

METALS PROCESSING LABORATORY

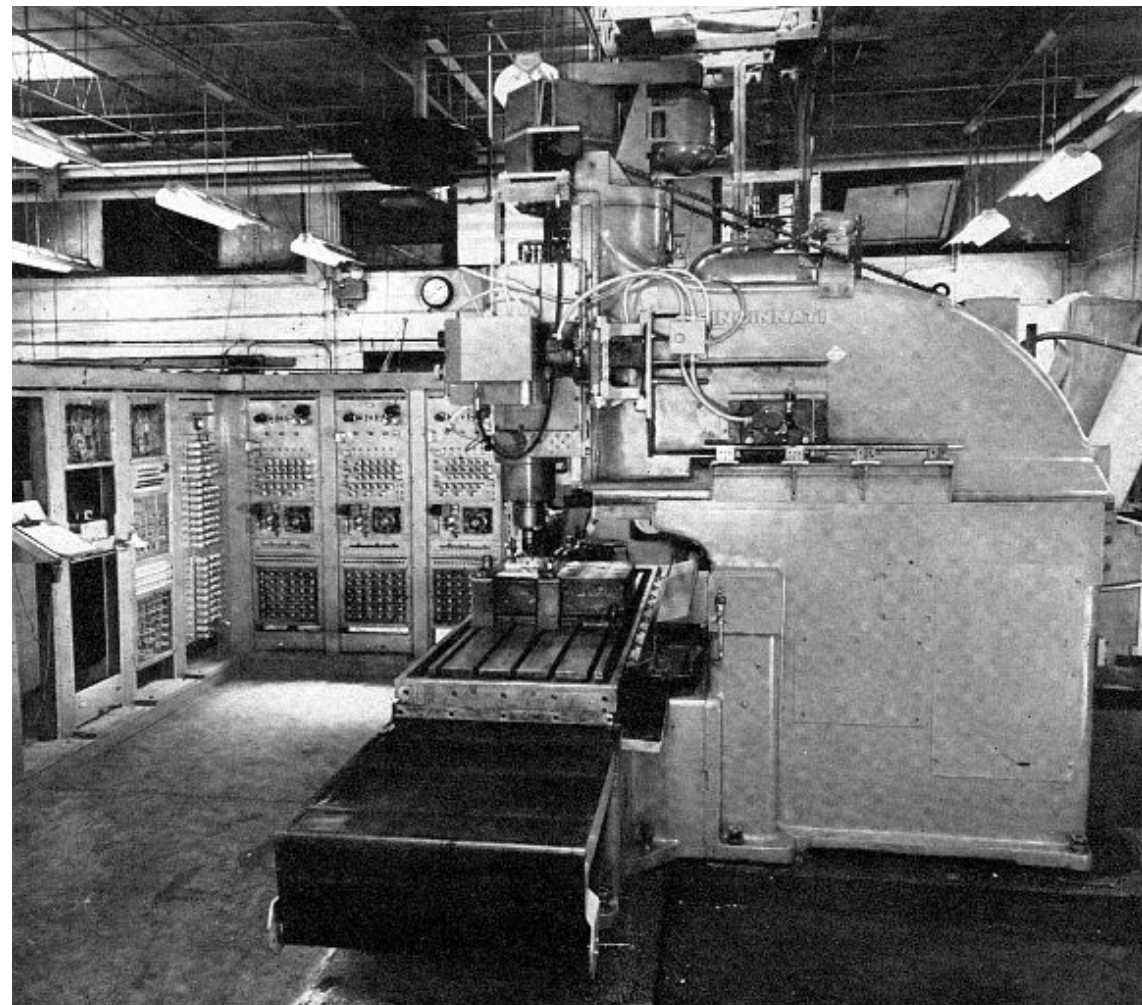
# Manufacturing at MIT

## 2022 and Beyond





# A history of manufacturing at MIT



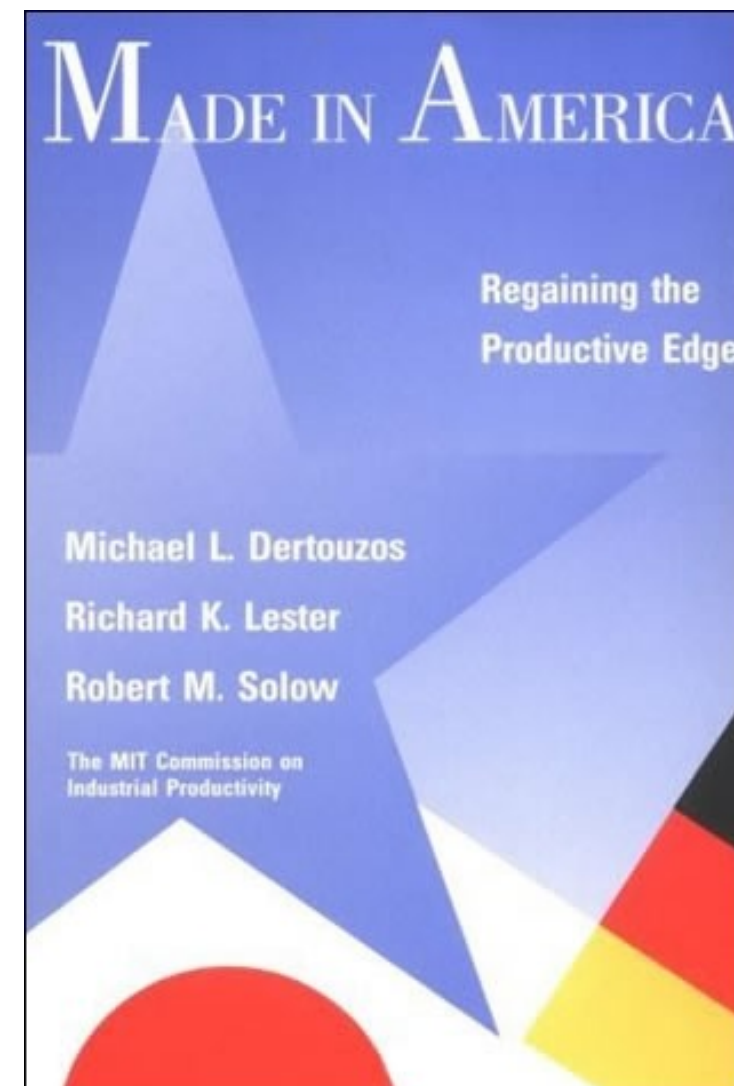
CNC machining (1955)



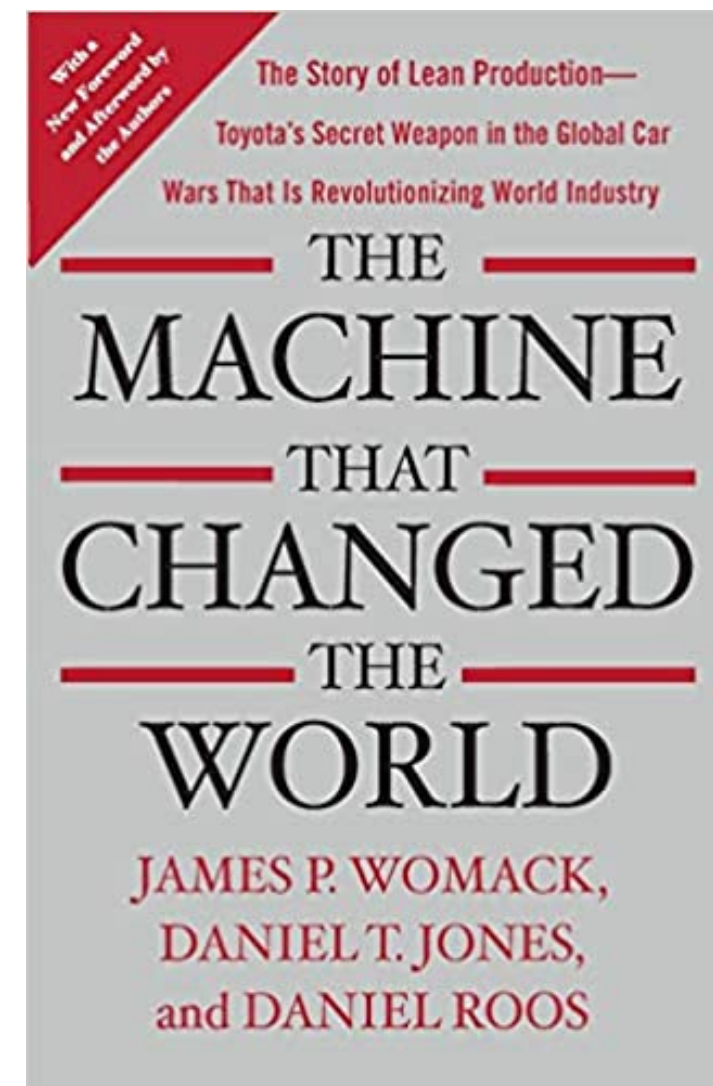
3D printing (~1990)



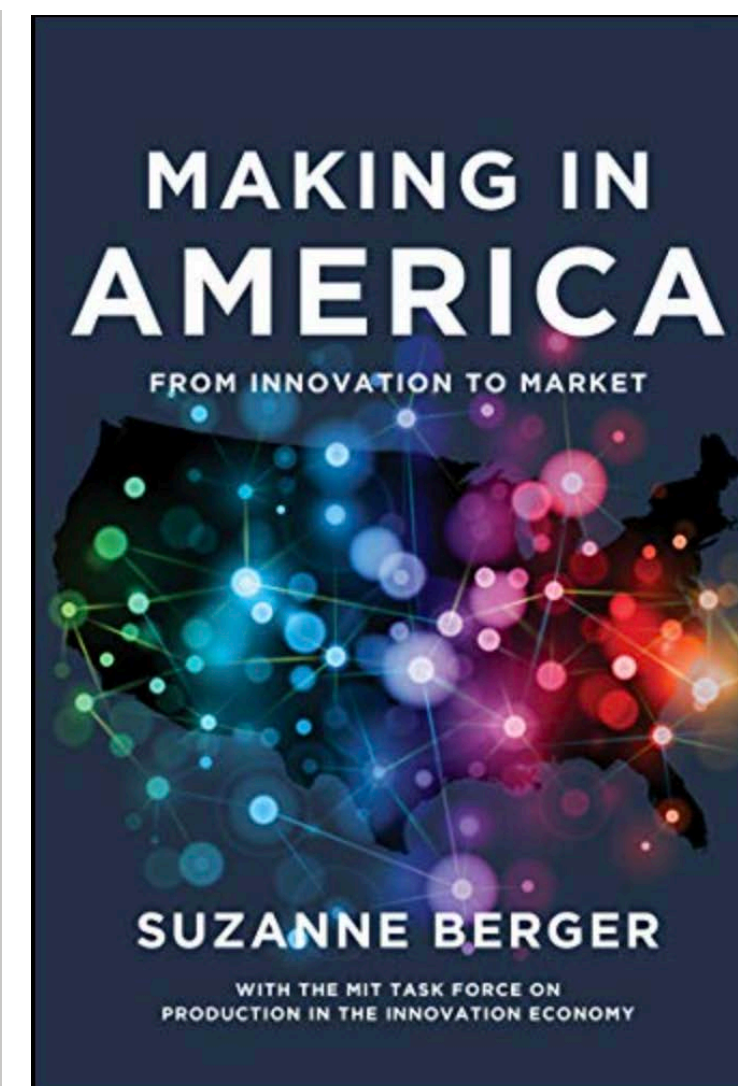
MIT startup Ginkgo Bioworks



1989



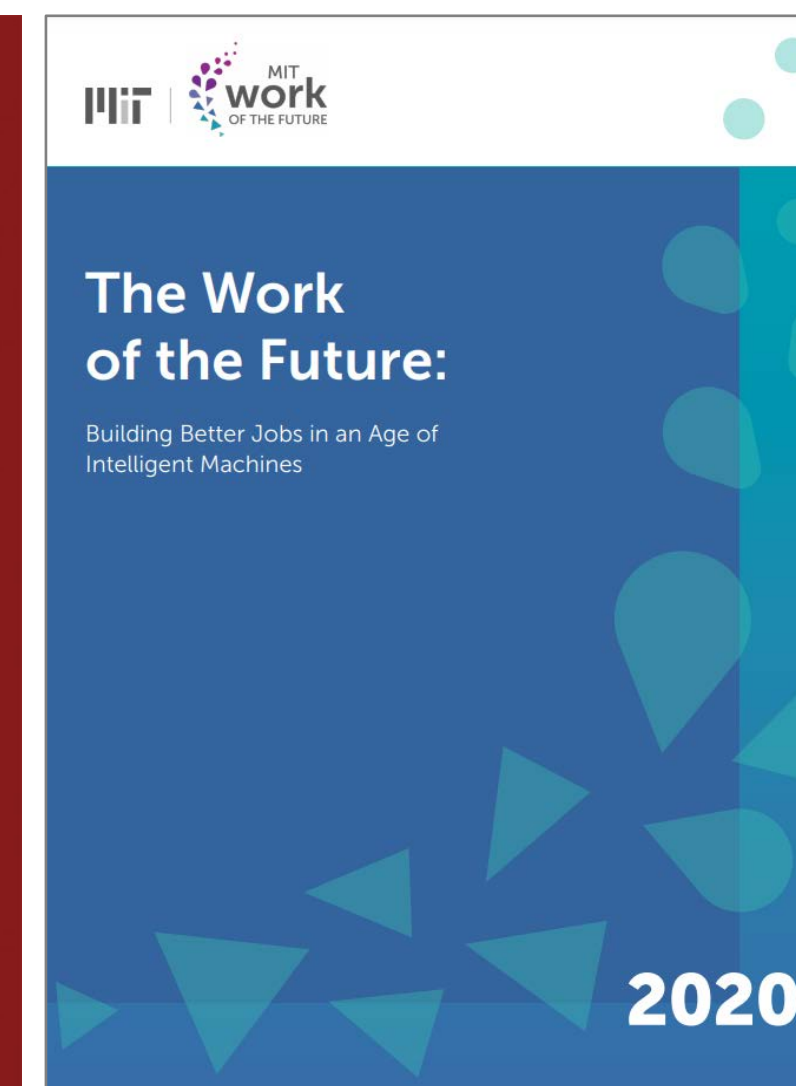
1991



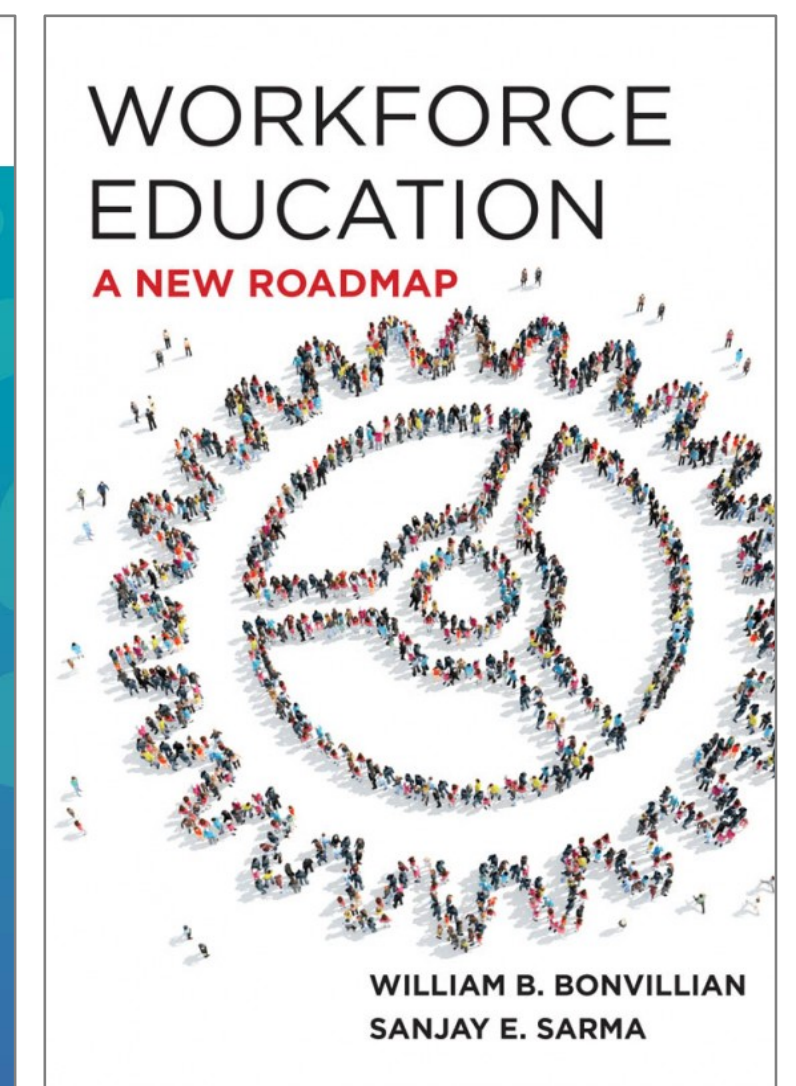
2013



2014



2020



2021





## Securing Defense-Critical Supply Chains

An action plan developed in response to President Biden's Executive Order 14017


February 2022



Tesla Gigafactory Texas (“largest factory building by volume”, 2022)  
*The factory is the product - the machine that makes the machine (Elon Musk)*

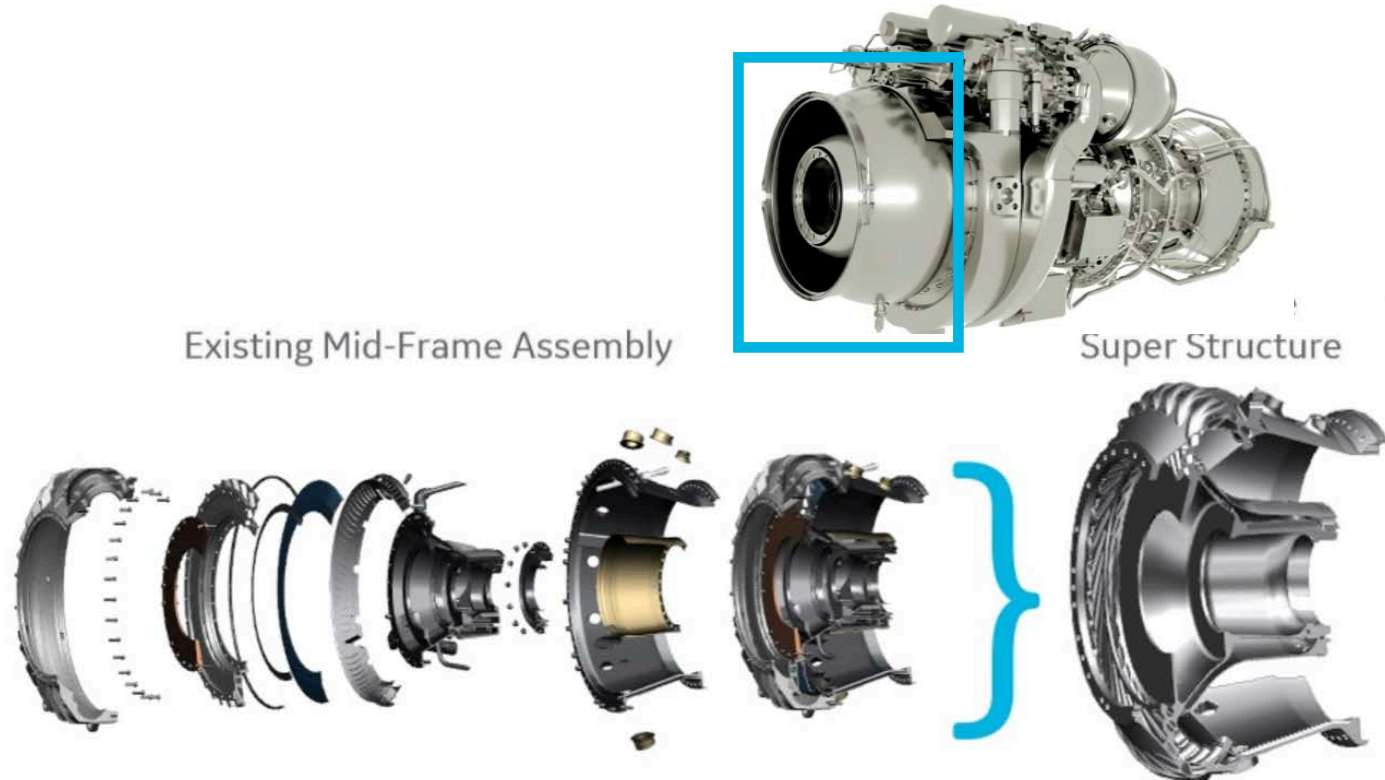
 **has a plan.**

**We've been carbon neutral since 2020.  
By 2030, all our products will be too.**

[See the plan](#) 



# Technology frames the frontier of manufacturing



Existing Mid-Frame Assembly

Super Structure

300 → 1 Parts


7 → 1 Assemblies

50 → 1 Sources

30% Lighter  
60% Cheaper

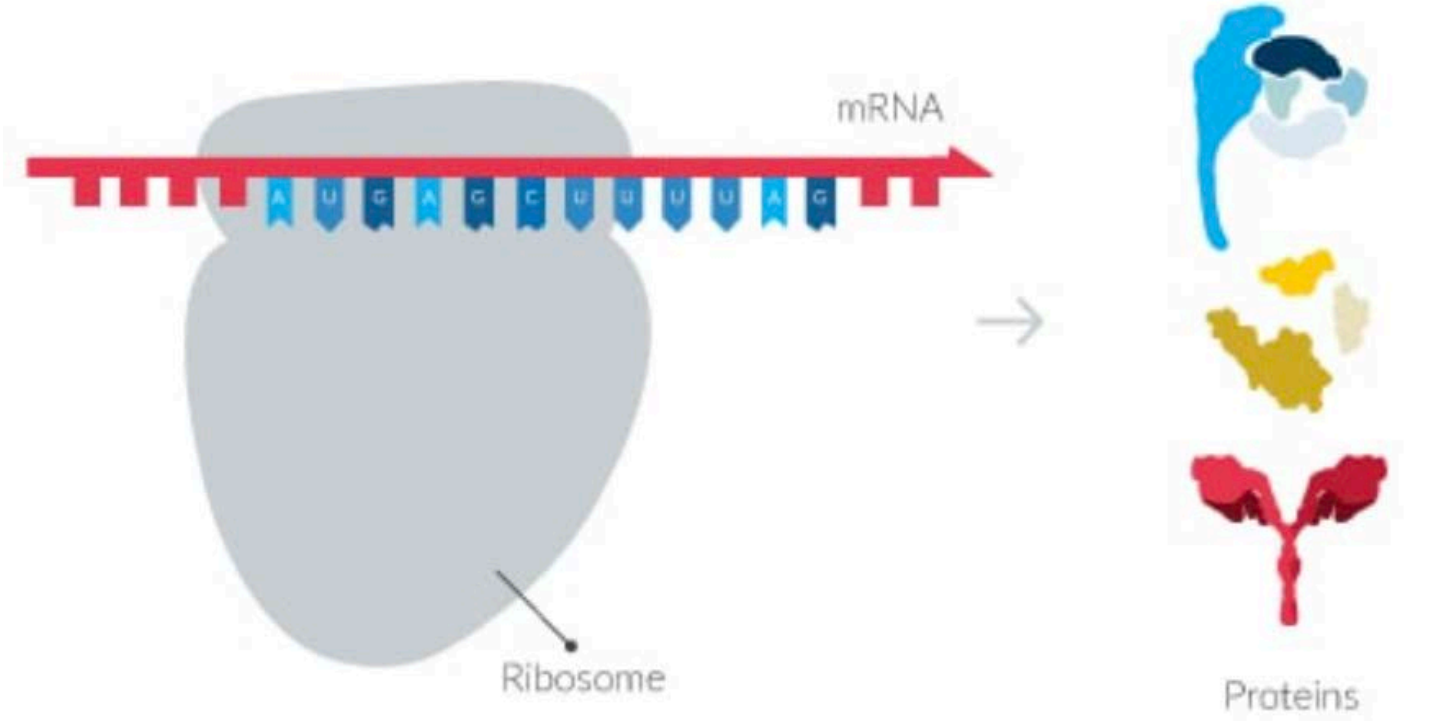
3D printing

Detailed description: This diagram illustrates the benefits of 3D printing for a jet engine component. It shows an 'Existing Mid-Frame Assembly' on the left, which is a complex assembly of many parts. On the right, a 'Super Structure' is shown as a single, integrated part. A blue bracket indicates that the super structure is 30% lighter and 60% cheaper than the assembly. Below the parts, statistics show a reduction from 300 parts to 1, 7 assemblies to 1, and 50 sources to 1.



Flexible automation

Detailed description: A photograph of a large industrial machine with multiple workstations and robotic arms, representing flexible automation in manufacturing.



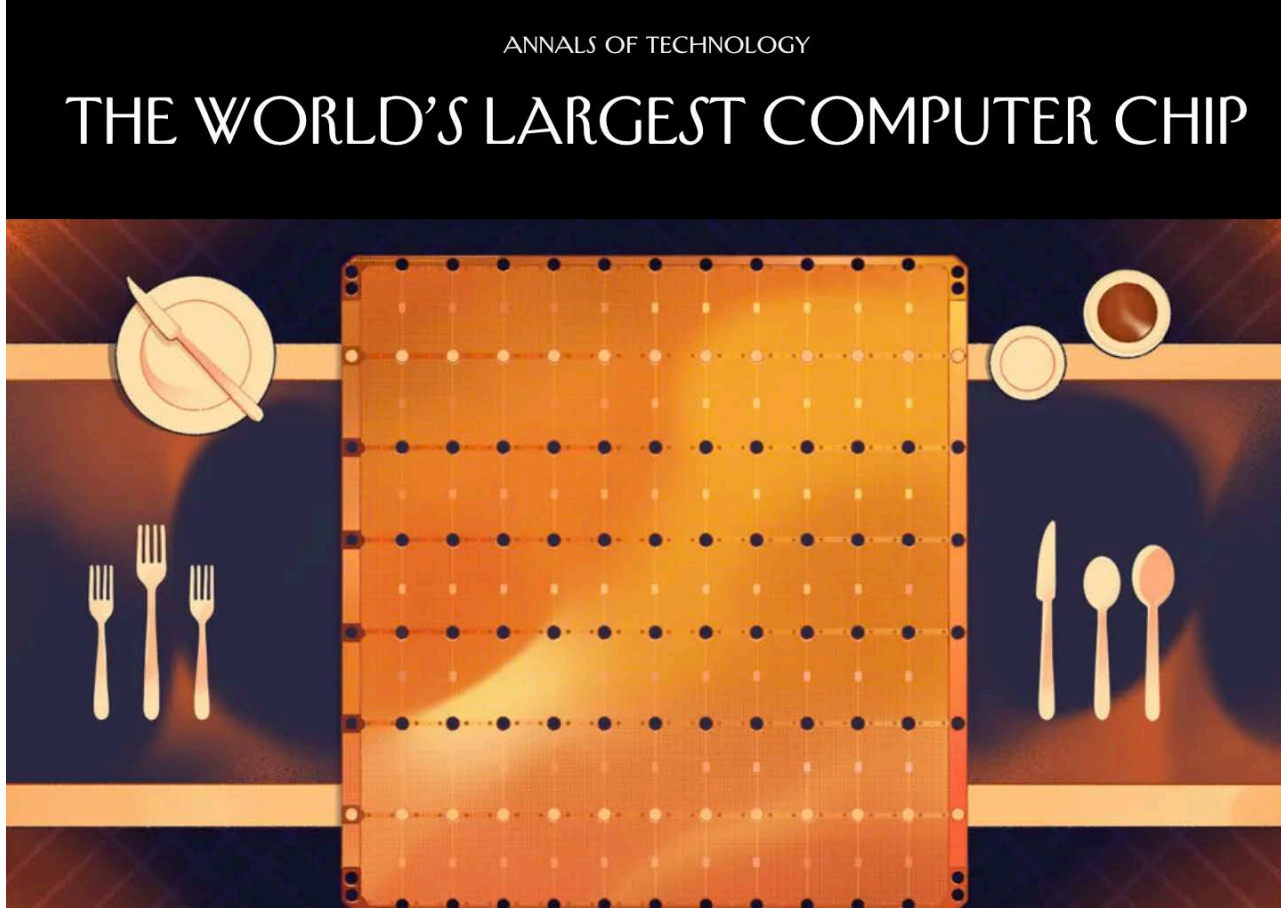
mRNA

Ribosome

Proteins

Bio and cell-based manufacturing

Detailed description: A diagram showing the process of bio and cell-based manufacturing. It starts with a red arrow representing mRNA with the sequence AUGAACCUCUUUUGC. This mRNA is processed by a grey ribosome, which then produces various colored proteins (blue, yellow, red).



ANNALS OF TECHNOLOGY

THE WORLD'S LARGEST COMPUTER CHIP

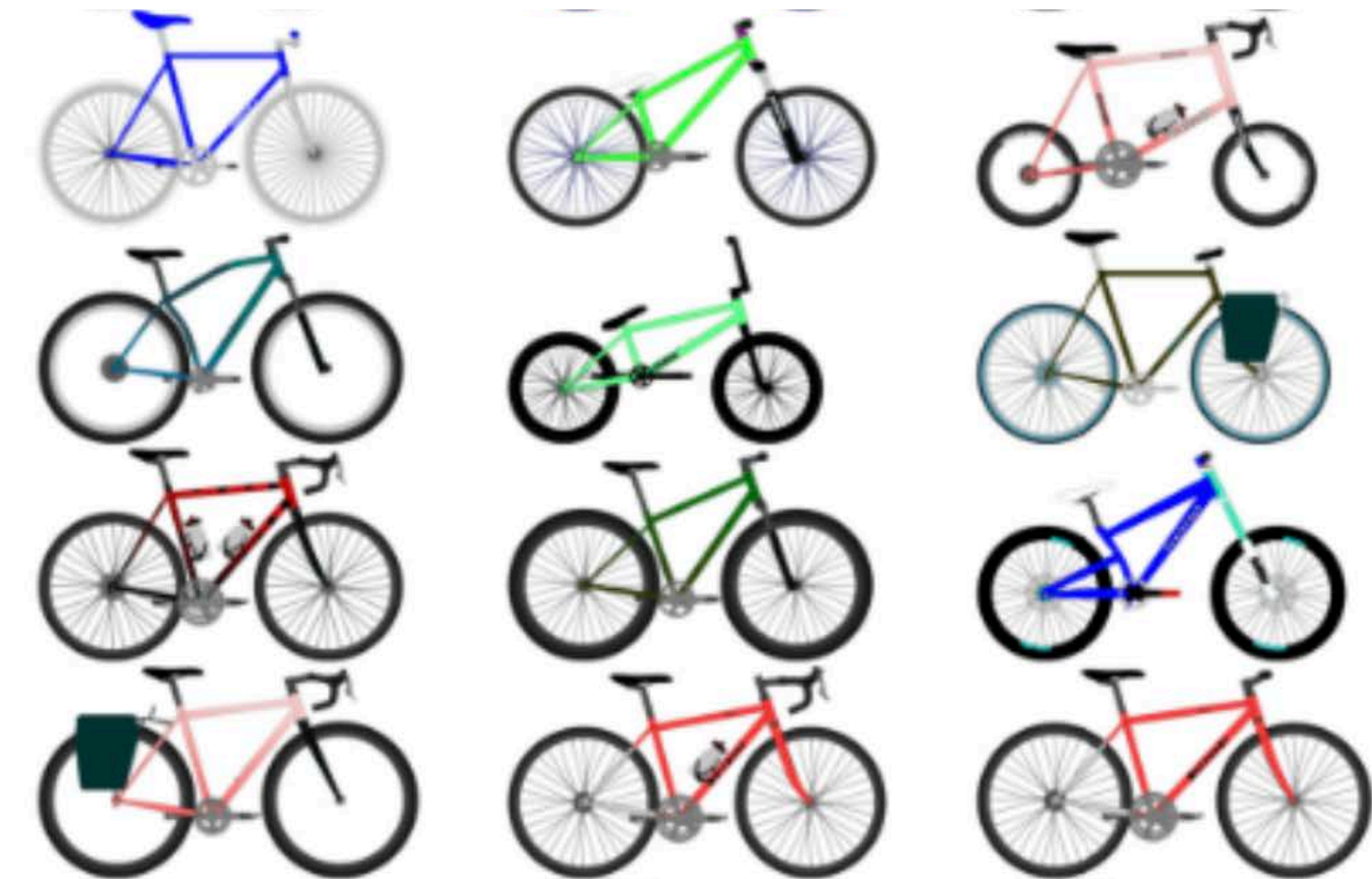
Electronics and photonics

Detailed description: A photograph of a large, square, orange computer chip. The chip is surrounded by icons of a plate with a knife and fork, and a set of cutlery, suggesting its size relative to everyday objects. The text 'ANNALS OF TECHNOLOGY' and 'THE WORLD'S LARGEST COMPUTER CHIP' is visible at the top.



Materials and recycling

Detailed description: A photograph of a large white sack filled with a pile of discarded electronic devices, such as old mobile phones and small circuit boards, representing materials and recycling.



Design and simulation

Detailed description: A grid of 12 different bicycle designs, each with a unique color scheme and frame shape, illustrating the results of design and simulation.



# 1: Charting the next generation of manufacturing

*Supported by Schmidt Futures*

- What are the technical and economic limits of flexible and digital manufacturing?
- Will these technologies redistribute value among firms, and enable more agile supply chains?
- What could restore high-value manufacturing in the US?

## Four research thrusts

Technology  
scaling laws

Software  
infrastructure

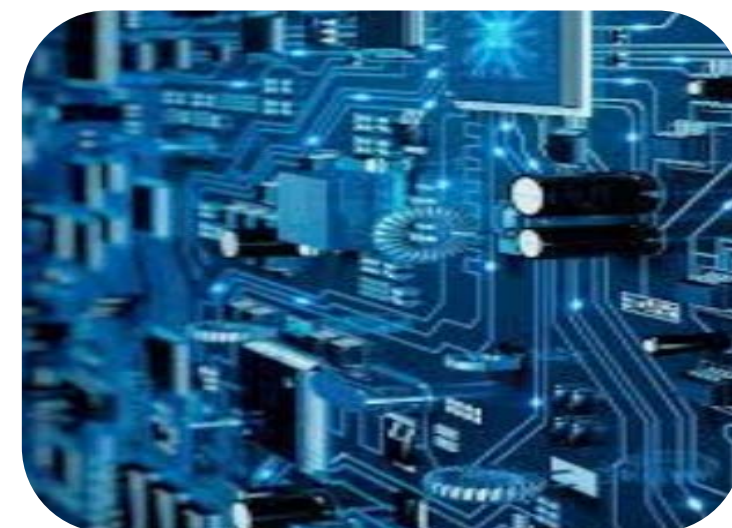
Economic  
models across  
scales

Workforce and  
organization  
needs

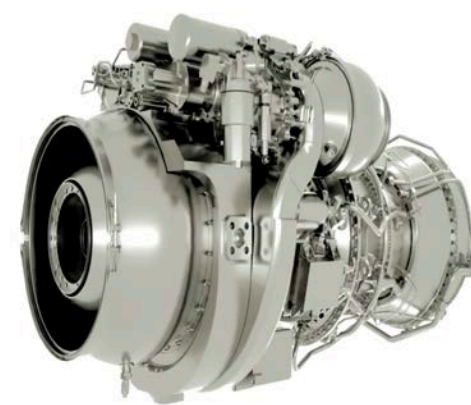
## Five contexts



Critical supplies



Advanced  
electronics



Low-volume  
complex systems



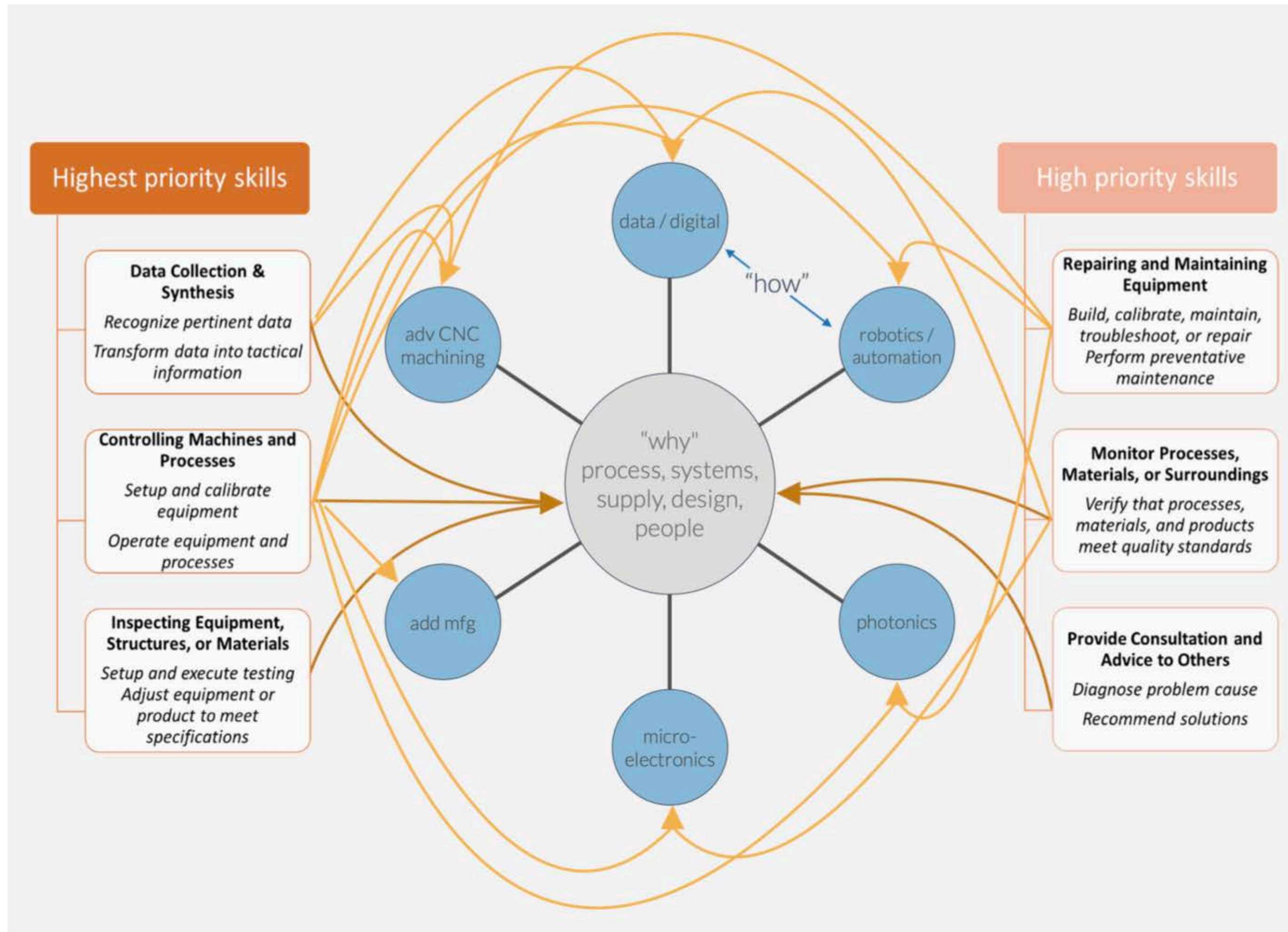
Batteries and  
electric vehicles



Mass-produced  
consumer goods



# 2: Advanced manufacturing technician training



- “Technologist” = technician-engineer hybrid
- 9-month training program
- Over 190 company commitments to internships and work-learn opportunities
- Plan to place 500+ technologists in New England Region

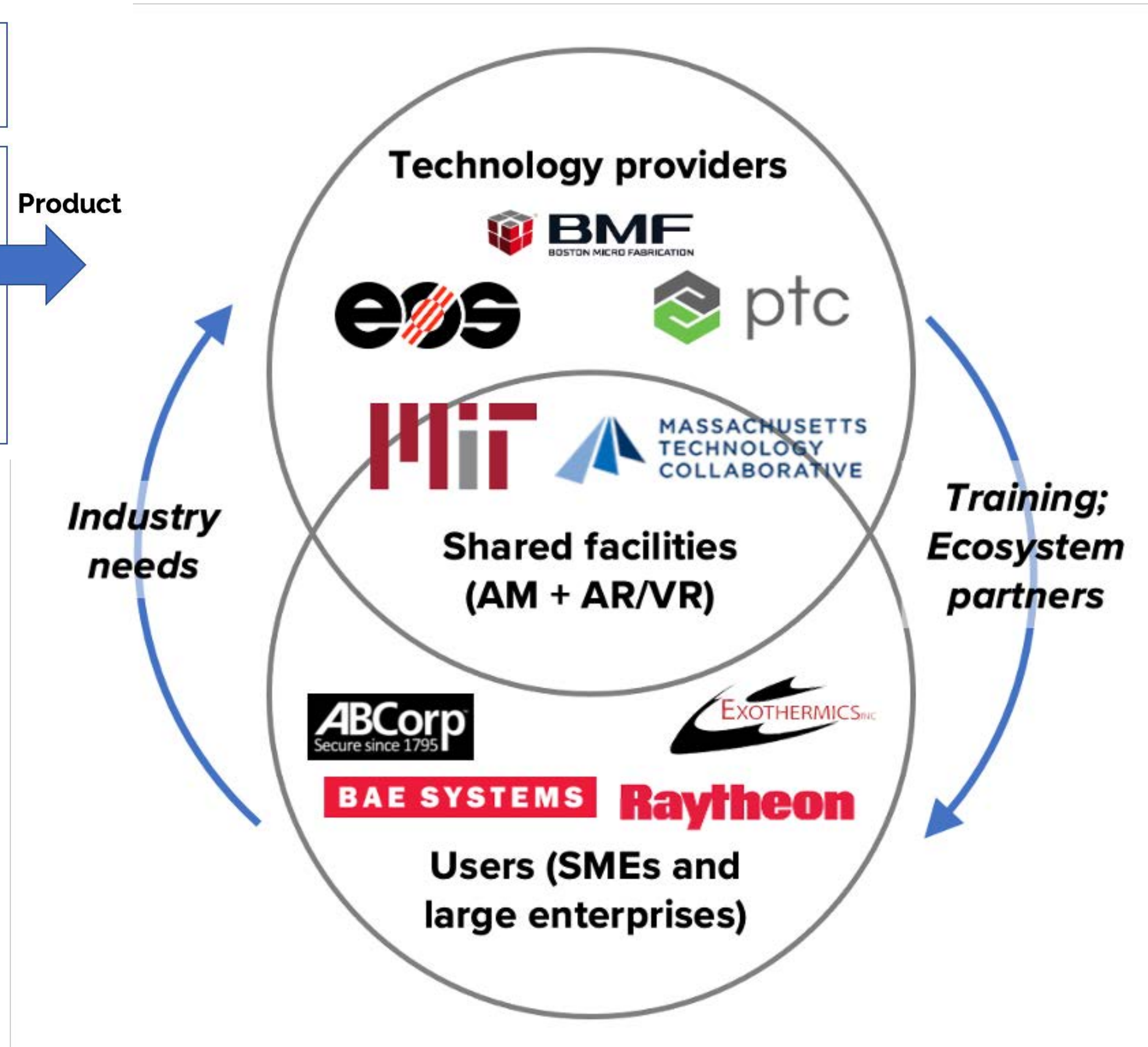
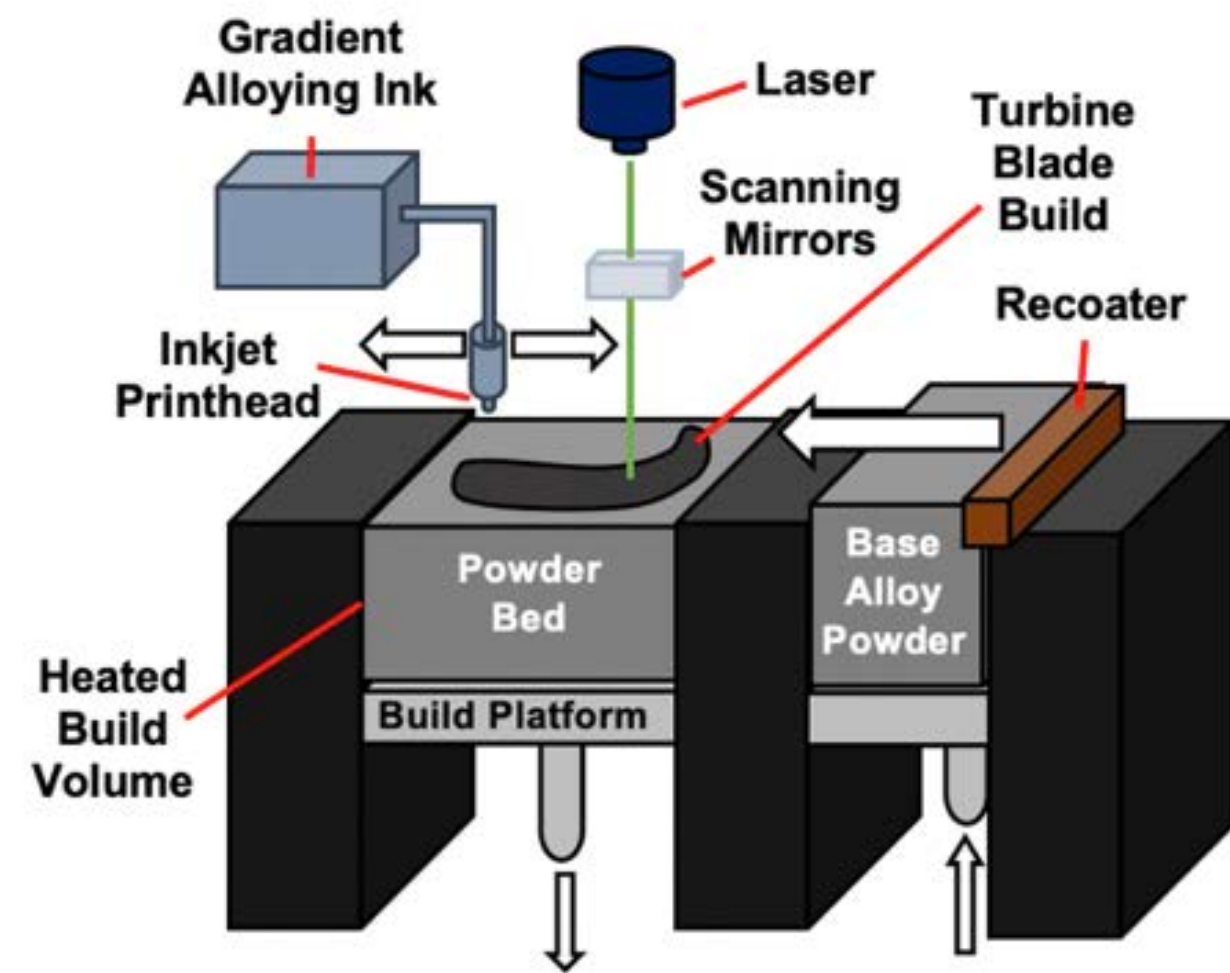
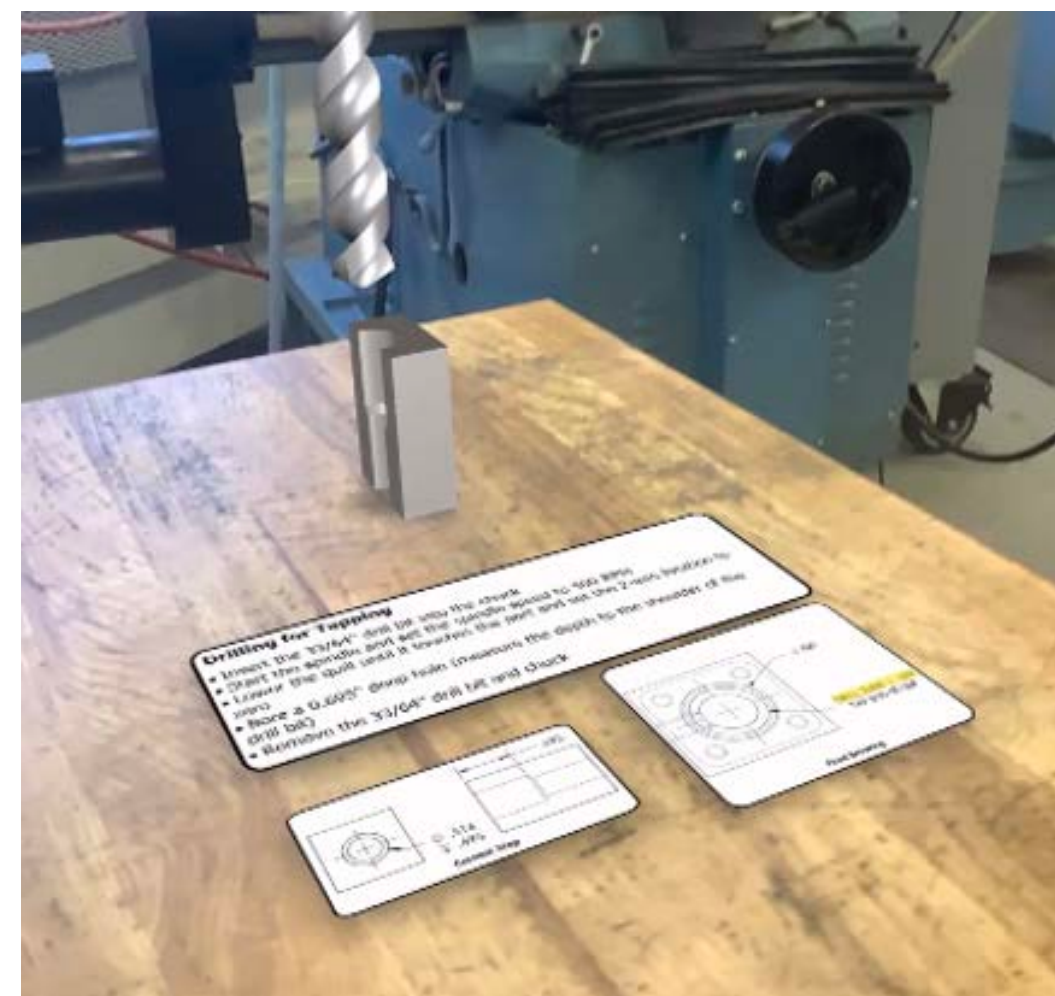
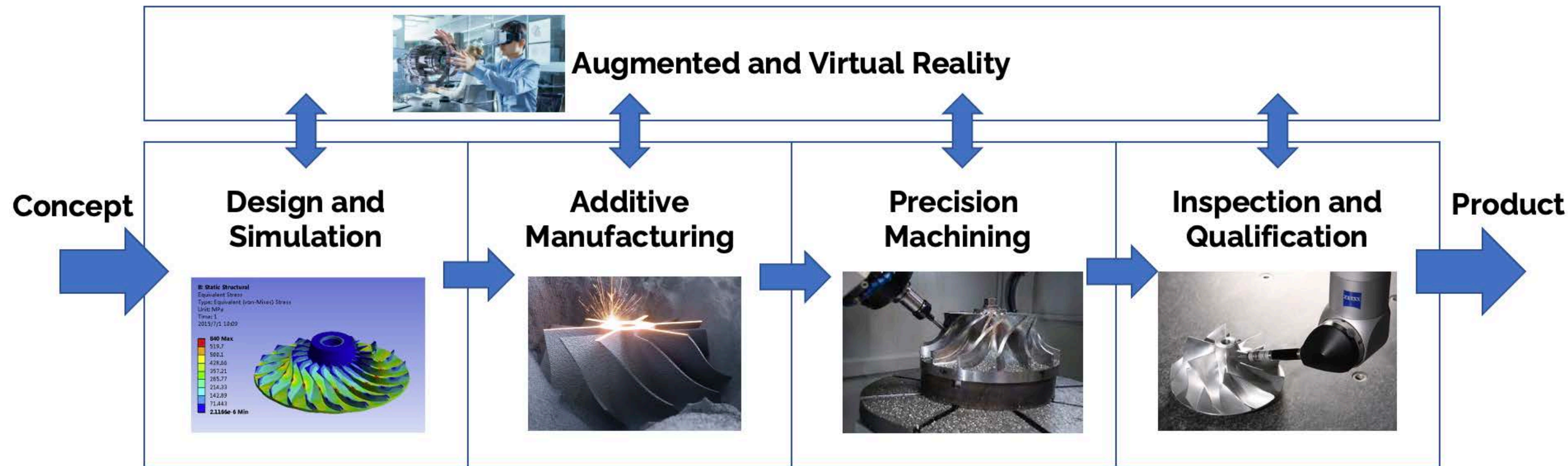


Led by Dr. John Liu



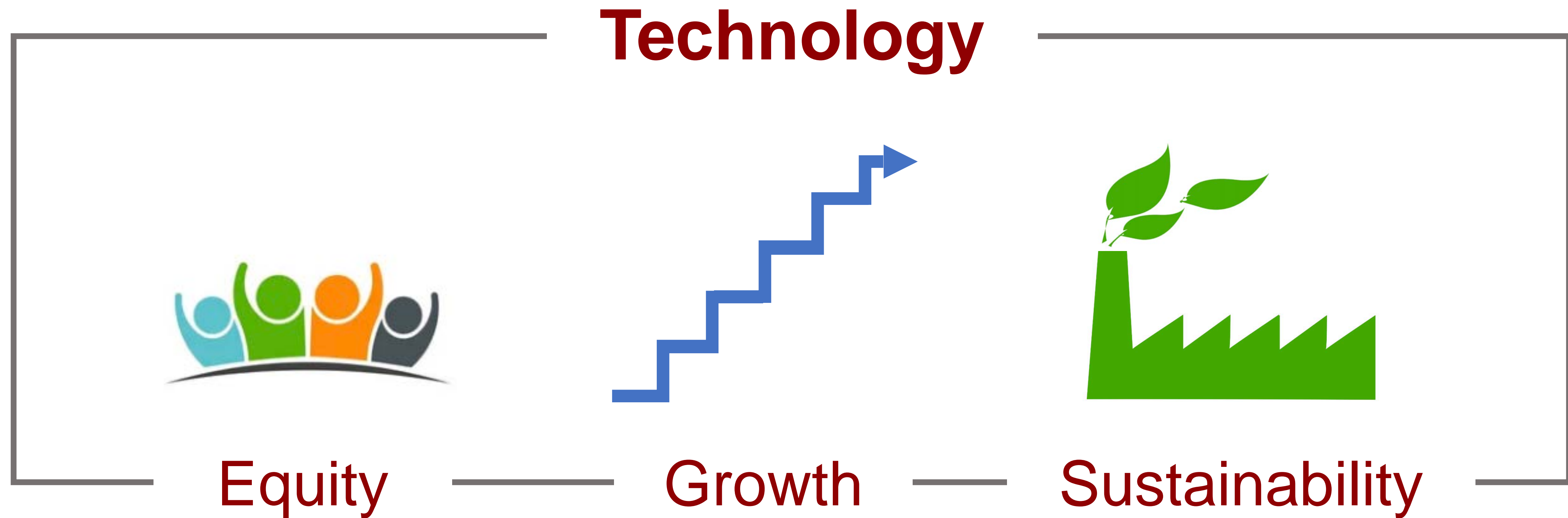


# 3: Integrated digital manufacturing facilities for research, prototyping, and education





# Manufacturing *for* a better world







# Thank you

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