Educating for the 4th Industrial Revolution: the role of the Universities and Research Centers

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1st Industrial Revolution

Water and Steam

Steam and water power replace human and animal power with machines

2nd Industrial Revolution

Electricity

Electricity, internal combustion engines, airplane, telephones, card, radio and mass production

3rd Industrial Revolution

Automation

Electronics, the internet and IT increase automaton and mass production

4th Industrial Revolution

Cyber-Physical Systems

Driverless cars, smart robotics, the internet of things, 3D printing

The 10 skills you need to thrive in the Fourth Industrial Revolution.

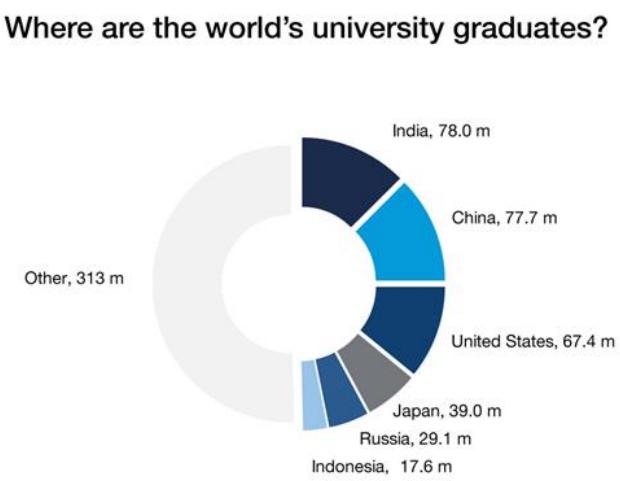
in 2020	in 2015
1. Complex Problem Solving	1. Complex Problem Solving
2. Critical Thinking	2. Coordinating with Others
3. Creativity	3. People Management
4. People Management	4. Critical Thinking
5. Coordinating with Others	5. Negotiation
6. Emotional Intelligence NEW	6. Quality Control
7. Judgment and Decision Making	7. Service Orientation
8. Service Orientation	8. Judgment and Decision Making
9. Negotiation	9. Active Listening
10. Cognitive Flexibility NEW	10. Creativity

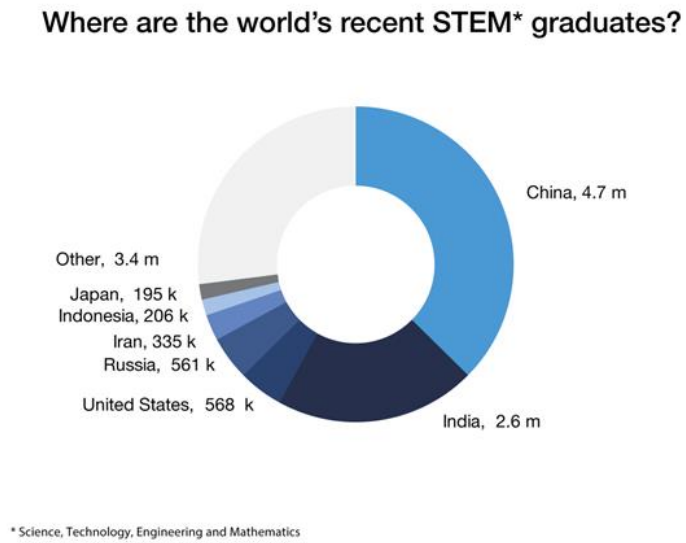
Source: World Economic Forum (2016)-The future of jobs.
The 10 skills you need to thrive in the Fourth Industrial Revolution.
https://www.weforum.org/agenda/2016/01/the-10-skills-you-need-to-thrive-in-the-fourth-industrial-revolution/.


Communication and Creativity
Critical thinking and Problem Solving
Future Specialisms
Big Data
Machine Learning
Artificial Intelligence
Cloud Computing
Cyber Security
Block-Chain
Crypto-currency
Financial analysis
Digital marketing
Supply Chain
Responsibility

Global Distribution of Tertiary Degree Holders and Recent STEM Graduates

STEM graduates are not evenly distributed geographically – many advanced economies are struggling to produce enough high-quality STEM graduates to meet demand from both the public and private sectors.





Currently, China and India together account for almost 60% of recent graduates in STEM disciplines.

Source: World Economic Forum and UNESCO, The Human Capital Report 2016

Skills Stability, 2015-2020, Industries Overall

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Skills Disruption

35% of core skills will change between 2015 and 2020

Disruption across countries and industries

43%	Financial Services & Investors
42%	Basic & Infrastructure
39%	Mobility
35%	Information & Communication Technology
33%	Professional Services
30%	Energy
30%	Consumer
29%	Health
27%	Media, Entertainment & Information

48%	Italy
42%	India
41%	China
41%	Turkey
39%	South Africa
39%	Germany
38%	France
37%	Mexico
31%	Brazil
29%	United States
28%	United Kingdom
27%	Australia
25%	Japan
21%	Gulf Cooperation Council
19%	ASEAN

average disruption

Source: Future of Jobs Report, World Economic Forum

Source: World Economic Forum, Future of Jobs Survey, The Future of Jobs

What kind of skills do we need?

Not being simply "*vocational*", but rather **contextual**, **critical and synthetic** –>

precisely because these are what make us human - Creativity

Universities should foster 4Cs:

Creativity, **C**ommunication, **C**ritical Thinking, **C**ollaboration

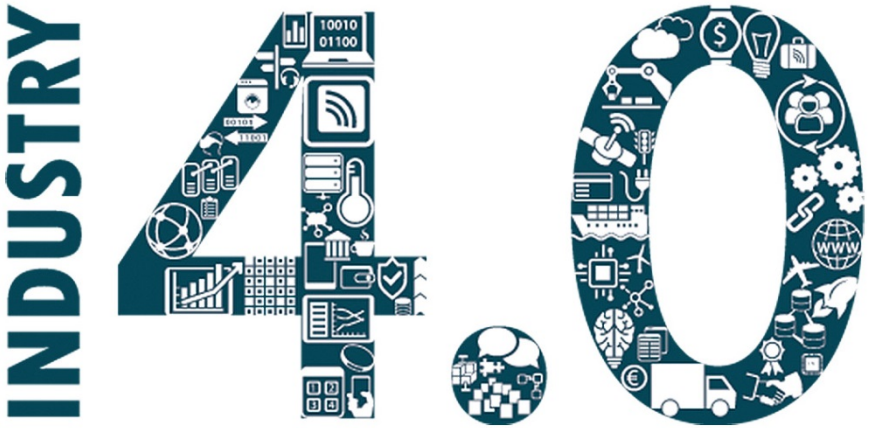
Communication and Creativity	Effective Communication Skills
	Creative and Innovation Skills
	Critical, Analytical and Integrative Thinking
Critical Thinking and Problem Solving	Problem Solving and Research Skills
	Social and Environmental Responsibility
Citizenship	Commitment to Continuous Learning
	Professional Judgement
	Ethical Citizenship

Source: *2017 German G20 presidency*
https://www.g20-insights.org/policy_briefs/advancing-human-centred-economic-progress-fourth-industrial-revolution-leadership-agenda-g20-governments/

The **WEForum's *Future of Jobs*** report indicates increasing demand for critical thinking, creativity, emotional intelligence and cognitive flexibility in 2020 when compared to 2015

As a result of the increasing technological intensity of industry, STEM skills – those related to Science, Technology, Engineering and Mathematics – are rising in demand.

While total employment in Europe from 2000-2011 grew by 8%, STEM employment increased by 34% over the same period.



Educate for I4.0 - Build educational content for interdisciplinary programs

Topics to cover:

- Maths
- Algorithms
- Data Management
- Computing Systems (IoT, Space, embedded, hpc)
- Robotics
- Machine Learning
- FinTech
- Cyberphysical systems
- Biotechnology
- Nanotechnologies-Materials

School of ECE-NTUA:
Interdisciplinary (2018-2019) postgraduate (MSc) programs

- Data Science and Machine Learning (new)
- Engineering - Economic Systems
- Digital Innovation and Entrepreneurship (new)
- Energy Production and Management Systems
- Space Science and Technology (under preparation/NTUA)

Greece

5th pillar: Higher education and training	44	4.9	
5.01 Secondary education enrollment rate gross %	28	106.5	
5.02 Tertiary education enrollment rate gross %	1	113.9	
5.03 Quality of the education system	106	3.0	
5.04 Quality of math and science education	53	4.4	
5.05 Quality of management schools	79	4.1	
5.06 Internet access in schools	99	3.6	
5.07 Local availability of specialized training services	100	4.0	
5.08 Extent of staff training	83	3.7	

12th pillar: Innovation	75	3.3	
12.01 Capacity for innovation	85	3.9	
12.02 Quality of scientific research institutions	65	3.9	
12.03 Company spending on R&D	87	3.1	
12.04 University-industry collaboration in R&D	129	2.5	
12.05 Gov't procurement of advanced technology products	131	2.5	
12.06 Availability of scientists and engineers	10	5.2	
12.07 PCT patents applications/million pop.	37	11.1	

Source: World Economic Forum , The Global Competitiveness Index 2017-2018 edition (rank 87th / 137 countries)

Greece

Pillar 12: Innovation capability 0-100 (best)	**-**	**45.0 ↓**	**44**	**Germany**
12.01 Diversity of workforce 1-7 (best)	3.7	45.8 ↓	123	Canada
12.02 State of cluster development 1-7 (best)	2.9	32.3 ↓	127	United States
12.03 International co-inventions applications/million pop.	1.30	25.6 ↓	39	Multiple (7)
12.04 Multi-stakeholder collaboration 1-7 (best)	3.0	33.3 ↓	123	United States
12.05 Scientific publications H Index	412.7	89.2 ↑	30	Multiple (7)
12.06 Patent applications applications/million pop.	9.72	43.6 ↑	36	Multiple (8)
12.07 R&D expenditures % GDP	1.0	31.9 ↑	40	Multiple (7)
12.08 Quality of research institutions index	0.06	16.2 ↓	31	Multiple (7)
12.09 Buyer sophistication 1-7 (best)	3.1	35.5 ↓	94	United States
12.10 Trademark applications applications/million pop.	n/a	96.8 ↑	n/a	Multiple (7)

Source: WEF, Global Competitiveness Index 4.0 2018 edition (rank 57th/140 countries)

Greece:

10th worldwide in engineers

30th in scientific publications

129th (out of 137) in University/Industry collaboration in R&D

The MIT initiative for Artificial Intelligence and Computing

The MIT Computing and AI Initiative:

MIT recently announced a new $1 billion commitment to address the global opportunities and challenges presented by the prevalence of computing and the rise of artificial intelligence (AI).

The initiative marks the single largest investment in computing and AI by an American academic institution.

$350 million donation from Mr. Schwarzman, the Chairman, CEO and co-founder of Blackstone.

Headquartered in a new building on MIT's campus, the new MIT Schwarzman College of Computing will be an interdisciplinary hub for work in computer science, AI, data science, and related fields.

MIT News

ON CAMPUS AND AROUND THE WORLD

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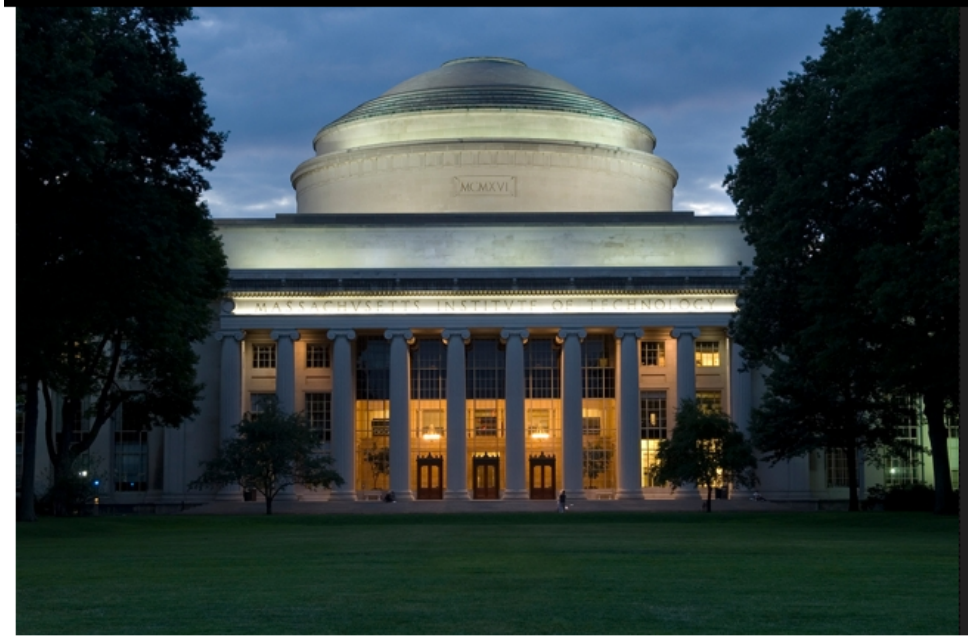


FULL SCREEN

MIT will reshape itself to shape the future, investing $1 billion to address the rapid evolution of computing and AI — and its global effects. At the heart of this effort: a $350 million gift to found the MIT Stephen A. Schwarzman College of Computing.

Photo: Christopher Harting

MIT reshapes itself to shape the future

Gift of $350 million establishes the MIT Stephen A. Schwarzman College of Computing, an unprecedented, $1 billion commitment to world-changing breakthroughs and their ethical application.

Watch Video

MIT News Office
October 15, 2018

Press Inquiries

PRESS MENTIONS

MIT's new college of computing represents the Institute's "first fundamental restructuring in nearly 70 years," writes Kaveh Wadell of *Axios*.

MIT today announced a new $1 billion commitment to address the global opportunities and challenges presented by the prevalence of computing and the rise of artificial intelligence (AI). The initiative marks the single largest investment in computing and AI by an American

The MIT College of Computing will:

reorient MIT to bring the power of computing and AI to all fields of study at MIT, allowing the future of computing and AI to be shaped by insights from all other disciplines;

create 50 new faculty positions that will be located both within the College and jointly with other departments across MIT — nearly doubling MIT's academic capability in computing and AI;

give MIT's five schools a shared structure for collaborative education, research, and innovation in computing and AI;

educate students in every discipline to responsibly use and develop AI and computing technologies to help make a better world; and

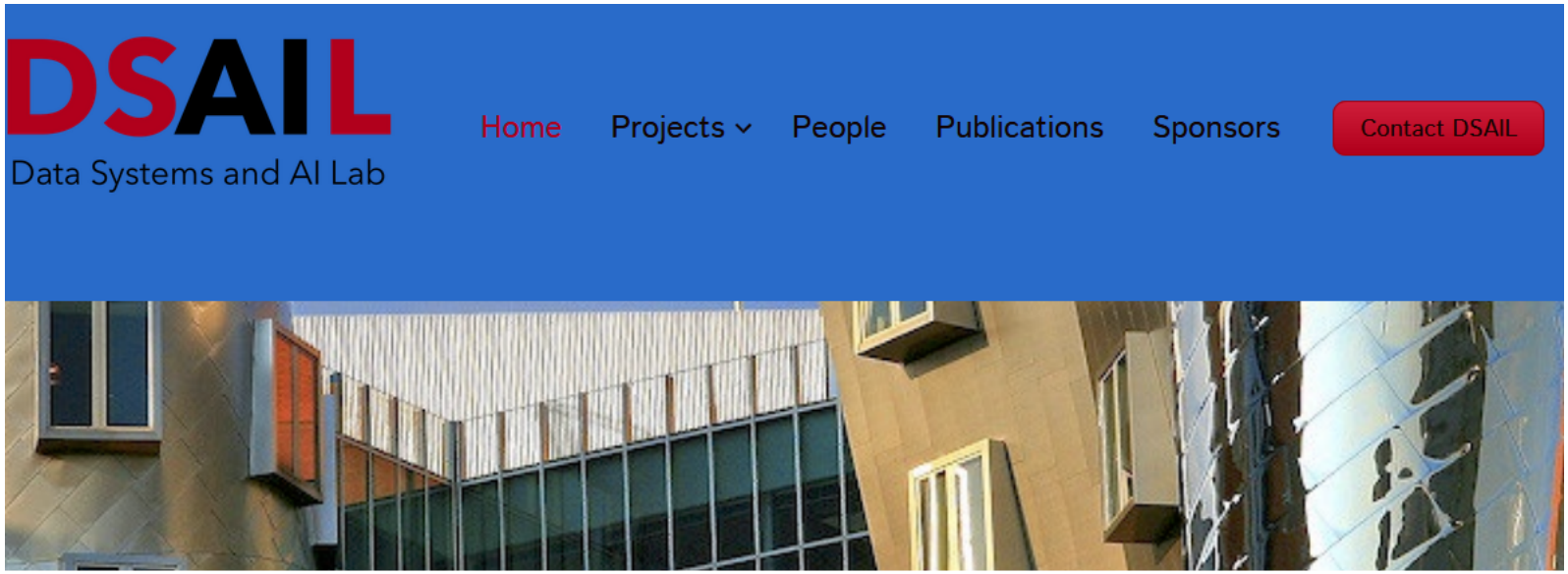
transform education and research in public policy and ethical considerations relevant to computing and AI.

Data Systems and AI Lab (DSAIL)

“We founded the Data Systems and AI Lab (DSAIL) to explore this frontier by going beyond the use of AI for automating simple perceptual tasks to investigating opportunities to enhance and optimize large-scale data systems and enterprise applications with learned components synthesized using AI. “

Over the past decade, AI has made substantial methodological advances in learning the complex relationships that have evolved among data. In addition, “deep learning” has excelled at a number of perceptual tasks, including image recognition and speech processing. These enhancements have enabled applications from personal digital assistants to autonomous vehicles.

An open question, however, is: ***How far can AI technology be pushed into other application domains***?



News Release - Oct. 3, 2018

Google, Intel and Microsoft team up with CSAIL on new data-driven initiative

Data Systems and AI Lab (DSAIL) will focus on using machine learning to improve data systems, and vice versa

Recent years have seen an explosion in the creation of machine learning models for everything from self-driving cars to social media feeds. Despite the success of these models at perception and simple prediction, they have yet to have a larger impact on traditional enterprise computing and data processing applications.