Part I: Literature (for further reading on industrial policy and innovation)

Aiginger, K., & Rodrik, D. (2020). Rebirth of Industrial Policy and an Agenda for the Twenty-First Century. *Journal of Industry, Competition and Trade*, *20*(2), 189–207. https://doi.org/10.1007/s10842-019-00322-3

Mazzucato, M. (2011). The Entrepreneurial State. *Soundings*, *49*(49), 131–142. https://doi.org/10.3898/136266211798411183

Mazzucato, M. (2018). Mission-oriented innovation policies: Challenges and Opportunities. *Industrial and Corporate Change*, *27*(5), 803–815. https://doi.org/10.1093/icc/dty034

Reynolds, Elisabeth B. (2017). Innovation and Production: Advanced Manufacturing Technologies, Trends and Implications for US Cities and Regions. *Built Environment*, *43*(1), 25–43. https://doi.org/10.2148/benv.63.3.25

Part II: Recent News

Bordelon, B., & Oprysko, C. (2023, March 17). Everybody in Washington wants a byte of the CHIPS law. *Politico*. https://www.politico.com/news/2023/03/17/chips-law-companies-washington-lobbying-00086687

Muro, M. (2023, March 6). Biden's big bet on place-based industrial policy. *Brookings Institution*. https://www.brookings.edu/blog/the-avenue/2023/03/06/bidens-big-bet-on-place-based-industrial-policy/

Selsky, A. (2023, March 26). Chance to host semiconductor factories under CHIPS Act has Oregon reconsidering rules against urban sprawl. *Fortune*. https://fortune.com/2023/03/26/oregon-chips-act-semiconductor-factories-urban-sprawl-farming/

Swanson, A. (2023, February 23). The CHIPS Act Is About More Than Chips: Here's What's in It. *The New York Times*. https://www.nytimes.com/2023/02/28/business/economy/chips-act-childcare.html

Part III: Question and Answer Session

Professor Jinhua Zhao's commentary:
- Of course, the federal government and MIT like to talk about this incredible amount of investment. It's important to thing about how the public thinks about this. Does the average person in the country talk about these things? The point of the Mobility Forum is to bring these questions to the public.

Audience Comments and Questions (Professor Zhao invited several esteemed guests to comment on the presentation, before turning to audience questions)

- Professor Alain Kornhauser (Princeton University): What are we going to do about labor? In a potentially automated future, what are people going to do?
- Professor Hani Mahmassani (Northwestern University): Drawing on mobility, it is important to think about failed experiments. Although there was a grand vision, Intelligent transportation systems under-delivered compared to expectations. What ultimately upended all of this is that Google and Waymo come up with an autonomous vehicle, while the ITS was focused on connecting/automated highways. Uber came through with on-demand mobility and Tesla brought electrification to the equation, while a lot of these broader visions didn't pan out. You can't always predict innovation, so its important to keep an open mind when these opportunities present themselves.
- Dr. Dirck Stryker (AIRD): There has got to be one big priority, which is climate change. If we don't meet this challenge, nothing else will matter. We're way beyond schedule on hitting targets. How can this country focus on areas where we can have some success?

Audience Questions:

Q: Are Liz and David familiar with the economist Mariana Mazzucato? She has studied federal government guarantees for companies like Solyndra and Tesla.
A: (Liz) She is one of the few economists who has put the role of the government on the table. She points out that the government's job is not only about correcting market failures but creating markets. She uses the word "conditionalities," which means the government has a right to ask the government for something in return for these things. This is a very fair area for exploration. We see this with the CHIPS Act: companies are now going to provide childcare for their workers. This solves a labor problem, allowing the broader policy to succeed. If we aren't going to create a national system, this is the way the Biden admin has tried to achieve some of its goal. It's also fair to reconsider stock buybacks; is this how public money should be used? I do take issue when she talks a lot about mission-driven work. You need a specific goal to get to this stage, beyond just something broad like a more resilient mobility system.
(David) I like a lot of her ideas, but I'm always a little weary of using the Apollo program as a model. It had such a simple and well-defined goal. Man, moon, decade, as they say. One of the challenges with these problems is defining a project that has such a simple goal. A lot of the startups I see, take Commonwealth Fusion, are entirely focused on one goal. They're just focused on making sure their reactor works, but once that happens, they'll transform as a company.

Q: Which revolutions in transportation do you believe would've happened or happened faster without government intervention?
A: (David) Aviation is a great example. The Wright Brothers were bicycle mechanics with no relationship to the government. However, the military as a customer played a big role in aviation. It was 30 years before aviation found its product market fit. I came away from the Work of the Future project very cognizant of the 30-year cycle. It's the 5 to 25 years that you need the government to be patient and provide some structure. An alternative is the Rainhill Trials (1829), which were a privately funded competition to build an effective locomotive.

But these transformations take time, and private capital isn't always willing to support that over the time frame.

Q: How can the US government support innovation in a way that balances competition across technologies while also supporting efficient network planning?
A: On the clean tech side, people have thought about this. Different technologies are at different stages. Solar and wind now are in a position for immediate deployment. But it takes 30 years for nuclear and hydrogen in terms of full adoption. There's a sense of sequentialness. Our needs are so vast and so enormous, that there's not a concern that we'll have a crowding out of technologies. If that's our challenge down the road, then that's perhaps a good one.

Q: How does liability law impact the development of technology independent of regulations?
A: (Liz) I don't have a good answer, but a lot of folks have thought about this. Ezra Klein, etc argue that we've forgotten how to build that we've created such a democratic structure that it slows down the actual doing of things.
(David) We're woefully behind in safety engineering. People are building 21st century safe systems, and we're trying to use techniques from the 70s – maybe sometimes the 1870s -- to safety certify them. There's only one or two faculty members that study safety engineering in a serious way, when there should be dozens.

Part IV: Summary of Reflection Memos

In this week's discussion, the class touched on a wide variety of topics presented in Liz and David's presentation:

- Supply Chain Issues and Onshoring: Shoichi pointed out that the talk confirmed the critical connection between supply chain problems and public policy, especially in the aftermath of the pandemic. Across the world, governments are investigating the feasibility of onshoring. Shoichi mentions the example of Japan, where the government is using pandemic supply chain disruptions as an impetus to bring manufacturing back onshore.

- Implementation – Risks and Opportunities: Ninevah and Yunhan focus on the challenges and opportunities of implementation. Both comments mention highly relevant examples. Ninevah highlights one effort – the Reconnecting Communities Pilot Program – that seeks to pursue both environmental goals while building equitable systems. The pilot program tries to build a pathway to economic recovery in communities that were divided by highways. Yunhan spotlights EV Infrastructure Development Plans; the federal government has mandated that states produce such a plan. Yunhan also points out that this could be a tool to build more equitable transit futures, since it will ensure all communities have access to charging infrastructure.

- Government-Industry Coordination: Michael, Ao, Spencer, and Yunhan all make great observations about the relationship between the public and private sectors. Michael casted some skepticism on the Apollo metaphor. Ultimately, that program was about getting one spaceship to the moon, while transforming our transportation system will

require coordinated action among hundreds of millions of people. Ao emphasizes the how daunting it is to coordinate among the mobility field's various players, echoing Professor Mahmassani's example of intelligent transportation systems. Yunhan highlights the enormous funding and effort that the Chinese government has dedicated to EVs, which provides a compelling reason for the US government to speed up its efforts to promote EV adoption. Lastly, Spencer is skeptical about the Biden administrations hesitation about "putting their finger on the scale" for one technology. With the urgency of the situation, Spencer suggests investing in technologies across the spectrum before its too late.

- Climate Change Targets: Yen-Chu brought in his own research experience on incentive allocations to promote EV adoption and meet climate goals. Yen-Chu's research suggests a two-pronged approach: government investments in charging stations and subsidies for EV purchases.

- New Technologies: Samuel observes that currently, governments are playing catch up with Artificial Intelligence technologies, and the private sector is very much leading. Samuel wonders how this will play out down the road.

My Reflection:

I think we're in an unprecedented moment for American industrial policy. What I mean by that is that there actually seems to be one right now, with Biden's IRA and CHIPS act. The mobility forum has offered some tentative answers or directions.

Mindell and Reynolds offered a nice 30,000-foot view of the government-academic-industry nexus and the technology development cycle. I would have loved for them to lay out a far more detailed industrial policy roadmap. One can't emphasize enough the crucial role that government plays in nurturing technologies through the research and development stage. Mindell and Reynolds spoke a lot about the 30-year cycle of development, and highlighted the fact that private industry rarely has the patience of financial ability to support technologies. The speakers also raised a crucial point about the challenges that the US faces with regards to building supply chains. My first thought is that what we have — CHIPS Act, IRA — is far from the magnitude necessary for the moment. During Nancy Pelosi's recent visit to Taiwan, Morris Chang – the founder of TSMC – more or less told her that $50 billion is nowhere near enough to build a semiconductor ecosystem in the US. I also wonder to what degree the current tension between China and the United States will affect the green energy transition.[1]

Part V: Other Resources

Kannan, V., & Feldgoise, J. (2022). *After the CHIPS Act: The Limits of Reshoring and Next Steps for U.S. Semiconductor Policy* [Working Paper]. Carnegie Endowment for International Peace.
https://carnegieendowment.org/files/Kannan_Feldgois_CHIPS_final2.pdf

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[1] Burns, Alexander. (2023, February 14). Taiwan's Tech King to Nancy Pelosi: U.S. Is in Over Its Head. *Politico.* https://www.politico.com/news/2023/02/14/taiwan-tech-king-pelosi-powerhouse-microchip-industry-00082646