

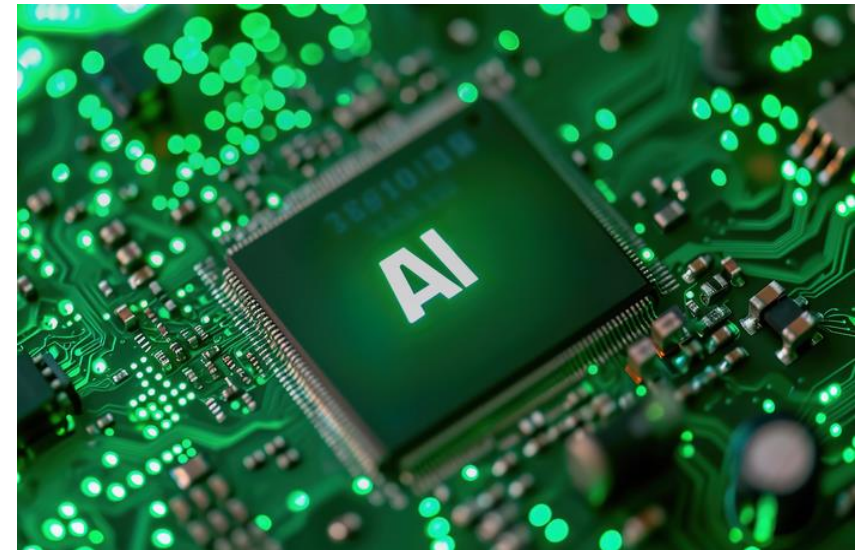
Effective Regulation of Complex, Technologically Intensive Systems

Lessons From the U.S. Commercial Nuclear Power Industry

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REGULATORY CHALLENGES OF COMPLEX, TECHNOLOGICALLY INTENSIVE SYSTEMS*

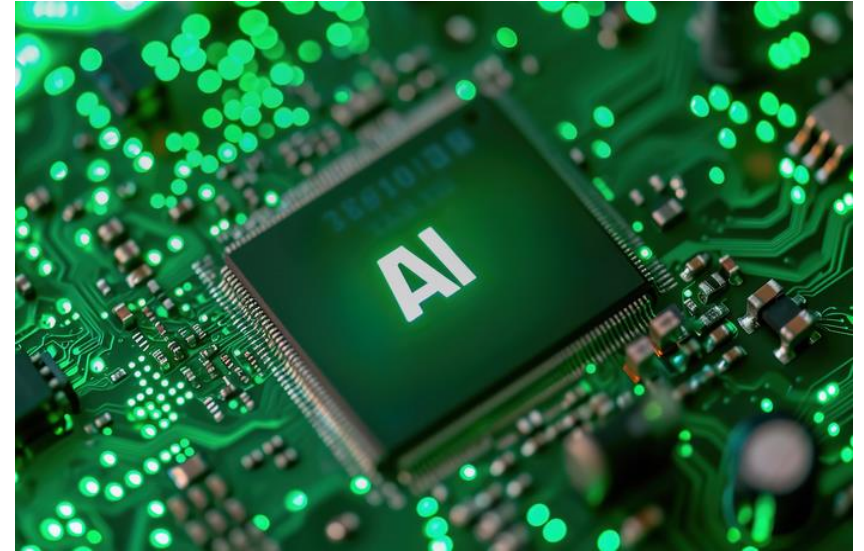
- Enabling and enabled by AI, the fields of microelectronics, advanced networks, biotechnology, energy, and advanced manufacturing are all key areas of technological competition, in which technology has outpaced policy, relative positional advantages are being decided, and with them, potentially, the future of the world order.
- Under the breakneck pace of current innovation development, governing agencies have struggled to predict and manage the negative externalities and anticipate the possible risks of new technologies.
- At the same time, an exclusive focus on de-risking may limit necessary government concentration on harnessing a new technology's unrealized benefits OR attempt to regulate risks that never materialize.
- Proactive technology governance must balance both mitigating harms and harnessing innovative benefits by establishing a mutable and iterative risk-based approach, focusing governance specifically on highly consequential use cases, both good and bad, as they actually develop.



* Based on *Vision for Competitiveness* by the Special Competitive Studies Project

REGULATORY CHALLENGES OF COMPLEX, TECHNOLOGICALLY INTENSIVE SYSTEMS*

- This truly effective and balanced technological governance demands a deep understanding of the technologies in to be regulated that, to a significant degree, resides only in those who are actively engaged in their creation AND the credible involvement of those most likely to be impacted.
- This implies that the regulator, the regulated, and the public must partner in ways that redefine the meaning of regulation and bring them together collaboratively in a relationship that cedes some level of self-regulatory authority to those at the cutting edge of creating, optimizing, and employing these technologies while, at the same time, creating a credible and trusted independent regulatory process, even as the governmental regulator matures in capability and expertise.
- The lack of an effective existing regulatory construct parallels exactly the situation confronting the United States' commercial nuclear power industry at the time of the Three Mile Island accident.



SELF-REGULATION IN THE US COMMERCIAL NUCLEAR POWER INDUSTRY

- Perhaps the only successful example of such a model is the Institute of Nuclear Power Operations, the self-regulatory entity that supports the U.S. commercial nuclear power industry.
- Established by all of the U.S. nuclear utility companies in 1979 after the Three Mile Island nuclear accident, INPO was empowered to oversee training, operations, and maintenance of commercial nuclear plants by collaboratively establishing the highest standards and conducting regular, rigorous graded inspections, and independent accreditation activities to ensure those standards are met.
- While the concept of self-regulation can bring to mind conflicts of interest between those promoting an emergent technology and the public that would be vulnerable to its failure or misuse, the lack of an effective existing regulatory construct parallels exactly the situation confronting the United States' commercial nuclear power industry at the time of the Three Mile Island accident.



FAILURES OF FEDERAL NUCLEAR REGULATION

- The government Nuclear Regulatory Commission had been created from the Atomic Energy Commission because of concerns that the AEC's focus on weapons the promotion of commercial nuclear power conflicted with its ability to provide rigorous and effective regulation.
- The NRC was still evolving and, in the eyes of the public and the findings of the *Kemeny Commission Report on the TMI Accident*, had been found seriously wanting. In a damning indictment the report concludes:

"We therefore conclude that there is no well-thought-out, integrated system for the assurance of nuclear safety within the current NRC.

With its present organization, staff, and attitudes, the NRC is unable to fulfill its responsibility for providing an acceptable level of safety for nuclear power plants."



COMMERCIAL NUCLEAR INDUSTRY RESPONSE

- The brutal facts of the matter were that the American commercial nuclear power industry was facing a severe loss of public trust and confidence resulting from the average citizen's fear of this new technology; Americans were afraid and did not understand the accident, its causes, and consequences.
- In the view of the owners and operators the commercial nuclear industry was facing, literally, a collective existential threat and saw no regulatory entity or agency that could capably and confidently reverse the trend.
- So, they decided to create their own, the Institute of Nuclear Power Operations.
- The commercial nuclear industry leadership moved quickly. Not content to wait for the Presidential Commission's report on Three Mile Island, they gathered repeatedly, led by the President of Duke Power, William "Bill" Lee to establish governing principles, create an organizational framework, begin hiring nuclear experts, and agree on funding.

The logo for the Institute of Nuclear Power Operations (INPO) is displayed in a blue, bold, sans-serif font. The letters 'INPO' are in a large, italicized style, followed by a registered trademark symbol (®). The logo is enclosed in a thin black rectangular border.

COMMERCIAL NUCLEAR INDUSTRY RESPONSE

- The TMI accident occurred in March of 1979. When the Commission report was published in October of that year it said: "At the same time, the Commission recognizes that merely meeting the requirements of a government regulation does not guarantee safety. Therefore, the industry must also set and police its own standards of excellence to ensure the effective management and safe operation of nuclear power plants."
- In October, the Institute of Nuclear Power Operations was already taking shape.
- It was chartered as a Non-Governmental Organization under Article 501 (c) 3 of the American tax code making it a tax-exempt not-for-profit entity. Its activities are centered around four cornerstones that anticipated the commission's findings:
 - Formal two-week long evaluations of every commercial nuclear power installation every two years
 - Extensive assessment of training effectiveness and a formal university-like accreditation process
 - Comprehensive analysis of industry events and trends with rapid communication to the entire industry
 - Creation of assistance teams to provide expertise to all members along with sharing of best industry practices

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THE IMPACT OF INPO

- The creation of INPO has contributed significantly to the operational safety and reliability of the U.S. commercial nuclear industry. The data would take hours to present but here are a few samples: the industry capacity factor, the percentage of available time that the reactor is actually generating power compared to the possible generation, has increased from 62 per cent to 92 percent; the median number of unplanned shutdowns per reactor has declined from 7 per year to zero, and the monitored radiation exposure during operations is now 1/6th of what it was in 1979.
- But, if you believe, as many do, that self-regulation is an oxymoron, why has it worked so well? I believe are the five key factors that have enabled INPO and self-regulation to be effective in fostering the highest standards of nuclear power safety at our nation's commercial nuclear plants. The five key factors are:
 - Chief Executive Officer (CEO) engagement
 - Nuclear power safety focus
 - Support from the nuclear power industry
 - Accountability
 - Independence.

The logo for the Institute of Nuclear Power Operations (INPO) is displayed in a blue, bold, sans-serif font. The letters 'I', 'N', 'P', and 'O' are all in the same weight and style. A registered trademark symbol (®) is located to the upper right of the final 'O'. The logo is enclosed within a thin black rectangular border.

WHY SELF-REGULATION CAN WORK

- SHARED CRISIS: REAL COMMON INTERESTS, “HANG TOGETHER...”
- SINGLE STRONG INDUSTRY LEADER: W. S. LEE, DUKE POWER
- ULTIMATUM: MANDATORY MEMBERSHIP; **INSURANCE RATES DETERMINED BY INSPECTION RESULTS**
- COLLABORATIVE STANDARDS: Performance Objectives and Criteria (“OPEN BOOK QUIZ”)
- SHARED INSIGHTS: INSPECTION PARTICIPATION, EMPLOYEE EXCHANGE
- COMPLEMENT REGULATOR: **EXCELLENCE VS MINIMUM REG. COMPLIANCE**, SHARE BURDEN, i.e. ACCREDITATION **BY INPO FOR NRC**, STANDARDIZED DEFINITIONS
- PEER PRESSURE
- HIGH QUALITY, CREDIBLE PERSONNEL: INDEPENDENT (NON-INDUSTRY) CEO, TECHNICAL PEOPLE WHO HAVE DONE IT...WELL, EXCHANGES OF PERSONNEL
- BOARD OF DIRECTORS: ACTIVE REVIEW, LEGALLY DISTANT, PRACTICALLY INFLUENTIAL, CRITICAL OF THEIR PEERS, HELP DELIVER THE MESSAGE (EVEN TO THEIR OWN TEAMS)



WHY SELF-REGULATION MIGHT NOT WORK

- No single transformational industry event
- Widely varying technological approaches
- No insurance pool leverage
- Industrial Secrets or Intellectual property concerns
- Large number of outcome uncertainties, not all equally likely, as to level and severity of risk
- Lack of transparency and public participation
- Other industries have tried and failed: Medical/Hospitals, Chemical and Petroleum Refineries, Oil and Gas Exploration



BUT WHY WE SHOULD TRY

- AI has enormous potential to improve the way the local and national governments operate across a range of responsibilities—executive, judicial, and legislative. With the help of new predictive models and novel data collection tools, it will allow executive branch leaders to make more informed and data-driven decisions, especially with time constraints in moments of crisis.
- Judges, too, will be able to make better, fairer, and faster decisions when assisted by AI models built on past cases and adjusted for human and data-based biases. And on a legislative level, policymakers will summon expert research at any moment and access tools that can help draft and amend laws in seconds.
- Beyond improving decision-making processes and government efficiency, AI can also help build support for and faith in democratic governance itself. **Through new crowdsourcing mechanisms enabled by AI, governments can more easily aggregate citizen preferences and encourage direct citizen participation, facilitating more people to engage in their own governance and scaling the practice of democracy. (Emphasis added)**
- By expanding the possibilities for new forms of collective decision-making, AI could fundamentally change what it means to be a politician, a citizen, and everything in between.

Eric Schmidt, *The Digitalist Papers*

Perhaps AI is not the PROBLEM but, rather, is the SOLUTION



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BUT WHY WE SHOULD TRY

- The United States and its allies and partners built and shaped the prevailing global architecture and international institutions to promote peace and stability over the previous eight decades.
- The unfolding complexities of the global stage demand a re-evaluation, reconstruction, and reimagination of these institutions.
- The United States and its allies and partners must once again lead this effort.
- These new institutions must be robust enough to enforce the norms and standards of today, and responsive enough to chart those of tomorrow, including for governing the emerging technology landscape.
- This next generation of institutions can establish an environment conducive to peaceful cooperation and technological exchanges for the development and deployment of open, safe, trustworthy, and secure technologies around the world.

What Are We Waiting For?

EFFECTIVE REGULATION OF COMPLEX, TECHNOLOGICALLY INTENSIVE SYSTEMS

“Today, we need a similar ambition of imagination. We, too, stand at technological, economic, and political crossroads that demand creative rebuilding or reinvention of new institutions... And as the political and economic tectonic plates shift radically, a powerful new technology, artificial intelligence, explodes onto the scene and threatens to transform, for better or worse, all legacy social institutions. The convergence of these political, economic and technological forces requires an ambitious and fundamental rethinking of existing principles and institutions of governance.”

Erik Brynjolfsson, Alex Pentland, Nathaniel Persily, Condoleezza Rice, and Angela Aristidou; Editors of *The Digitalist Papers*



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EFFECTIVE REGULATION OF COMPLEX, TECHNOLOGICALLY INTENSIVE SYSTEMS

“There are simple answers.

There are just no easy answers.”

President Ronald Reagan

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