Future of STEM work

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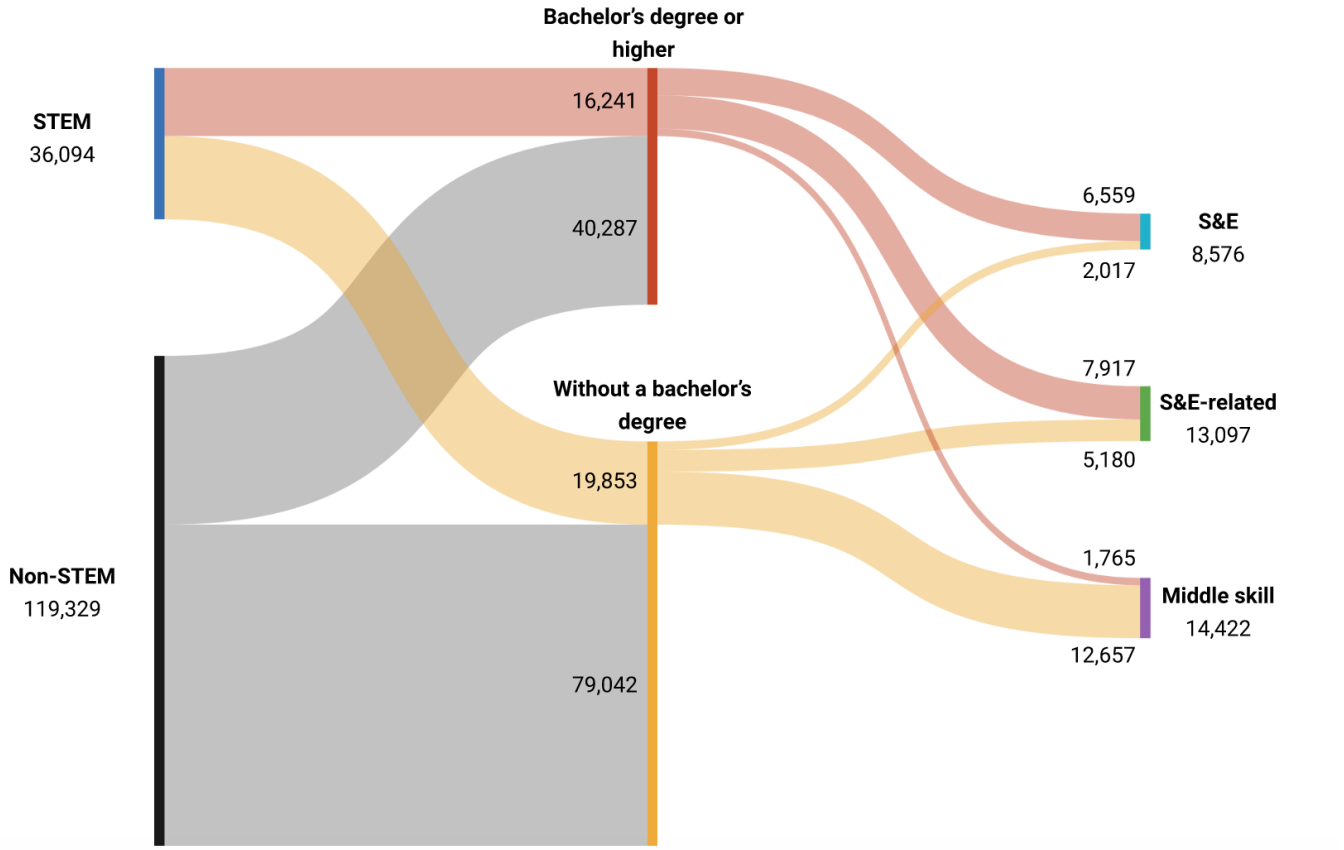
What is the US STEM Workforce?

U.S. workforce, by STEM occupational group and education level: 2019

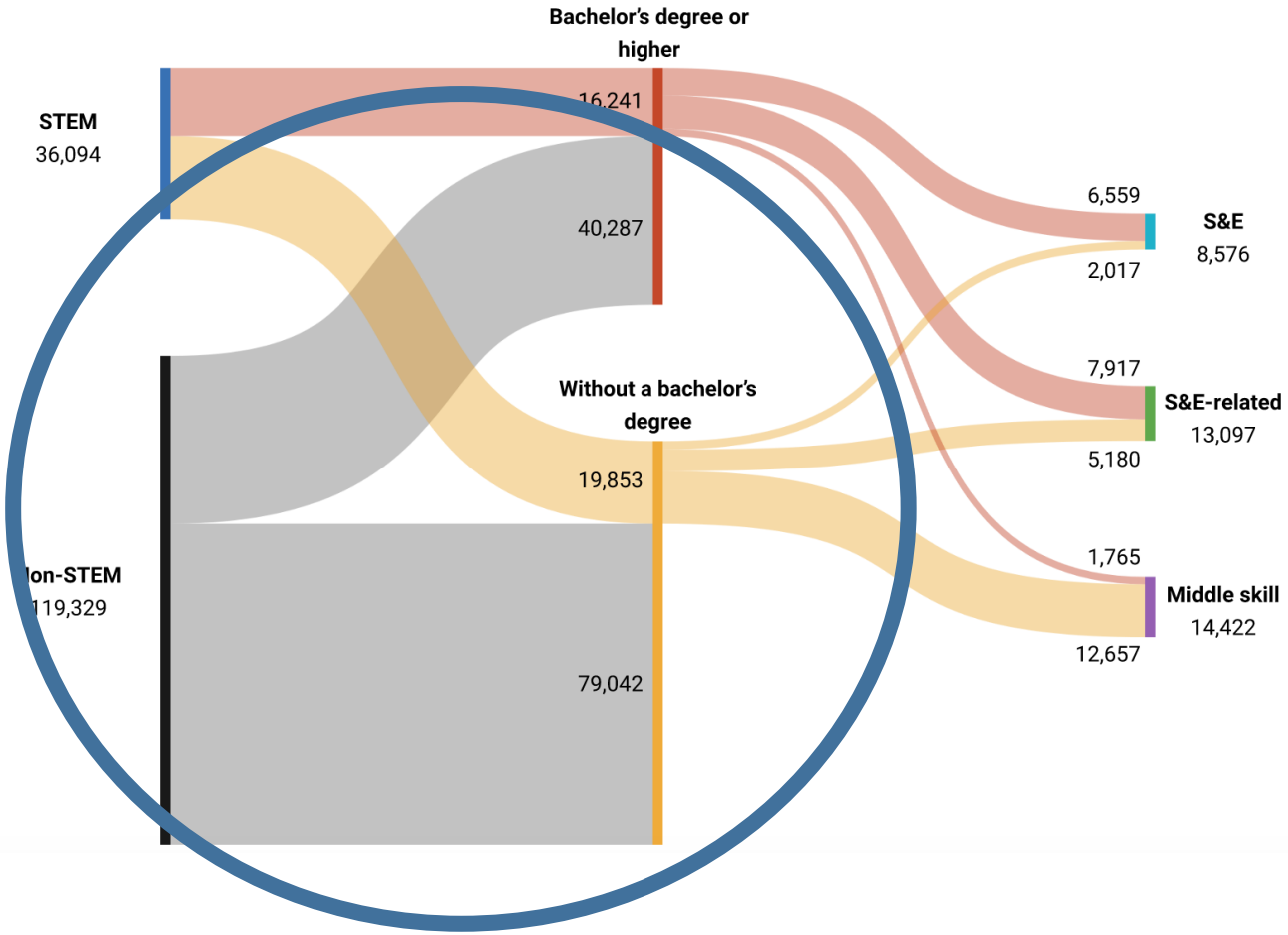


NSF: The State of U.S. Science and Engineering 2022

What is the US STEM Workforce?

But What About This 77% of the US Workforce?

U.S. workforce, by STEM occupational group and education level: 2019



NSF: The State of U.S. Science and Engineering 2022

There are no unskilled workers…

Increasingly “non-STEM” employers have expectations of:

- Numeracy
- Systems thinking
- Comfort with computing devices and automated systems
- Mechanical reasoning
- Ability to achieve competency with complex tools

In what educational environments are these skills developed?

- To the extent they are addressed in K-12, they are addressed as part of STEM standards

Robotic displacement

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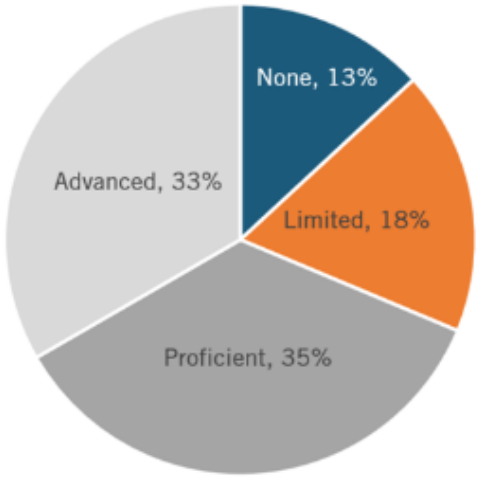
General US workforce isn't keeping pace with technology

Extent of digital skills in the U.S. workforce according to OECD PIAAC survey data



https://itif.org/publications/2021/11/29/assessing-state-digital-skills-us-economy/
Bergson-Shilcock, "The New Landscape of Digital Literacy,"

Percentage of workers with no or limited digital skills, selected industries

Industry	Percentage of Workers With No Digital Skills	Percentage of Workers With Limited Digital Skills	Combined Percentage of Workers With Limited or No Digital Skills
Construction, transportation, and storage	22%	28%	50%
Retail, wholesale, and auto repair	14%	23%	37%
Hospitality and other services	18%	18%	36%
Manufacturing	16%	19%	35%
Administrative and support services; arts, entertainment, and recreation	13%	22%	35%
Health and social work	12%	21%	33%
Finance, insurance, and real estate	6%	14%	20%
Education	5%	11%	16%

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The changing nature of STEM “careers”

A 21st century STEM “career” is typically self-managed

- **Individuals must take ownership of and accountability for their personal career trajectories**
- **Advancement is driven by individual action, not promotion**

Major Influences:

- **Shorter tenure with individual employers**
- **Accelerating introduction of white-collar automation**
- **Shorter half life of technical skills**

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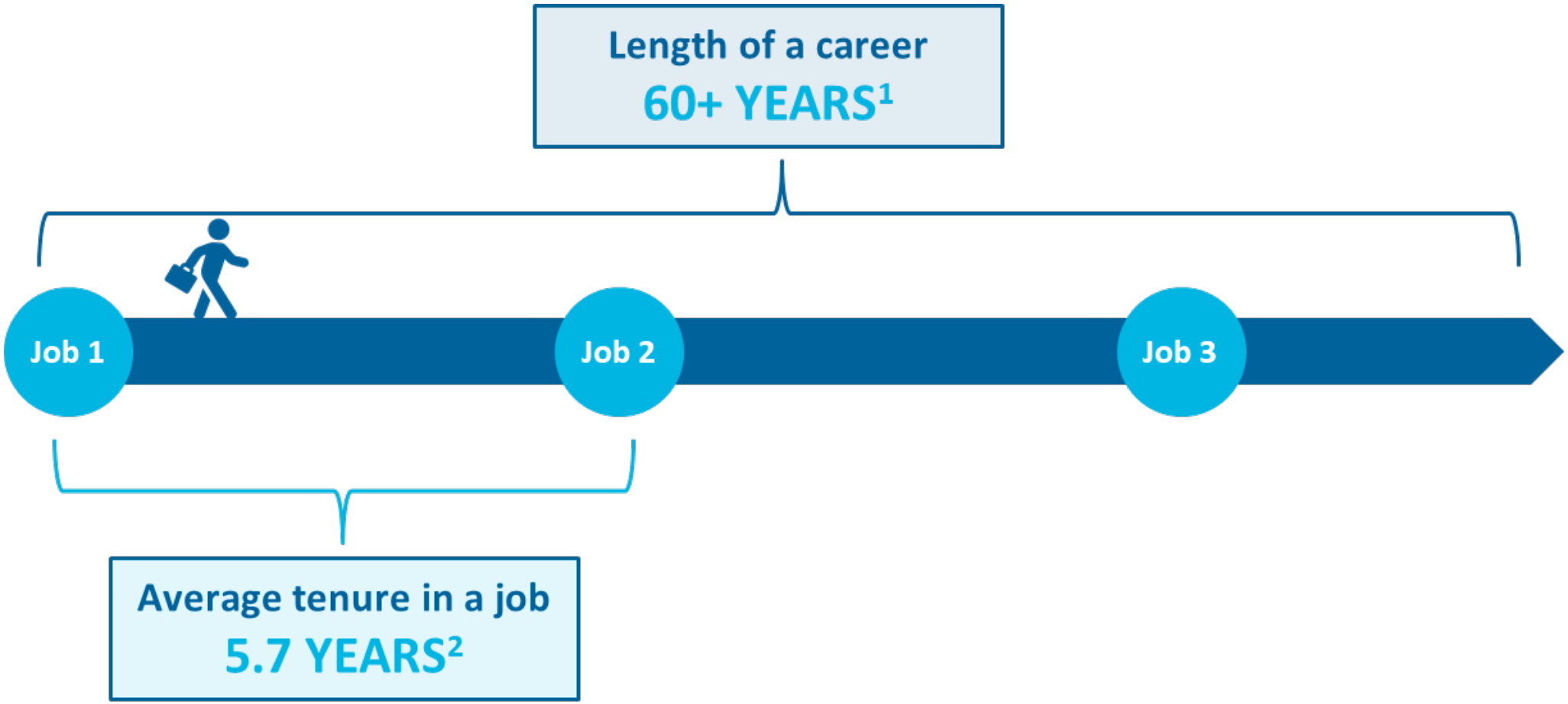
Technology professionals will have longer careers at more employers than previous generations



Our current education models fail to keep pace with demand for skill currency

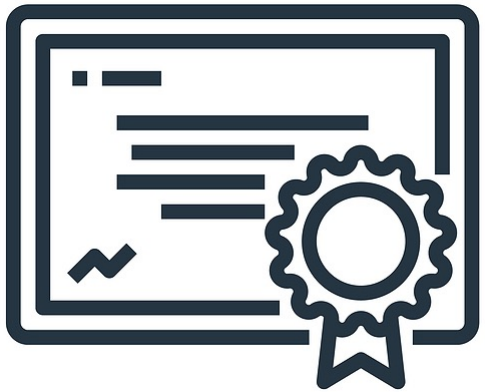
Degrees

Valuable for a base of knowledge and critical thinking, but burdensome, expensive and slow

Continuing Education

Not quick enough to adapt to industry need

Certifications



Primarily motivated by safety compliance, or often product specific

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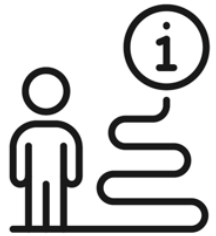
Learning throughout professional life is no longer optional; it's necessary to sustain because of the changing nature of job-relevant knowledge.

Continuing Education

Optional Learning

"Nice-to-have," except in compliance-mandated settings



Lifelong Learning

Necessary Learning

Imperative to support advancement in 21st-century career, especially in technical fields

Artificial Intelligence and Design Automation

From MATLAB to Semiconductor EDA toolchains

GitHub Copilot (https://github.com/features/copilot)

Influence of Digital Twins

Implications for STEM Workforce

Need to change the way we frame and conceptualize a STEM career

- **New markers, measures and milestones for career progression**

STEM workforce requires employer-independent professional career support

- **Connection to a community of peers and mentors**
- **Establishment of expectations, rules and norms**

Need for new models to support continuous educational refresh

Adopt expectation of Human-Machine teaming in STEM professions

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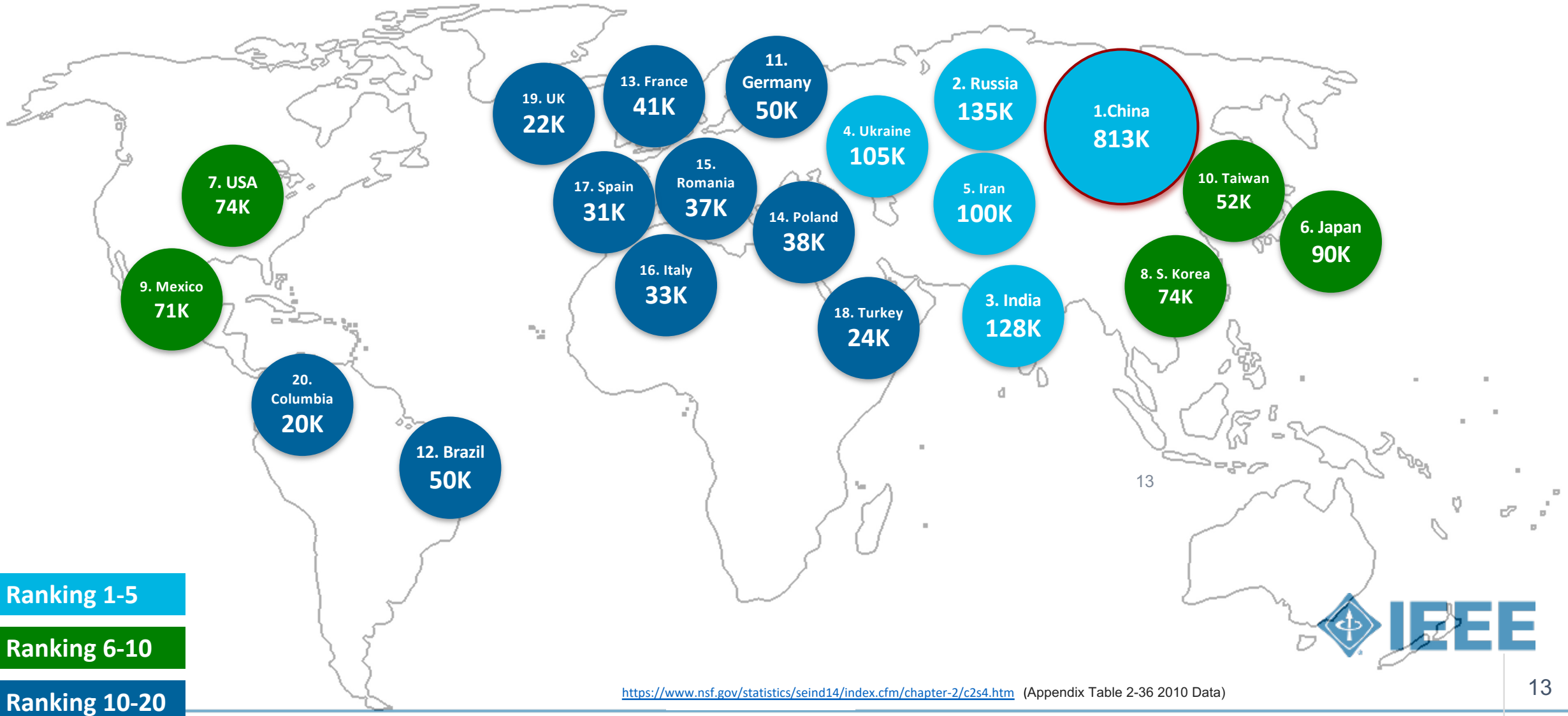
S T E & M are different

Technology and Engineering have largest direct and indirect employment impacts and most immediate connection to economic output

US national policy does not differentially promote growth of US Engineering workforce

K-12 Educational standards place little emphasis on Engineering

The top 20 countries producing the most engineers with a first degree.



https://www.nsf.gov/statistics/seind14/index.cfm/chapter-2/c2s4.htm (Appendix Table 2-36 2010 Data)