



**PENN PROGRAM ON
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A Systems Approach to Regulatory Excellence

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In its broadest meaning, “regulation seeks to change *behavior* to produce desired *outcomes*.”¹ A regulator’s intervention should change behavior and, in turn, produce desired results. Regulators, in other words, aim to identify interventions that will lead actors to change their behavior; they then have to implement these interventions so that behavior changes produce the desired outcomes. Yet the connection between those interventions and the achievement of desired outcomes is by no means guaranteed. It is possible for a regulator to implement interventions in a subpar fashion and yet somehow still see successful outcomes. It may also be possible for a regulator to execute carefully-designed interventions in a conscientious way, with undesired outcomes still arising because of seemingly irreducible chance interactions of complex systems.

Theories of complex systems greatly complicate the practice of regulation. By complex systems, I refer to relationships involving dynamic interactions of multiple agents and technologies. Societies around the world comprise many major complex systems of food, transportation, energy, and communications, among others. The kinds of large industrial operations that fall under the purview of the world’s regulators are themselves complex systems. Among the properties these complex systems exhibit are both a resistance to regulatory change and a tendency to produce outcomes that are difficult to predict.² And yet, despite the challenges complex systems pose for regulators, systems theory also opens up important pathways for regulators who seek to “influence the flow of events”³ by changing the dynamics of systems. Such an approach to regulation – what I call “systems thinking”⁴ – constitutes the hallmark of regulatory excellence.

Regulatory excellence comes about from learning how to change the dynamics of systems and to move those systems toward greater public value. It includes measuring regulatory outcomes to determine whether the system is moving in the right direction. But regulatory excellence is also concerned with assessing the *way* that regulators intervene in systems.⁵ This means that excellent regulators should focus on measures of performance generated by continuous monitoring. Such monitoring will enable them to keep track of the steps they take to induce other stakeholders to engage in processes of creating new relationships. These relationships, in turn, will support further continuous improvement. In short, excellent regulators should learn to work synchronously with, and take advantage of, the properties of complex systems. As one systems thinker has described it, “mastery” of working with complexity has “less to do with pushing leverage points than it does with strategically, profoundly, madly, letting go and dancing with the system.”⁶

Regulating Complex Systems

Several features of complex systems complicate the problem of regulation. The “core question” for complexity is “to explain the spontaneous emergence of order by self-organizing processes at multiple levels in nature and society”.⁷ Complexity theory grew out of work in the

fields of mathematics, the natural sciences, and engineering. Scientists in these fields were able to “demonstrate by computer simulations that collective order may emerge purely from local interaction at the micro level, without any need of central control.”⁸ From this perspective:

[S]ystems are inherently dynamic and adaptive. Components (agents) modify their behavior to improve it (in terms of success, fitness, survival, etc.) through learning or evolutionary mechanisms such as variation and selection. This generates new behavioral patterns in the sense that an organized whole is more than the sum of its parts.⁹

The capacity of agents to adapt to changes in their environment, and for new forms of order to emerge out of these adaptations, greatly complicates the practice of regulation.

In complex systems, interactions between agents “lead to dynamic patterns created by iterative and mutual adaptation.”¹⁰ In this sense order emerges out of the interactions between agents. “Emergence” refers to the “fact that the individual level interaction produces social effects at the macro level, which are not reducible to the aggregate alone.”¹¹ This property of emergence allows individual-level adaptation between agents to give rise to new or changing states of order at the macro or system level.¹² It also gives complex systems a bottom-up explanation of social events.¹³

There is a non-linear relationship between particular adaptations made by actors in a system and the order that emerges out of these changes. A complex system exhibits the property of non-linearity because when “components are interdependent ... changes in one component affect many others.”¹⁴ Together these properties of complex systems make it difficult to predict how a system will adapt to any particular intervention that a regulator chooses to implement. The unpredictable nature of complex systems further complicates the problem of using regulation to influence the flow of events in a system.

Yet the very properties of complex systems that *complicate* the task of regulation are in fact often the very processes that *facilitate* the practice of regulation. From the perspective of complex systems theory, the goal of regulation is to change the behavior of a system, that is, to change the direction or speed of its movement towards or away from public policy goals.

In natural systems, the movement of a system is often described as one of “increasing” or “decreasing” fitness, or the ability of a species to survive in a specific context. With social systems, fitness is better thought of in terms of a system’s performance in fulfilling its purpose. For example, the purpose of the health care system is to improve the health of individuals and of populations. When a social system’s performance improves, the agents in that system are adapting to the changes in the actions of other agents and in the local environment in such a way that the system is moving towards the public goals of the system.¹⁵

To move systems effectively toward increasing public value, regulators need to act on the basis of systems thinking. Specifically, regulators need to:

1. Develop models of the system that will support bold, far-reaching goals to create public value;

2. Use these models to design interventions to make use of leverage points to change the behavior of the system; and
3. Use trial and error problem-solving iteratively to implement and monitor interventions that are designed to change the dynamics of the system.

The successive application of these three steps constitutes a “plan-do-check-act” cycle that gives regulators the capacity to solve particular, immediate problems but also opens up the possibility of changing the dynamics of systems.¹⁶

Public health specialists Don de Savigny and Taghreed Adam have outlined “Ten Steps to Systems Thinking” in the context of improving health systems. Their approach to systems thinking deals with both the problem of designing interventions and of evaluating those dimensions. The first four steps for designing interventions relate to learning about a system and finding productive points of leverage:

1. “Convene stakeholders” who are part of the system;
2. “Collectively brainstorm on possible system-wide effects of the proposed intervention;”
3. Conceptualize effects, or “develop a conceptual pathway mapping how the intervention will affect the system;” and
4. “Adapt and redesign the intervention to optimize synergies ... while avoiding or minimizing any potentially major negative effects.”

Their remaining six steps concern evaluation mechanisms, such as determining the indicators to track the intervention, choosing methods of evaluation, selecting an evaluation design, developing a plan and timeline, setting a budget, and sourcing funding.¹⁷ Although De Savigny and Adam developed their ten steps to systems thinking for implementing large-scale health care projects, their approach provides a version of the Plan-Do-Check-Act cycle that could be used by a regulator to learn how to leverage and shape the dynamics of the system.

There are other examples of forms of governance that aim to address the problem of working with complexity. These forms of governance combine the formation of far-reaching goals to create value, the use of deep knowledge of systems to identify leverage points, and the iterative use of trial and error problem-solving. Taichi Ohno used this combination to create the conditions for the emergence of the Toyota Production System,¹⁸ and this remains a central part of Lean business systems as well.¹⁹ This process of goal-setting and learning is also a central part of PerformanceStat,²⁰ and CompStat,²¹ two approaches to performance management in the public sector. Overall, what these various approaches have in common is setting ambitious goals to change the dynamics of a system supported by the systematic use of iterative trial and error learning to move closer to reaching these goals. This combination is central for regulatory excellence as well. The excellent regulator learns to use systems thinking to move the system closer to the goals included in the regulator’s mission statement by looking for effective leverage points and by implementing interventions to take advantage of the influence generated by making use of these leverage points.

Excellent regulators can be said to exhibit a number of key attributes. One recent study described these regulators as: efficient; educative; multiplicative (through cooperation and collaboration); proportional; vital; just; and honest.²² Although this list of attributes of excellence seems comprehensive, it provides no insight about how a regulator will adapt and mobilize these attributes to achieve desired outcomes. It is here that a systems perspective is useful in describing how a regulator can adapt and make use of its other attributes of excellence as a resource for seeking continuous improvement by other actors in the system to achieve target outcomes.

The task of identifying regulatory excellence therefore begins with assessing how well the regulator uses systems thinking to learn to “dance with the system”. A regulator becomes excellent – or more precisely, excellence in the regulator emerges – by finding and pursuing pathways that change the dynamics of a system, a process that requires iterative learning.

Using Systems Thinking to Solve Public Problems: The Case of BRAC

The case study that I have chosen to illustrate the process of achieving regulatory excellence by changing the dynamics of a system may appear surprising. It is a non-governmental organization (NGO) that was founded in Bangladesh in 1972 following the surrender of the Pakistani army and the creation of Bangladesh as an independent state. Despite its status as an NGO, BRAC functions effectively as a regulator, but it is also much more than that. BRAC has a far-reaching mission “to empower people and communities in situations of poverty, illiteracy, disease and social injustice.”²³ BRAC has used systems thinking to bring social and economic systems in Bangladesh closer to the goals included in its mission. It is for this reason that it provides some key lessons for regulators seeking to use systems thinking to achieve regulatory excellence.

BRAC – which is today not an acronym but a mnemonic that refers to the organization’s motto, “building resources across communities” – operates in Bangladesh and in ten other developing countries.²⁴ It is by any measure a stellar success as a social enterprise, advancing its mission “to empower people and communities in situations of poverty, illiteracy, disease and social injustice.”²⁵ BRAC includes 97,000 community health promoters providing essential health care to 24.5 million people in Bangladesh. Over a million children attend primary and pre-primary schools run by BRAC. The organization has 5.54 million micro-borrowers with a total cumulative disbursement of \$9.73 billion. Over 600,000 poor women are members of economic and social organizations supported by BRAC. More than 100,000 human rights and legal education graduates have been trained by BRAC. And more than 25 million people have access to clean toilets as a result of a program supported by BRAC.²⁶ BRAC has implemented successful programs to alleviate poverty in spite of a mostly ineffective, and sometimes corrupt, central government.²⁷ It has done so by moving closer to creating a self-sustaining set of interventions to alleviate poverty. For example, in 2013 BRAC’s total income was approximately \$630 million, of which just 30% came from donor agencies. The remaining 70% came from self-sustaining income generating projects.²⁸

These indicators reveal the magnitude of some of the programs supported by BRAC. They do not, however, reveal the complexity of the “institutional mediation” used by BRAC to support these initiatives.²⁹ Nor do these indicators reveal the strength and power of the dynamic

forces driving many citizens of Bangladesh and other developing countries into poverty.³⁰ In a recent account of the history of BRAC, Ian Smilie argues that:

[BRAC] has shown that poor, even completely destitute, women in a conservative Muslim society can earn, learn, and lead. It has shown that enterprise, sound business principles, and the market can be powerful allies in the fight against poverty. BRAC has demonstrated that a charitable organization need not be soft, small or irrelevant. It has breached the borders of small, turning tiny experimental efforts into huge enterprises that are staffed almost exclusively by tens of thousands of villagers who one had nothing and whose borders were once defined by ignorance, ill health, isolation, and fear.³¹

In summary, BRAC is an organization that has, in the words of Amartya Sen, “made a huge contribution to social change in Bangladesh and abroad.”³² It has achieved these results by “tackling poverty on multiple fronts.”³³

BRAC’s experience reveals lessons about regulatory excellence that are useful for all regulators who engage with complex systems in the hope of aligning those systems with the goals set out in their mission statements. BRAC achieved its excellence by using each of the elements of systems thinking to create its mission to empower people and communities. It conceptualized poverty as a system so as to identify leverage points to use to modify the dynamics of poverty. Finally, BRAC used innovative and forthright methods to implement interventions that were designed to disrupt some of the relationships of dependence that produced poverty in Bangladesh. In using systems thinking, BRAC learned to “dance with the system”; it learned to be pragmatic and to make use of all available resources to help it achieve its goal. Most importantly, it managed to persuade poor women to make a leap of faith in hopes of something better. The challenge of bringing each of these elements together is the same as the challenge of moving towards regulatory excellence.

Defining Poverty as a Systems Problem

BRAC did not set out on its development work with a formed “systems” approach to alleviating poverty. In fact, some of its early community development efforts failed to produce expected results, merely reproducing in some cases the inequality between the rich and poor in villages.³⁴ But BRAC carefully evaluated these failures and sought to learn from them.³⁵ In particular, BRAC set out to learn about the dynamics of poverty in Bangladesh – and to view it as a systems problem.³⁶ Poverty, BRAC came to realize, has a dynamic in which rich and poor interact.³⁷ To break out of a steady equilibrium of poverty, BRAC shifted from general community development efforts to a much more targeted set of interventions:

Under the new strategy, development efforts were to be directed to the poorest group in the villages so that they could break out of the dependency relationships. The poorest would be organized into mutual support groups so that mutual help among members of a group, combined with the opportunities BRAC could provide, would gradually break the hierarchical dependency relationships that existed in the village.³⁸

In particular BRAC directed specific attention to poor women. By targeting this group, BRAC transformed the system of poverty and gave people an opportunity to break free of its chains. After settling on this “target group” approach, BRAC implemented a number of programs that were designed to create opportunities for poor women to improve their economic circumstances, health, and education. Improving the lives of poor women in these ways usually resulted in improving the conditions of their families. In this paper, I focus on one of BRAC’s earlier programs that aimed to empower women to care for family members with severe dehydrating diarrhea.

BRAC’s Oral Therapy Extension Program (OTEP) has sometimes been referred to as “a simple solution.”³⁹ This project aimed to teach mothers to use oral rehydration therapy (ORT) to treat family members with severe, dehydrating diarrhea at home. ORT involves administering a solution of water, salt and sugar to a person, or child with severe watery diarrhea. The solution requires a particular combination of each ingredient in order to be effective. A solution that is mixed with too much salt is toxic. In order to be effective a person has to drink the oral rehydration solution (ORS) at a rate that is equal to the loss of fluids in the diarrhea. Once a person starts to drink the solution he or she is able to eat and drink normally but must continue to drink the solution until the diarrhea is “stopped.”⁴⁰ The result of BRAC’s program was a major public health achievement. Launched in 1978, OTEP eventually reached 12 million households, teaching family members how to save lives.⁴¹ Moving from baseline usage rate that was close to zero, the rate of successful use of ORT increased by 1993 to as high as 82% of all diarrhea cases.⁴²

Changing the Dynamics of Poverty

BRAC initially considered three alternative interventions to control the impact of severe diarrhea: (1) a program to treat all diarrhea patients by trained personnel; (2) a diarrhea prevention program through the provision of safe water and sanitation; and (3) a program to market widely ORS packets.⁴³ But it rejected these alternative options for reasons of cost and the inability of the health system in Bangladesh to reach the poor. It also was interested in working on a program that it could do by itself, and each of these alternatives would require cooperation and support from the government or other entities.⁴⁴

Perhaps more important than these practical considerations was that the option of teaching mothers how to make ORS would allow BRAC to use its “target group” approach to change the dynamics of poverty. It concluded that “[i]ncreasing mothers’ capacity to take care of their children’s diarrhea without dependence on outside factors was a form of empowerment.”⁴⁵ It was a chance to begin to change the dynamics of poverty in Bangladesh. By connecting women and mothers in Bangladesh with the world beyond their families, BRAC was seeking to change one of the paradigms that supported the dynamics of the system of poverty. In its research and work in trying to understand the dynamics of poverty, BRAC had identified mothers as a key leverage point, as they were the primary caregivers, their families’ chief nutritionists, and primary role models for young children.

The third step in using systems thinking is implementing and monitoring the intervention. In implementing this “simple solution,” BRAC faced huge challenges. According to data from 1985, approximately 80% of women in Bangladesh were illiterate.⁴⁶ This created challenges in

developing materials and approaches to teaching how to prepare the right mixture of ORS and then how to follow the steps to administer ORT. But perhaps equally importantly, ORT was then, as it is now, a highly counterintuitive treatment for diarrhea. As Atul Gawande notes, making a child who is vomiting and suffering diarrhea drink more fluids “seems only to provoke more vomiting. Chasing the emesis and diarrhea seems both torturous and futile. Many people's natural inclination is not to feed the child anything.”⁴⁷

In addition to these practical challenges, the broader institutional context created other obstacles to the implementation of OTEP. The medical profession believed that teaching mothers to treat diarrhea undermined doctors' influence and authority. Even the World Health Organization set out to prevent OTEP from proceeding on the “grounds that ingredients incorrectly measured could be dangerous.”⁴⁸ The World Health Organization supported instead the Bangladesh government's National Oral Rehydration Program to control diarrhea. Within two years this program had failed because “it was a poorly planned venture which failed to take account of the poor infrastructure of Bangladesh and the vastness of the problem that it was meant to tackle.”⁴⁹

Using “Systems Thinking”

BRAC's initiative succeeded because of systems thinking. It engaged in the process of using trial and error problem-solving to achieve well-specified target outcomes. One part of OTEP, for example, involved the creation and use of educational teams to spread out through Bangladesh's 75,000 villages to teach mothers to use ORT.⁵⁰ Throughout the life of the OTEP, between 35 to 45 of these teams worked simultaneously.⁵¹ In the pilot project, BRAC decided to make partially literate young women serve as teachers.⁵² The size of the project required the creation of teams of young women to move through the villages of Bangladesh. These teams needed to be “as self-contained and independent as possible.”⁵³ Through a process of trial and error, teams of between 14-16 women were developed. These teams moved from village to village teaching a standardized set of points concerning the use of ORT. During the pilot program, BRAC tested a number of different ways of presenting a standardized set of points to convey information about the use of ORT. Over the whole life of the project BRAC continually monitored the effectiveness of the presentation of these standardized points about the use of ORT.⁵⁴

The self-contained teams of teachers needed to be able to perform on a number of dimensions. BRAC needed to “regulate” or govern these teams to make sure that they would be safe as they traveled throughout the country, that they would teach diligently and effectively, and that finances would not be squandered or pilfered. The teams followed a code of conduct that governed their approach to teaching in the villages and their behavior in their camps as they traveled the countryside.⁵⁵ Each team of 14-16 young women were accompanied by one male chaperone and one male cook. Those designing these teams sought to make use of the interactions between the members of the team to ensure the safety of all members of the team.⁵⁶

The design of the teams created the context in which BRAC could induce members of the teams to engage in the practice of continuous improvement. Following a process of trial and error experimentation, BRAC came to limit each team member to teaching no more than 10 mothers per day.⁵⁷ It also implemented an incentive scheme in which a portion of each trainer's

salary was dependent on the effectiveness of their teaching. Each month a monitor visited 10% of the mothers taught by each trainer. This sample of mothers was asked questions that were based upon the standard message that each trainer was supposed to deliver. The responses of each mother were graded on the basis of their capacity to remember the specific points in the standard message. The size of each woman's bonus was then determined by the grade that mothers received on this test.⁵⁸ In this way, the system of monitoring became part of the structure that made each team self-regulating and self-sustaining, encouraging each trainer to engage in the process of continuous improvement.⁵⁹ After some experimentation, it also used visits by these monitors to reinforce the message about the use of ORT.⁶⁰ During the life of the project, BRAC continually evaluated the effectiveness of this process of monitoring the teaching teams. BRAC learned to use the authority of men in the villages and members of the medical profession to encourage the use of ORT.⁶¹ BRAC also enabled the teaching teams to improve the quality of their teaching by adapting to the circumstances of the women they were teaching.⁶²

Clearly, combining innovation with strong fiscal accountability and support for trainers made it possible for BRAC and its trainers to engage in a relentless search for continuous improvement. The *way* BRAC intervened in the system of poverty was an important part of developing a solution to the problem of changing the dynamics of poverty.⁶³ BRAC's competence in implementing this program, its capacity to engage with all involved stakeholders, and its own integrity encouraged mothers to engage with both the trainers and a broader society as they learned to trust the messages that they received about the effectiveness of ORT.

Catherine Lovell has argued that BRAC's success derived from the following organizational attributes, ones that regulators would do well to keep in mind.⁶⁴

1. Propensity to risk, that is, willingness to attempt to implement programs with the knowledge that they may be failures;
2. Investment in organizational development;
3. Strong fiscal accountability and control;
4. Setting its own agenda;
5. Market perspective and entrepreneurial spirit;
6. Responding to the field;
7. Responding to opportunities and successes;
8. Commitment to rapid scaleup;
9. Facilitation efforts with the public sector;
10. A learning organization.

Ultimately, this last attribute proved critical. BRAC's rigorous evaluation of its programs was essential for its trial and error learning.

BRAC's achievements over the whole period since its foundation in 1972 also offers another lesson for organizational excellence: the ability to sustain the use of systems thinking in different communities, in different domains, over long time scales. This involves the consistent use of systems thinking to move closer towards the goal of changing the dynamics of systems over longer time scales.

Lessons for Regulatory Excellence

The implementation of the 'simple solution' and other programs designed to create opportunities for poor women in Bangladesh make BRAC a model of an "excellent regulator." It is not just that BRAC achieved successful outcomes, although that is important. Rather, it is that BRAC implemented its successful programs in ways that genuinely engaged poor, landless women in the process of disrupting harmful relationships of dependence. But how can this example of regulatory excellence inform other regulators as they pursue their missions to improve human health, safety, or the integrity of the systems they are responsible for regulating? Each of the steps that BRAC took are the same steps that excellent regulators take to identify and implement interventions designed to further their missions. The failure of regulators to make use of systems thinking is a key reason for the lack of success in what often appear to be well-founded regulatory initiatives.

Take for example the decision of the American Council for Graduate Medical Education (ACGME) in 2003 to limit the work hours of medical residents to 80 hours per week. The ACGME took this action in response to concerns about patient safety and a well-publicized patient death that appeared to be the result of a fatigued medical resident.⁶⁵ This apparently well-intentioned initiative took what appeared to be a common-sense approach to reducing the risk of harm to patients -- but in the end, it proved difficult to implement and did little to improve patient safety.⁶⁶ This initiative was not informed by a deep understanding of the systemic forces that produce harm to patients in hospitals and in other health care settings. Subsequent work in this field has emphasized the complex nature of the problem of improving patient safety. This work has identified the complexity of the interactions between stakeholders.⁶⁷ It has also analyzed the resilience of the health care system, especially its capacity to prevent harm to patients in a broad range of different circumstances.⁶⁸ The ACGME decision to reduce the working hours of medical residents was not part of a far-reaching mission to improve patient safety. It was rather a pragmatic response to particular set of patient harms. ACGME had little sense of how or why limiting resident working hours would be a useful leverage point in moving the health care system in the direction of improved safety. The contrast with BRAC's approach to alleviating poverty is clear. BRAC had a clear mission and, through persistent learning, built up an understanding of the systemic forces that brought people into poverty. BRAC had clear understanding of why using the "target group" approach identified productive points of leverage. Lastly, BRAC relentlessly and productively used the process of trial-and-error learning to implement the "simple solution."

The attempt by the Food and Drug Administration (FDA) in the early 1990s to regulate tobacco is, by contrast with the ACGME decision, a very powerful example of system thinking used to search for a leverage point to change the dynamics of producing and consuming tobacco. Under the leadership of Dr. David Kessler, the FDA implemented a rule to regulate tobacco by focusing on access of cigarettes and other tobacco products to children. Although this rule was

ultimately set aside by the Supreme Court, the way that the FDA introduced this rule had important role in transforming perceptions of smoking from a recreational activity into a harmful source of addiction.⁶⁹ The FDA was motivated during this period by a strong and far-reaching commitment to improving public health, notwithstanding the longstanding position taken by Kessler's predecessors that that FDA lacked authority to address the public health threats posed by smoking.⁷⁰ Once the FDA decided to investigate whether cigarettes met the statutory definition of a drug, the agency remained open to learning about the system of producing and consuming tobacco. It used this knowledge to seek out a system-level intervention that would change the dynamics of that system. In focusing on the sale and marketing of cigarettes to children, the FDA set out to shift paradigms, viewing smoking as a "pediatric disease."⁷¹ In this instance, the FDA used systems thinking to inch towards a regulatory approach that would reduce the harm caused by smoking and improve public health. The FDA's leadership laid the groundwork for legislation adopted in 2009 that explicitly gave the agency authority to undertake many of the same kinds of regulatory interventions Kessler had proposed.

Some regulatory authorities are explicitly recognizing their tasks in "relational" terms, which serves as another good example of a form of regulatory excellence that makes use of systems thinking. For example, sociologist Susan Silbey has provided a richly detailed account of the way in which the Environmental Protection Agency (EPA) collaborated with a major university to see that its research laboratories established environmental management systems.⁷² In influencing the universities to adopt their own environmental management systems the EPA relied upon a form of self-regulation – or what is sometimes called "management-based" regulation.⁷³ But what made this approach so effective for EPA in this context was the phenomenon of what Silbey described as "relational regulation." A group of coordinators, charged with helping departments and laboratories bring their activities into compliance with environmental protection standards, engaged in the practice of systems thinking. Committed to the goal of bringing the university into compliance, this group observed the broad range of research activities in the university to learn about the systems that they were monitoring. They used this knowledge to identify points of leverage to change the dynamics of those systems and they constantly monitored the effectiveness of these interventions.⁷⁴ This group of coordinators helped to "close the gap" between what the law required and the practices within the research laboratory.⁷⁵

Systems thinking can assist regulators in defining and pursuing regulatory excellence in many ways. The BRAC case study shows what can happen when an organization applies a "top-to-bottom" use of each of the elements of systems thinking to tackle vexing public problems. The best regulators will follow its footsteps to do the same in their realms. Given that all regulators interact with and try to shape complex systems, any regulator will benefit from improving their use of any one or more of the elements of system thinking. For some regulators, such as in the case of the FDA and the regulation of tobacco, the primary concern may be learning about the system that they are regulating and identifying strategic system-level interventions that will create effective leverage points. For other regulators, such as with the EPA's regulation of research institutions, regulatory excellence may involve ensuring that individual regulated organizations themselves make use of systems thinking. Still other regulators with integrated portfolios of responsibilities, whether in aviation safety or the oversight of nuclear power, will have to use systems thinking in a variety of ways.

Most important is recognition that regulatory excellence necessitates the formation of broad goals that are in the public interest, the searching out and discovering points of leverage to change the dynamics of the systems being regulated, and the relentless and systematic monitoring and adapting of interventions that aim to make use of those leverage points. In short, excellent regulators must learn how to dance with systems.

Notes

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³ Christine Parker and John Braithwaite, “Regulation,” in *Oxford Handbook of Legal Studies*, edited by Peter Cane and Mark Tushnet (New York: Oxford University Press, 2003), pp. 119.

⁴ Don de Savigny and Tahgreed Adam, “Systems Thinking for Health Systems Strengthening” (Alliance for Health Policy and Systems Reserch and World Health Organization, 2009).

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⁶ Donella Meadows, *Thinking in Systems: A Primer*, (White River Junction, Vermont: Chelsea Green Publishing, 2008), p. 179.

⁷ Schneider, “Governance and Complexity,” p.133.

⁸ Ibid, p.135.

⁹ Ibid.

¹⁰ Ibid, p.136.

¹¹ Ibid, p.138.

¹² Meadows, *Thinking in Systems*, p.88.

¹³ Schneider, op cit., p. 138.

¹⁴ Ibid, p.137

¹⁵ The goal of changing the direction or valence of systems is central part of creating a framework for improving safety in organizations. See James Reason, *Managing the Risks of Organizational Accidents* (Aldershot, England: Ashgate Publishing, 1997), pp.110-112; Sidney Dekker, *Drift in Failure: From Hunting Broken Components to Understanding Complex Systems* (Aldershot, England: Ashgate Publishing, 2011).

¹⁶ For discussion of the “plan-do-check-act” model and its application in the policy setting, see generally Cary Coglianese and Jennifer Nash, eds., *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* (Washington, D.C.: Resources for the Future Press, 2001).

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¹⁹ John Shook, *Managing to Learn: Using the A3 management process to solve problems, gain agreement, mentor, and lead* (Cambridge, MA: Lean Enterprise Institute, 2010), pp.1-4.

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²³ BRAC, “Who We Are: Mission and Vision,” 2015, <http://www.brac.net/content/who-we-are-mission-vision#.VXT-9WAniuA>

²⁴ *Ibid*, p.3.

²⁵ BRAC, “Who We Are: Mission and Vision,” 2015, <http://www.brac.net/content/who-we-are-mission-vision#.VXT-9WAniuA>.

²⁶ BRAC, “Who We Are,” 2015, <http://www.brac.net/content/who-we-are#.VXT-mWAniuA>.

²⁷ Ian Smilie, *Freedom From Want: The Remarkable Success Story of BRAC, the Global Grassroots Organization That’s Winning the Fight Against Poverty* (Boulder, CO: Kumarian Press, 2013), pp.84-85, 209-222.

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²⁹ Catherine H Lovell, *Breaking the Cycle of Poverty: The BRAC Strategy* (West Hartford, CT: Kumarian Press, 1992), pp.97-114.

³⁰ Smilie, *Freedom From Want*, pp.35-54

³¹ *Ibid*, p.1.

³² BRAC, “Who We Are”, 2015, <http://www.brac.net/content/who-we-are#.VXUDaGAniuA>.

³³ Ibid.

³⁴ Smilie, *Freedom From Want*, pp. 45-48; Lovell, *Breaking the Cycle of Poverty*, pp.28-31.

³⁵ Smilie, *Freedom From Want*, pp.38-39, 104; Lovell, *Breaking the Cycle of Poverty*, pp.4-5, 175-179.

³⁶ Smilie, *Freedom From Want*, p.42.

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