Appendix

B

Systems Thinking in Tobacco Control: A Framework for Implementation

The Initiative on the Study and Implementation of Systems (ISIS) was an exploratory effort to apply systems thinking to tobacco control and public health. As such, it examined trends in systems methods and their application through the eyes of a team composed primarily of researchers and leaders in both the tobacco control field and numerous systems thinking disciplines. The conclusions in this monograph outline a broad, general direction for better harnessing a systems revolution that already is under way in this and many other fields.

What does this effort mean to the tobacco control practitioner, the bench scientist, or the community activist? The answer may be "a great deal, in time." This monograph's chapters look ahead to how systems could affect daily life in practice, but the specifics are still unformed and the subject of much investigation to be done in the near future. The real value of this effort lies in setting overall directions for how systems approaches and, more important, their synthesis can benefit tobacco control. This appendix outlines some possible paths for how these directions can be put into action for tobacco control stakeholders.

First, this appendix examines some of the open questions that surround the use of systems approaches by key tobacco control stakeholder groups. It then explores a possible future storyline for how these approaches might affect the work of some of these stakeholders. Next, it discusses some of the core issues in putting systems thinking into practice within tobacco control, together with possible directions for specific stakeholder groups and steps for getting this process started. Finally, it explores key questions that remain for implementing systems approaches in the future.

ISIS did not seek to "build a system." Rather, it sought to foster an ecological process that is ultimately driven by simple rules, which must continue to evolve. In nature, evolution is driven by a process described by Campbell as "blind variation, selective retention." In that process, the more diversity the system has (i.e., the more variation and selective retention it has), the more quickly the system converges on an optimal solution instead of remaining in a static monoculture.[1] Similarly, in systems thinking, more variation (through broader stakeholder groups, systems approaches, and multiple systems) and more selective retention (through improved evaluation and implementation) will accelerate the results of efforts toward tobacco control. Thus, variation and selective retention operate in much the same way that other ecological models do, such as survival and economic competition. The ideas presented in this appendix serve as one possible starting point for simple rules within an ecological framework that could lead to fundamental changes in tobacco control and public health outcomes.

Integrated Systems Thinking: Story Line for the Future

Predicting the future is always fraught with peril: futurists of the 1950s foretold advances such as residential colonies on the moon and personal transportation using jet-propelled backpacks, but they completely missed trends like personal computers and the Internet.[2] At the same time, their visions of a more technological and interconnected future helped to produce today's reality.

The vision of a systems future in tobacco control and in public health more generally is informed by inputs at multiple levels. These inputs range from ongoing trends in practice and methodology, to the increasing complexity and nonlinearity of outstanding issues in tobacco control, and even to the evolution of group thinking among the participants in the ISIS project during its initial two years, which itself can be seen as a systems effort. Like all predictions, the picture of the tobacco control field and public health overall for decades into the future is necessarily hazy, but the overall direction is clear—an integrated systems approach that becomes a natural part of daily practice at all levels of the field. Today's world is a place where increasingly complex issues are understood and managed, where research and practice are tightly linked, and above all, where the possibility of a smoke-free and healthier environment with an attendant decrease in preventable mortality becomes more and more likely.

With this vision in mind, it might be instructive to revisit the real-world questions for tobacco control that are raised in chapter 3 and to examine how the lessons learned from systems

thinking might address these questions. The next step is to write a forward-looking scenario of how key tobacco control stakeholders might operate in the systems environment of the near future. First, it is useful to examine some of the questions that initially framed the ISIS study.

Practitioners

Questions relating to systems approaches and practitioners are as follows:

- How can practitioners cope with competition from other organizations for scarce resources?
- How do practitioners communicate the positive achievements of their organizations and still argue that there is a need for continued and/or additional funding?
- How can practitioners maintain trust with clients when changes in funding levels alter the services they are able to provide?
- How can practitioners spend more time in the field and less time with administrative details?
- Where can practitioners find succinct, clear, and practical information on the latest research?

These questions share key threads addressed by the fundamentals of systems thinking: concerns about isolation, access to resources and information, dissemination of results, and perhaps above all, the productive use of human effort. The lessons learned from this project include the following:

- Networks and tacit knowledge resources can provide an infrastructure for discovering the needs, the available resources (e.g., financial) to address them, and the contacts and expertise to support the process of building coalitions. A common data infrastructure also holds the potential to streamline administrative overhead, paperwork, and reporting requirements.
- Explicit knowledge bases can serve as repositories for accumulated data on local outcomes. Tacit knowledge bases can provide a resource for people to access the expertise of individual practitioners. At a more active level, networks serve as a foundation for organizing formal dissemination activities such as conferences, electronic communications, and bulletin boards.
- Data from systems models and their concomitant research results stored in knowledge bases can streamline the planning process and more efficiently keep practitioners abreast of research.
- Perhaps most important, a systems organizing approach of working in a participatory, information-sharing manner with other stakeholders—locally, nationally, and globally—can lead to adaptive changes in the course of both research and practice, focusing practitioners toward efforts that more effectively improve health outcomes.

Researchers

Questions relating to systems approaches and researchers are as follows:

- How can researchers contribute to preventing their research from sitting unread in journals?
- Why don't more people use the science developed by researchers?
- How can researchers access the experiential knowledge of practitioners to be certain they are providing an evidence base for the most important programmatic applications?
- Where can researchers connect with other researchers who have common or complementary interests but who may work in other departments or fields?
- How can researchers streamline the approval and funding processes for their work?

The researchers' questions reflect a sense of responsibility to advance science, coupled with frustration over the funding issues that underpin researchers' work and the dissemination issues that follow it, combined with what may seem to be a structural isolation from the stakeholders they serve. Systems approaches can address these issues in the following ways:

- Adaptive, participatory systems approaches in research can lead to research efforts that engage the very stakeholders the efforts are directed toward. This strategy leads to a more direct path to dissemination and implementation and, perhaps more important, to multidirectional links that push the course of research toward public health outcomes.
- Systems models can provide an evolving, multifactorial basis for research projects, which can help these projects link more directly to the needs of practitioners and other stakeholders.
- Networks and knowledge bases serve as an infrastructure linking researchers to explicit knowledge such as research data, tacit knowledge such as who shares common or complementary research interests, and an infrastructure that in time could be leveraged to streamline research funding and implementation efforts.

Policy Makers

Questions for policy makers are as follows:

- What priorities dictated past resource allocation, and what priorities will be dictated in the future?
- How can policy makers get a better return on investment for research expenditures?
- How can policy makers synthesize all the "silos" of information out there?

- How can policy makers reduce or eliminate duplication of effort among stakeholder organizations?
- How can policy makers convince more professionals to use evidence-based practices?

Policy makers face the need to look ahead and "make decisions at 20,000 feet" that, in turn, must support the objectives of their organizations and of public health outcomes. At a more practical level, they also must make the best use of resources and function effectively in a world of multiple organizations and stakeholders. Systems tools can help in the following ways:

- Systems models can examine the potential multifaceted effects of likely future options to guide policy decisions, resource allocation, and priorities.
- Network and knowledge-based resources can provide access to collaborators and/or funding to efficiently address organizational priorities and break down cross-organizational barriers.
- A common knowledge infrastructure for explicit and tacit knowledge in tobacco control and other public health issues, particularly if linked with existing knowledge resources, can provide a consistent portal for information, as well as a means to disseminate information from organizations.
- Adopting participatory systems-organizing approaches within and outside an organization can tie its efforts more directly to stakeholders and outcomes.

These answers for different stakeholder groups hold promise for each of these groups but share an even more important characteristic—*their similarity*. Moreover, these answers point toward answers to the broader, discipline-wide issues posed in chapter 3 of this monograph. How can a shared vision be built to reduce the prevalence of tobacco use and consumption of tobacco products, link actions (missions) to this vision, learn from each other's knowledge, and ultimately forge a closer integration of research and practice? By linking shared goals, taking action in light of enhanced mutual understanding among stakeholders, and moving each stakeholder group toward a collective vision, participatory action, and common infrastructures, systems approaches do much more than solve individual problems. They move all parties toward an adaptive, collaborative environment that, in turn, holds the key to major changes in the future of tobacco control.

Looking ahead from the lessons learned, it is possible to imagine a future integrated systems environment for tobacco control—not a monolithic system but an accepted environment of tools and procedures, analogous to today's computing environment. Activities of hypothetical stakeholders might include the following:

Researcher. Jessica Smith is a public health scientist studying population-level tobacco control issues.

Practitioner. Michael Washington is a state public health administrator working to reduce the state disease burden due to tobacco use.

Advocate. Stan Rodriguez is a lawyer who, years after becoming a widower due to issues of tobacco use, is actively involved in community antismoking efforts and provides litigation support to regional efforts.

Leader. Barbara Fellows is the chief executive officer of a for-profit hospital chain on the West Coast.

Legislator. State Representative Cheryl Stanton is a legislator who has become a key figure in proposing state legislative action in support of tobacco control.

The findings of this project suggest the vision of an environment in which all of these stakeholders interact in a variety of ways, which are discussed here.

Smith (the researcher) helped to organize an online "town hall" meeting through a central network of stakeholders at many levels of tobacco control to clarify future research priorities. Discussions at the meeting have given her a quantitative and qualitative sense of these priorities. Based on this input, Smith plans to research the relationship between a policy intervention and changes in smoking prevalence and consumption of tobacco products. The policy intervention is a one-cent increase in the federal excise tax on cigarettes to pay for expansion and promotion of national "quitline" services (hotlines for help to stop smoking). Going online to a repository of tobacco control knowledge, she first scans existing research involving quitlines and tobacco health outcomes, and the search convinces her that this proposed increase in excise tax is a promising area for study. Representative Stanton is prepared to support this effort through legislative channels on the basis of the results of the study.

Washington (the practitioner) uses the same network data to link his organization with other state administrators for regular online and onsite meetings, as well as a source of data on current tobacco control trends and practices. As part of the tacit knowledge base in tobacco control, Washington also frequently participates in planning and evaluation of research such as Smith's. He recently used the network to link with global colleagues to collaborate on a peer-reviewed journal article on trends in population-level intervention.

Smith constructs systems models for her research work based on explicit data from tobacco control knowledge bases, as well as feedback and participation from network-based clusters of tobacco control stakeholders, including contacts with collaborative partner organizations, community activists such as Rodriguez, and leading health care professionals like Fellows. These stakeholders assist in developing study designs and evaluation criteria and approaching potential funding sources for the research.

Rodriguez has online access to data that support his advocacy efforts and linkages with advocates in other communities, providing communications and visibility for possible class-action legal challenges and helping him to tap into complementary community resources for building coalitions. More important, the data also provide information on best practices in community activism for tobacco control to help synchronize his efforts with the evidence base

of similar advocates in other parts of the country. Conversely, his work influences stakeholders in Smith's research in policy interventions and Representative Stanton's legislative agenda.

Using network data, Fellows linked with colleagues and shared practices, leading to the successful Tobacco Intervention for Patients program her hospital group implemented last year. This year, data from this program are being retrieved from the tobacco control knowledge base for use by researchers in another state as part of an epidemiological study on tobacco control interventions in the health care setting. As a participant in dialogues on research and dissemination efforts, Fellows also is a voice for national efforts at the patient level, in collaboration with stakeholders such as Smith and Washington.

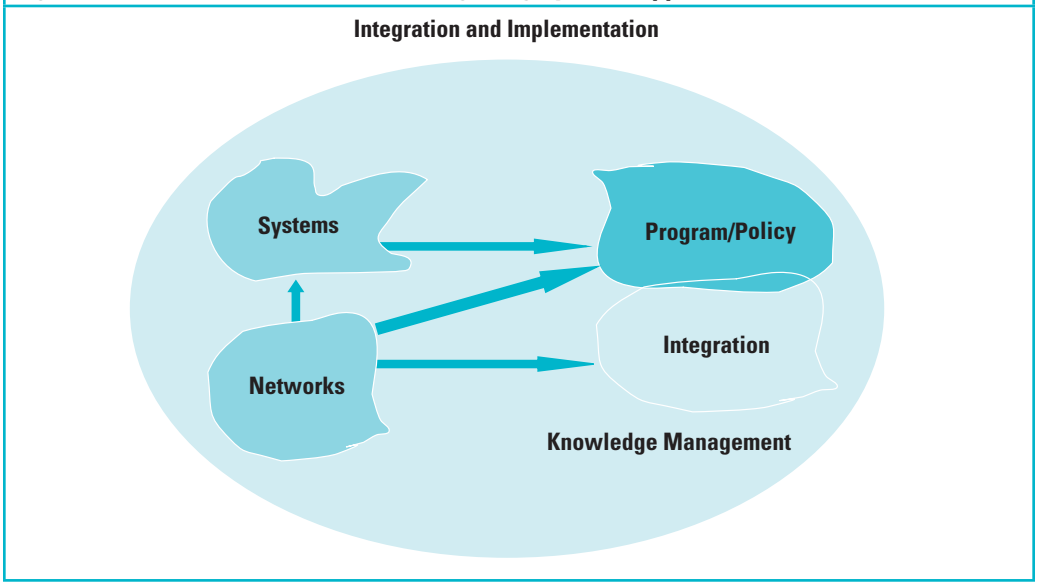
Smith's research studies frequently use an online collaborative group process, and data from this knowledge base are used to help identify simulation models and evaluation methods for her studies. Data from these studies, as well as Smith's own growing expertise, later become part of the tobacco control knowledge base for future research efforts. Network channels are used to actively disseminate the study results among key stakeholders and to publicize them through appropriate industry and publication channels.

The tobacco industry knowledge base provides Representative Stanton with quantitative data on the nation's disease burden and costs associated with tobacco control, as well as access to information she uses to counter tobacco industry lobbying efforts among colleagues. More recently, these data, network information, and tacit knowledge have all enabled her to become active in helping to set the national research agenda in policy-based interventions.

Stories such as these point to a larger environment in which many things depart from business as usual. Local stakeholders have a national or even global reach, clusters of people with common interests or expertise become known to each other, and research becomes more participatory and outcome based, in turn affecting the efforts of practitioners, policy makers, and other stakeholders. Networking, data-driven systems models, and integrated planning, implementation, and evaluation become the norm, leading to an environment in which the actions of any stakeholder ultimately affect the efforts of all stakeholders—a system unto itself. Above all, they create an overall environment for bidirectional linking of research and practice, harnessing both to uncover optimal solutions for complex problems and to change outcomes. However accurate the specifics of predictions such as these are over time, the promise of systems thinking is to create an integrated environment for tobacco control that uses the efforts of all its participants to produce results that could not exist today.

To keep the ideas relatively simple, this example was confined to tobacco control. A more likely future scenario is one in which systems methods are integrated but there also is an integrated approach to public health, so tobacco control is considered in a system that examines factors such as obesity, heart disease, healthy lung function, and stress reduction. Such a scenario is analogous to Milstein's[3] description of syndemics in epidemiology. Thus, Smith might consider a research study on promotion of a lifestyle among adolescents that discourages smoking, excessive drinking, and use of illicit drugs, while encouraging exercise,

Figure B.1 Common Framework for Integrating Systems Approaches



personal development, and community-based activity and service. Multiple stakeholders would be involved in defining the parameters of well-being.

Putting Systems Thinking into Practice

Moving forward from what is currently known, a desirable near-term goal is engineering a synthesis of methodologies from existing systems approaches to change outcomes. Based on what has been learned and the potential for systems approaches, it may be critical to move past the current "smorgasbord" approach—choosing from among disparate islands of systems approaches—toward further research and development of an integrated environment in which the component pieces work together (figure B.1). Much as early research on computer networks led to the Internet, so must proactive research lead to the systems environment of the future in a way that engages both tobacco stakeholders and the technology field to build an infrastructure that can be applied within tobacco control, public health, and beyond.

Bringing this goal to fruition requires a process that involves tobacco control stakeholders in defining and implementing the future of systems in tobacco control and connecting its vision and missions more effectively to the context of tobacco control. Discussion here centers on a framework for engaging the tobacco control field to move toward an effective systems environment that serves its needs. Systems knowledge is not a "thing." It is an inherently dynamic social process, and the end game of this process is an agenda of research that pushes this social process forward and implements it. At the same time, this effort must engage the public and private sectors, join efforts supporting other disciplines, and lead to a real change

in the functioning of the tobacco control stakeholder community, much like the evolution of computing described earlier.

Tobacco control is a diverse field that includes studies of issues such as population surveillance on the prevalence of tobacco use and consumption of tobacco products; research such as developing models to better understand addiction; issues related to practice such as community and clinical interventions and prevention strategies; and policy issues relating to advertising, promotion, pricing, and use of tobacco products. It is a field with a great deal of ongoing activity, with little underlying clarity on the global meaning of the activity, the efficient use of resources, and the optimal linkage of the various segments of the field to increase results. Moreover, because there is no tobacco control discipline per se, scientists and practitioners come from diverse disciplines such as medicine, public health, economics, marketing, health education, toxicology, and genetics. This situation creates a substantial degree of disconnection within the loose "system" that constitutes tobacco control.

Herein lies the challenge for integrated, adaptive efforts to change tobacco control outcomes. *Guidance for Comprehensive Cancer Control Planning,* from the Centers for Disease Control and Prevention,[4] states,

> The scope of comprehensive cancer control involves a diverse group of **stakeholders** who must *coordinate their efforts* to implement such a plan.…These coordinated efforts usually occur in the context of a formal **collaboration** across multiple disciplines and organizations.[4] (boldface and italics in original)

This guidance does not address the question of how stakeholders apply this excellent advice. From a systems perspective, there are three requirements for tobacco control initiatives:

1. Feedback mechanisms to enable appropriate responses to changing influences on the system
2. Leadership and decision-making capacity to institute appropriate responses
3. A mechanism for synthesis and translation of research findings into practice

A comprehensive approach to applying systems thinking approaches such as systems organizing, system dynamics modeling, network analysis, and knowledge management techniques has the potential to create this kind of adaptive, collaborative environment. These tools, which are used increasingly in public health and bridge a range of systems approaches, may in turn create a cultural shift to help tobacco control agents "do the right thing right."

An integrated approach to systems thinking can help bring these models together to form a comprehensive strategy for prevention and cessation of tobacco use. Systems thinking also can increase the impact of the tobacco control strategy. Both scientists and practitioners will contribute to and benefit from an integrated approach to identifying how tobacco control could operate in a more systemic way and suggesting steps to create the infrastructure and processes that could make this new mind-set work.

Framework for Large-Scale Change toward Systems Thinking

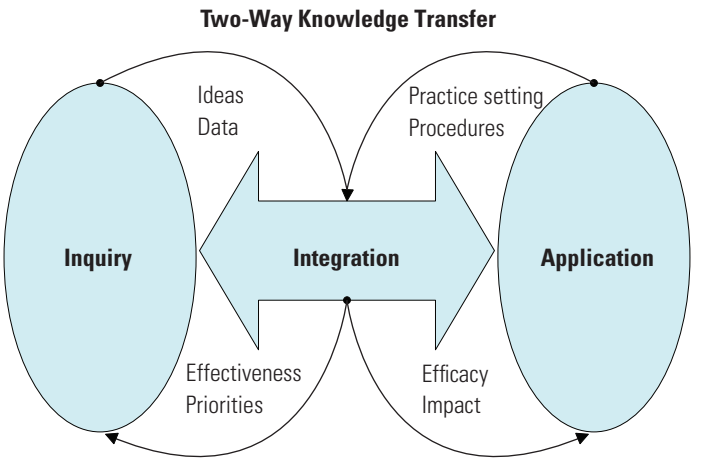
Between the research efforts outlined in this monograph and its recommendations lies a process of engaging tobacco control stakeholders to strategize and prepare for the form a systems environment should take. Here, broad guidelines for moving forward from theory to practice are examined, and the use of lessons learned to make changes in the real-world practice of tobacco control is explored.

Public health planning has typically proceeded incrementally and in a disjointed fashion, constrained by time pressures and limited guidance. Now that the view of organizations is far more organic than the previous industrialized view of organizations as silos, there is a shift away from these silos toward a systems strategy for organizing an approach to national priorities. International evidence about effective change management can inform the approach to the special case of tobacco control. The main driver of this project will be a synthesis of lessons about large-scale organizational change in public health that can be learned from knowledge management, network theory, and systems theory. This synthesis will help organizations look in depth at their processes and services, to plan change more confidently, and to implement improvements year after year.

A systems thinking approach addresses root-cause issues such as the following:

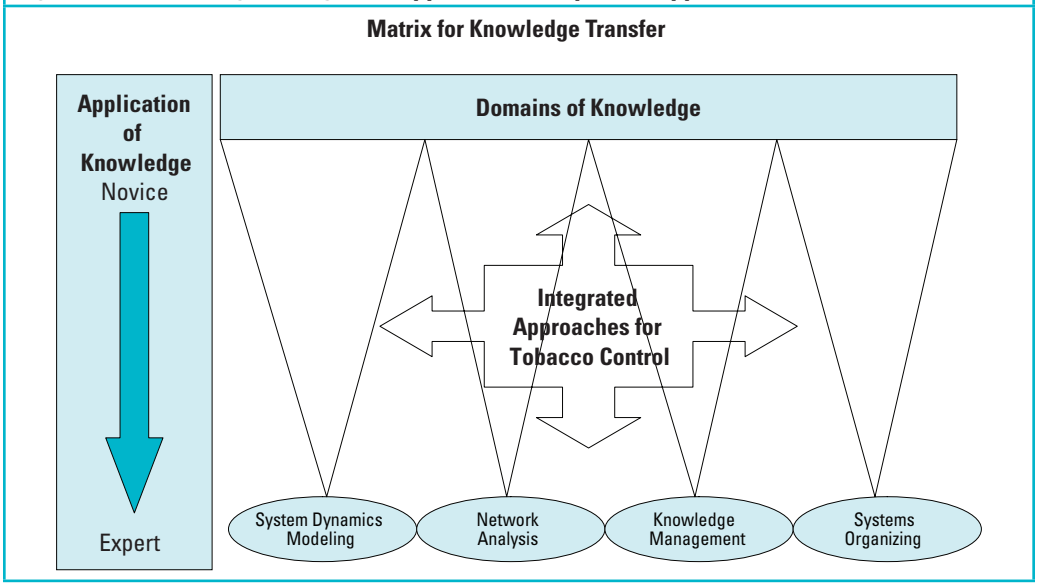
- What are the systemic leverage points at all levels?
- How should collaborative tobacco control networks be organized?
- How can research and practice be engaged more productively?
- How can tacit knowledge be captured more effectively?

Figure B.2 Integrated Approach that Benefits Scientists and Practitioners



Note. Presented as bidirectional for simplicity, but multidirectional in reality.

Figure B.3 Tailoring of Integrated Approaches to Specific Applications



With specific and evidence-based tools, tobacco control planning can develop an integrated approach in each agency and community. This integrated approach will be based on the notion of adapting to specific circumstances from various knowledge domains (figures B.2 and B.3).

The process of developing an integrated approach could be broken down into steps such as the following:

1. Identifying an overall vision based on systems thinking and key targets for delivery, according to local priorities
2. Identifying relevant local actions (missions) that are aligned with the vision
3. Analyzing how to develop capacity through a local network or alliance and the specific responsibilities of each health care, social care, or educational organization
4. Creating models for comprehensive planning options that can show different agents in the tobacco control networks where they are and how their missions align to address a common vision
5. Establishing meaningful indicators for monitoring progress and managing performance across whole systems, enabling system learning and adaptation
6. Improving communications and accountability to demonstrate progress

Scope and Objectives: Audacious Vision and Focused Goals

A possible vision for systems thinking is to encourage evolution of self-organizing adaptive networks or federations of systems that can improve effectiveness within the field of tobacco

control. Resulting from collaborative development of a coherent integrated framework for tobacco control, this vision could ultimately lead to a significant decrease in use of tobacco products and a reduced toll of disease and death. With use of the systems thinking approach, the framework could establish a cohesive vision at national, state, and local levels, and could provide explicit targets for policy makers and others working in the field of tobacco control. The approach would not attempt to impose a single approach from all agents in the tobacco control system but would instead provide the context for different agents to contribute according to their strengths and abilities. The added power of the project would come from the enduring relationships across the network of experts involved in developing the framework. Through its specific objectives to achieve the overarching goal, a possible next phase could include the following accomplishments:

1. Distill broad priorities for the next 5 to 10 or 20 years through a process, including consultations and workshops, that builds on respectful appreciation and mutual understanding of different perspectives from diverse segments of the tobacco control field
2. Foster a sense of cohesion in the field among key opinion leaders by synthesizing and fostering alignment among their planning activities
3. Develop an articulated tobacco control framework that links priorities and strategies, providing a foundation reference for stakeholders (e.g., researchers and funding sources)
4. Disseminate the framework with advice for strategic implementation, such as critical success factors and guidelines for implementation in diverse settings

The principal outputs of this project could include the following:

- Consultation forums with key stakeholders
- Increased understanding among stakeholders of different perspectives on the problem of tobacco control, the advantages and disadvantages of different approaches, and differences and similarities in visions of desirable future approaches and outcomes
- A series of reports providing guidance to apply concepts such as systems organizing, network analysis, systems theory, and knowledge management to tobacco control at the research, policy, and practice levels
- Planning tools and templates to assist planners in applying the integrated systems thinking framework to local situations and priorities
- Recommendations for pilot projects to apply the systems thinking framework
- An evaluation framework for comprehensive assessment of systems approaches

Bringing the concepts of systems thinking into practice involves specific changes for each of the principal stakeholder groups in tobacco control. The conclusions presented in this

monograph represent a possible first step toward making that systems future happen. At the same time, translating these steps into practice requires implementation of new practices at each stakeholder level, and the task of working out specific details remains the next phase of this process. Table B.1 presents one possible vision for putting these conclusions into practice for researchers, practitioners, advocates, and leaders.

The future does not fit neatly into little boxes. Many of these implementation objectives, such as creating learning environments and working across disciplines, apply to groups of multiple stakeholders. Other objectives are global efforts that transcend specific groups, such as the development, use, and maintenance of knowledge infrastructures. Nevertheless, charts such as these illustrate a broader point: implementation of a systems environment revolves around changing the "simple rules" by which each of these stakeholder groups operates in daily practice.

Systems thinking has the potential to become a unified discipline that is crosscutting in terms of other disciplines and fields of endeavor, perhaps by analogy to fields such as statistics that operate at three distinct levels. First, statistics represents an academic field of study unto itself, in which theory and methods of statistics are developed and advanced. Second, other fields (e.g., biology, psychology, sociology, and geography) incorporate statistical training into their core methodologies and have staff and research programs with a strong quantitative orientation. Third, statistics serves as a core competency throughout the fields of research and practice, with an expectation that a large proportion of research staff and students, as well as practitioners, will have at least a basic level of statistical competence.

Like statistics, some elements of systems thinking already are embedded in other significant research areas. For example, many researchers who study environmental issues incorporate integrated assessment, other systems approaches, and participatory approaches into their

Table B.1 Steps for Implementation of Conclusions in Specific Stakeholder Groups

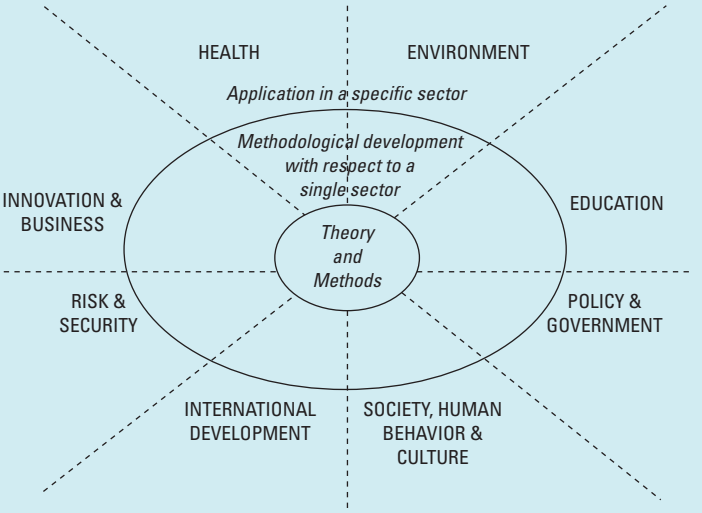
Step	Researchers	Practitioners	Advocates	Leaders
Develop and apply systems methods and processes	Move from logic models to systems models	Use participatory approaches for planning and evaluation	Adopt ecological view of impact of advocacy efforts	Encourage systems thinking and systems processes
Build and maintain network relationships	Link with collaborators within and across disciplines	Build global communities of practice	Harness national and global efforts	Study and leverage network dynamics
Build system and knowledge capacity	Use and add to evidence base	Adapt and incorporate best practices	Share efforts, successes, and processes	Create knowledge infrastructures and break down "silos"
Encourage transformation to systems culture	Engage practitioners and other stakeholders in planning and evaluation	Create learning environment	Foster shared purpose with other stakeholders	Facilitate evolution of vision and paradigm

Integration and Implementation Science: A New Academic Field

In proposing the synthesizing field of Integration and Implementation Sciences discussed in chapter 3, Bammer[a] has gone so far as to propose a full department-level academic field of study for the implementation of systems methods to build the kinds of shared understanding and individual competence that exist in established fields such as statistics. This position supports the view of a unified, integrated approach to systems thinking as a fundamental discipline underlying areas of public health such as tobacco control, in much the same way that fields such as epidemiology and informatics became integrated with public health in years past (see figure below). Like statistics, a "home" department would concentrate on the development of theory and methods, which can be applied in a wide range of areas. These areas can range from specific topics like tobacco control to health more generally, as well as environment and security. A second level of activity would be in sectors in which practice-based research is used to test and develop theory and methods, which in turn are fed back to and assessed by the home department. The third level of activity focuses more on application, with less interest in the development of new theory and methods.

The proposal for a structured academic field or discipline seeks to learn from the troubled history of systems thinking. Institutional barriers stymied attempts to introduce systems thinking in the 1960s and 1970s, and thus avoided a disciplinary focus. This proposal seeks to adopt and take advantage of existing institutional structures to create a new academic field of study, producing graduates prepared for the implementation of systems thinking approaches in specific fields such as public health.

Overview of Integration and Implementation Sciences



Note. This overview shows how a specific home discipline would relate to key sectors of activity.

[a]From Bammer, G. 2005. Integration and implementation sciences: Building a new specialization. *Ecology and Society* 10 (2): 6. http://www.ecologyandsociety.org/vol10/iss2/art6.

teaching and research. Public health efforts often have a strong orientation to participation and implementation. However, incorporation of systems thinking is largely idiosyncratic, without a "core curriculum" of best practices. The field of systems thinking still is growing and defining itself, as opposed to having well-defined core methods in the way that probability serves as a nucleus for statistics.

A process such as the one proposed here for getting started in systems thinking may serve as an important step to prepare for planning an integrated systems environment for tobacco control. More important, engaging tobacco control stakeholders in the planning for such an environment could build a participatory framework for systems methods in the future. Finally, it can help to focus these systems efforts toward real-world health outcomes in tobacco control, as seen through the shared vision of the organizations and people working to deliver these outcomes.

Implementing Systems Thinking in Tobacco Control: Open Questions and Next Steps

Systems approaches, by their nature, involve creating the capacity to solve more complex problems across a broader network of stakeholders. Implementing such approaches in tobacco control will require key decisions, on the part of these stakeholders, to create this capacity. Four critical open issues remain as the tobacco control community moves forward with the process of integrating systems approaches and engaging stakeholders in the conclusions of this monograph.

1. **Who will construct the infrastructure of systems for tobacco control?** Who will take primary responsibility for moving an integrated systems environment forward? Will the effort be specific to tobacco control needs or leverage more generalized systems efforts in the broader domain?
2. **Will this systems environment be open or proprietary?** To use an analogy from computer science, will this environment be managed by a few, to serve a broad market, as Windows or America Online are, or by a "committee" of stakeholders, as Linux or the Internet are? What will its mechanisms for change be over time?
3. **Will this system be in the public domain?** Do the interests of tobacco control and public health require that ownership and management of those issues rest in the public sector, or can private interests provide more competitive technology and growth?
4. **How does the field of tobacco control get where it wants to go?** What is the role of ISIS in providing incentives for the movement down the road, in a way that is valuable? How does tobacco control begin and sustain the process leading to this systems environment?

A concerted effort to synthesize these systems approaches may hold the potential to answer the field's key questions: What factors lead to prevalence of tobacco use and consumption of tobacco products and their related morbidity and mortality? Can good science be placed into the hands of practitioners within days or weeks instead of years? Can tobacco control stakeholders be linked to work more closely together toward common goals? Perhaps most important, how can the underlying mission to substantially improve health outcomes be fulfilled? Creation of a synthesis of systems approaches holds the promise of a new process that, in turn, holds the answers to these questions.

Based on observations by participants in ISIS and recommendations from key informants, several procedural "next steps" can potentially assist in moving such an implementation process forward, as well as clarify the implications of systems thinking for tobacco control stakeholders:

1. **Identify emergent visions and missions (actions).** All agencies conduct regular planning exercises, so this recommendation is helpful in grounding theory with application. Structured processes for identifying collective vision can enable emergent thinking from many stakeholders. Identifying existing strengths and successes can point to system adaptations that can improve results rapidly. The language of systems thinking must be made accessible to all stakeholders. These processes also would allow for respectful appreciation of differences in perspectives.
2. **Connect system processes overall—focus on the "glue."** Addressing this recommendation begins with a broader and deeper awareness of tobacco control as a "system." The systems perspective focuses on "context" as well as "content." A first step would be to group and classify agencies based on their strategic roles and functions. Description and transformation in the relationships within the tobacco control community are needed. Therefore, the first "adhesive" process should be for agencies at various levels and in various groupings to redesign strategy individually and collectively. This process would create a setting to address the context of tobacco control, specifically its strengths, weaknesses, opportunities, and threats. Such a process should be inclusive to the extent that is realistic. The tobacco control stakeholder community then should consciously encourage the development of "long bond" connections in the network that bring together people and organizations with distinctly different capabilities and strengths. These connections increase both the adaptability and sustainability of the effort.
3. **Recognize that context counts, especially in large organizations, so help practitioners to identify and share tacit knowledge.** This recommendation also requires the full combination of systems thinking approaches. Identification is not only a knowledge management problem, because no one could cope with full disclosure of all tacit knowledge. System dynamics modeling and network analysis must be used to help determine which interventions are relevant (1) to strategic priorities, (2) for efficient use of resources (e.g., stakeholders' time), and (3) for applicability. Systems thinking approaches can help in optimally shaping what is needed from this exchange of tacit knowledge. After this shaping process, initiation

of forums for exchange is a relatively easy task. The approach of knowledge management would again be used to help decide who needs to know what and how.

4. **Help all stakeholders bring their thoughts together on dimensions of the system, not just describing the current system but developing characteristics of the future system.** This key tenet of systems thinking and organizational change also dovetails with the recommendations voiced by many informants throughout this project. The importance of participatory approaches in planning systems strategies for the future should be emphasized. In addition, a vision should be set forth for a forum in which stakeholders would use systems thinking to project the paths of tobacco control and the tobacco industry over the next 5 and 10 years.

The Newtonian view of the world, a world of simple causes and effects, appears to be giving way to a more complex environment that more closely mirrors the behavior of the real world. This evolution of systems is a process of autonomous agents following rules and, in the fashion of Darwinism, ultimately leads to more optimal results. One lesson learned from the science of ecology is that evolution occurs more rapidly with more variations. This conclusion leads to perhaps the central argument for implementation of a systems approach: creation of a participatory environment having multiple stakeholders with interaction across multiple levels and capable of modeling and solving problems of complex phenomena. Such an approach could lead to substantial improvement in the state of public health.

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