3RD NATIONAL CONFERENCE

ASOSIASI PENDIDIKAN BETHEL

REVOLUSI INDUSTRI 4.0 DAN DAMPAKNYA PADA PENDIDIKAN MASA DEPAN

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APB
Asosiasi Pendidikan Bethel

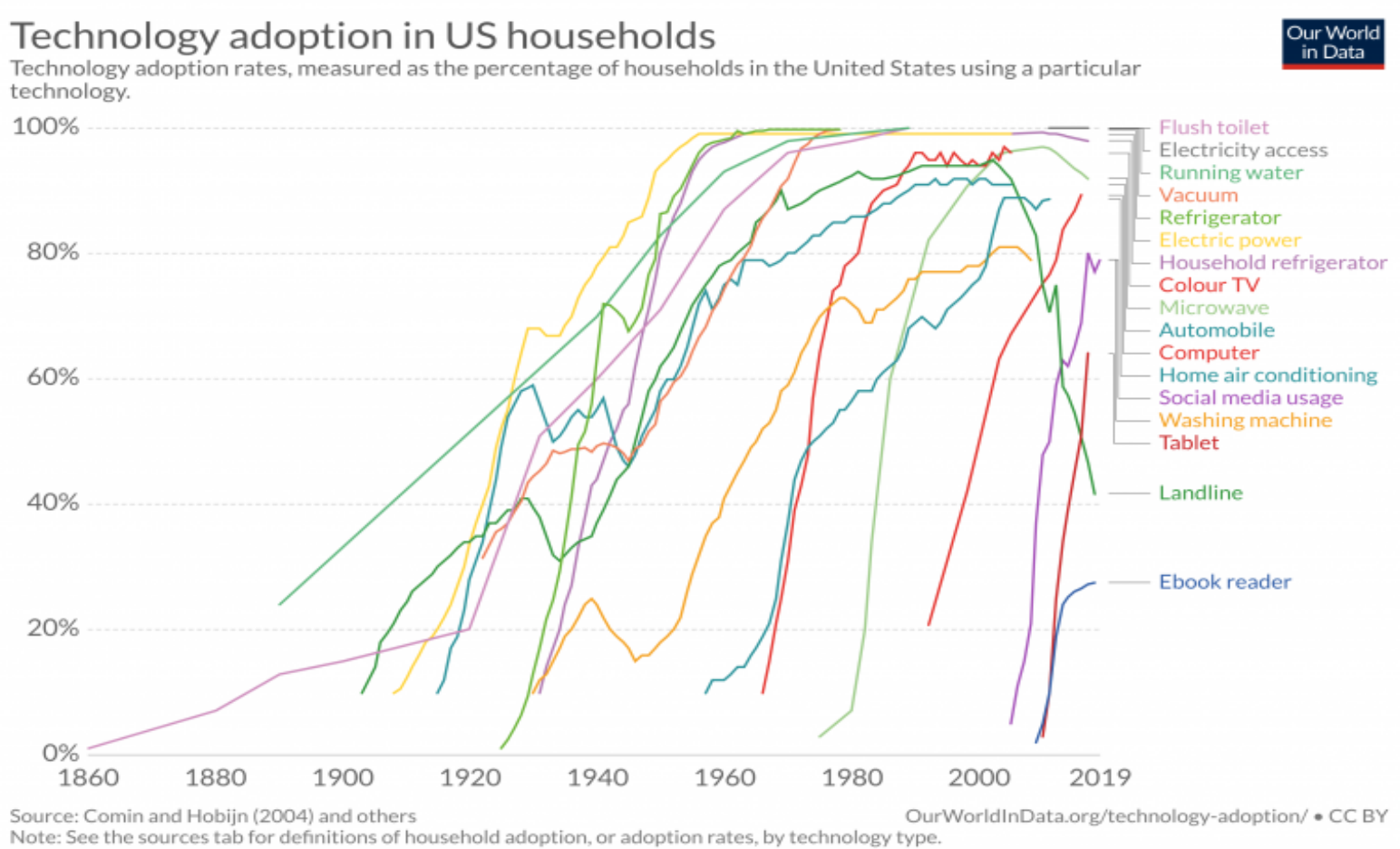
AGENDA

Revolusi Industri 4.0

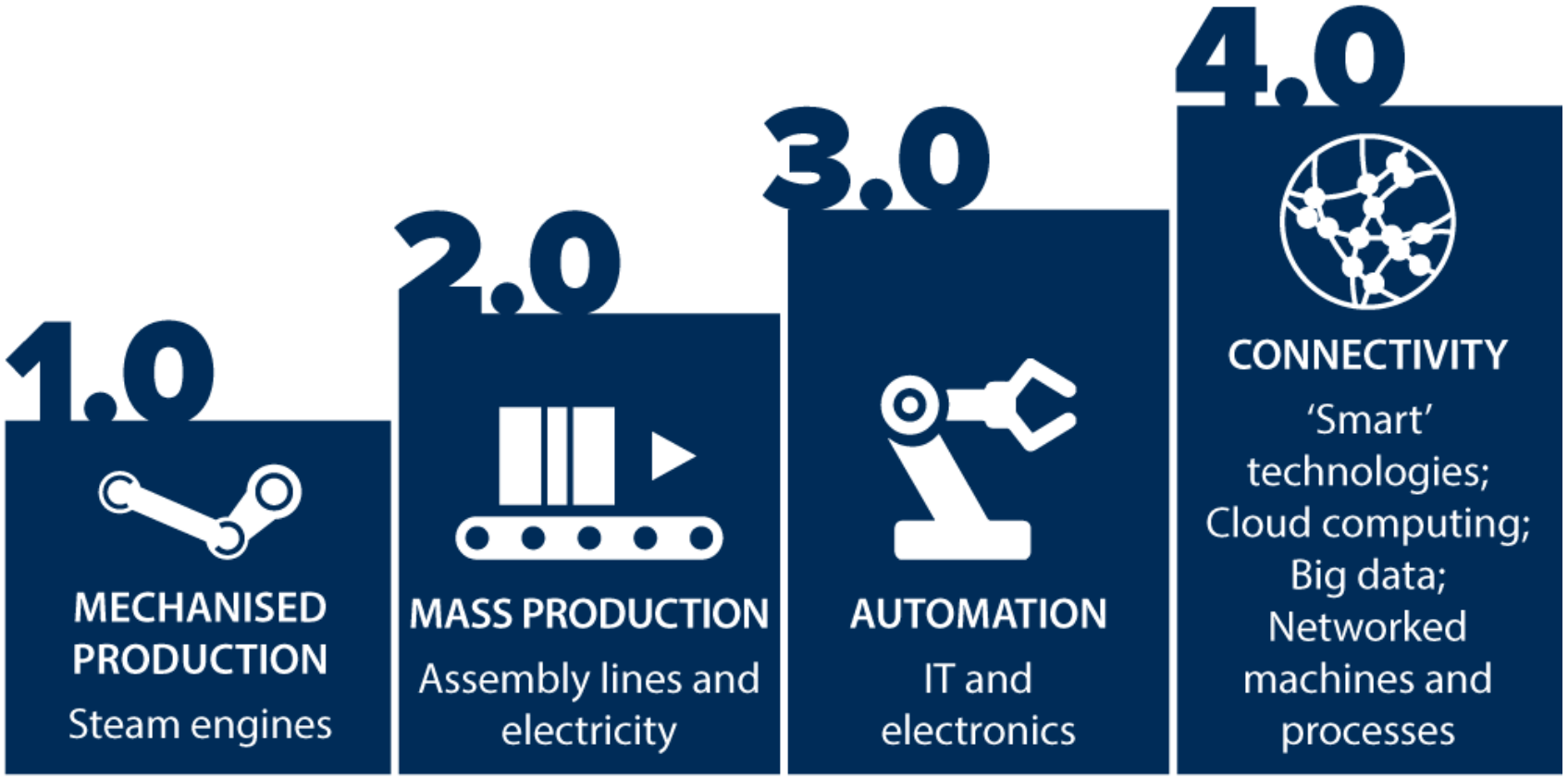
Dampak Ekonomi dan Sosial

Pendidikan Untuk Masa Depan

Adopsi teknologi baru di dunia mengalami percepatan, mengakibatkan Hypercompetition



Teknologi digital dan internet telah mengakibatkan revolusi industri ke 4



The stages of industrial development
Source: Oxford Analytica

Istilah Revolusi Industri 4.0 sebenarnya telah diperkenalkan sejak 10 tahun lalu

"Industrie 4.0"

Wolfgang Wahlster

2011: Strategi high-tech pemerintah Jerman untuk mempromosikan komputerisasi industri
2012: Rekomendasi Industry 4.0 untuk pemerintah federal Jerman

"4th Industrial Revolution"

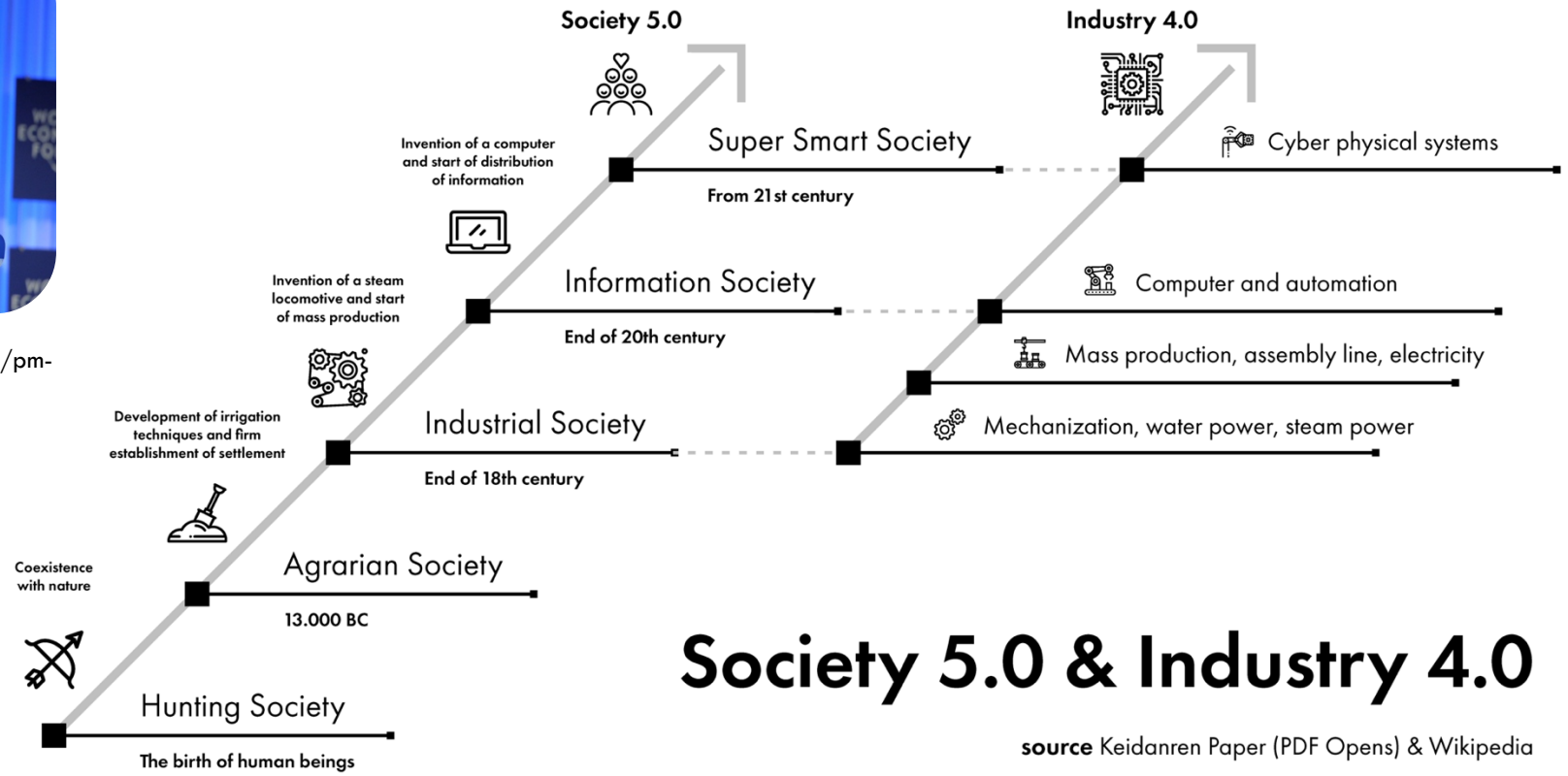
Klaus Schwab

World Economic Forum

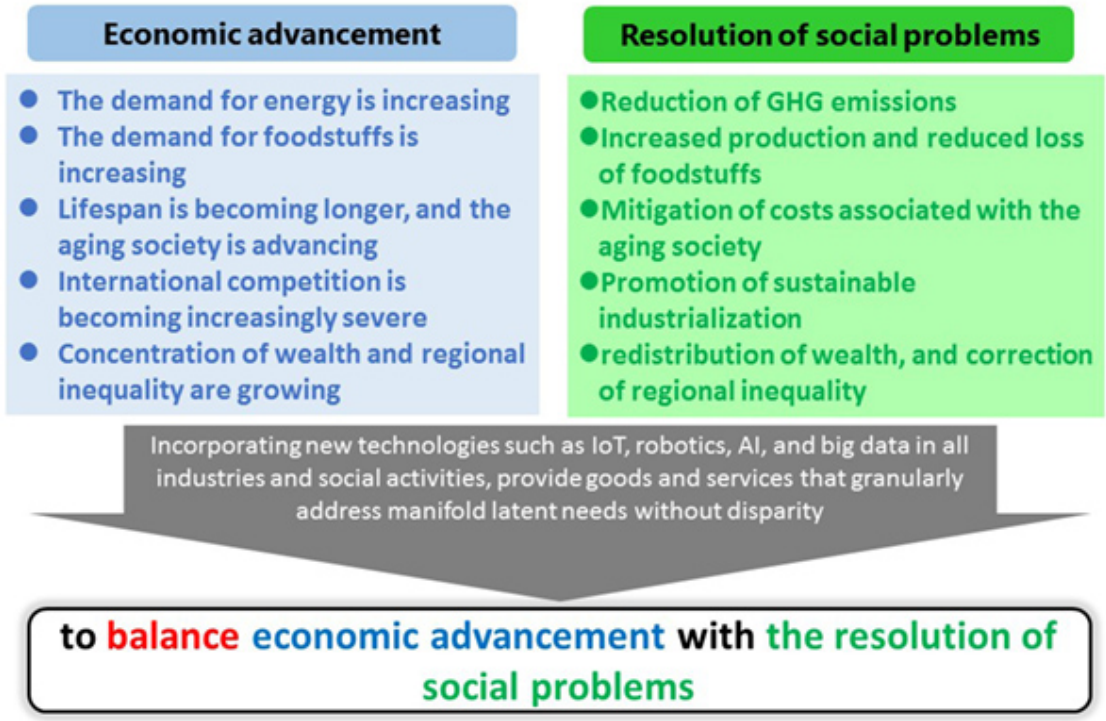
2015: Majalah Foreign Affairs
2016: WEF Meeting , Davos, Switzerland

Jepang mengadopsi pendekatan lebih menyeluruh dengan mempromosikan Society 5.0,...

https://www.weforum.org/press/2019/01/pm-shinzo-abe-heralds-new-era-for-japan-as-policies-bear-fruit/



…untuk meresponi berbagai masalah sosial, termasuk masyarakat yang ‘menua’

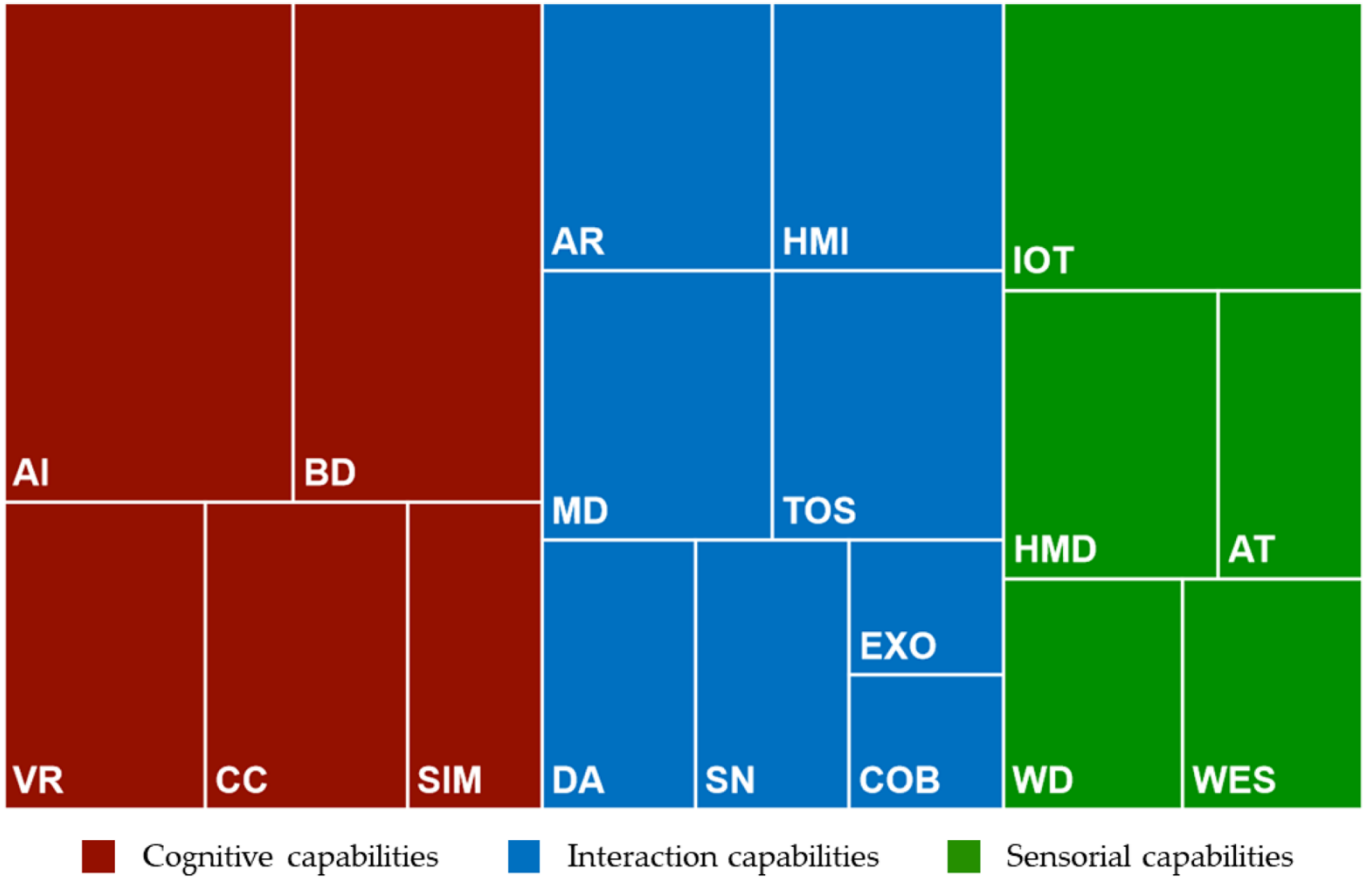


Sumber: https://www8.cao.go.jp/cstp/english/society5_0/index.html

Visi Society 5.0

"Masyarakat yang berpusat pada manusia yang menyeimbangkan kemajuan ekonomi dengan penyelesaian masalah sosial dengan sistem terintegrasi dengan ruang internet dan ruang fisik.”

Untuk memahami arah perubahan, kita perlu mengenal 3 elemen utama teknologi yang sedang dikembangkan



List of Technologies
AT: Activity and Motion Trackers
AI: Artificial Intelligence
AR: Augmented Reality
BD: Big Data
CC: Cloud Computing
COB: Collaborative Robots
DA: Digital Voice-enabled Assistants
EXO: Exoskeletons
HMD: Health Monitoring Devices
HMI: Human-Machine Interface
IOT: Internet of Things
MD: Mobile Devices
SIM: Simulation
SN: Social Networks
TOS: Teleoperated Systems
VR: Virtual Reality
WD: Wearable Devices
WES: Work Environment Sensors

Appl. Sci. **2020**, *10*, 4182; doi:10.3390/app10124182

Revolusi ini mengawali Abad Imajinasi

Revolusi Industri 4.0

Trend menuju otomasi dan pertukaran data pada teknologi dan proses manufakturing, yang mencakup:

- Cyber-physical systems (CPS)
- Industrial internet of things (IoT)
- Cloud computing
- Artificial Intelligence

Revolusi Industri 4.0 adalah awal dari

"THE IMAGINATION AGE"

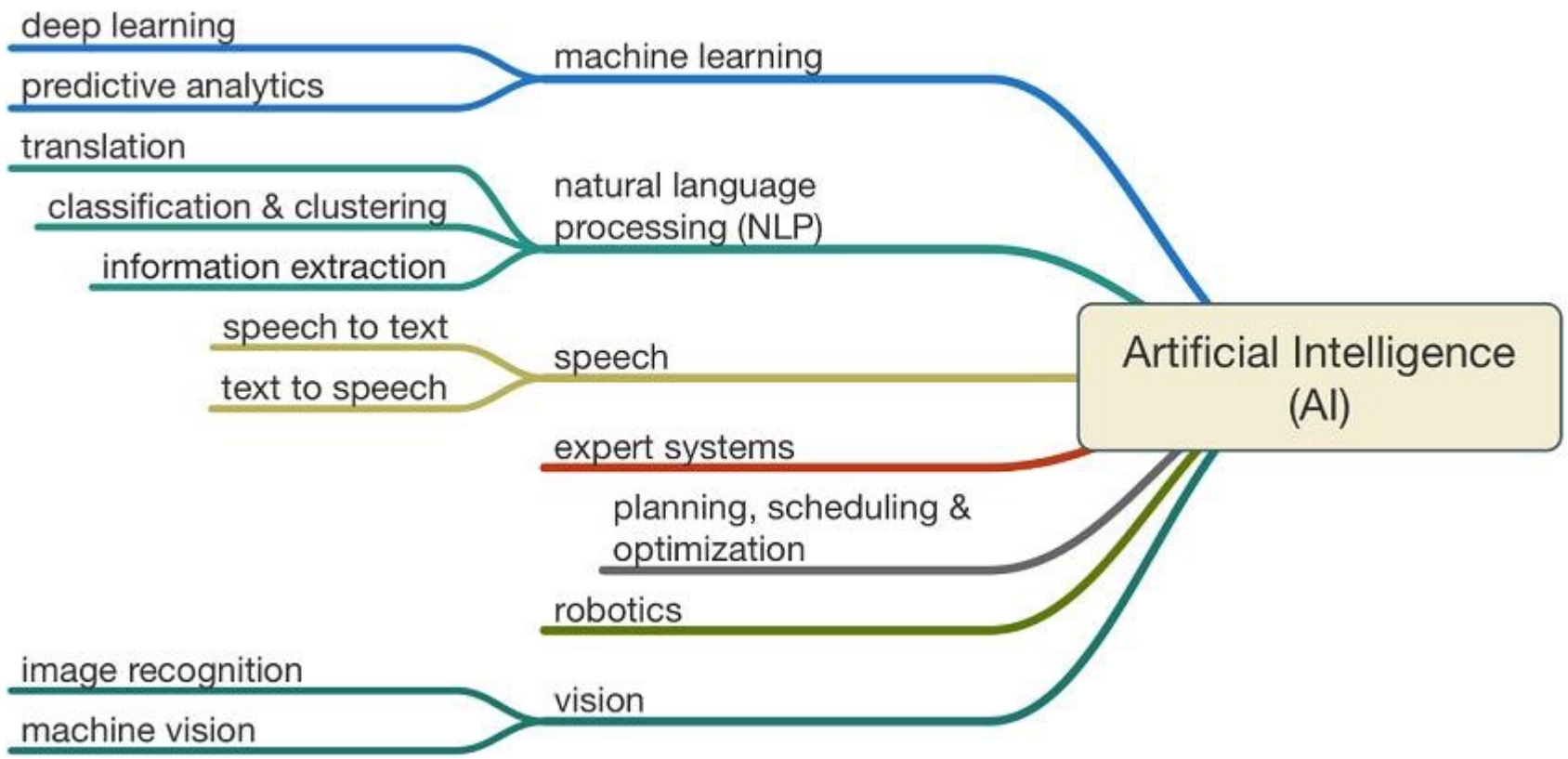
pasca Agriculture age, Industrial age, dan Information age

delegates knowledge work, thinking and analysis to the machines, leaving human workers with everything that can't be yet automated: creativity, imagination (hence the name), social and emotional intelligence, to name a few.

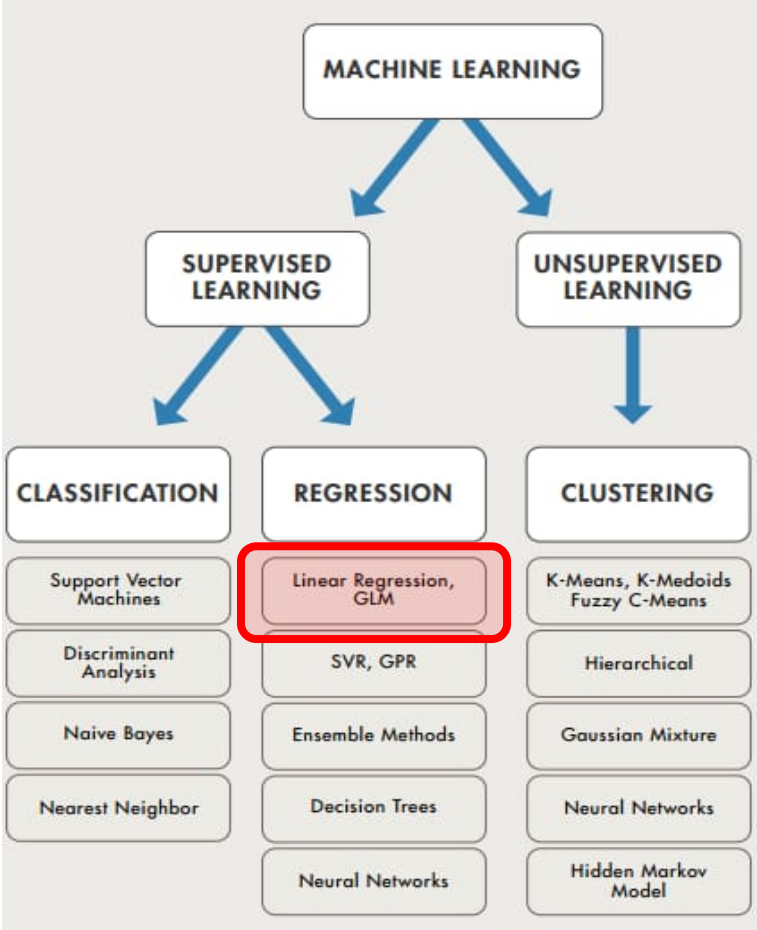
https://nextconf.eu/2019/06/why-imagination-and-creativity-are-primary-value-creators/

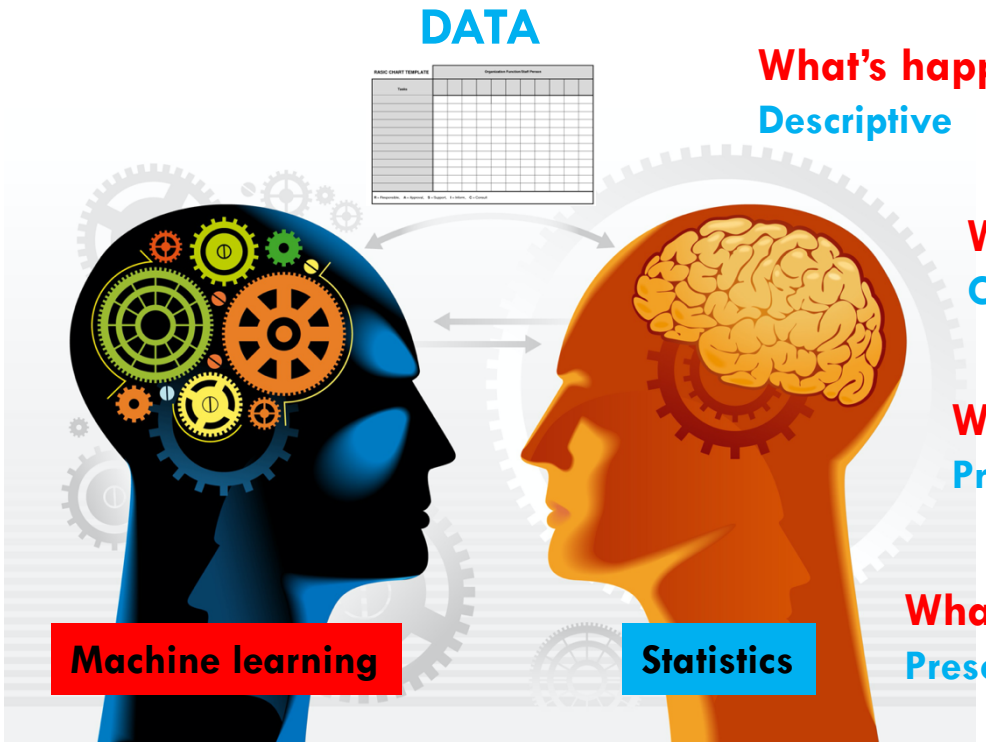
THE DIGITAL REVOLUTION

AI mencakup beberapa bidang yang jauh lebih luas daripada sekedar robotika



Machine learning adalah cabang AI yang paling berkembang saat ini





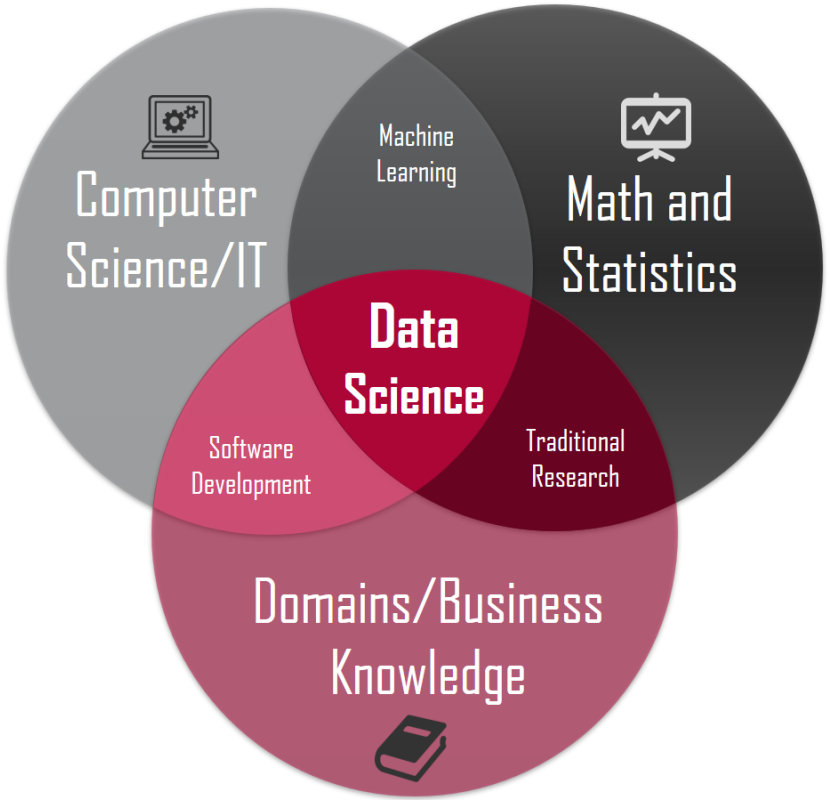
What's happening?
Descriptive

Why (diagnostic)?
Correlation

What could happen?
Prediction

What should I do?
Prescription

Aplikasi Machine Learning pada berbagai domain menghasilkan bidang baru yang disebut Data Science.



Precision Medicine

Precision Marketing

Precision Agriculture

AGENDA

Revolusi Industri 4.0

Dampak Ekonomi dan Sosial

Pendidikan Masa Depan

I4.0 membawa dampak ekonomi maupun dampak sosial yang besar dan disruptif,…

DAMPAK EKONOMI

- New Business Models
- Pekerjaan muncul/hilang/berubah
- Produktivitas meningkat
- Kesenjangan ilmu pengetahuan dan kesejahteraan (baca: GINI ratio) meningkat

DAMPAK SOSIAL

- Gaya hidup (cepat, efisien, instan)
- Literasi dan misinformasi
- Kompetisi meningkat
- Akses vs Distraksi
- Interaksi
- Individualisme vs Sharing
- Polarisasi vs Toleransi
- Budaya global

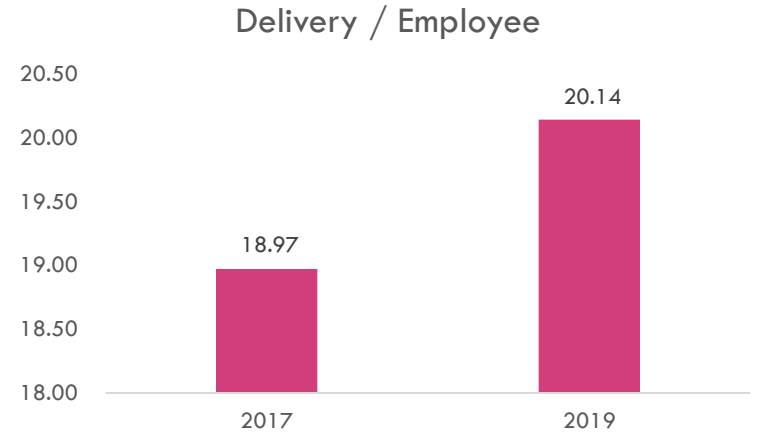
…dan berpotensi menghasilkan '*irrelevant people*'

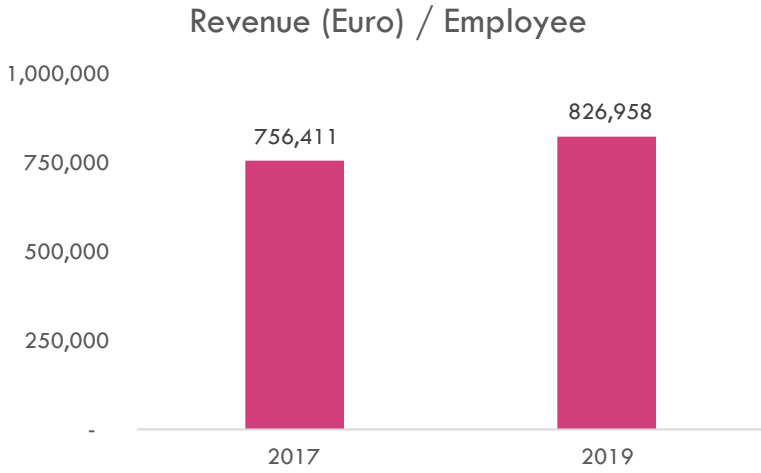
Professor Yuval Noah Harari
University of Jerusalem

Penulis dari buku best-seller:

- Sapiens: A Brief of Humankind (2014)
- Homo Deus: A Brief History of Tomorrow (2016)
- 21 Lessons for the 21st Century (2018)

Teknologi berpotensi mendorong pergeseran fasilitas produksi dari '*cheap labor countries*', serta…





menimbulkan berbagai pergeseran nilai, norma, budaya, hubungan dalam kehidupan sosial

	Traditional	Modern
Social Change	Slow	Rapid
Size of Group	Small	Large
Religious Orientation	More	Less
Formal Education	No	Yes
Place Of Resistance	Rural	Urban
Demographic Transition	First stage	Third stage
Family Size	Larger	Smaller
Infant Mortality Rate	High	Low
Life Expectancy	Short	Long
Health Care	Home	Hospital
Temporal orientation	Past	Future
Material Relations		
Industrialized	No	Yes
Technology	Simple	Complex
Division of Labour	Simple	Complex
Income	Low	High
Material possessions	Few	Many
Social Relationships		
Basic Organization	Gemeinschaft	Gesellschaft
Families	Extended	Nuclear
Respect for Elders	More	Less
Social Stratification	Close	Open
Gender Equality	Less	More
Norms		
View of reality, life and morals	Absolute	Relativistic
Social control	Informal	Formal
Tolerance of differences	Less	More

"Family leisure time, offline family bonding and communication is negatively affected due to technology use" (Tadpatrikar, Sharma, Viswanath, 2021, Asian Journal of Psychiatry).

https://www.researchgate.net/publication/349219764_Influence_of_technology_usage_on_family_communication_patterns_and_functioning_A_systematic_review

Sumber:
https://www.semanticscholar.org/paper/The-impact-of-technology-on-social-change%3A-a-Mutekwe/ba4f706033bddd90bf8d450279a951a7c123304a?sort=relevance&page=2

Keunggulan bersaing berubah dari berbasis pasar (oligopoli) ke sumberdaya, dan akhirnya ke pengetahuan

MARKET BASED VIEW (MBV)

Keunggulan bersaing bukan berasal dari faktor internal, tetapi faktor eksternal yakni struktur pasar yang oligopolistik.

Hoskisson, Hitt dan Ireland, 2004; Porter, 1980, 1985, 1996)

RESOURCE BASED VIEW (RBV)

Keunggulan perusahaan berasal dari sumberdaya internal yang memiliki nilai bagi pelanggan *(value)*, langka *(rare)*, tidak mudah ditiru *(inimitable)*, tidak dapat disubstitusi *(non substitutable)*, dan dapat dieksploitasi *(exploitable)*.

Amit dan Schoemaker, 1993; Barney, 1991; Dierickx dan Cool, 1989; Prahalad dan Hamel, 1990; Mahoney dan Pandian, 1992; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984.

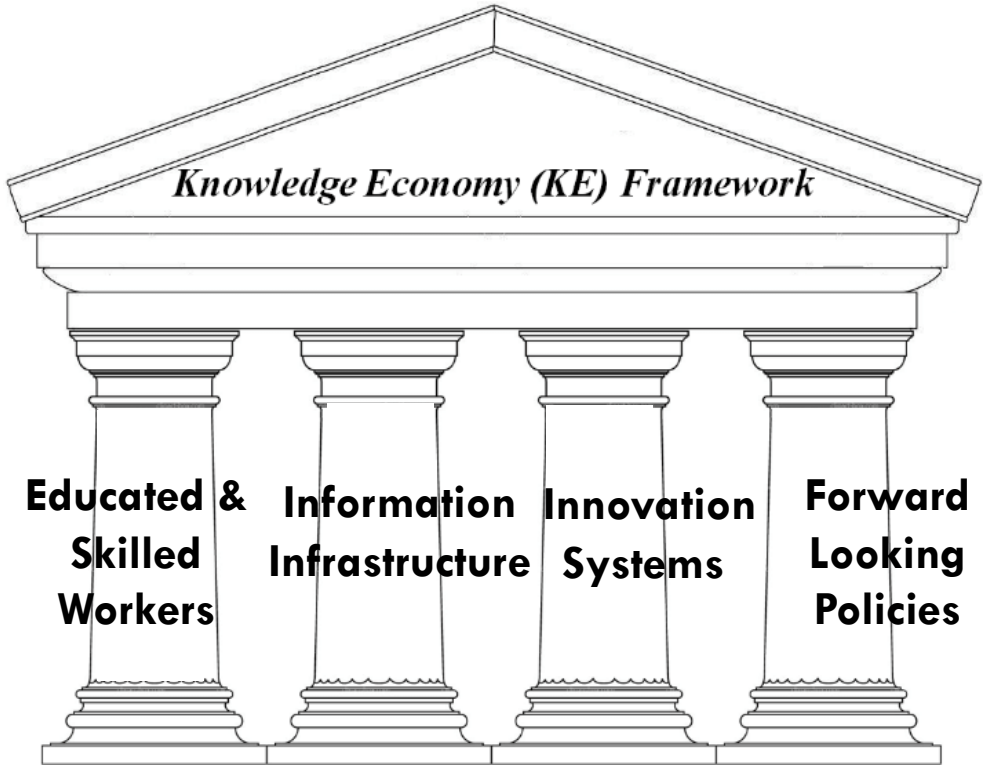
KNOWLEDGE BASED VIEW (KBV)

Keunggulan perusahaan berasal dari pengetahuan dan kapabilitas yang dimiliki perusahaan.

Nonaka, I., and Takeuchi, H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation, Oxford University Press, New York, 1995.

Kogut, Bruce. and Ugo Zander “Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology,” Organization Science (3:3), 1992, pp. 383–397.

Tenaga kerja terdidik dan terampil menjadi salah satu dari pilar terpenting dalam *knowledge economy*.



- Strong education
- Academic standards

- Digitalization
- Fast & reliable 5G

- FDI
- Ease of doing business

- Hubs & clusters
- Incubators
- Patents & commercialization

Sumber: World Bank

Peluang kerja berubah, banyak yang hilang, namun lebih banyak yang muncul (McKinsey)

- **Perishing**: low value add, repetitive, clerical jobs

- **Remaining**: service requiring personal touch (caregivers), educators, product designers, artist

- **Emerging**: big data analyst, computer engineers, internet engineers, cyber security, SCM

Peluang kerja berubah, banyak yang hilang, namun lebih banyak yang muncul (McKinsey, WEF)

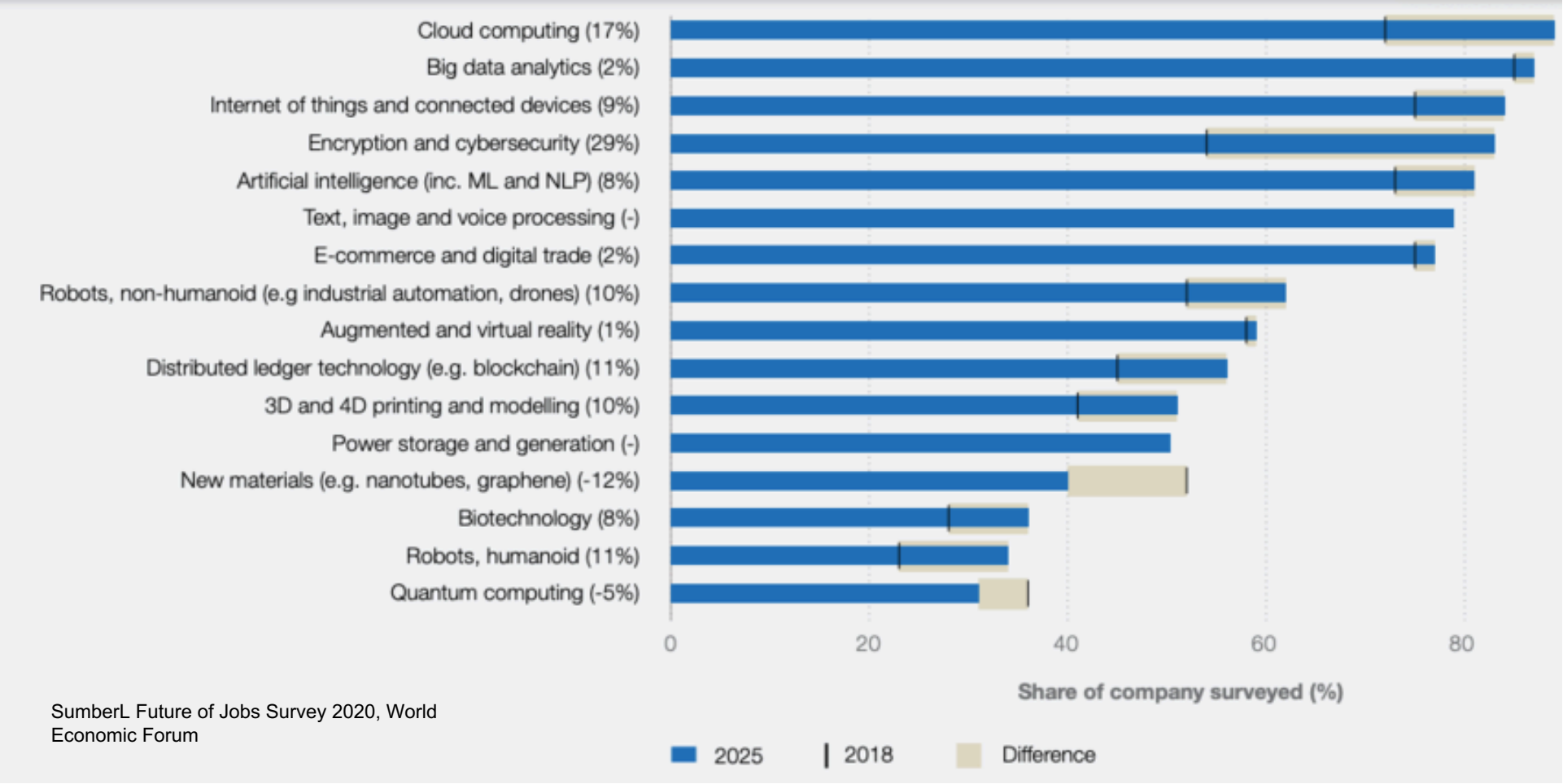
↗ Increasing demand		↘ Decreasing demand	
1	Data Analysts and Scientists	1	Data Entry Clerks
2	AI and Machine Learning Specialists	2	Administrative and Executive Secretaries
3	Big Data Specialists	3	Accounting, Bookkeeping and Payroll Clerks
4	Digital Marketing and Strategy Specialists	4	Accountants and Auditors
5	Process Automation Specialists	5	Assembly and Factory Workers
6	Business Development Professionals	6	Business Services and Administration Managers
7	Digital Transformation Specialists	7	Client Information and Customer Service Workers
8	Information Security Analysts	8	General and Operations Managers
9	Software and Applications Developers	9	Mechanics and Machinery Repairers
10	Internet of Things Specialists	10	Material-Recording and Stock-Keeping Clerks
11	Project Managers	11	Financial Analysts
12	Business Services and Administration Managers	12	Postal Service Clerks
13	Database and Network Professionals	13	Sales Rep., Wholesale and Manuf., Tech. and Sci.Products
14	Robotics Engineers	14	Relationship Managers
15	Strategic Advisors	15	Bank Tellers and Related Clerks
16	Management and Organization Analysts	16	Door-To-Door Sales, News and Street Vendors
17	FinTech Engineers	17	Electronics and Telecoms Installers and Repairers
18	Mechanics and Machinery Repairers	18	Human Resources Specialists
19	Organizational Development Specialists	19	Training and Development Specialists
20	Risk Management Specialists	20	Construction Laborers

Source

Future of Jobs Survey 2020, World Economic Forum.

Namun, kebanyakan pekerjaan baru tersedia bagi tenaga intelektual

MOST IN DEMAND JOBS



SumberL Future of Jobs Survey 2020, World Economic Forum

Di Indonesia, pergeseran pasar tenaga kerja tersebut juga pasti akan terjadi,...

https://katadata.co.id/ariayudhistira/infografik/5e9a4e601630e/kesiapan-indonesia-hadapi-era-industri-40 (12 Oktober 2019)

…meskipun mungkin lebih lambat daripada negara-negara lainnya

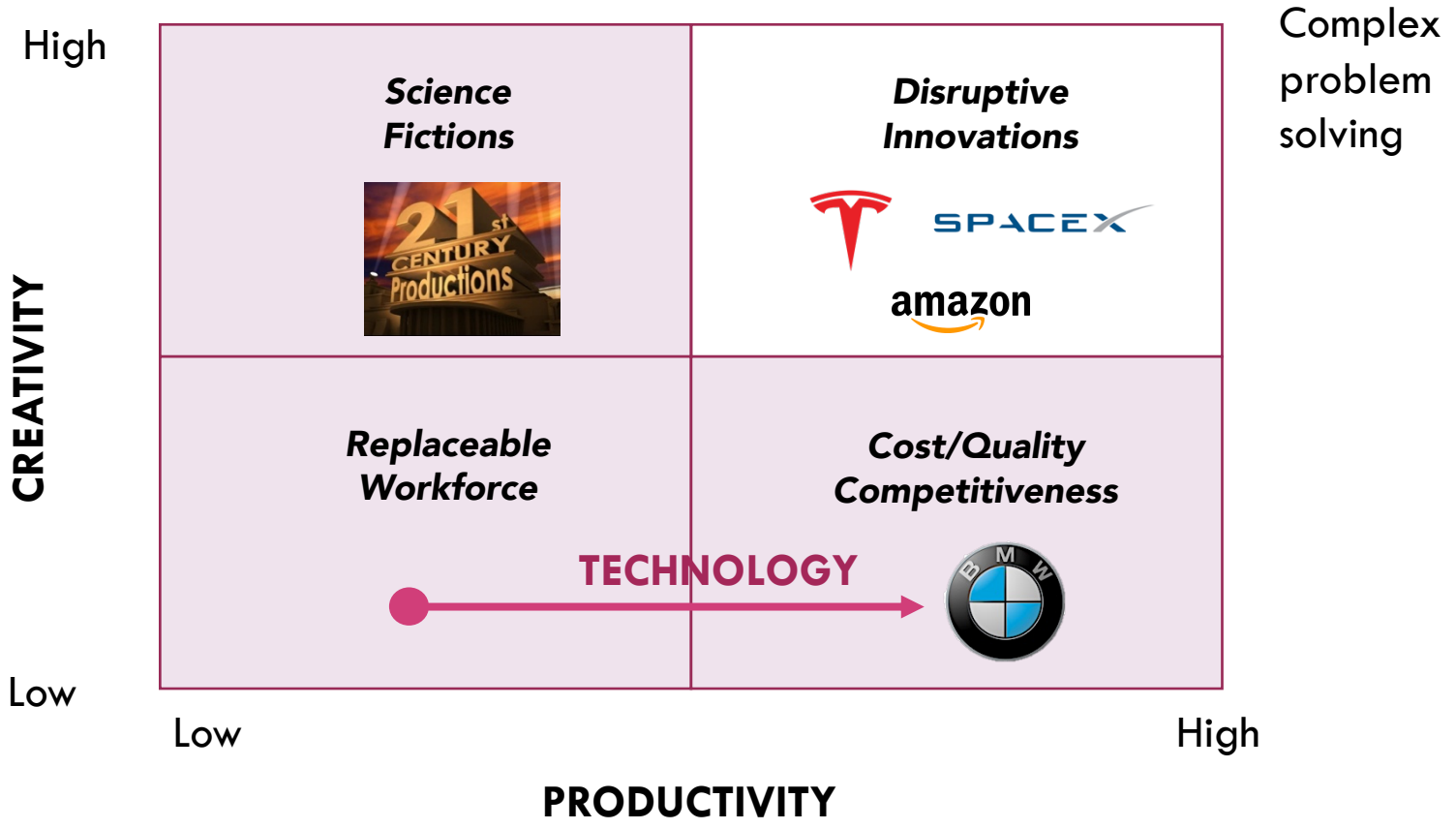
AGENDA

Revolusi Industri 4.0

Dampak Ekonomi dan Sosial

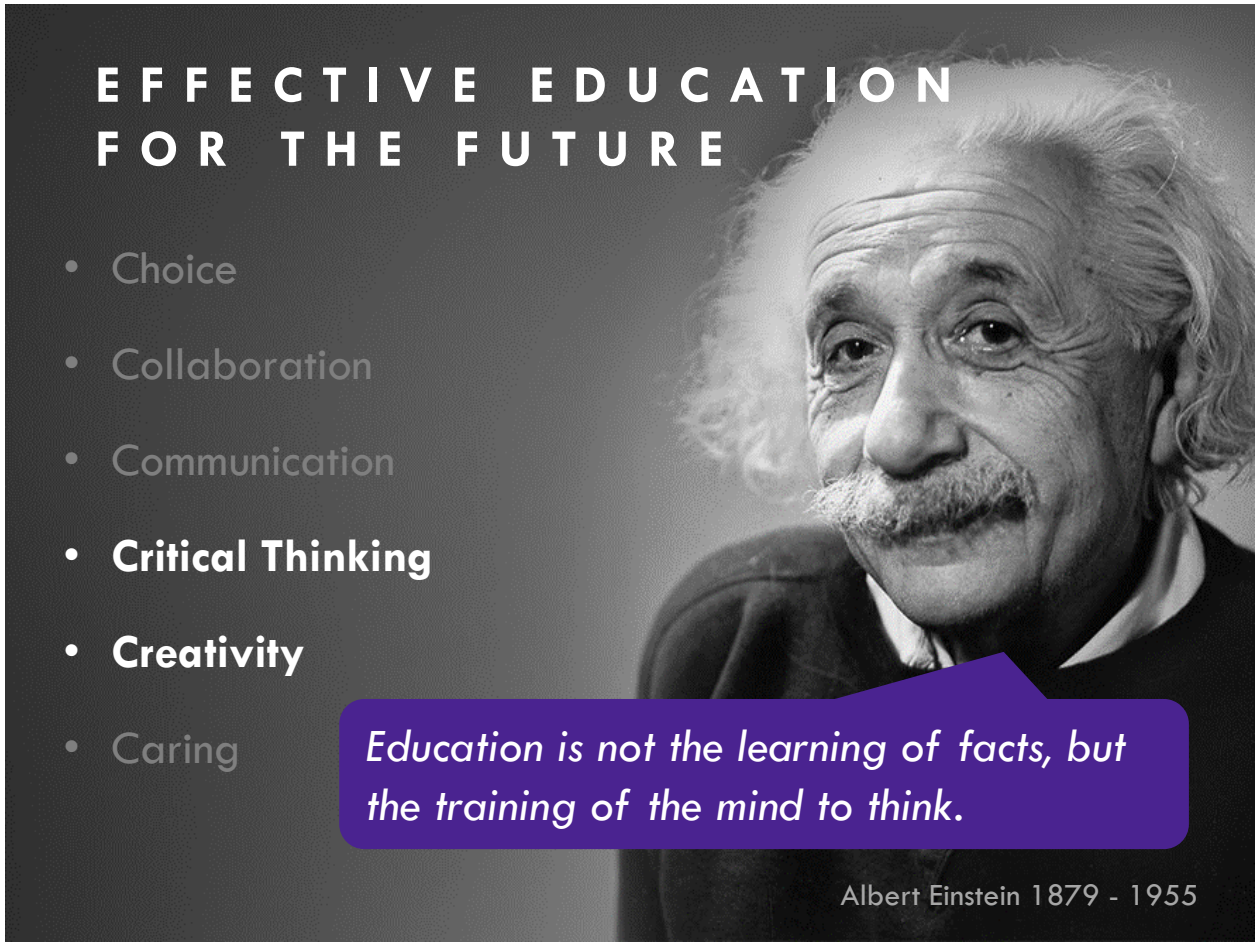
Pendidikan Masa Depan

Untuk dapat bersaing secara global, dibutuhkan masyarakat yang produktif dan kreatif

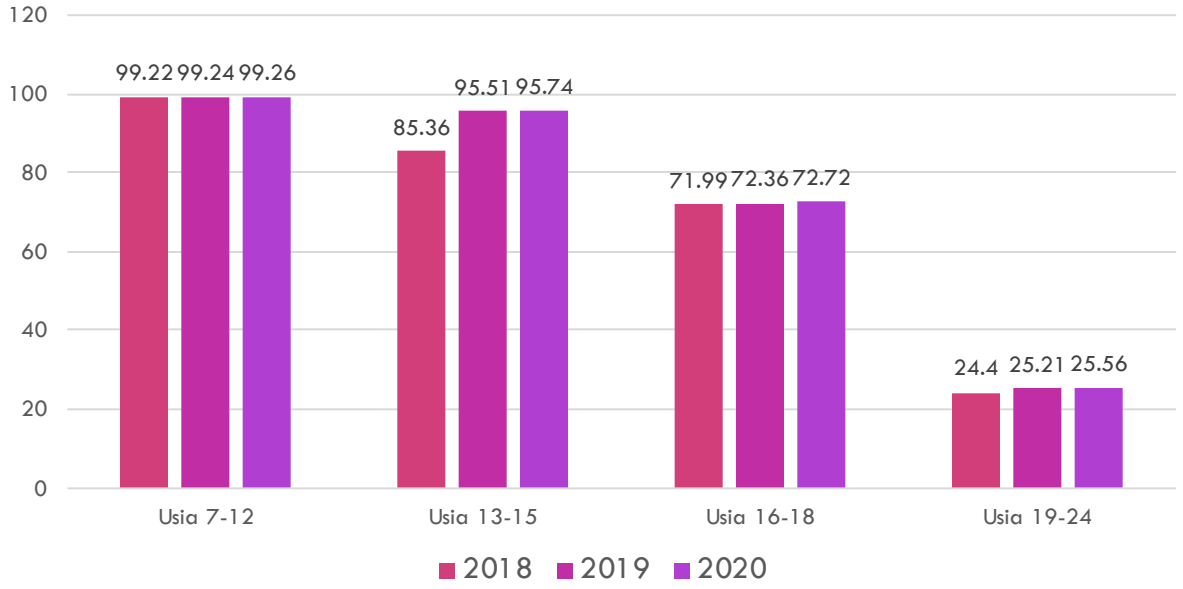


Untuk dapat bersaing secara global, dibutuhkan masyarakat yang menguasai teknologi dan kreatif

https://www.weforum.org/agenda/2020/10/top-10-work-skills-of-tomorrow-how-long-it-takes-to-learn-them/



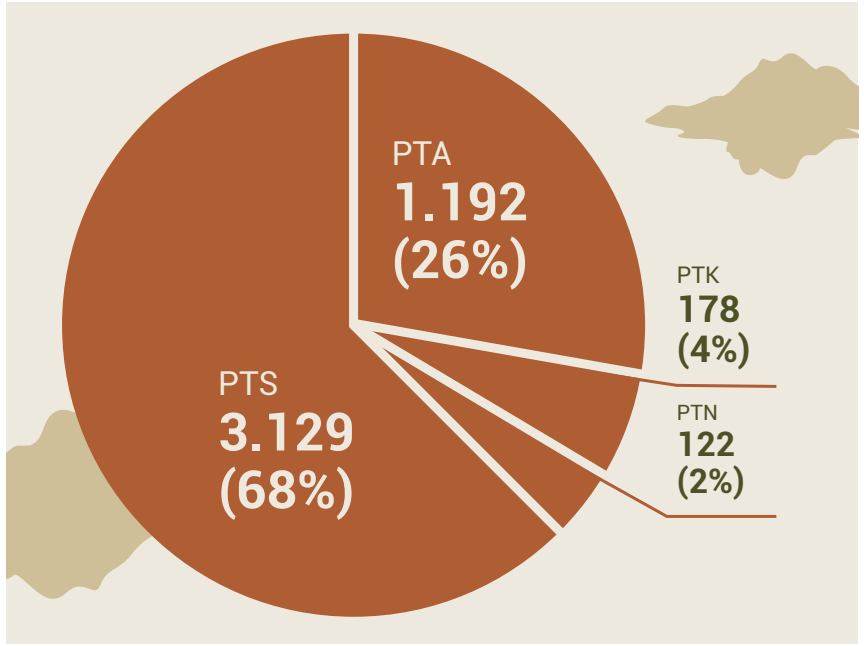
Pembangunan pendidikan kita masih fokus pada peningkatan akses (Angka Partisipasi)



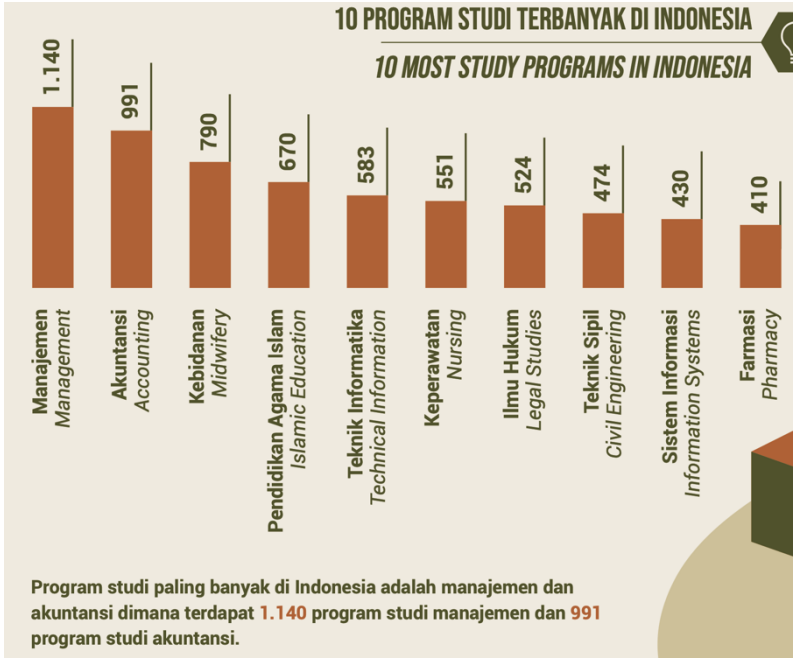
https://www.bps.go.id/indicator/28/301/1/angka-partisipasi-sekolah-a-p-s-.html

Sumber: Statistik Pendidikan Tinggi 2019 (Kemenristekdikti)

Namun belum menjawab kebutuhan ekonomi kita untuk beralih ke industri manufaktur dan kreatif



Jumlah Perguruan Tinggi (2019)
Total 4,621



Jumlah Program Studi (2019)
28,879

Sumber: Statistik Pendidikan Tinggi Indoensia. 2019. Kemenristek dan Dikti

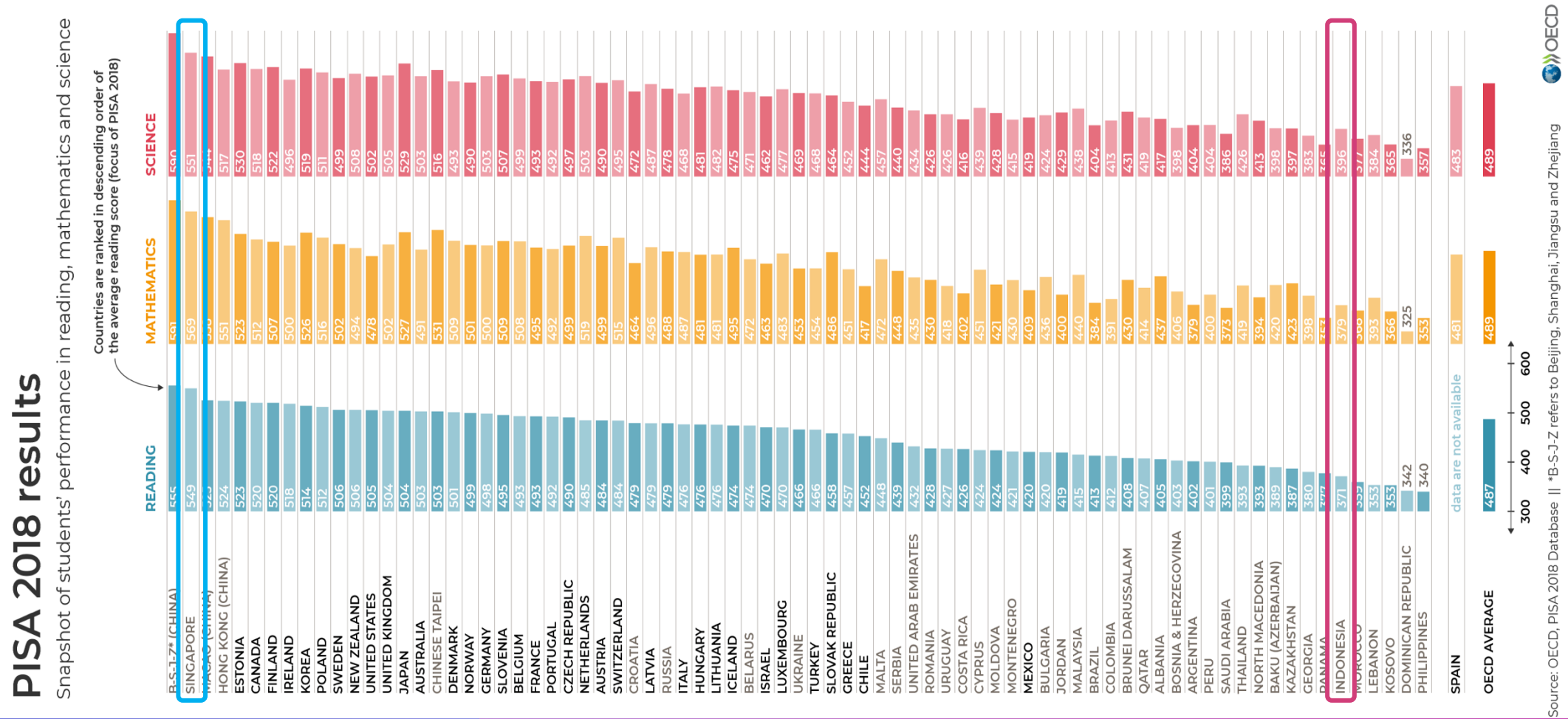
Bahkan secara global, kualitas SDM kita masih berada di bawah rata-rata dunia

Source: The Programme for International Student Assessment (PISA)

Bahkan secara global, kualitas SDM kita masih berada di bawah rata-rata dunia

2nd

72th / 78 countries



Indonesia perlu kebijakan jangka panjang untuk mengejar ketertinggalan dalam pendidikan

So why is Indonesia trailing behind?

A recent report entitled "Beyond access: Making Indonesia's education system work" from the Sydney-based Lowy Institute found that one of the main problems with Indonesia's education system stemmed from **"politics and power".** The report claims that there is little incentive for old elites to drastically overhaul the education system, arguing that they would rather exploit it to "accumulate resources, distribute patronage, mobilise political support, and exercise political control."

https://theaseanpost.com/article/how-will-indonesia-fare-pisa-2018-0

Tanggapan Menteri Pendidikan Nadiem Makarim

- Tidak perlu dikemas jadi positif
- PISA jadi perspektif menilai diri
- Capaian pemerataan akses belajar
- Sadari ketimpangan kualitas
- Bukan hanya sebaran murid, sebaran guru penting
- Bullying dan karakter juga masalah serius
- Menumbuhkan percaya diri siswa
- Sangat penting meningkatkan literasi
- Pelibatan peran orangtua
- Ajakan melakukan perubahan

https://edukasi.kompas.com/read/2019/12/07/17393181/10-tanggapan-mas-menteri-soal-rapor-merah-skor-pisa-indonesia?page=all

Kita bisa mempelajari kisah sukses Singapura, dari sejarah mereka membangun pendidikan

SURVIVAL DRIVEN
(1959-1978)

Economy: from port (70% GDP) to export oriented industrial base.

Goal of education is to produce a good man and **useful citizen**.

EFFICIENCY DRIVEN
(1979-1996)

Economy: from labor intensive (3rd league) to capital and skill intensive economy (2nd league)

Goal of education is to produce **technically skilled** labor force.

ABILITY BASED
(1997 - present)

Economy: focus on innovation, creativity, and research

Vision of Education: **Thinking Schools, Learning Nation** (Goh, 1979) to promote: creative thinking skills, lifelong learning passion, nationalistic commitment in the young, and make learning as the national culture.

Source: OECD https://www.oecd.org/countries/singapore/46581101.pdf

Singapura membangun pendidikan sesuai kebijakan ekonomi untuk memiliki kekuatan industri

Mr. Lee Kuan Yew (Prime Minister)

Speech when he opened the seminar on "The Role of Universities in Economic and Social Development" at the University of Singapore on February 7th, 1966.

Source:
https://www.nas.gov.sg/archivesonline/data/pdfdoc/lky19660207.pdf

- …what I want a university to do. It is first, to produce the teachers, the administrators, the men to fill the professions -- your accountants, your architects, your lawyers, your technocrats, just the people to do jobs in a modern civilised community. And next and even more important, it is to lead thinking -- informed thinking -- into the problems which the nation faces.
- …[in other newly independent nations]… the faculties that have been established invariably are the easier facilities to establish -- the Arts and the Humanities. Very few have had science and technology faculties established.
- Your men who can produce your modern industrial society -- your industrial chemists, your technocrats -- are missing.
- This presents us with our first problem. Is the university degree a symbol or proof that a man has imbibed knowledge?
- I think there is considerable truth in the proposition that the more you persist in producing men who are educated but unable to increase your productive capacity, the more you are heading for an unstable situation.

Singapura membangun pendidikan sesuai kebijakan ekonomi untuk memiliki kekuatan industri

A forward looking, integrated planning system

Commitment to equity and merit

A strong focus on mathematics, science and technical skills

Close links between policy implementers, researchers and educators

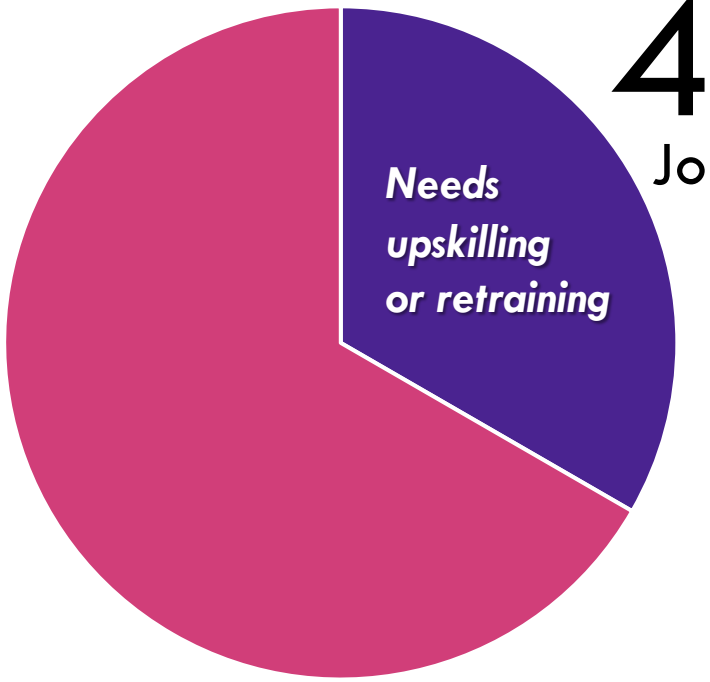
The advantages of a small scale

HRM that matches demands of the system
(Teacher recruitment, training, compensation, development, appraisal)

A system which is continuously being improved

Source: OECD https://www.oecd.org/countries/singapore/46581101.pdf

Ke depan Singapura, juga menghadapi tantangan yang sama



44%

Jobs are automatable

Singapore's Key Strategies

- International Networks
- Deepen skills (modular training)
- Build strong digital capabilites

Source: McKinsey Global Institute. Higher Education in The Era of the Fourth Industrial Revolution (2018) – Yale NUS College, Singapore

Ke depan Singapura, juga menghadapi tantangan yang sama

Interestingly, in March 2018, President Tan of the National Univeristy of Singapore (NUS) announced that computational thinking - namely **statistics and programming** - will be required of all NUS students regardless of their major. (p. 155)

"Singapore's education system has a reputation for preparing excellent Science Technology Engineering and Math (STEM) learners, where students learn to the test. This was useful in creating a workforce that crunches and manages numbers efficiently.

Creative and critical thinking did not come from this sort of preparation, however."

Sumebr: Higher Education in The Era of the Fourth Industrial Revolution (2018) – Yale NUS College, Singapore

Pemerintah sudah mulai meningkatkan kemampuan STEM dan kreativitas dengan berbagai program

Google bangkit

A **structured, high quality, training program** to produce high-calibre, graduates for world-class technology companies to select talented, qualified, and motivated Indonesian technologists by opening the opportunity and access to a curated set of **in-demand learning resources**, and **world-class mentors** so they can improve Indonesia's technology ecosystem and support her vision of becoming the largest digital economy powerhouse in SEA.

gojek tokopedia traveloka

Top 3 National Projects 2021
(BACARA)

Timotius Haniel
Mobile Technology

Thomas Ken Ronaldi
Mobile Technology

Top 4 National Projects 2020
(What's Cooking)

Daniel Alexander
Informatics

Natasha Yulian
Informatics

Pemerintah sudah mulai meningkatkan kemampuan STEM dan kreativitas dengan berbagai program

International Student Mobility Award

Daniel Alexander (IF)

Penn
University of Pennsylvania

USA

Paula (OLB)

MICHIGAN STATE

USA

Yemima Sofia (DKV)

University of Limerick
Ollscoil Luimnigh

Ireland

University Innovation Fellow

Timotius Haniel (MT), Thomas Ronaldi (MT)
Vincentsius Pradipto, (SI), Cintya Kristianto (IF)

Stanford University

Saran untuk pengembangan pendidikan Indonesia

Pemerintah

1. Rumusan bidang-bidang prioritas (industri nilai tambah, pariwisata, logistik)
2. Peningkatan sarana online untuk pemerataan kualitas guru dan materi pendidikan
3. Pengembangan kemampuan STEM:
   - Kurikulum (semua jenjang)
   - Kerjasama internasional
   - Beasiswa ke luar negeri
   - Program studi
4. Pengembangan kreativitas dengan panduan implementasi Merdeka Belajar.
5. Pembelajaran dewasa *(lifelong learner)*

Sekolah/PT

1. Peningkatan motivasi untuk menjadi *lifelong learner (why learn)* dan kemampuan belajar mandiri *(how to learn)*.
2. Pemanfaatan sarana online secara lebih luas (*when, where, who, from whom to learn*)
3. Peningkatan kreativitas, melalui Merdeka Belajar dan Kampus Merdeka.
4. Memberikan wawasan tentang dunia masa depan kepada peserta didik sejak dini.
5. Peningkatan penguasaan STEM: statistika dan *programming* sejak dini *(what to learn)*, serta aplikasi teknologi.
6. Program studi masa depan: OLB, SCM, AI/ML/Data Science.

TERIMA KASIH