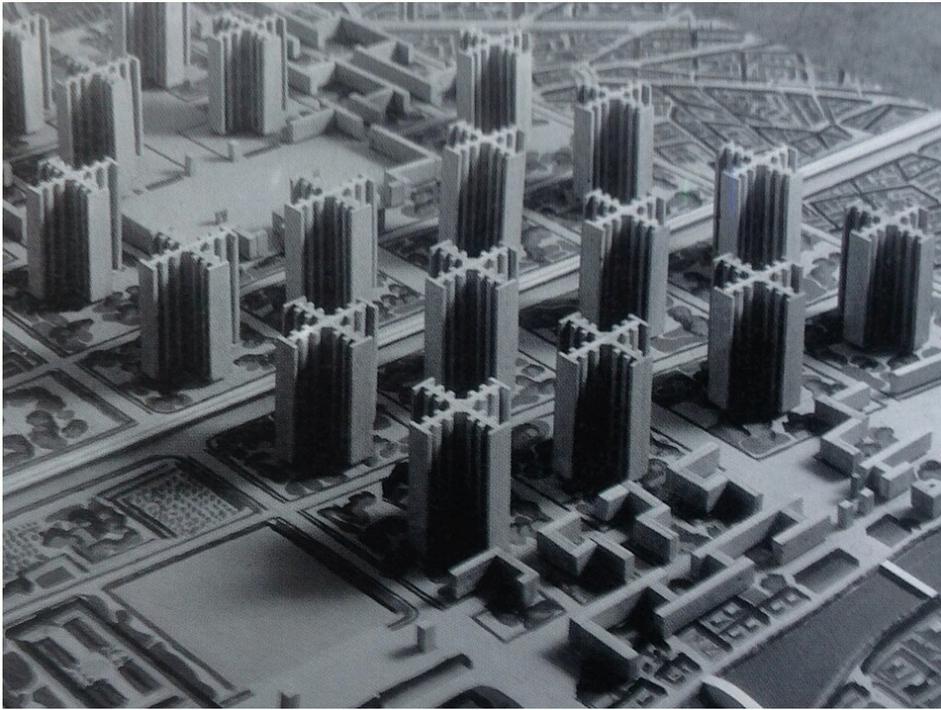


Progress

Class 11 - Top-Down Innovation

Kevin A. Bryan - Toronto Rotman - Nov 26 2025

After class notes in Red

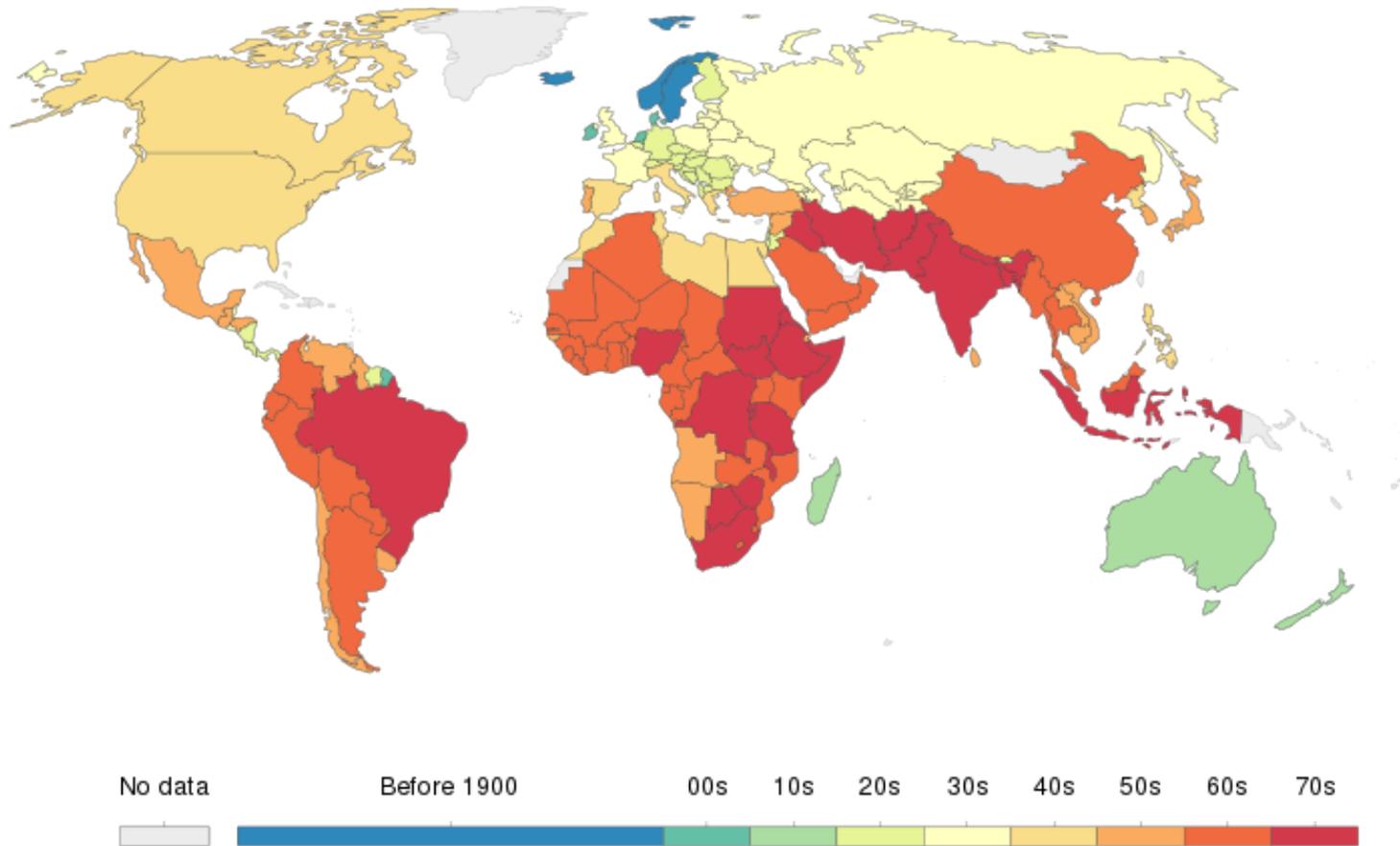


Which will we get when we ask a genius to rebuild Paris?

Both the Plan Voisin from Le Corbusier and the beautiful Haussmann Parisian streets were "top-down innovation". How do we get the good rather than the bad?

Decade in which smallpox ceased to be endemic by country

The decade in which smallpox was eliminated by country. Smallpox was globally eradicated in 1977.



Source: Fenner et al. (1988)

Late 1950s, call for WHO to work on global eradication of smallpox. 300 million spent over next 20 years, went from 2 million deaths per year to complete eradication, first time ever in human history, Donald Henderson and Karel Raška's smallpox eradication unit begin in 1967 and in ten years smallpox was gone. Pretty topdown, and surely successful - not clear how a non-topdown solution would have gotten here.



"Industrial policy" seems to be back ("China effect?")

But can we go too far? "Industrial Policy" and other top-down solutions are in the air, from China to Europe to Canada and the US. When are they a good idea? When are they not?

What do we mean by 'top-down'?

- Centralized industrial policy
- "Major" coordinated projects (eg Apollo)
- Scientists organized, not free to explore
- Science funding w/ strong program managers

Topdown progress is not just "industrial policy". It might also mean, e.g., funding science in a more centralized way via program managers rather than giving scientists autonomy on research choice, or a large firm doing centralized multi-year plans versus "Google 20% Time"-type programs.

A quick brainstorm: what types of progress are unlikely to be achieved by decentralized individuals or firms?

Limited appropriation of returns, incredibly high expenditure requirements beyond bounds of individuals, (maybe) strategic complementarities, specialized public inputs like infrastructure that is difficult to build otherwise

Let's start small: how should we decide what
science to fund?

What are our options?

Let's start small: how should we decide what science to fund?

- 1) *Fund researchers directly on basis of CV and potential*
- 2) *Fund projects through grant competitions*
- 3) *Fund outcomes through prizes*
- 4) *Direct scientists via program manager-led, long-run initiatives*

How should we decide? DARPA-type programs are having a popular moment. But are they best?



Following Sputnik in Oct '57, DARPA created in 1958 to help US science catch up particularly on military applications. Exact nature of DARPA varies over time, but imagine



STRATEGIC COMPUTING

Huge DARPA program in 1983 to build "general machine intelligence"

Strategic Computing Initiative attempted to build, via huge investment from DARPA, "human level intelligence" in a decade after 1983. It did not, of course, succeed. But some of the spinoffs turned out to be important for future computing and self-driving. High-variance plays sometimes fail!

Heilmeier Catechism

1. What are you trying to do? No jargon.
2. How is it done today, and what are the limits of current practice?
3. What is new in your approach? Why will be successful?
4. Who cares? If you are successful, what difference will it make?
5. What are the risks?
6. How much will it cost?
7. How long will it take?
8. What are the mid-term and final “exams” to check for success?

Heilmeier, DARPA director, had a set of questions to ask if you want to fund centralized, program manager-led progress. One might also add "Why wouldn't this occur if we didn't we do it?" and "Why are we best placed to do this?"

Three arguments for doing things top-down:

- Externalities
- Coordination Failures
- Goal-specific infrastructure

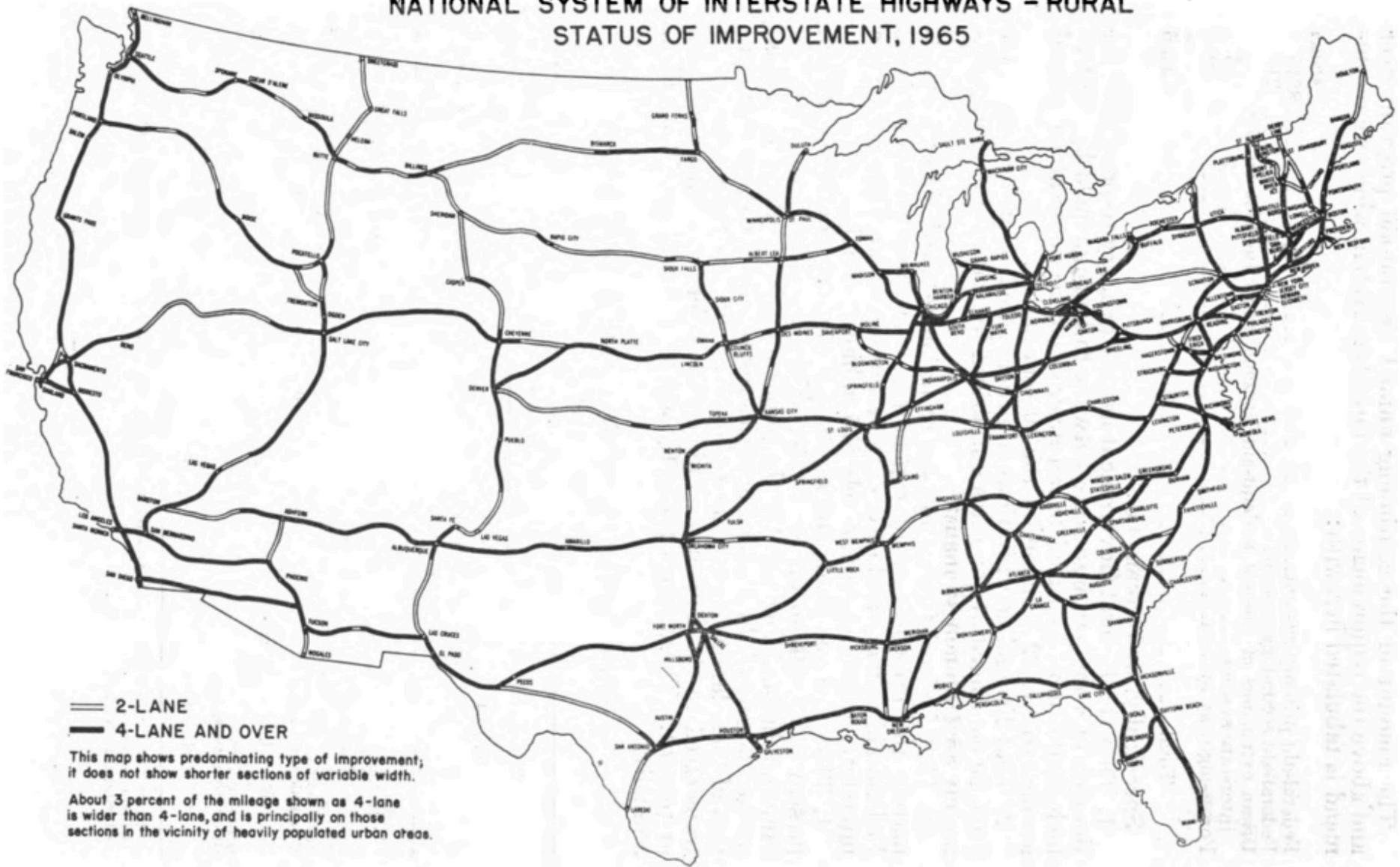
Juhász, Lane and Rodrik (2024) on industrial policy has a nice explanation of the "best possible case" for top-down projects related to growth.



One influential model, Rosenstein-Rodan's "Big Push"

Rosenstein-Rodan's "Big Push", popular in the 1950s and 1960s, argued that many things were strategic complements and involved increasing returns to scale, and also that they would not be provided in a decentralized market. No one builds the port without the factory, the factory without the road, the road without the mine, the mine without the port. Build the port and the road and the mine, and you "push" enough that the market builds the factory. That said, empirical evidence for the importance of "big push" since then is fairly weak for these effects at national level, but some evidence for very poorest people and countries.

NATIONAL SYSTEM OF INTERSTATE HIGHWAYS - RURAL STATUS OF IMPROVEMENT, 1965



Is it really true that even in these very costly, hard-to-coordinate, big spillover industries like Interstate production that centralization is the only way?



This is the 1900 US rail map. Not that different from the Interstate, not top down! And of course, witness what has happened to space innovation since we stopped running it purely as a top-down planned initiative: 100x drop in the cost of reaching space (per kg).

And three arguments against:

- Public Choice
- "Metis"/Local Knowledge
- Can we "let losers go"?

And here are the best arguments against top-down progress - there is local knowledge as we saw when we discussed Hayek and Scott, "program managers" are people too with potentially distorted incentives, and an important public choice issue is the government "throwing good money after bad" rather than letting projects die.

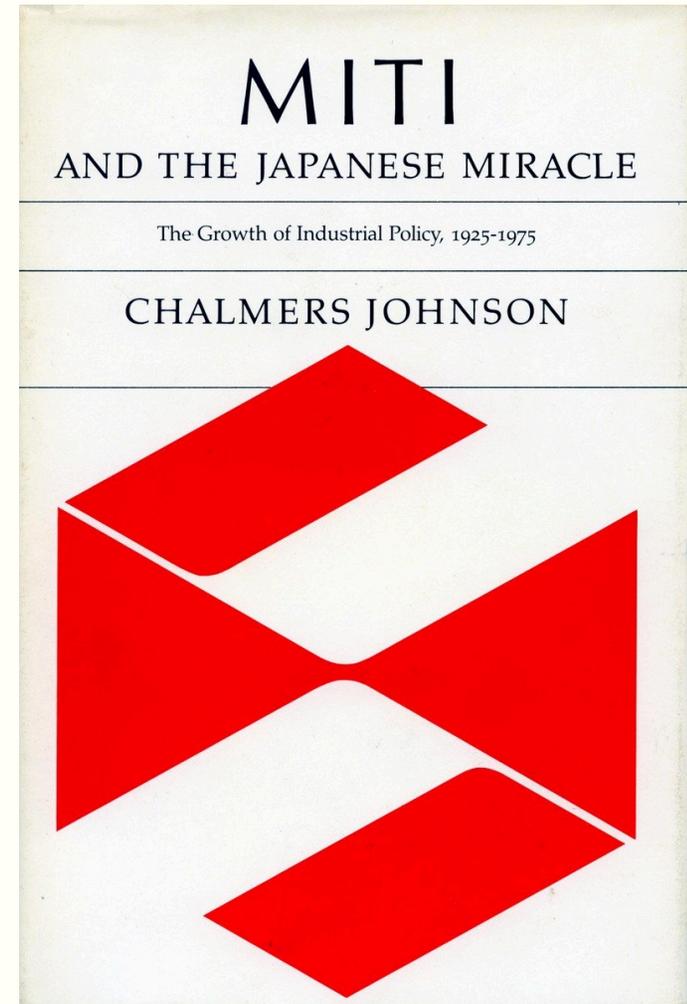


Productivity growth in Japan, esp. 1950-1990.

Nonetheless, look at places like Japan. Incredible growth! How much was due to top-down progress?

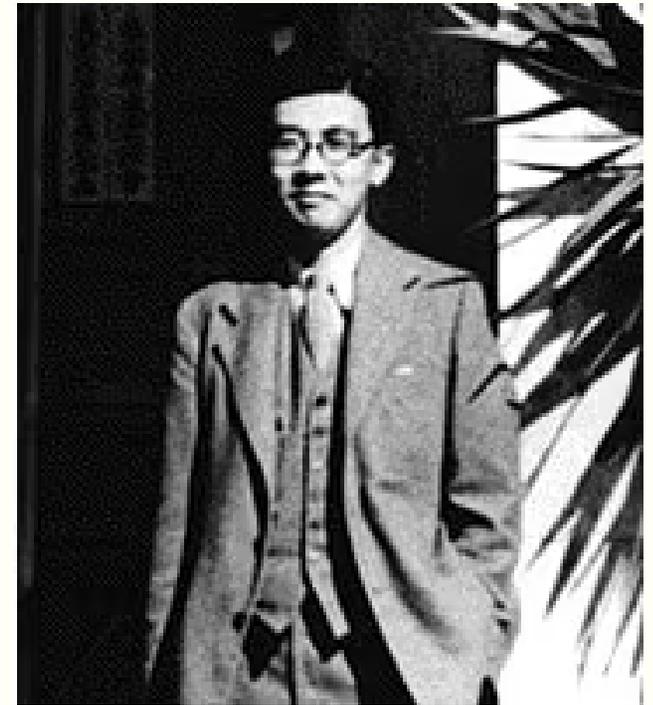
*It is an utterly self-centered
[businessman's] point of view to
think that the government should be
concerned with providing only a
favorable environment for industries
without telling them what to do.*

Sahashi Shigeru, VM, MITI



The standard view on MITI, via Wiki: "The close relationship between MITI and Japanese industry has led to foreign trade policy that often complements the ministry's efforts to strengthen domestic manufacturing interests. MITI facilitated the early development of nearly all major industries by providing protection from import competition, technological intelligence, help in licensing foreign technology, access to foreign exchange, and assistance in mergers." This is Johnson's "Developmental State".

Ibuka went to MITI at once to obtain a license for manufacturing the transistor. MITI refused point-blank: "Transistors cannot be produced so easily." How could Totsuko's small factory produce such a complex thing as the transistor?



Masaru Ibuka, Sony

Attempt by Sony to license the transistor from Western Electric to make radios was turned down! The "winners" of MITI are easy to observe, but most "losers" who didn't get permission to try economic growth are never heard from (Sony survived anyway so we know the story).

Naive model

- 1) Design incentives that favored groups receive
- 2) Select areas to get incentives
- 3) Design conditions to keep them

More effective?

- 1) Create embedded relations with favored groups
- 2) Continuously renegotiate goals/find problems
- 3) "Active program management" a la DARPA

Evans "Embedded autonomy" model for top-down policy

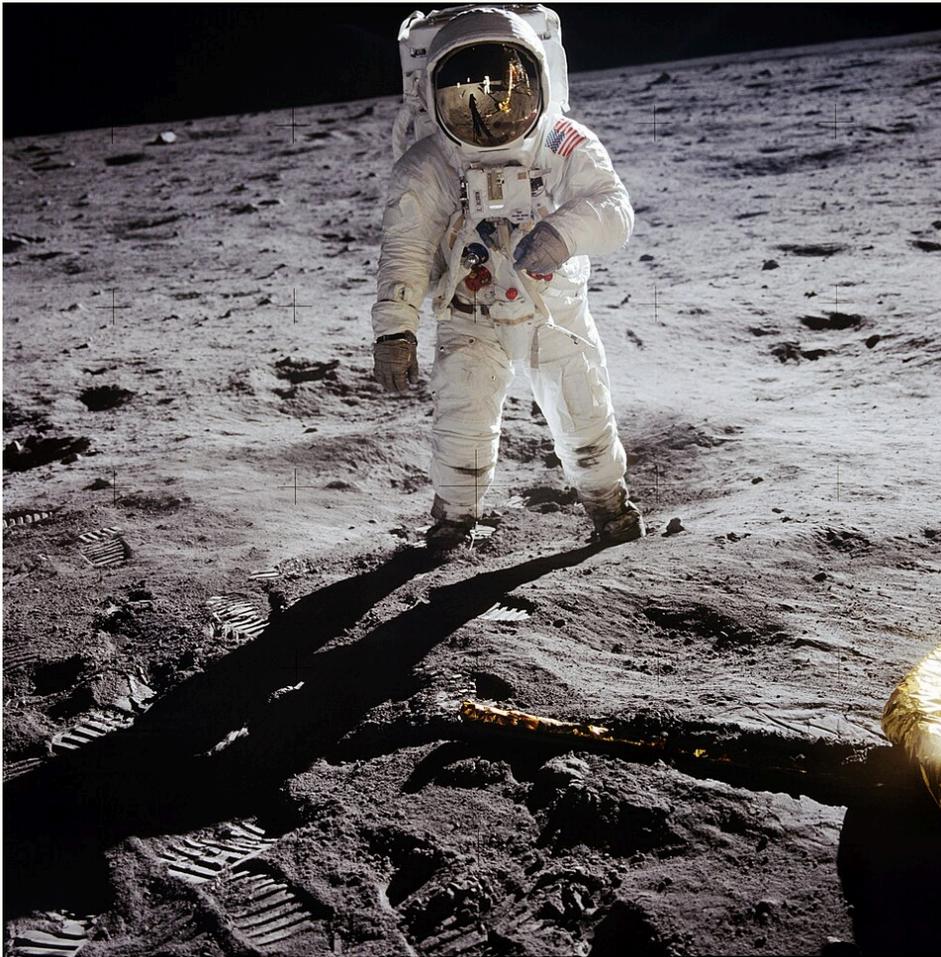
Many understandings of MITI-type programs are quite naive, and research like Evans finds particular lack of success when there isn't heavy embeddedness between topdown agencies and the orgs they work with, including an attempt to modify and adjust plans quickly. This can be seen as an attempt to balance coordination with Hayekian local knowledge (though Hayek would certainly not find it acceptable!)



"Our job" versus "your job"

A good example of this is Peru's "Executive Tables" in industries like forestry. The role of the topdown agent is not just telling others what to do, but also helping clear away red tape. See this interesting podcast from the Minister involved:

<https://www.hks.harvard.edu/centers/wiener/programs/economy/podcast/episode>



Do "big things" spill over? NASA was 4.4% of govt spending. .7% of GDP in 1960s!

NASA was huge! 0.7% of GDP today would be 200 billion dollars per year! Roughly all of Germany and France's R&D, public and private, per year...

Of course, man landed on the moon.

But what else did we get for 400k employees working on this, esp. in tech development?

90% contractors rather than direct or university hires

"Moonshot": no particularly strong short-run or long-run spillovers on growth from huge NASA spending

Sampat and Gross: long-run impact of WW2 spending big...mostly in places with pre-existing capability

Consistent with Evans' idea on "what is the purpose of the spending?" rather than growth traps - despite some famous spinoffs from the Apollo mission, at least thus far, the spillovers to other parts of the economy are fairly small. And we saw the same with WW2 research spending - it definitely helped boost already strong regions in a given technology, but didn't create much in the way of new ecosystems. That is to say, topdown progress can be useful, but the most famous examples of topdown innovation do not appear to have been uniquely successful.



SPECIAL SERIES

The Apollo 11 Moon Landing, 50 Years Later

Space Spinoffs: The Technology To Reach The Moon Was Put To Use Back On Earth

JULY 20, 2019 · 8:42 AM ET

By Jacob Margolis, KPCC, Christopher Intagliata

The Apollo program was gigantic.

The U.S. government spent roughly \$26 billion (about \$260 billion in today's dollars, [according to one estimate](#)) between 1960 and 1972 to hire contractors and subcontractors who employed hundreds of thousands of people to create and improve on technology that led us to the moon and back.

Article lists

- freeze-dried food
- cooling suits
- PBI for fireproof clothing
- fly-by-wire
- "demand for integrated circuits"

Many articles like this, but is that 0.7% of GDP worth of progress? So Kantor/Whalley result maybe not surprising.

Let's go even bigger

政府引导基金 (zhengfu yindao jijin - government guidance funds)



GGFs are "government-guided", goal-specific VCs, essentially, with private investment. Integrated Circuit Fund being a particularly notable one, 20bln USD raised vs. 55bln total at huge VCs like Andreessen Horowitz and Sequoia.

Almost 2000 GGFs...

but 2/3rd hadn't made an investment

Chinese investment and economic planning often
highly decentralized, uses market discipline



Northvolt files for bankruptcy in blow to battery hopes

Company failed to secure a lifeline for its battery-cell business in a faltering market for electric vehicles



Bloomberg News
Irene Garcia Pérez and Kati Pohjanpalo

Published Nov 21, 2024 2 minute read [Join the conversation](#)



CATL vs Northvolt - 内卷 + competition vs. "picking winners"

As in, e.g., Dan Wang's "Breakneck", Chinese competition is very intense. Difference between topdown support for battery tech in China vs. Canada/Europe was that in China, dozens of regions competed to support local champions, failures went out of business, then CATL grew. But Northvolt, prior to bankruptcy, received extensive support to become a "government champion" without the necessary frequent-consultation, adaptation, and willingness to "let losers go".

So, a survey. You are asked by a friend (or policymaker!) "how important are large top-down governmental or international initiatives to progress?"

Let's vote: 1-5, where 1 is "not at all" and 5 is "I imagine the most important factor we'll discuss this term". We'll keep track of these votes as we go!

2.87/5. Comments: 1/5 "The successes are well-known from top-down attempts at progress, the failures are forgotten." 5/5 "We have seen this work in many cases, including Airbus, the French nuclear industry, the TGV system, Japan, and so on."

Next Week

Conclusion

How should we think about progress? How do we create a culture that values it? Indeed, should we value it more or less than we do now? And of course, your presentations!