

# Artificial Intelligence for Supply Chains & Resource Allocation

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Artificial Intelligence for Medical and Public Health Preparedness and Response: Opportunities and Challenges  
NASEM Forum on Medical and Public Health Preparedness for Disasters and Emergencies



"Technology is neither good, nor bad; nor is it neutral."

—MELVIN KRANZBERG





The term “artificial intelligence” means a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments.

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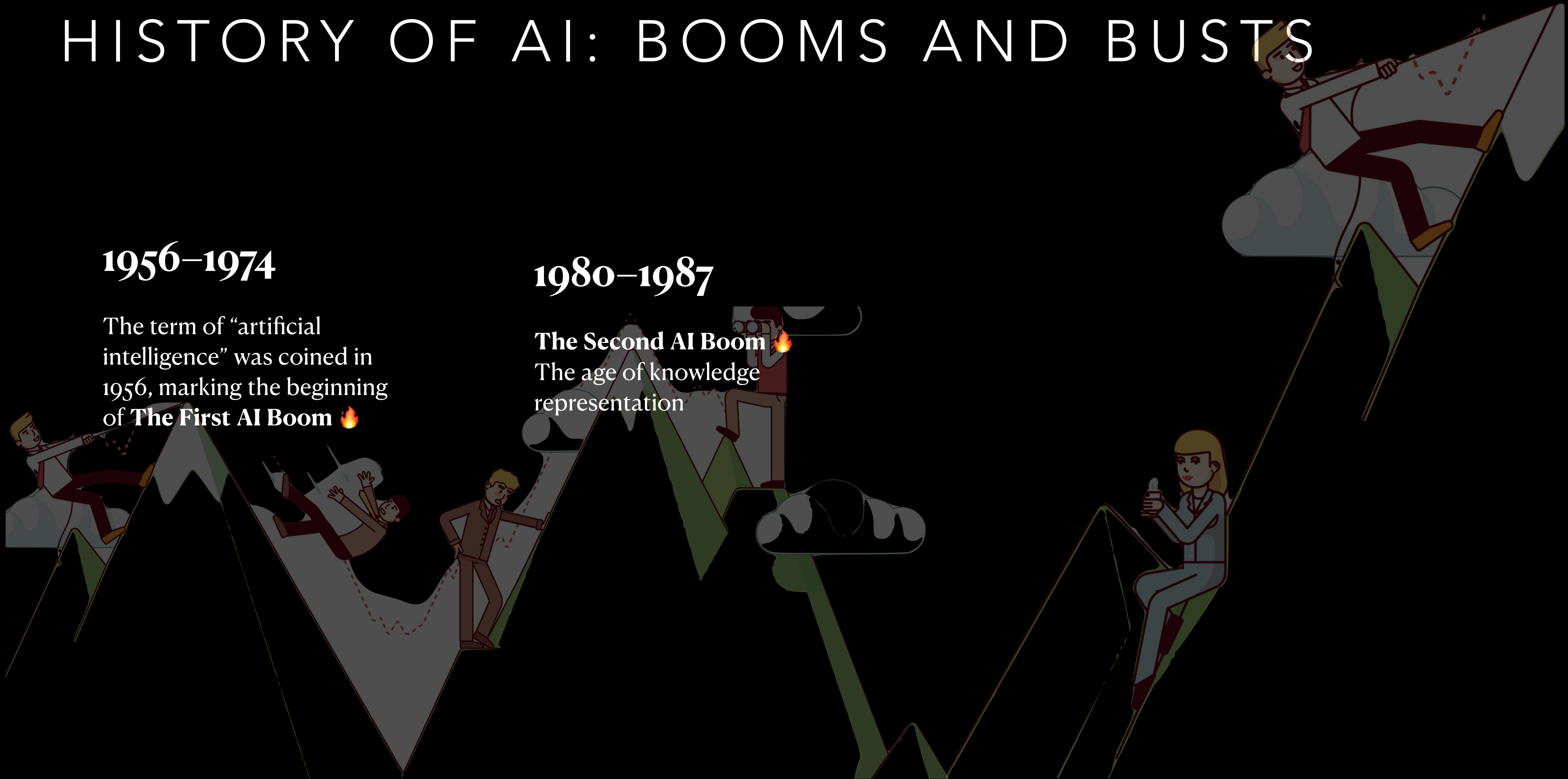
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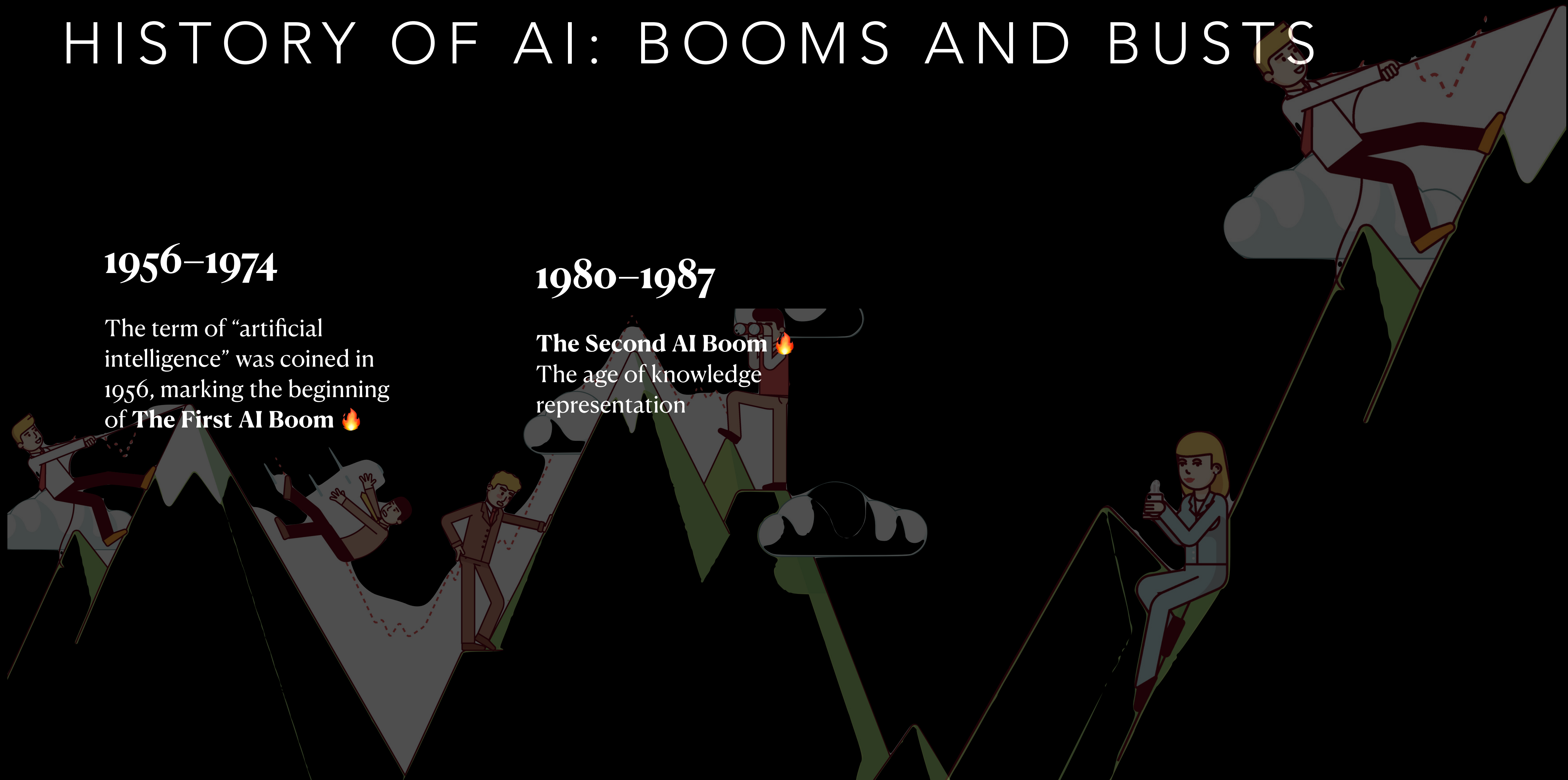
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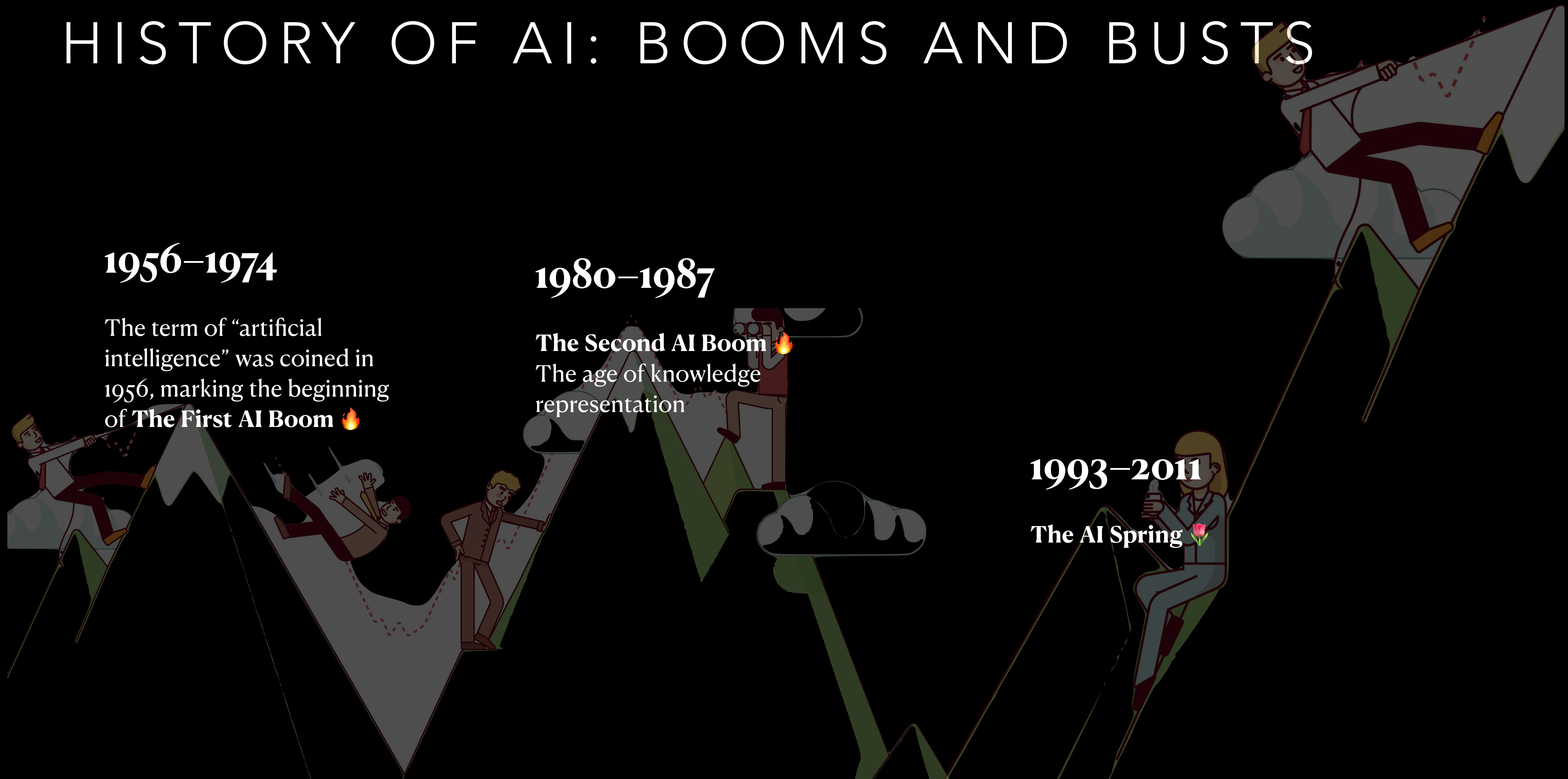
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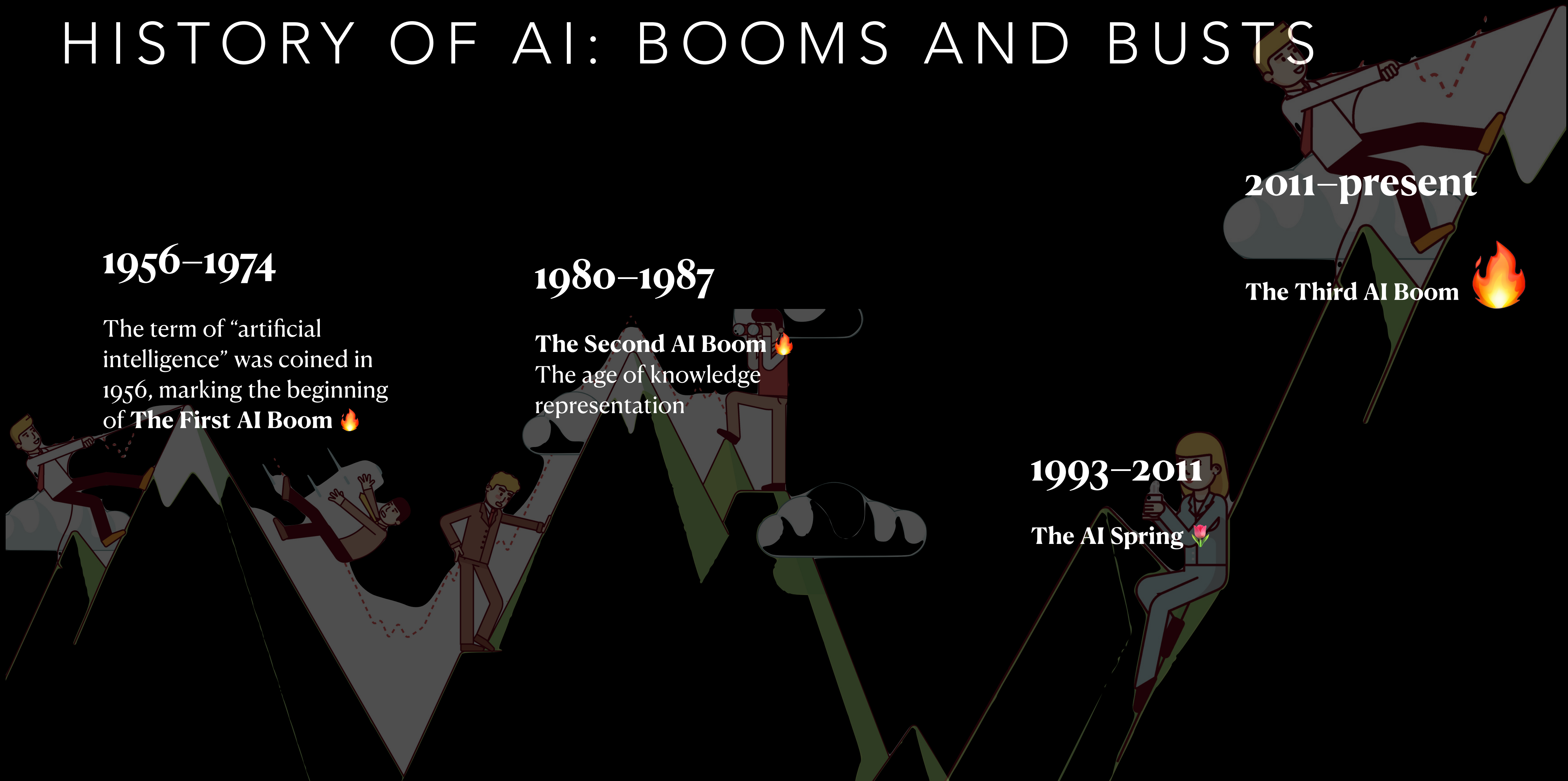
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- Incorporating AI into workflows



# DEFINING SUPPLY CHAINS

**A supply chain is the flow of information, money, people, and resources connecting supply and demand**





# HISTORY OF SUPPLY CHAINS

**1750S-1840S**

**First Industrial Revolution**  
Invention of factory system

**1920S-1960S**

**Golden Era of Big Business**

- World Wars I & II
- Invention of the computer
- Birth of Artificial Intelligence

**1990S-2010S**

**Third Industrial Revolution**

- The birth of global supply chains
- Artificial intelligence and data analytics
- Internet and mobile technologies

**1850S-1910S**

**Second Industrial Revolution**

- Mass production/ transport
- Rise of modern manufacturing (Carnegie, Ford, Sloan)
- Scientific management (Taylorism)

**1970S-1980S**

**Reinventing Manufacturing**

- Lean
- TQM (six sigma)
- Birth of the term "Supply Chain" (in 1982)

**2020-present**

**Global Supply Chain Transition**

- Incorporating AI into workflows
- Environmental, Social, & Governance Issues
- Supply chain resilience



# THE A.I. LANDSCAPE IN THE SUPPLY CHAIN WORLD

- Simple machine learning (ML) models: mature and powerful, but limited to **structured** data and require intensive feature engineering
- "Practical A.I.": giving machines the ability to **see, hear, and speak**; relatively mature, data-efficient, and easy to develop and deploy
- Generative A.I.: Not production ready and requiring human intervention for high-stakes scenarios; can help develop ML and "practical A.I." solutions



# AI for Supply Chains

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Let's start with generic drugs



# Drug Shortages Stem From Quality Problems in Indian Factories

Eye drops, chemotherapy drugs raise concerns about generic products

The FDA said that it visited India in February to discuss drug quality with regulators and manufacturers and that Congress should require drug manufacturers to be more transparent about product ingredients.

Congress should give the FDA authority to routinely conduct surprise overseas inspections and compel generic manufacturers to be more transparent about their supply chains, said Tinglong Dai, a professor of operations management and business analytics at Johns Hopkins University.

“You’re buying these products at your own risk,” he said.

**THE WALL STREET JOURNAL.**

June 19, 2023

# 62%

Percentage of drug shortages caused by **quality issues**.

Data source: FDA (2013–2017)



6%

Percentage of ~3,000 foreign drug manufacturing facilities inspected  
by the FDA in 2022. Data source: Pro Publica

# IT'S NOT JUST FOREIGN MANUFACTURERS

## FDA Probes Cause of Failed Johnson & Johnson Covid-19 Vaccine Batch



J&J said it detected the problem while making quality checks at a plant belonging to contract manufacturer Emergent BioSolutions. PHOTO: JIM LO SCALZO/EPA/SHUTTERSTOCK

**THE WALL STREET JOURNAL.**

April 1, 2021



# AND DON'T FORGET INFANT FORMULAS

The Food and Drug Administration investigated reports that as many as nine children have died since early 2021 after consuming baby formula produced at an Abbott Nutrition plant in Michigan — seven more than previously acknowledged by the FDA, according to newly released documents.

**The Washington Post**

June 10, 2022

# ROLE OF AI IN GENERIC DRUGS SUPPLY CHAINS

- The FDA's foreign (and domestic) inspection program is poorly funded, far too infrequent, and increasingly ineffective
- “Practice A.I.” solutions are mature, data-efficient, and low-cost, with applications in virtually every industry
- AI can help easily catch process violations before bad batches are created
- It will be harder to argue against not requiring a consistent set of AI tools in the manufacturing process on an ongoing basis



# AI for Resource Allocation

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Let's think about COVID-19 vaccination, a stunning  
success from a supply chain perspective



# January 13, 2020

The date on which Moderna finalized the design of its COVID-19 vaccine,  
**2 days** after the genetic sequence of the novel coronavirus was released

COVID-19 vaccination is proof that a largely  
**domestic** medical supply chain is possible



# HOW WE DISTRIBUTED VACCINES...



# WAYS A.I. CAN HELP VACCINE DISTRIBUTION



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- Connecting vaccination progress with infection control ("How do we know it's working?")
- Fighting misinformation through transparent safety monitoring and disclosure



MAY AI BE WITH YOU



MAY HEALTH BE WITH YOU



# THANK YOU!

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