Industrial Research Labs Powered the Golden Age of U.S. Innovation

Analysis of 1.6 million patents finds that early-20th-century research labs and professional engineers sparked a surge in novel inventions and reshaped who innovates—and where.

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CAMBRIDGE, MA - The rise of industrial research labs fundamentally reshaped the U.S. innovation system in the early 20th century by enabling large-scale, science-based, team-oriented invention, according to new research from Harvard's Growth Lab and the Complexity Science Hub (CSH). The findings, published in the journal *Research Policy*, suggest that new technologies, such as AI-powered digital collaboration tools, could play a similar role today by reducing coordination costs and potentially reshaping how collective invention is organized.

The paper, authored by Matte Hartog, Andres Gomez-Lievano, Ricardo Hausmann, and Frank Neffke, documents how the United States transformed from an agricultural economy to the frontier in science and innovation between the mid-19th and mid-20th centuries. The authors digitized roughly half a million pages of historical patent yearbooks covering 1.6 million patents and linked these to census records and surveys of industrial research laboratories. This unique dataset allowed them to track inventors' occupations, collaborations, organizational affiliations, and the technological novelty of patents.

"The nature of invention changed substantially, and patents increasingly combined more and newer technologies," said Ricardo Hausmann, co-author, director of the Harvard Growth Lab, and professor at the Harvard Kennedy School. "The innovation system was transformed from one centered on craftsmen, laborers, and family ties, to one dominated by professional engineers working in organized teams inside firms."

This research demonstrates the power of modern data science tools to unlock information contained in historical documents. "These data are incredibly rich and provide a new quantitative lens on a tremendously important episode in U.S. history," added Matte Hartog, co-author and researcher at the Growth Lab.

The data reveal many stylized facts about the shift in the U.S. innovation system:

- At the level of inventions, the 1920s mark a precipitous take-off of inventions that list radically new combinations of technologies.

- At the level of inventors, they observe lengthening learning curves, a rapid rise of engineers, a greater reliance on academic literature, and the emergence of academic patenting.

- At the meso-level, there is a sudden shift to teamwork that is no longer coordinated through family ties but through organizational ties within firms and labs.

- At the macro level, invention reconcentrates in large cities, especially on the East Coast and in the Rust Belt, and the new innovation system exhibits drastically lower participation rates among women and foreign-born inventors.

“Over the last decade, we have seen a revival of R&D labs driven by tech giants, like Google, Facebook, and Amazon,” said CSH’s Frank Neffke, co-author and Professor of Economic Transformation and Complexity at the Interdisciplinary Transformation University Austria. “As in much of the 20th century, when behemoths like Bell Labs not only patented, but also pushed the scientific frontier, spawning several Nobel prize winners, important breakthroughs in AI are nowadays driven by industrial, not academic labs.”

The researchers propose future examination of whether today’s organized corporate research once again promotes radical versus incremental innovation, to what extent women and immigrants participate, and how it may change the geographic concentration of innovation.

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About the Complexity Science Hub
The Complexity Science Hub is addressing some of society’s biggest challenges by extracting meaning from the enormous amounts of data representing our planet in its various dimensions: the economy, human migration, health and disease, climate crisis, social values, urban development, conflict, and more.

About the Growth Lab
Housed at Harvard Kennedy School and led by Ricardo Hausmann, the Growth Lab pushes the frontiers of economic growth and development policy research, collaborates with policymakers to design actions, and shares our insights through teaching, tools, and publications, in the pursuit of inclusive prosperity.

About the Transforming Economies Lab
The Transforming Economies Lab studies how individuals, firms, cities, and countries learn to do new things. It investigates how workers change careers, how firms diversify, how regions transform their economies, and how global forces such as migration and investment reshape the capabilities for transformation in local economies.