the components as I recall, was built into the facilitators job, was to try to communicate to other schools. … The facilitators themselves trying to go out and actually bringing in these … publicizing what was going on in the schools they were involved with, to other districts, and hopefully other districts getting excited about what they saw.

The Beacon School concept was so compelling to the broad group that crafted the initially funded proposal for the SSI that the language was also carried over to the higher education component of the initiative. An effort to reform teacher preparation and teaching and learning in mathematical and scientific disciplines at the state public and private colleges and universities was described as the Beacon College component of the SSI plan. Within a few years several participating institutions of higher education had developed a separate proposal to NSF's Collaboratives for Excellence in Teacher Preparation program to support the Beacon College. When this proposal was not funded, the Beacon College idea largely disappeared from the SSI effort, although the institutions of higher education remained active in other areas of the initiative, particularly in providing summer professional development institutes for teachers.

As MMSA, the newly created, non-profit, organizational home of the SSI, began to implement the Beacon School component of the initiative, changes to the design were almost immediate. First, the idea of beginning with one school as a pilot site was abandoned in favor of rapid start-up in all of the Beacon Schools in order to establish the presence of the initiative more broadly in the state. Second, although individual schools were originally envisioned as Beacon Schools, collections of schools, including whole districts, applied to the MMSA and the concept was broadened to allow Beacon Sites, which could involve multiple schools. Third, MMSA received more than sixty applications for the Beacon Schools/Sites component of the initiative. Although MMSA was able to fund only seven sites, the additional sites were incorporated into the initiative in broader professional development, leadership development, community involvement, and strategic planning components.

The Beacon Sites were supported primarily through on-site human resources in the form of one Mathematics Facilitator and one Science Facilitator. The facilitators were deployed early in the initiative. Although careful selection of the facilitators led to a group that all of the SSI leaders considered very strong and capable, the facilitators received little advance preparation before being put into their Beacon Site assignments. Simultaneously participating in support activities that MMSA provided for the facilitators and conducting work in the sites was difficult to accomplish. In addition to facing the challenges of their new positions, many facilitators also faced the initially unexpected challenges of working with multiple schools in the Beacon Sites.
The difficulties of working with multiple schools soon escalated as forces inside the state and NSF pushed the project toward scale-up to additional schools. Although a gradual shift in the facilitators' responsibilities from assisting the Beacon Site to supporting reform more broadly in the region was always a part of the MMSA plan, the facilitators found themselves being stretched very thin when the Beacon Sites became Beacon Regions and the facilitators' responsibilities shifted largely from supporting reform in a

few schools to supporting reform in whole regions of the state. In retrospect, one of the MMSA leaders acknowledged:

> *Seven Beacon schools couldn't disseminate to a whole state, even though they were strategically placed, which was one of the criteria for them … we tried to have a representative from seven… different locations so the … Beacon Schools had to have a location in their favor; they had to have a reflective plan, strategy; they had to be able to look at a long plan; they had to look at how they would support it, etc., etc., all of those things. But to only have seven was not enough, and I think that became pretty obvious fairly early to us.*

Although many saw the Beacon School/Site/Region component of the initiative as the centerpiece of the SSI in Maine, MMSA was also involved in policy work. MMSA was a key player in developing Maine's Curriculum Framework and Learning Results policy documents, and revising the long-standing statewide assessment, the Maine Educational Assessment, in support of the framework and the standards of the Learning Results. MMSA shared staff and leadership with the Department of Education, particularly in the persons of the science and mathematics supervisors for the state. MMSA was an independent organization, however, and brought connections to and resources from business, higher education, and local communities that the Department of Education was not in as good a position to include in policy development work for frameworks, standards, and assessments. MMSA made itself an invaluable partner to the Department of Education.

It was a nearly devastating blow to MMSA when Maine was not included among the SSIs funded by NSF for continuation in Phase II. Discussions ensued regarding whether MMSA should disband altogether. However, a private foundation made an offer to provide continuation money to MMSA in gradually decreasing amounts over three years while the initiative regrouped following its five years of NSF funding. However, the funds would not approach what continuation funding from NSF would have been.

When MMSA decided to continue, it was still faced with very difficult choices about what components of the initiative should remain. MMSA had also to begin planning immediately for self-sustaining support. The Beacon concept was among the first to go. The expense alone may have kept the Beacon Sites or Beacon Regions from being continued, but the lack of a mechanism for the Beacon Sites or Regions to scale up reform to the whole state proved just as important in the demise of this component of the initiative.

Although the Beacon concept was abandoned, a great deal of important work had been accomplished as part of its development: the work in Beacon Sites established MMSA's local visibility and credibility for working with districts; the work on frameworks, standards, and assessments provided a partnership with the Department of Education; and the work of developing proposals for Phase I and Phase II funding from NSF developed MMSA as an organization that could write and manage grants. Perhaps most importantly in Maine, MMSA was itself established as an independent, non-partisan entity. At this critical juncture, MMSA did not depend on a parent organization to dictate whether or

not it could continue. All of these forces have come together to provide a basis on which to continue MMSA without direct support from NSF.

MMSA has shifted its focus and diversified its funding base in recent years with ongoing fiscal support from the legislature and Department of Education. It continues to partner with the Department of Education in policy and support work in the state. It has also become an umbrella organization for a number of mathematics and science projects and programs in the state. MMSA's connections to schools and districts, its history as a support partner for districts looking to implement the Learning Results, coupled with its grant writing capabilities have also positioned MMSA to lead improvement efforts such as the Maine Local Systemic Change through Teacher Enhancement (LSC) project involving a collection of schools and districts across the state implementing standards-based instructional materials in mathematics with substantial professional development support for teachers. MMSA's connections to higher education in the state, despite the failure of the Beacon College component to obtain independent funding early in the life of the SSI, have come together years later. The Maine Mathematics-Science Teacher Excellence Collaborative was recently funded under NSF's Collaboratives for Excellence in Teacher Preparation. MMSA has partnered with the University of Maine, the University of Southern Maine and the University of Maine at Farmington in this program. A critically important part of garnering support for this program was a study of the teacher shortage conducted by MMSA. In essence, MMSA created this opportunity for itself by demonstrating the need for strong teacher preparation in mathematics and science to respond to an impending shortage due to an aging teaching population, especially in secondary science and mathematics.

Conclusions and Next Steps

Examples of the planning and implementation of systemic reform that occurred in the SSIs, such as those highlighted from Michigan, Vermont, and Maine provide a context in which to describe and examine the strategic thinking of the SSIs. In most cases, SSI leaders concerned themselves first with the technical demands of reform—identifying needs in the system, identifying capacities to meet those needs, and developing activities to build capacities and match capacities to needs. In some cases, SSI leaders also attended to the political demands of systemic reform from the get-go. In all cases, leaders of the SSIs found themselves operating in a highly political environment. Technical strategies met political realities, and the matter of how to position the SSIs and their work quickly emerged as a concern just as crucial as choosing the needs to address and the activities to address them. Developing political strategies meant forging new relationships, making compromises, and in many cases, changing the technical strategies of the initiative.

In the cases of Michigan, Vermont, and Maine, as well as in many other states, the SSIs entered into systems with some components of systemic reform already planned or in place. In the realm of technical strategizing, reading the system to identify areas of need at the state and local levels, both in the planning phases and in the implementation phases, proved critical. Important factors in political strategizing included involving a broad group of influential stakeholders in the planning process to create widespread buy-in and taking on a few aspects of the reform initially in order to create visibility and credibility for the initiative.

In many cases at least some of the technical strategies planned and implemented by the SSIs succeeded. Politically the initiatives then had to be ready to capitalize on the next steps for statewide reform. Positioning the initiative as the logical partner with the right capacities to assist at the statewide and local levels for the "next step" of reform kept many SSIs active in statewide mathematics and science reforms. Moreover, when initial strategies did not succeed as hoped, either for technical or political reasons, the initiatives had to remain flexible enough to address the needs identified in the system through other means. Being opportunistic, and even creating opportunities for the initiative, involved careful monitoring of the politics surrounding education within the state so that the initiative was ready to fill important needs of the reform when they arose.

Our research on strategic thinking in systemic reform has so far resulted in the delineation of the technical and political aspects of strategic thinking. We have developed several analytic memos and case reports out of document reviews and interviews with SSI leaders that contextualize technical strategies and political strategies, and perhaps most importantly, detail the interdependence of technical and political strategizing in systemic reform. Our next step is to look across the memos and cases to understand the effectiveness of particular strategies and combinations of strategies under the varying contextual circumstances within states over time, and across states.

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