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**Attachment 52**

**How Planned Adaptation Works in Practice: Seven Case Examples**

Starting by identifying policy arenas for which outcomes have, by objective measures, improved meaningfully over time, MIT researchers have attempted to discover the adaptive decision mechanisms that have helped reach those superior outcomes over time. The term “Planned Adaptation” is used here to signify such mechanisms.[[1]](#endnote-1)

The cases show a range of practical ways to make sure that policy can, over time, stay abreast of hard-to-anticipate changes in science, technology, and public opinion. One thing these cases have in common is a way of rewarding those who seek new knowledge relating to the benefits and risks of existing policies and standards. The cases also reflect a general willingness to acknowledge that the assumptions that underlay past policy decisions may need to be corrected in order to further improve decision outcomes.

*[] Internet Standards*

Government entities attempted to set standards for internet protocols over three decades ago, but could not reach timely agreement. Instead, technical leaders among internet users devised a system for deciding on rules of operation. That nongovernmental system, operated by the Internet Engineering Task Force, is marked by an open online discussion of newly-proposed standards, and the use of “rough consensus,” rather than unanimity, to determine what new and revised standards are adopted.[[2]](#endnote-2) By the time a new standard is approved, it has normally been user-tested thoroughly by IETF specialists.

With this setup, interconnectivity and growth have continued in the face of continual and major technology advances.

*[] Guidelines for Cardiac Surgery*

The first US science-based guidelines for cardiac health were written in the early 1980s. Since then, the guidelines have been repeatedly revised to reflect the latest science, and the latter versions show notable migration from the early versions. Survival rates and life expectancy continue to rise toward that of populations that have not experienced intervention to alleviate cardiac disease.

The American College of Cardiology and the American Heart Association (ACC-AHA), two private groups of cardiac specialists, work jointly to provide this routine self-correction capability. For each guideline that is reassessed, the first step is a thorough review of recent outcome studies, including all known random clinical trials (RCTs) and meta-data reports for multiple RCT studies. Unlike many knowledge assessments, these guidelines do not restrict themselves to simple “do’s and don’ts;” instead, they address all of the major clinical decisions that have to be made, and where the available research in less than conclusive, that fact is stated, thus throwing light on continuing research gaps.

The ACC-AHA guidelines process reflects the move toward evidence-based medicine (EBM) in US health care. Formal study results are ranked higher than subjective expert opinion in assigning the strength of evidence ratings behind a particular action recommendation. The nongovernmental Institute of Medicine (IOM) has produced a series of influential reports on guideline-writing procedures across the whole field of U.S. health care.

*[] National Transportation Safety Board (NTSB) and US Air Carrier Safety*

U.S. government’s NTSB is often cited as a model of integrity and technical competence; it conducts intense (and strictly independent of U.S. regulatory programs) studies of the causes of actual airliner crashes in order to help assure that their causes are eliminated.

With the expansion of commercial air travel, it is estimated that if 1960’s levels of risk had not improved, we would see an airliner crash about every other day; instead, in recent years the US has seen no major fatal crashes at all[[3]](#endnote-3). One unique practice in the NTSB program is that the Agency tracks the proportion of its recommendations that are actually implemented. Over 80% of them found to be adopted.[[4]](#endnote-4) Also unique to the NTSB program is the practice of publishing a “Most Wanted” list of subjects for new research -- and for renewed consideration of better safety solutions-- that NTSB finds to be generally underappreciated.[[5]](#endnote-5) One recent example is the problem of school-bus safety, symbolizing NTSB’s credibility even beyond the boundaries of its original core mission.

*[] EPA Regulation of Airborne Particulate Matter (PM)*

Under the Clean Air Act, the Environmental Protection Agency (EPA) is tasked to control risk from the emission of particulate matter (PM) and other airborne contaminants. The Agency is required to review its basic approach for each pollutant every five years in light of emerging knowledge. The agency’s Clean Air Science Advisory Committee (CASAC), a group of outside experts, systematically reviews the latest scientific information on health and environmental risks, and its air program then issues a new regulation on PM.

Then upshot: originally the emission of “black smoke” was the main target of emissions controls for PM. In successive reviews, as more evidence came to light, the target was first changed to small (10 micron) airborne particles instead, and later still the target was further adjusted to reduce human exposure to 2.5 micron particles. The monetized health benefits of the resulting PM controls have been calculated to be in the range of $5 billion a year. Another interesting past feature of the PM program is that Congress allocated over a half-billion dollars for additional research on PM risk, and the independent National Academy of Science guided the setting of relative priorities for those research funds, based on potential health impact.

*[] Highway Safety*

In the past 30 years, the U.S highway fatality risk per mile traveled has improved by about 60%.[[6]](#endnote-6)

Many state and federal and private-sector factors contribute to this success. One of key factors the emergence of safer car designs. Here, planned adaptation takes the form of systematic new knowledge about survivability of different types of collisions. The Insurance Institute for Highway Safety (IIHS) has been a leader in this effort through its innovative crash-testing facility. It has been estimated that the fatality risk in a car with IIHS’ “good” rating is a factor of four better than risk in a car with a “poor” rating.[[7]](#endnote-7) IIHS, organized in 1959 with funding by three major insurance companies, has over time introduced and implemented new varieties of crash tests in order to learn how car design affects occupant safety.

*[] Delta Management in the Netherlands*

In 1953, within 20 days of a catastrophic flash flood of the south-west of the Netherlands, a commission was installed to lead the effort of to write the ‘Deltaplan’, which involved the constructions of dams and surge barriers to prevent reoccurrence. Only during the construction of the immense project, which lasted from 1958 till 1986, did the impact of the interventions on the ecosystem and society became visible. In September 2014 the Dutch parliament approved the follow-up ‘Deltaprogramma 2015’ that is projected to last till 2050. Having learned from the first program, the key feature now is planning flexibility explicitly termed ‘adaptive delta management’. It goes far beyond flood defense and includes safeguarding fresh water supply, ecosystem management, the climate-proofing of the built environment, and maintenance of economic infrastructures. Alternative strategies are being prepared right from the start in order to be able to adjust the program to changing conditions, e.g. in climate and sea level rise, as they occur. Adaptive delta management builds on coordinated decision making by a large number of ministries and agencies, research institutes, national and local population, and industry and commerce.[[8]](#endnote-8)

*[] Urban Fire Safety* [[[STILL TOO WISPY TO RETAIN???]]]

Since the late 1970s, the number of building fires in the U.S. has fallen by more than 60%, and the number of fire deaths in homes has declined by over 50%.[[9]](#endnote-9) Today, a fire department’s emergency responses are much more likely to supply medical aid (which account for 64% of all calls) than either fires (4%) or false alarms (8%).[[10]](#endnote-10)

The reasons for this steady long-term improvement are not clear, and are probably multifactorial. Representatives of the National Fire Protection Association (NFTA) cite the introduction of technologies including fire detectors and automatic sprinklers.[[11]](#endnote-11) The contribution of insurance entities, and their loss data, may prove to be a significant part of this story.

[[[KEN]]]

[[[Other Cases to be added?]]]

[] Methyl Mercury (help, Ken!)

[] European BSE (help, somebody!)

[] European Medical Agency (help, if this is a documented case of improvement!)]]]

Possible Implications for the Stewardship of Biotechnology

These cases show how real institutions have managed to accommodate, and often to stimulate, new technologies in the furtherance of public safety and other national pjurposes. They demonstrate an ability to learn, over time, about causal factors that were not appreciated at the outset.

Can contemporary biotechnology adopt some new version of the institutional measures that are found in these instances? Some general points to consider:

* Nongovernmental entities are central to several of the cases: Unilateral action by government is not the only way to ensure continuing progress.
* While the recurring (often five-year) reviews are one mechanism for planning for future adaptations, it is not the only one that works. Event-based reviews are effective for airliner safety, and independent crash-testing has been important contributor to improved highway safety.
* The deliberate separation of risk assessors from risk managers seems to be one organizational tendency: To take two examples, the NTSB operates independently from the powerful Department of Transportation, protecting its investigatory integrity, and the IETF is plainly built to ensure technical expertise, and operate at a distance from political sway and from self-interested market power. There appears to be some value in isolating the knowledge assessors from both public and private material interests until the risk assessment phase is settled by professional risk analysts.
1. One early exposition of Planned Adaptation is found in L. McCray, K. Oye and a. Peterson, “Planned Adaptation in Risk Regulation: An Initial Survey of US Environmental, Health, and Safety Regulation, Technological Forecasting and Social Change, vol. 77, no. 6 (July 2010): 951–959. Administrative law scholars have used the term “lookback regulations‘ to reflect similar ends; and recently the Duke Law School’s Center for Innovation Policy introduced a series of “Laws That Learn” seminars along similar lines. For a recent international conference on adaptive regulation, see <http://www.irgc.org/event/planning-adaptive-risk-regulation/>. [↑](#endnote-ref-1)
2. A. L. Russell, “OSI: The Internet that Wasn’t,” *IEEE Spectrum*, June 30, 2013. [↑](#endnote-ref-2)
3. Sweetman and Washington, “Staying Alive,” *Aviation Week*, January 2016, pp 46-51. [↑](#endnote-ref-3)
4. <https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=11186>. [↑](#endnote-ref-4)
5. See <http://www.ntsb.gov/safety/mwl/Pages/default.aspx>. [↑](#endnote-ref-5)
6. “Saving Lives: Improved Vehicle Designs Bring Down Death Rates,” IIHS *Status Report,* Volume 50, no.1 (January 2015). [↑](#endnote-ref-6)
7. Ibid. [↑](#endnote-ref-7)
8. [www.deltawerken.com/Deltaworks/](http://www.deltawerken.com/Deltaworks/) [↑](#endnote-ref-8)
9. M. Ahrens, Trends and Patterns of U.S. Fire Loss (National Fire Protection Association, February 2016), pages 1 and 3. [↑](#endnote-ref-9)
10. Ibid, page 9. [↑](#endnote-ref-10)
11. Personal interviews, 2009. [↑](#endnote-ref-11)