

Collaborative Networks and Incubators for Development, Adoption and Diffusion of 4IR Technologies

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July 22th, 2021



Prelude

Contextualizing the Fourth Industrial Revolution & COVID-19.

Collaborative innovation Networks in Frontier Countries.

Emerging Asia Pacific & Place on 4IR era.

Epilogue

As of July 2021 ~ The “3 WAR” Fronts

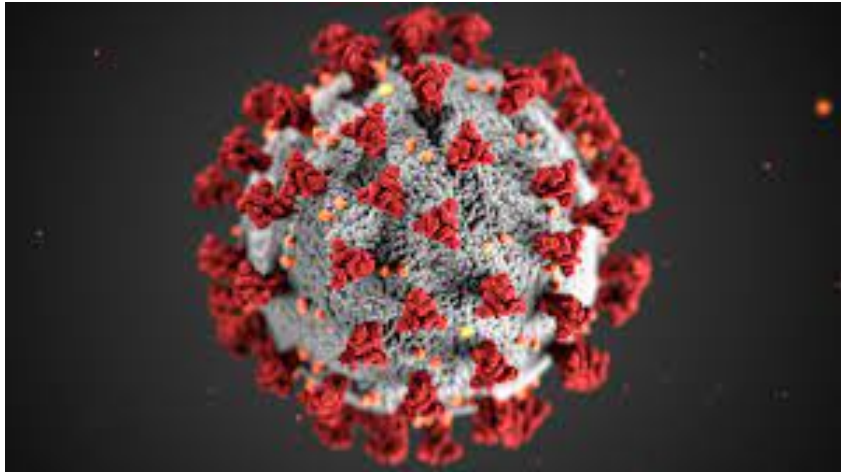


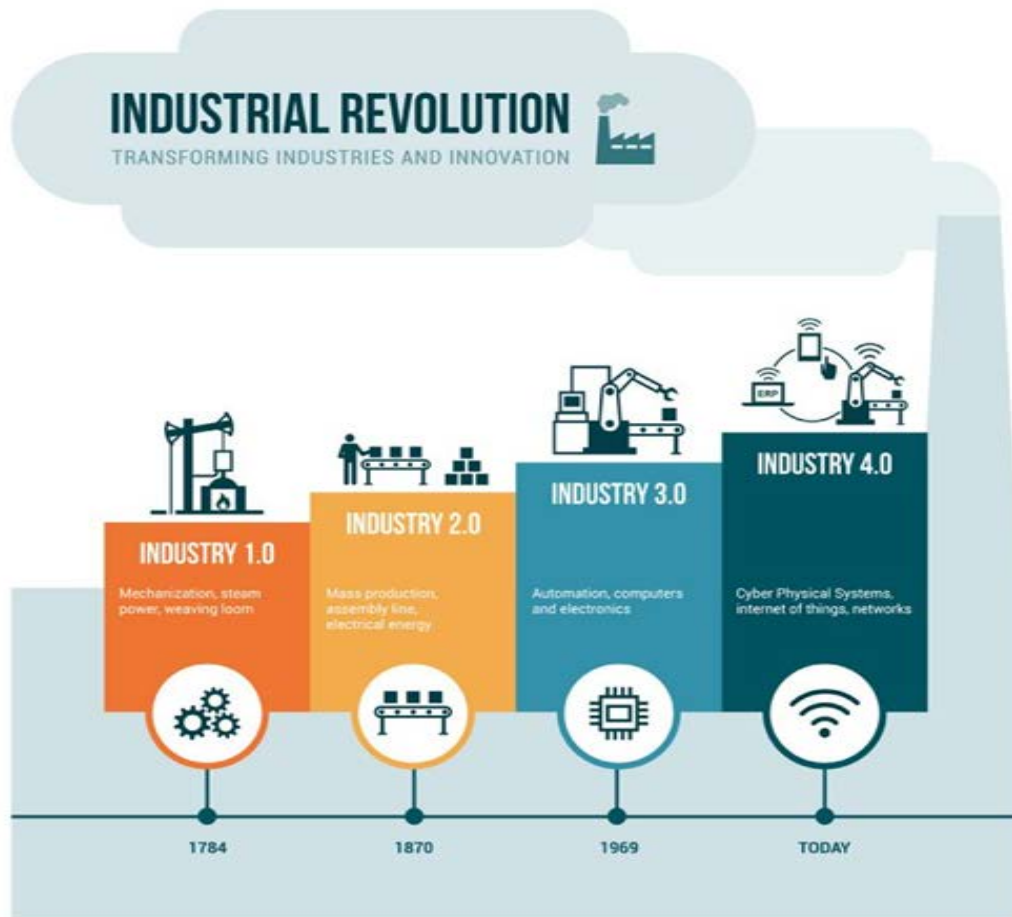
Illustration of the ultrastructure of the Covid-19 virus
CDC/SCIENCE PHOTO LIBRARY



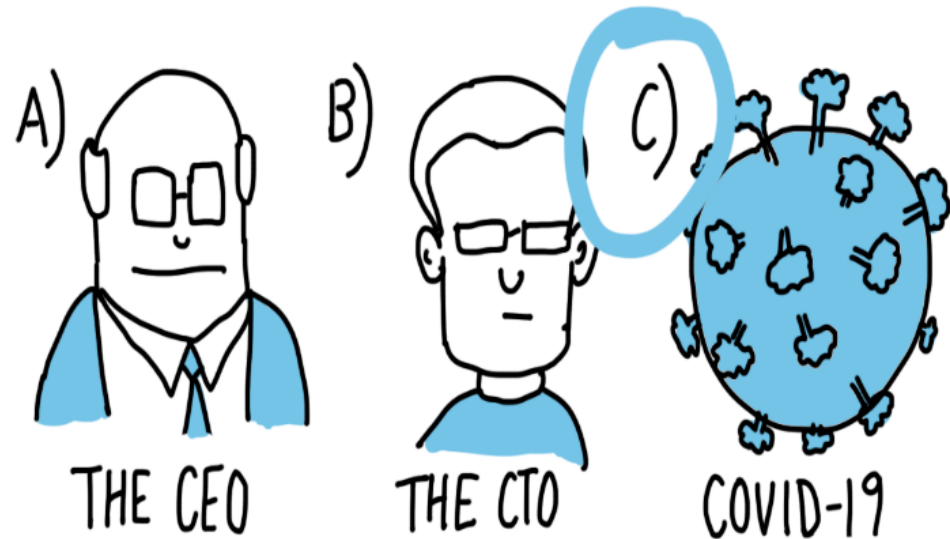
Source: CNN, July 16, 2021



COVID-19: The dawn of 4IR-a New Endless Frontier



WHO LED THE DIGITAL TRANSFORMATION OF YOUR COMPANY ?



BUSINESSILLUSTRATOR.COM

- World War 2 led to Science the Endless Frontier- COVID leading to a 4IR Endless Frontier.



Prelude

Contextualizing the Fourth Industrial Revolution & COVID-19

Collaborative innovation Networks in Frontier Countries

Questions for Emerging Asia Pacific & Place on 4IR Frontiers

Epilogue

Innovation and 4IR R&D in Frontier Countries

Table 1. –Distribution of global 2500 companies by industrial sector and region-no' of companies

Industry	EU	EU 28	US	Japan	China	RoW	Total
Aerospace & Defence	10 (39.7%)	15 (48.8%)	14 (40.6%)	0 (0%)	5 (2%)	16 (17.7%)	45 (2.3%)
Automobiles & other transport	42 (44.6%)	47 (45.9%)	33 (15.2%)	36 (24.4%)	44 (8.1%)	32 (7.8%)	187 (16.3%)
Chemicals	20 (23.9%)	25 (25.8%)	27 (18.7%)	34 (34%)	25 (7.1%)	24 (16.2%)	130 (2.6%)
Health industries	81 (19.5%)	106 (25.9%)	284 (49.5%)	36 (7.7%)	54 (3.5%)	75 (19.7%)	530 (20.5%)
ICT producers	49 (12.9%)	58 (13.3%)	122 (40.9%)	55 (10.4%)	125 (17.1%)	110 (18.7%)	461 (23.1%)
ICT services	32 (8.7%)	48 (10.7%)	162 (68.6%)	8 (3.6%)	70 (13.6%)	50 (5.5%)	322 (16.9%)
Industrials	71 (24.5%)	79 (26%)	42 (19.4%)	54 (21.2%)	85 (22.9%)	39 (12%)	291 (5.5%)
Others	116 (18%)	164 (27.7%)	91 (17.9%)	86 (16.4%)	128 (26.1%)	113 (21.5%)	534 (12.9%)
Total	421 (20.9%)	542 (24.4%)	775 (38.5%)	309 (12.7%)	536 (13.1%)	459 (14.8%)	2500

Note: The figures in brackets show each sector's regional percentages of total R&D in the sector. The cell representing the higher sectoral share by region is highlighted. The total in the final column shows the number of firms in the sector and in brackets their share of the total R&D. The total in the final row shows the number of firms in the region, with their share of R&D in brackets. The EU28 column does not account for the final column total

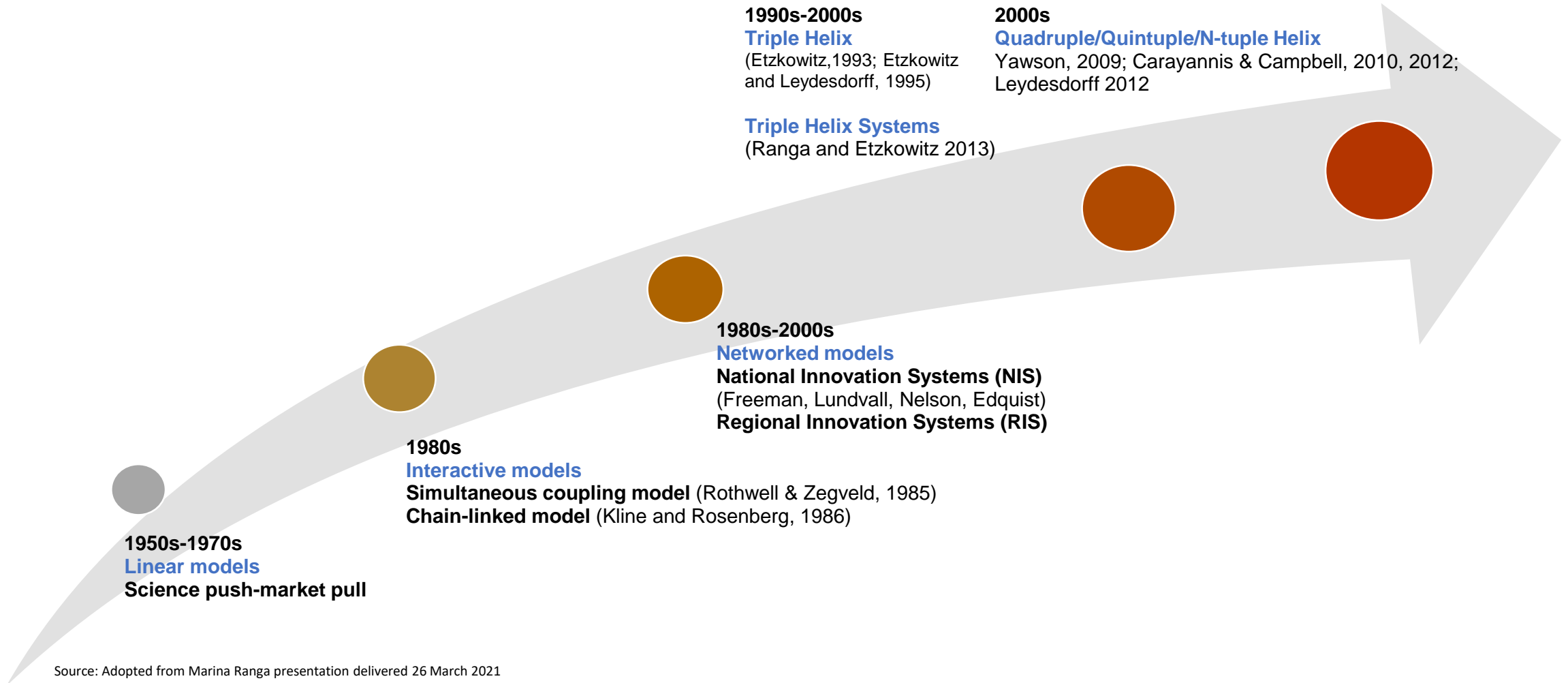
Source: The 2020 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG R&I.

Table 2. –Distribution of global 2500 companies by industrial sector and region-R&D invested (€ bn)

Industry	EU	EU 28	US	Japan	China	RoW	Total
Aerospace & Defence	8.2 (22.2%)	10 (33.3%)	8.3 (31.1%)	0 (0%)	0.4 (11.1%)	3.6 (35.6%)	20.6 (1.8%)
Automobiles & other transport	65.7 (22.5%)	67.5 (25.1%)	22.4 (17.6%)	35.9 (19.3%)	11.9 (23.5%)	11.4 (17.1%)	147.2 (7.5%)
Chemicals	5.5 (15.4%)	6 (19.2%)	4.3 (20.8%)	7.9 (26.2%)	1.7 (19.2%)	3.7 (18.5%)	23.1 (5.2%)
Health industries	36.3 (15.3%)	48 (20%)	91.9 (53.6%)	14.3 (6.8%)	6.5 (10.2%)	36.5 (14.2%)	185.6 (21.2%)
ICT producers	26.9 (10.6%)	27.8 (12.6%)	85.3 (26.5%)	21.6 (11.9%)	35.7 (27.1%)	39.1 (23.9%)	208.5 (18.4%)
ICT services	13.2 (9.9%)	16.3 (14.9%)	104.9 (50.3%)	5.5 (2.5%)	20.7 (21.7%)	8.4 (15.5%)	152.8 (12.9%)
Industrials	12.1 (24.4%)	12.9 (27.1%)	9.6 (14.4%)	10.5 (18.6%)	11.3 (29.2%)	6 (13.4%)	49.4 (11.6%)
Others	21 (21.7%)	32.4 (30.7%)	21 (17%)	19.2 (16.1%)	30.5 (24%)	25.2 (21.2%)	116.9 (21.4%)
Total	188.9 (16.8%)	220.9 (21.7%)	347.7 (31%)	114.9 (12.4%)	118.8 (21.4%)	133.9 (18.4%)	904.2

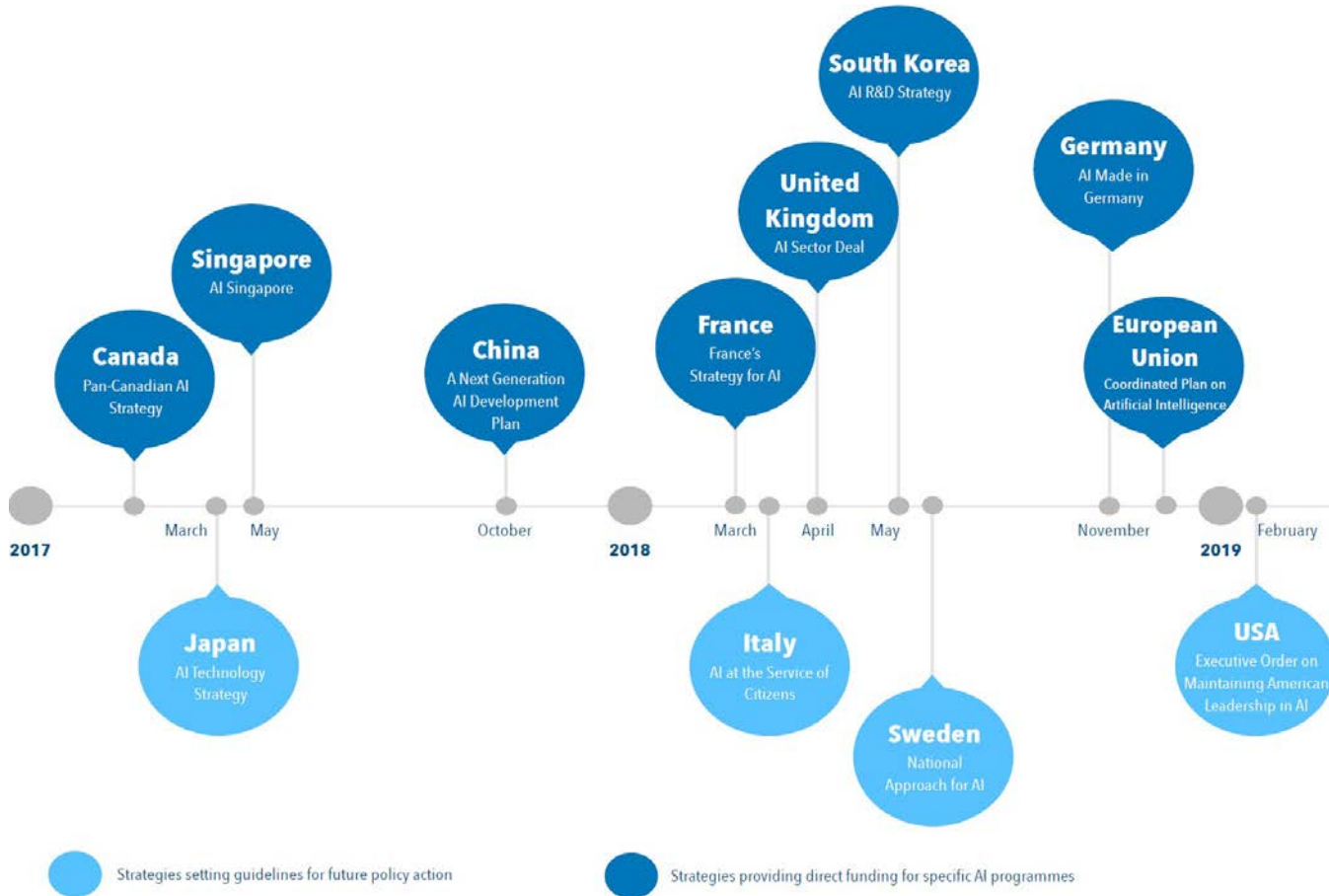
Note: The figures in brackets show each sector's regional percentages of total number of firms in the sector. The cell representing the higher sectoral share by region is highlighted. The total in the final column shows the total R&D invested in the sector and in brackets their share of the total number of companies. The total in the final row shows the R&D invested by firms headquartered in the region, with their share of firms in brackets. The EU28 column does not account for the final column total Source: The 2020 EU Industrial R&D Investment Scoreboard, European Commission, JRC/DG R&I.

Evolution of Innovation Model Discourse



Evolution of the 4th Industrial Revolution Discourse

Figure 1. Timeline of national Artificial Intelligence strategies adoption



- We experiencing rapid development of 4IR and the technologies associated with it – scale, speed, diversity is unprecedented in human history
- This has opened new competition ground introduced by 4IR technologies - Technology hegemonic struggles that will redefine many innovation ecosystems, networks, and alliances.
- New 4IR era introduces new challenges including digital infrastructure, competences and skills, Job creation to every country etc.
- All these requires rethinking of our innovation ecosystems and theories- to reset towards inclusive growth

COVID-19: HOW COUNTRIES ARE APPROACHING 4IR, OUR NEW ENDLESS FRONTIER?



	Innovation Policy	Recent Regulatory	Ethics framework
	The US just passed \$ 250 billion dollars industrial policy for 4IR technologies last month June, 2021, new 1 trillion dollar infrastructure bill just passed senate	Mostly Market driven self regulation, for example the US has no comprehensive data and privacy regulations -support for EU-US Digital tax regime	Light approaches, principles, standards, self regulation by 4IR Companies and advisory
	EU GREEN NEW DEAL & NEXT GENERATION EU €806.9 billion*. Emerging technologies including AI and Blockchain, are central to these transition plans	GDPR polices external flows; free flow of data regulation removing barriers within the EU; European Commission assessing link between anti-trust and data concentration	A number of ethical frameworks, guidelines, standards and frameworks for 4IR technologies have been adopted in Europe
	UK GREEN NEW DEAL and UK Digital Strategy	The Data Protection Act 2018 is the UK's implementation of the General Data Protection Regulation (GDPR). Regulatory sandboxes	European Commission's High-Level Expert Group on artificial intelligence developing ethical guidelines.
	"Digital China" massive investments in digital technologies, piloting/implementation with AI, Blockchain, 5G, HPC, CBDC, Belt & Road Initiative etc	Heavy restrictions in cross boarder crypto trading as of July 2021, mixture of government-mkt friendly regulatory support	Commitment to national data ethics framework by 2015
	Korea Green and Digital New Deal- focusing on Renewable energy and 4IR technologies including AI, Blockchain, Data and Network , (\$133 billion)	Heavy restrictions on cross blockchain crypto currency space. Comprehensive personal information protection act	

Source: Author's compilation based on multiple data

Mapping the Pillars of US Collaborative Networks & 4IR Incubators (selected)

Industry: Microsoft, Amazon, Hewlett-Packard
Skills 4.0 Workforce: Washington State University, Western Washington University, Whitman, etc.
Policy:

Industry: Silicon Valley ecosystem, Big Tech Apple, Google, Facebook, **Smart manufacturing institute**
Skills 4.0 Workforce: Stanford, UCLA, UC Berkeley, University of Southern California, Caltech
Policy: Federal grants, Jobs tax credit, R&D tax credit
Capital: Strong VC Funding

Industry: Intel semi conductor
Skills 4.0 Workforce: Arizona state, 38 advanced STEM Degree programs, **Manufacturing research hub**
Policy: Jobs tax credit, R&D tax credit



Industry: General Electric, Biotech, IT in healthcare, etc. **Lab Central hub**, Novartis, Takeda
Skills 4.0 Workforce: MIT and Harvard, **Broad Institute, Draper** etc.
VC: Strong VC Funding

Industry: 3D industry, GE Additive, Comcast,, etc.
Skills 4.0 Workforce: Carnegie Mellon University, University of Pittsburgh, Robert Morris University, **Penn State- Center for Additive Technology** etc.

Industry: Foxconn Assembly LLC, Houston TX, Texas Industry cluster
Skills 4.0 Workforce: Texas A&M, Rice University, University of Houston, University of Texas at Austin etc.
Policy: cluster policies, Freeport tax exemption, training incentives, foreign trade zone

Industry: JELD-WEN ,Genpak, Daimler Trucks (connected automotive solutions), Groninger, etc. Lulu, Citrix, Cree
Skills 4.0 Workforce: The University of North Carolina Chapel Hill– **The Center for Precision Metrology**, Duke University, etc

Source: Author's compilation based on multiple data

Mapping the Pillars of US Collaborative Networks & 4IR Incubators (selected)

- **The National Network for Manufacturing Innovation (NMI) Similar to German's Fraunhofer**

1. **National Additive Manufacturing Innovation Institute ([America Makes](#))**

“Government/industry/academia no profit to accelerate 3D and AM Innovations”

2. **Lightweight Materials Manufacturing Innovation Institute ([Lift](#))**

“Public-private partnership between the U.S. Department of Defense, industry and academia, driving the U.S. mobility sector toward the future manufacturing revolution to support our nation's economy and enhance our national security.”

3. **Smart Manufacturing Innovation Institute ([CESMII](#))**

“Public-private partnership between the Manufacturer, System Integrator, Machine Builder, SW APP vendor, Academic Labs to invest in technology, Research, Education, Collaboration, to Transform Manufacturing in U.S.”

4. **Advanced Functional Fabrics of America ([Affoa.org](#))**

“As a non-profit, public-private partnership and DoD funded Manufacturing USA Innovation Institute, AFFOA bridges the gap between early-stage technology and commercialization”. Members (STARTUPS, MANUFACTURERS, Industry, Academia, Non-profit, DOD/Governemnt

5. **Digital Manufacturing and Design Innovation Institute ([Rebranded as Manufacturing x Digital \(MxD\)](#))**

“MxD equips U.S. manufacturers with the digital manufacturing tools and expertise they need to begin building every single part better than the last.”

6. **American Institute for Manufacturing Integrated Photonics ([AIM Photonics](#))**

“Government/industry/academia no profit to accelerate Photonics

European Pillar I: Digital Innovation Hubs (DIH)

CeADAR- Applied R&D on AI

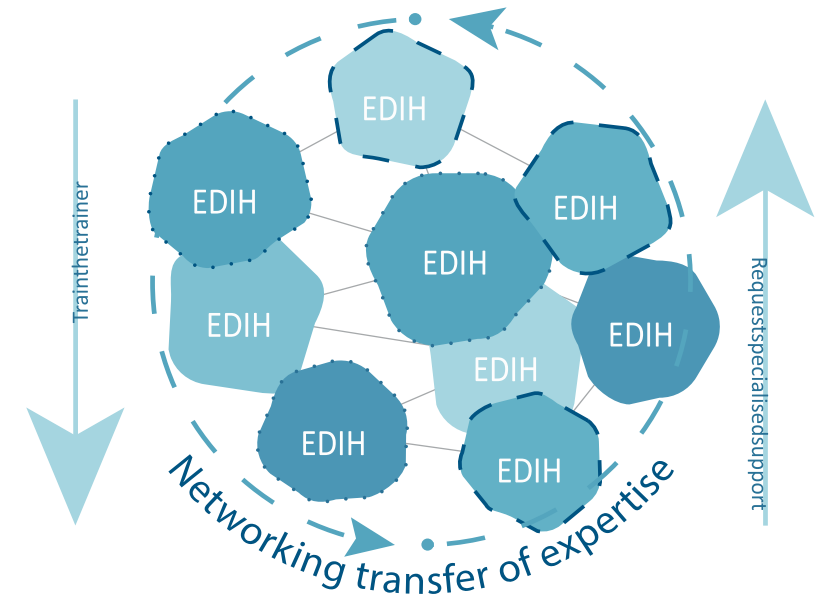
Fraunhofer Produktion-4IR, Industrie 4.0

4IR Hub in France

Czech Institute of Informatics, Robotics and Cybernetics

Digital innovation hub for industry CROBOHUB –Business processes
4P Public and Private on 4IR
KNOW Center- Big data and AI

- High performance computing
- Artificial intelligence
- Cybersecurity and Trust
- Advanced digital skills
- Deployment, best use of digital capacity and interoperability



Test before invest, skills and training, innovation ecosystem, support to get investments

The EC has proposed for 2021-2027 the Digital Europe Program (DEP) -with a proposed budget of 9.2 b€- and focus on investments in digital capacities mainly in the areas of High Performance Computing (HPC), Cybersecurity and Artificial Intelligence (AI), related advanced digital skills as well as digital solutions / interoperability for the public sector

European Pillar 2: European Institute of Technology (EIT)

EIT Climate-KIC is Europe's largest network for climate-friendly innovations.

EIT InnoEnergy Innovation Hub based in Sweden – smart grids & storage, education, EU energy incubator

The Case of De hub German 12 hubs, one Digital Ecosystem



EIT FOOD – innovator, Education, Start up incubator, Public engagement

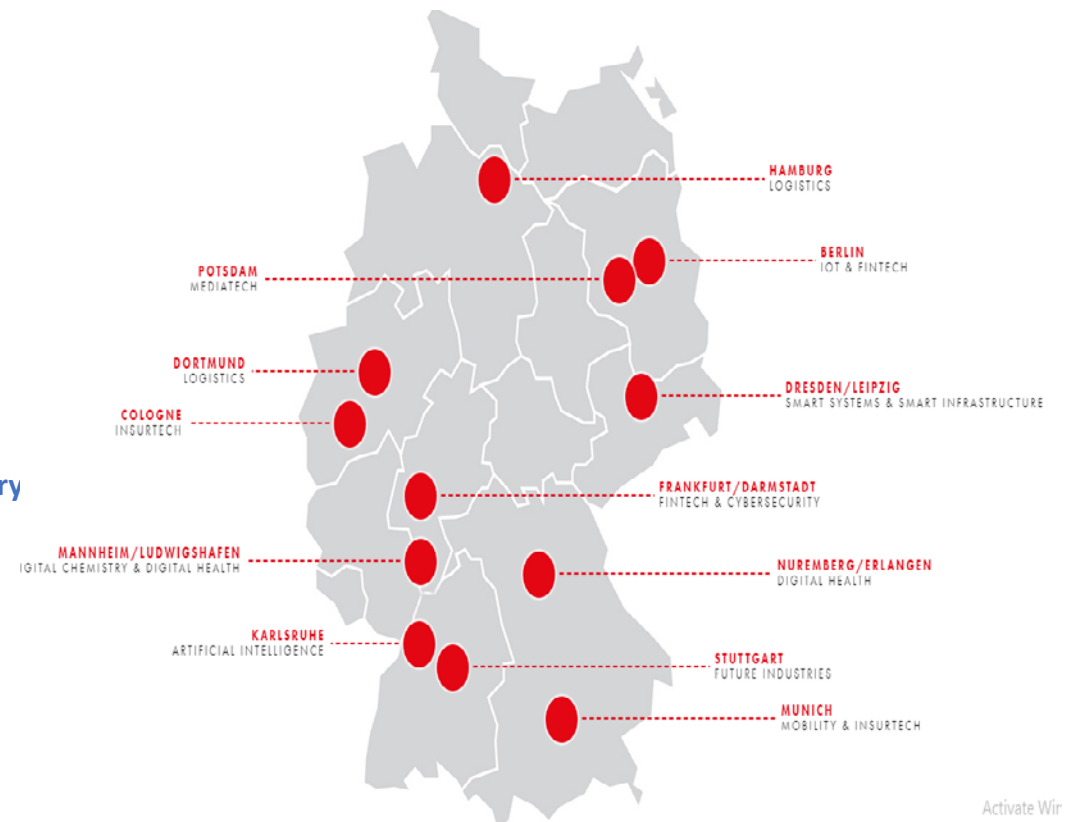
EIT Manufacturing– connects leading manufacturing actors in Europe- focus education (BS, MS PHD, Innovations, Business creation , RIS

EIT Digital Innovation Networks Based in Italy to leverage digital technologies- Business & industry startups, scaleups, investors, Research and academia

Urban Mobility-Education and innovation and start-ups, education, and Factory

EIT Raw Materials – innovator, Education, Start up incubator, Accelerator,

EIT Health- accelerator and innovation and start-ups, education, and think tank



Other notable examples- [its oWI](#) –the Technology Network: OstwestfalenLippe, German De hub digital ecosystems German , [Tech Barcelona](#)

European Pillar 3: Smart Specialisation Key features

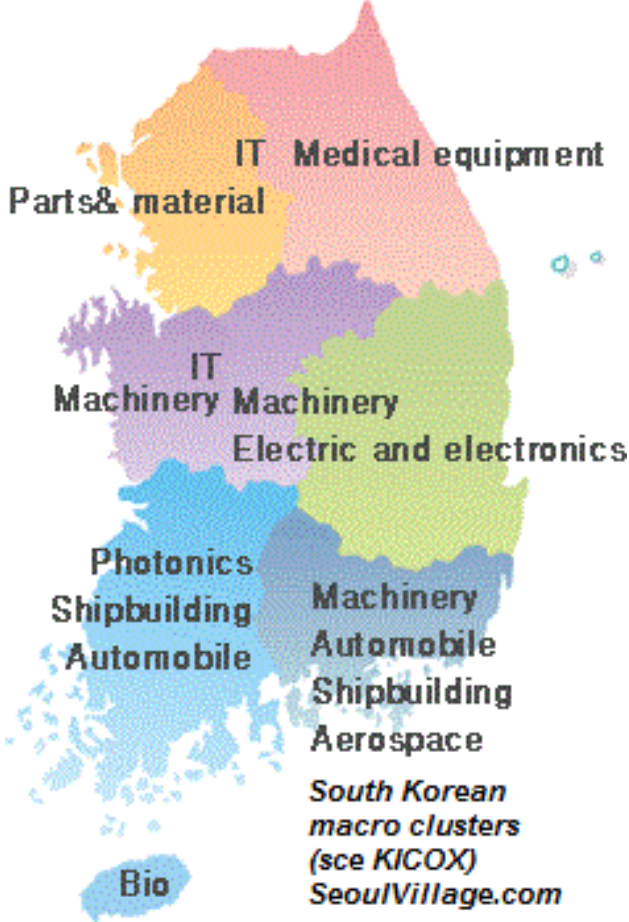


Core of 2014-2020 EC Cohesion Policy for place-based regional innovation

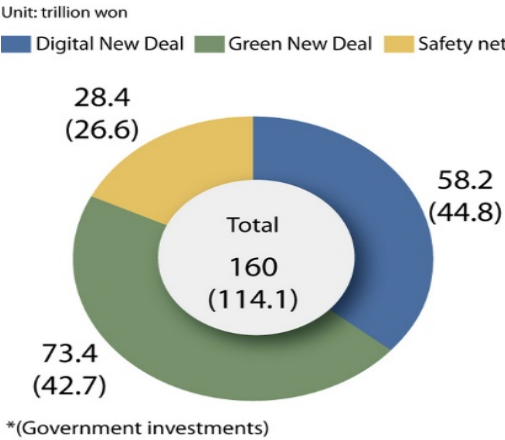
- **TARGETED, STRATEGIC INVESTMENT:** each region/country defines a limited set of priority areas for public investment in competitive areas, by matching R&I strengths to business and regional development needs
- **BOTTOM-UP PRIORITY-SETTING:** “Entrepreneurial Discovery Process” to identify and pursue the most promising development projects
- **STRATEGIC PARTNERSHIPS** among Quadruple Helix actors to define a shared vision for regional innovation, address emerging market opportunities, niches
- **MULTILEVEL GOVERNANCE:** implementation across different territorial scales
- **RESPONSIVE:** Better use of EU Structural Funds in line with regional needs

Collaborative Networks & Pillars in South Korea

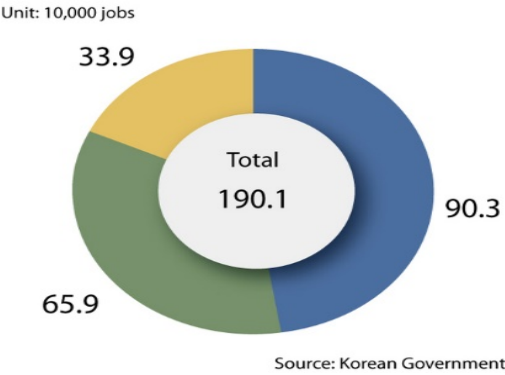
Korea's Innovation Clusters



Korean New Deal investment plan



Jobs created

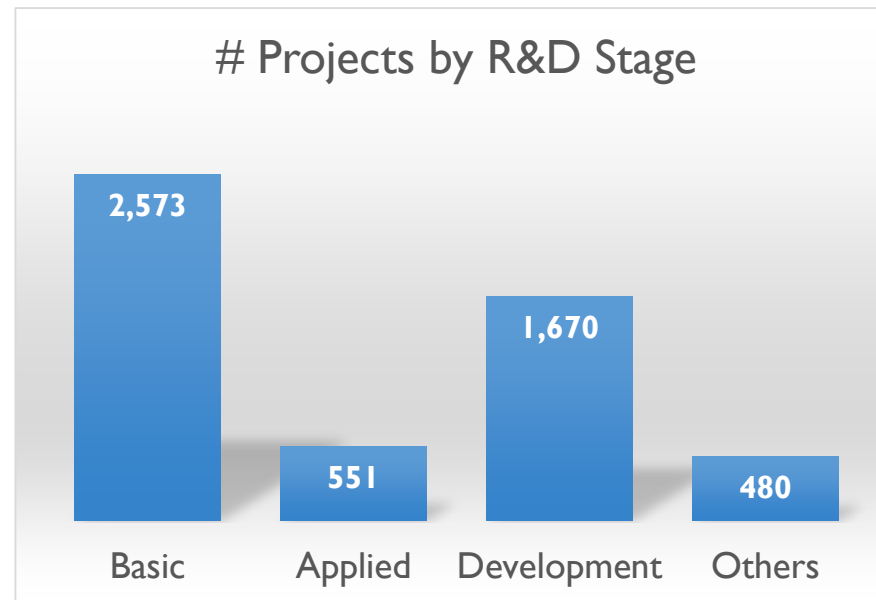
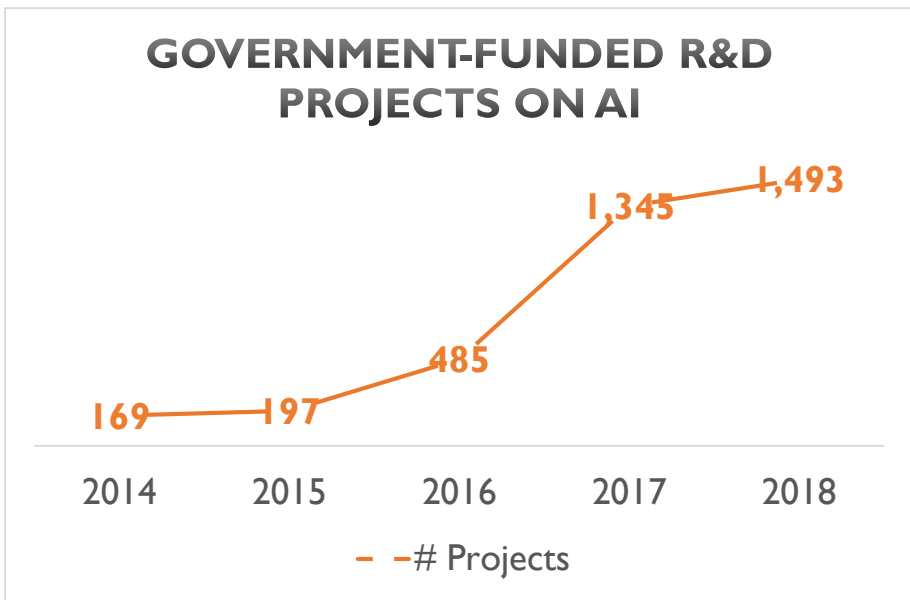


- STARTUP promotion policy- Incubators, Accelerators, VC, Seed Funding, Seoul, Busan, Pangyo the silicon Valley of Korea, Ministry of Startups
- Entrepreneurial Universities
 - [KAIST STARTUP INSTITUTE](#)
 - [SNU STARTUP INSTITUTE](#)
 - [Korea University STARTUP Station](#), etc.

Source: <http://english.seoul.go.kr/koreas-innovation-clusters/>

Witnessing a surge of R&D funding on AI

- Threefold increase in government-funded R&D projects on AI



AI Graduate Schools

KAIST Graduate School of AI
Korea Graduate School of AI
Sungkyunkwan AI Grad School
POSTECH
GIST AI School

Data: Korean National S&T Information Service (NTIS)

Preliminary: Common Features in Frontier countries

- **Top down “4IR” New Deal Policies**, US’ recent “4IR Policy”, Next Gen Europe, EU GREEN NEW DEAL, Korea’s Digital and Green New Deal, UK’s, Japan’s, China’s, Singapore’s – New digital and power infrastructures to power countries beyond COVID-19.
- **RISE of regional innovation ecosystems – EIT, EHIB, Manufacturing America**, increasing the ability of innovators to exploit technological trajectories, technology transfer, in-house R&D, spillovers, networking, demand factors, etc.
- **Government-industry-start-up-academia relationships and interactive learning between local actors, faster responses to changes in market demand to create new innovations.**
- **Investments in skilling and reskilling e.g., EIT, Korea AI Schools, Start-ups, and entrepreneurial universities.**
- In short, **INDUSTRIAL POLICY and GOVERNMENT “HAND” in guiding national economy is BACK!!!!**



Prelude

Contextualizing the Fourth Industrial Revolution & COVID-19

Collaborative innovation Networks in Frontier Countries

How about emerging Asia Pacific & Place on 4IR era?

Epilogue

Emerging Asia Pacific?

- **Does this kind of collaborative ecosystem exist in emerging Asia Pacific countries?**



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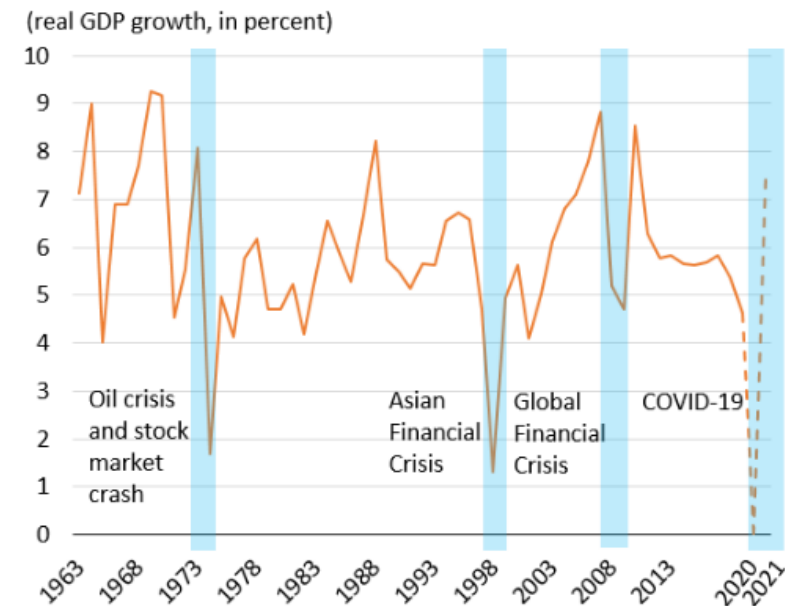
Epilogue

Epilogue: COVID 19 & CLIMATE EFFECT?

- COVID-19 Pandemic and the Asia-Pacific Region: Lowest Growth Since the 1960s.
- Countries in the Asia Pacific that relied on commodities, remittances and tourism were badly hit.
- Their priority is to overcome healthcare crisis.
- It is likely that they neither have the ability or the capacity to recharge the innovation ecosystems on the foundations of 4IR .

Historic fall

The COVID-19 crisis is expected to inflict steep declines in output across Asia.



Source: IMF Staff calculations.

Epilogue: COVID 19 & CLIMATE EFFECT?

- Do we need a “Asia Pacific” 4IR New Deal- (Each country)? System wide transformation of national economies of Asia Pacific on foundation of 4IR and new energy sources? US UK, EU, South Korea, Singapore, China, Japan etc. are taking this route, but how about Laos, Cambodia, Philippines, and others in Asia Pacific ?
- Do we need new **multi-lateral frameworks in place for needed large scale funding?** *Some countries have the ability to take advantage of 4IR to create some new economies, some Asia pacific countries, whose economies are on Knees (covid-19 and climate change) are clearly not able to take advantage of these technologies. They need both large scale funding and technical support.*
- What practical multi-lateral frameworks and roadmaps for increasing access to large scale 4IR infrastructure financing? The recent G7 2021 Meeting hinted on this commitment , and now the ball is in hands of political leadership, to keep this promise on the table?



[Source:](#) South Korea's President Moon Jae-in speaks at the Douzon Bizon's office in Chuncheon, Gangwon Province on June 18, 2020. [Photo by Cheong Wa Dae]

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Thank you.

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