INFRASTRUCTURE AND THE ANTHROPOCENE

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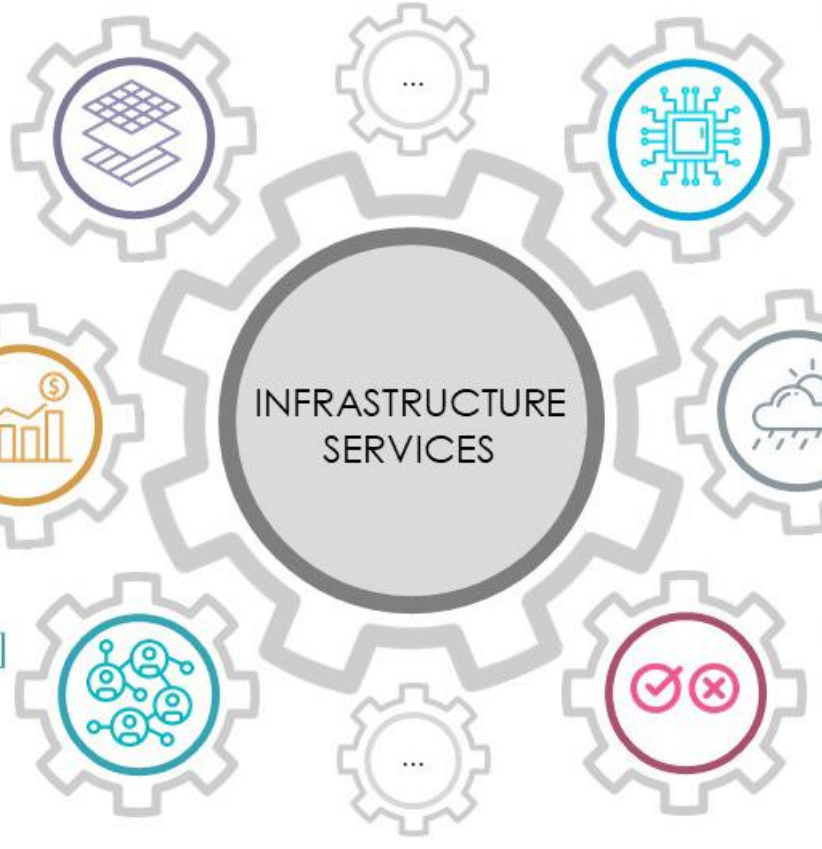
ACCELERATING, UNCERTAIN AND VOLATILE FORCES



INFRASTRUCTURE TECHNOLOGIES [ω =]

Increasing complexity due to layering of technologies (accretion, interactions, edge cases, and common rarities). Increased coupling of systems, including feedback loops.

FINANCING [ω =]

Increasing needs for infrastructure financing, restructuring of financing, yet large uncertainty about infrastructure investment. Increasing tying up of infrastructure financing with other goals.

SOCIAL/CULTURAL [ω =]

Changing values, customs, and beliefs informed by selected information. Changing patterns of war and conflict.

CYBER TECHNOLOGIES [ω =]

Acceleration of technologies where cycle times exceed that of infrastructure. Decreasing of technology costs, increasing data processing capabilities, increasing of communication capabilities. Cybersecurity in an age of civilizational conflict, where infrastructure is a primary target. Emergence of Machine Learning and Artificial Intelligence.

ENVIRONMENT/CLIMATE [ω =]

Non-stationarity in environmental conditions (water, temperature, fire, etc.) that threatens the basic design assumptions of infrastructure, and their reliability. Feedback loops that future climate change will reduce the efficiency of the earth system to absorb anthropogenic carbon. Changes, impacts and management of water, nutrient, and other earth systems.

POLITICAL [ω =]

Increasing ideological polarization resulting in support for infrastructure and their services held hostage.

Chester and Allenby, In review, Toward Adaptive Infrastructure: The Fifth Discipline.
Sources: Allenby, 2015; Arbesman, 2017; Friedlingstein et al., 2006; Fukuyama, 2018; Kissinger, 2014; Kurzweil, 2005; Nye, 2011.

INFRASTRUCTURE AND THE ANTHROPOCENE
DESIGN TENETS

Agility and Flexibility

Complexity

Cybersecurity

Extremes (and Failure)

Knowledge

Background Readings

- Keeping Infrastructure Reliable Under Climate Uncertainty, Mikhail Chester, B. Shane Underwood, and Constantine Samaras, *Nature Climate Change*, 2020, 10, pp. 488-490, doi: 10.1038/s41558-020-0741-0.
- Toward Adaptive Infrastructure, Mikhail Chester and Braden Allenby, *Sustainable and Resilient Infrastructure*, Expected 2020, In Press, 10.1080/23789689.2020.1762045.
- Reconciling Complexity and Deep Uncertainty in Infrastructure Design for Climate Adaptation, Alysha Helmrich and Mikhail Chester, *Sustainable and Resilient Infrastructure*, 2020, In Press, doi: 10.1080/23789689.2019.1708179
- The Cyber Frontier and Infrastructure, Mikhail Chester and Braden Allenby, *IEEE Access*, 2020, 8(1), doi: 10.1109/ACCESS.2020.2971960
- Infrastructure as a Wicked Complex Process, Mikhail Chester and Braden Allenby, *Elementa*, 2019, 7(21), doi: 10.1525/elementa.360
- The Infrastructure Trolley Problem: Positioning Safe-to-Fail Infrastructure for Climate Change Adaptation, Yeowon Kim, Mikhail Chester, Daniel Eisenberg and Charles Redman, *Earth's Future*, 2019, pp. 704-717, doi: 10.1029/2019EF001208
- Infrastructure and the Environment in the Anthropocene, Mikhail Chester, Samuel Markolf, and Braden Allenby, *Journal of Industrial Ecology*, 2019, 23(5), pp. 1006-1015, doi: 10.1111/jiec.12848
- Sustainability and Infrastructure Challenges, Mikhail Chester, *Nature Sustainability*, 2019, 2, pp. 265-266, doi: 10.1038/s41893-019-0272-8
- Reconceptualizing Infrastructure in the Anthropocene, Braden Allenby and Mikhail Chester, *Issues in Science and Technology*, 2018, 34(3), http://issues.org/34-3/reconceptualizing-infrastructure-in-the-anthropocene/.
- Rethinking Infrastructure in an Era of Unprecedented Weather Events, Thaddeus Miller, Mikhail Chester and Tischa Munoz-Erickson, *Issues in Science and Technology*, 2018, 34(2), https://issues.org/rethinking-infrastructure/.
- Toward Adaptive Infrastructure: Flexibility and Agility in a Non-stationarity Age, Mikhail Chester and Braden Allenby, *Sustainable and Resilient Infrastructure*, 2018, 3(1), pp. 1-19, doi: 10.1080/23789689.2017.1416846

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