



European Competitiveness and Industry

Benchmarking Report 2022

Introduction

More than ever before, Europe faces fierce global competition. Our position in the world is in decline – for many years already. Russia's war in Ukraine adds to the challenge. To remain relevant and prosperous both economically and politically, we need to strengthen our competitiveness. That requires constant effort, action and forward-thinking and builds on innovation and investment – by both the private and public sectors.

Today we are not doing enough to counteract this decline successfully.

This 2022 ERT Benchmarking Report shines a spotlight on two very problematic trends.

First, global economic power has shifted East as China's incredible economic growth is setting the pace of global competition. This has already been made apparent by various reports, amongst others, the ERT Benchmarking report of 2019. It is deeply worrying that this latest report does not show any evidence of corrective action; many Europeans, including policymakers, obviously still believe that our former market strength is a given and that we can afford to underperform on our potential. Both the incompleteness of the EU Single Market and insufficient investment in R&D are dragging us down.

Second, in several key areas of investment in infrastructure and future technologies Europe is seriously falling behind.

This includes strategic areas as:

- **Energy:** a lack of infrastructure is delaying the transition to renewable energy sources
- **Industrial raw materials:** Open Strategic Autonomy has to work in practice
- **Connectivity:** underdeveloped 5G infrastructure and fibre networks reduce innovation potential for new ways of production across all sectors
- **Semiconductors:** an example where the EU is scrambling to re-establish vital value chains. The European Chips Act can be a turning point in the right direction, let's not waste this opportunity.

At this geopolitically alarming time, the 2022 Benchmarking Report shows where EU policymakers and business are not doing enough yet and where action is urgently needed to reinvigorate the EU's broad competitiveness to the world.

Someone has told me that reading the Benchmarking Report was like a cold shower. The good thing about cold showers is that afterwards, you are awake.

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Industry gross value added

Global market share, %

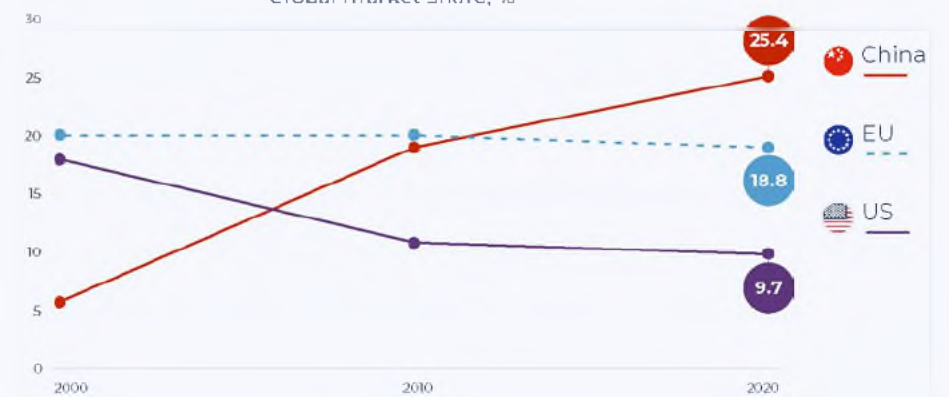


KPI 1

FROM LEADER TO LAGGARD: Europe has lost 30% of global market share. European companies are being pushed out of the Fortune Global 500 by their Chinese peers...

Exports of manufacturers

Global market share, %

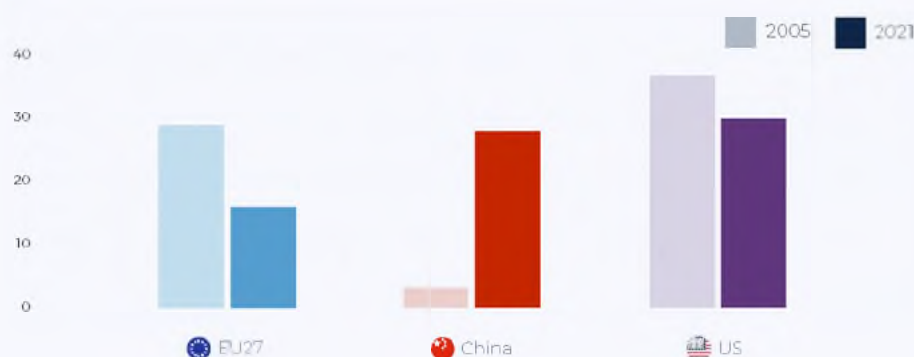


KPI 51

...but the EU is holding its ground in exports and in high technology manufactured goods

Share of companies in Fortune Global 500

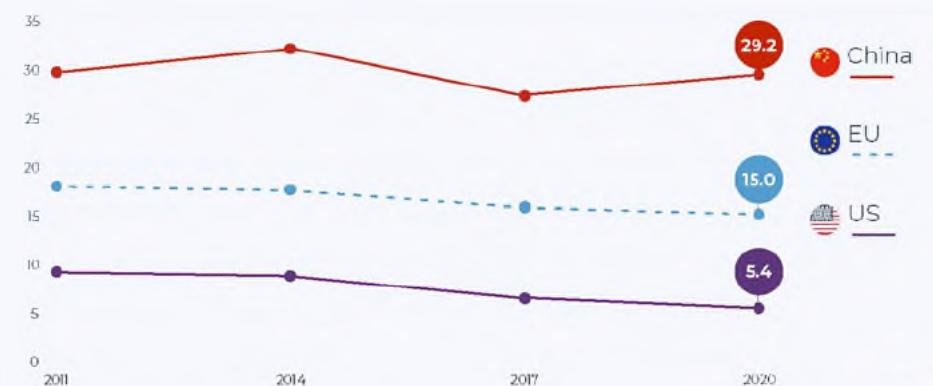
By revenue



KPI 5

Exports of high technology manufactured goods

Global market share, %

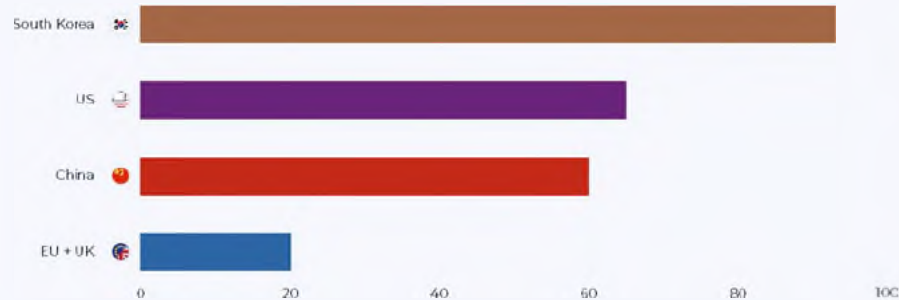


KPI 52

Top Insights

5G mid-band rollout, 2021

Adoption rate, %

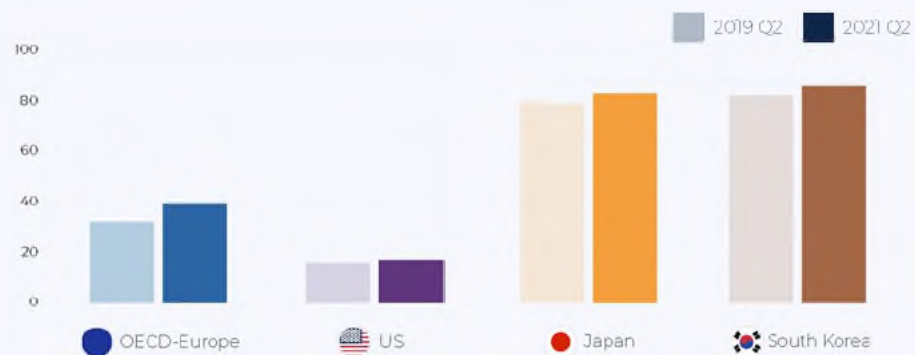


KPI 26

EUROPE'S POTENTIAL AT RISK: Europe is far behind in digital infrastructure...

Percentage of fibre connections in total fixed broadband

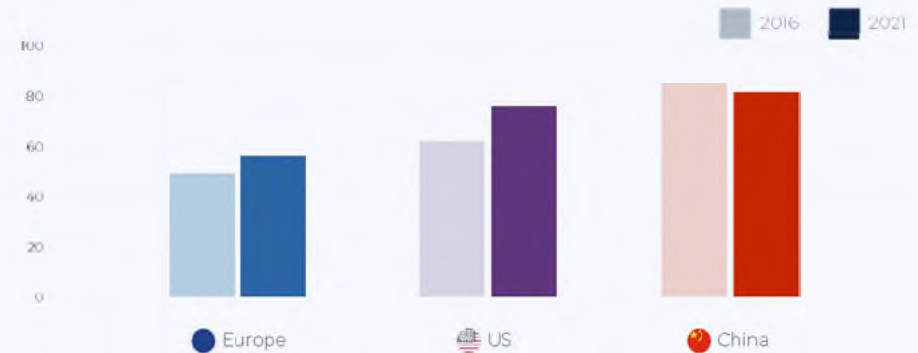
%



KPI 27

Electricity network investment

Investment spending in USD billion

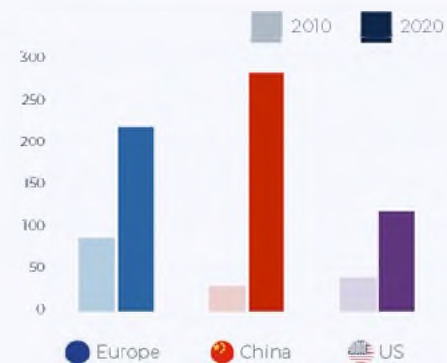


KPI 36

...and does not invest enough in energy infrastructure & renewables

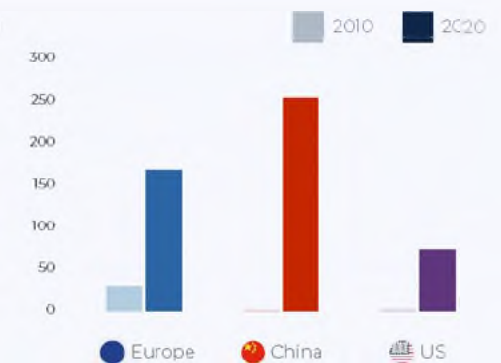
Installed solar capacity

CW



Installed wind turbine capacity

GW



KPI 42 & 43

Intra-EU trade in goods

% of GDP

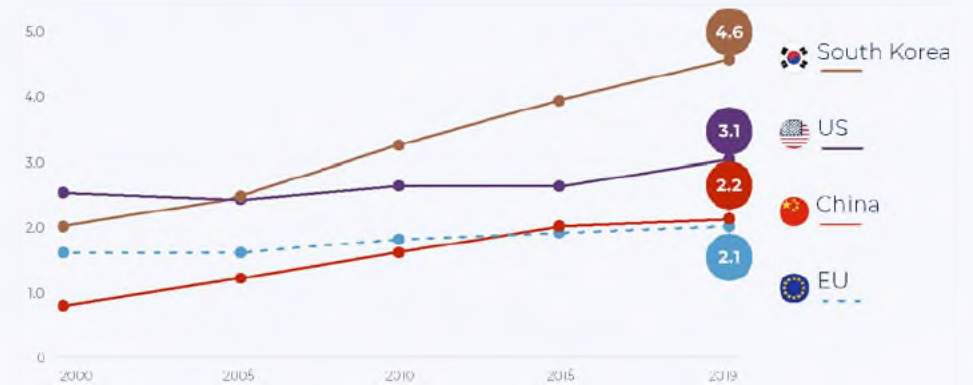


KPI 11

UNTAPPED POTENTIAL: The EU needs to invest political capital in completing the Single Market...

Total R&D spending

% of GDP



KPI 13

.. and we have to invest more in innovation, to keep up with international peers

Overview



Single Market & industrial performance

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Single Market & industrial performance

This section sheds light on how European companies and industries perform compared to their global peers. Europe can no longer take its global competitiveness and prosperity for granted. Within Europe, we have untapped potential as our Single Market is far from complete.

You will also find data on the added economic value brought by industry, the investment rate and internal trade.



KPI 1 Industry gross value added**KPI 2** Medium and high technology manufacturing gross value added

Europe's industry has lost its global leadership position

Observation: Europe's share of global industry gross value added declined from almost 25% in 2000 to 16.3% in 2020 (20.8% and 14.3% respectively for the EU-27). Already 10 years ago, China surpassed all other markets.

Europe's share of global medium and high technology manufacturing has declined marginally less.

Recommendations:

- The EU and national governments should re-focus their attention on deepening the Single Market and speed up the implementation of the EU's industrial strategy.
- European and/or national policy need to be coherent according to priorities that drive investment, innovation and competitiveness.
- Efforts should focus on technologically advanced high value-added sectors – and progress should be monitored quantitatively.

Note: Industry includes mining, manufacturing, and utilities, but excludes construction. Medium and high technology manufacturing includes industries with a high intensity in R&D. It includes chemicals, pharmaceuticals, defence equipment, computer, electronics, electrical equipment, machinery, motor vehicles and medical instruments.

Note: Europe = EU-27, Norway, Switzerland, UK.

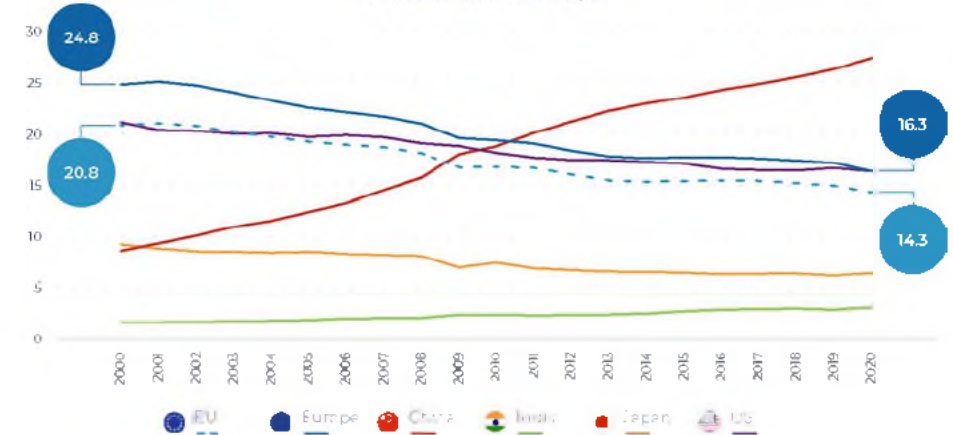
Source (1): UN Statistics Division

Source (2): UNIDO Statistics Data Portal

KPI 1

Industry gross value added

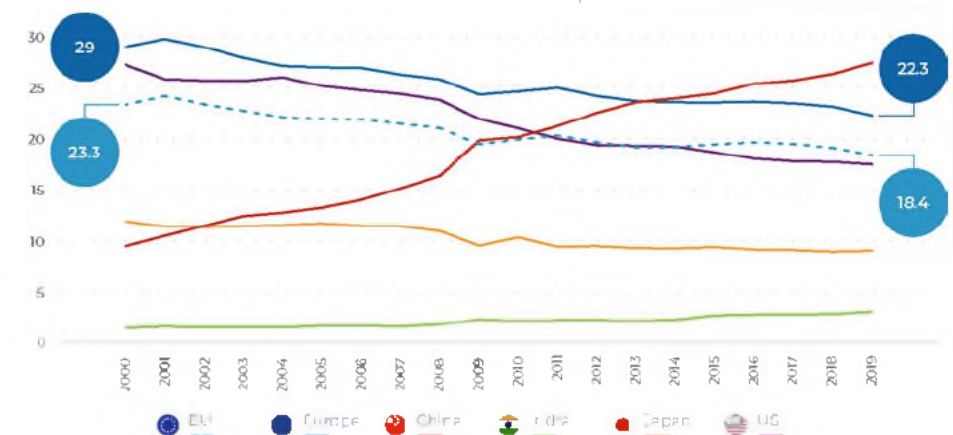
Global market share, %



KPI 2

Medium and high technology manufacturing gross value added

Global market share, %



Reversing the decline in labour productivity growth is a must

Observation: Labour productivity growth in EU industry has deteriorated over two decades. Industrial investment in the EU is lower and growing more slowly in the EU than in the US and Japan. Unless investment becomes more productive, EU productivity growth is set to decline further. In this scenario, the EU would become less competitive, and less able to support high standards of living and future sustainable development.

Recommendations:

- European governments and the EU have to step up their support for innovation and an investment-friendly environment.
- European policymakers and national governments need to prioritise the modernisation of infrastructures and the uptake of key enabling technologies.
- Together we need to boost the up/re-skilling of workers. This is the best way to ensure that the ageing labour force keeps up with new technologies like AI, Cloud-Edge and 5G.
- We should give more room to fostering flexible and digital work models that strengthen productivity in the digital economy.

Note (1): Quintile data does not include Malta. Countries within 2016-19 upper quintile: Ireland, Latvia, Luxembourg, Slovenia, and Romania. Countries within 2016-19 lower quintile: Germany, Netherlands, Portugal, Spain, and Bulgaria.

Note (2): GFCF: Gross Fixed Capital Formation.

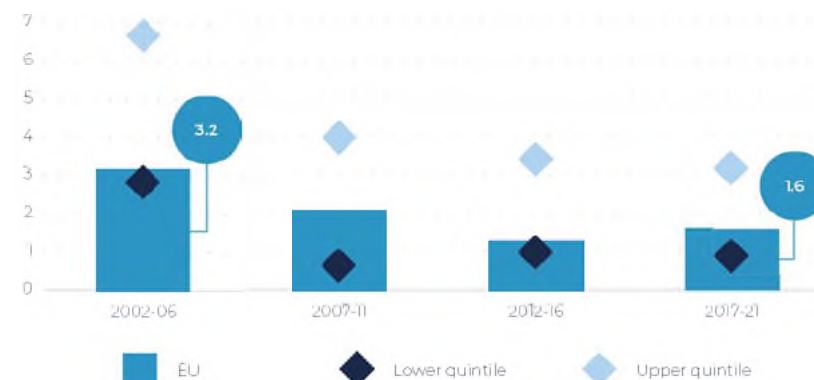
Note (3): Latest available data for Japan: s from 2018

Source (1): OECD Productivity Statistics; **Source (2):** OECD

KPI 3

Labour productivity growth in EU industry

Annual growth of gross value added per hour worked, %, with bubble indicating EU value



KPI 4

Industrial investment rate

Industrial GFCF as a share of industrial gross value added, %, with bubble indicating EU value



KPI 5 Companies in Fortune Global 500

KPI 6 High-growth companies in manufacturing

Corporate Europe is losing its relevance on the world stage

Observation: As global competition intensifies, Chinese companies have overtaken many of Europe's largest companies in terms of revenue. For European companies, the risk of a downward spiral is real: declining revenue puts pressure on investment and holds back labour productivity growth. This trend could accelerate as R&D is becoming more expensive.

In Europe's manufacturing sector, high-growth enterprises are becoming more important, indicating an improving environment for innovation.

Recommendations:

- A renewed push for the Capital Markets Union (CMU) is needed to improve access to finance within Europe and deepen the Single Market for critical scale facilitation.
- We need to boost the adoption of digital technologies, especially for smaller companies.
- Both European Commission and the EU Member States should make use of available instruments to protect the Single Market from unfair trade and investment practices.

Note (1): Europe ex-EU = Switzerland, UK and Norway

Note (2): High-growth companies are defined as companies with at least ten employees at the beginning of their growth which have average annualised growth in the number of employees of more than 10% per annum over three years. For Ireland, data for 2019 are not yet available.

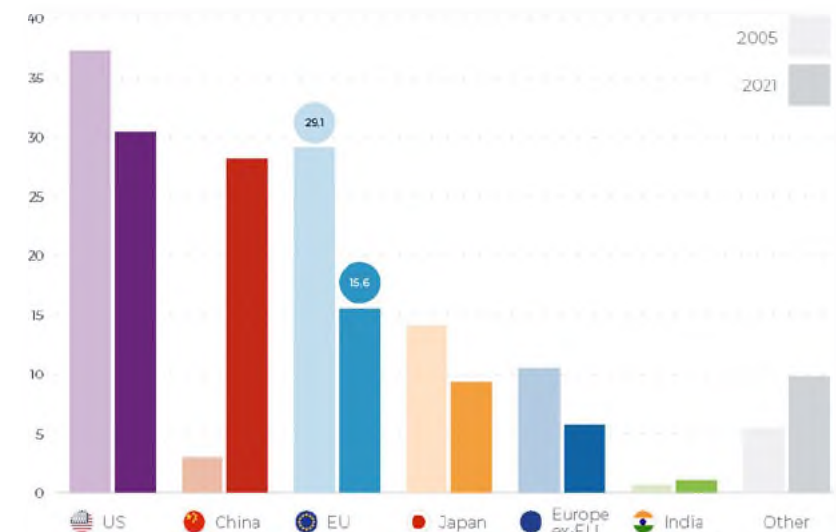
Source (1): Fortune Global 500 List (2021)

Source (2): Eurostat

KPI 5

Share of companies in Fortune Global 500 by revenue

%, with bubble indicating EU value

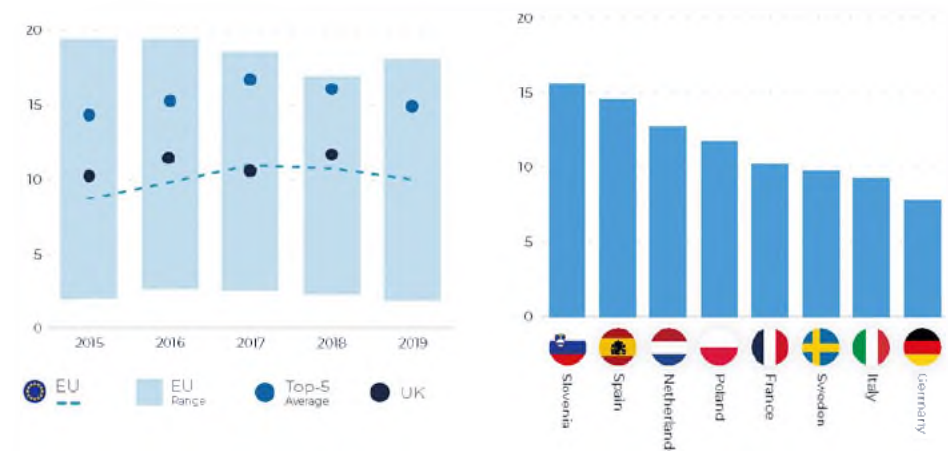


KPI 6

High growth companies as a share of total manufacturing companies

%, European Union

%, selected economies, 2018



European companies are leading the green transition but need to become stronger

Observation: European industry is a global leader in clean value creation. The EU has a perspective to successfully complete the green transition and ensure high living standards and sustainable growth for future generations. However, European (and especially EU) companies are often smaller than their American peers, limiting their ability to take advantage of the benefits of scale.

Recommendations:

- EU Green Deal needs to take place in a scale-up friendly environment. A more integrated Single Market with fewer barriers would enable European companies to thrive – allowing them to grow, export sustainability solutions and remain global market leaders.
- Europe needs stronger incentives for companies to adopt technologies that produce goods and services sustainably.
- Labelling and eco-design should promote the consumption of sustainable products and services – with a strong role for public-private cooperation.

Note (2): Clean revenue in this index indicates the amount of revenue each company earns from products and services aligned with the Corporate Knights Clean Economy Taxonomy. Companies are also screened against activities considered contrary to socially responsible investments, such as thermal coal or weapons.

Note: Europe = EU, 27, Norway, Switzerland, UK

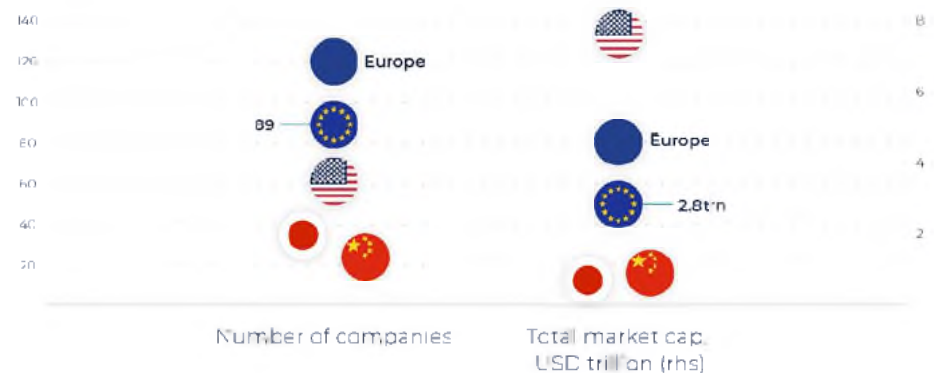
Source (1): Dow Jones Sustainability Index (mid-February)

Source (2): Corporate Knights Clean200 List

KPI 7

Firms in Dow Jones Sustainability Index, February 2022

Number (left) and USD trillion (right)

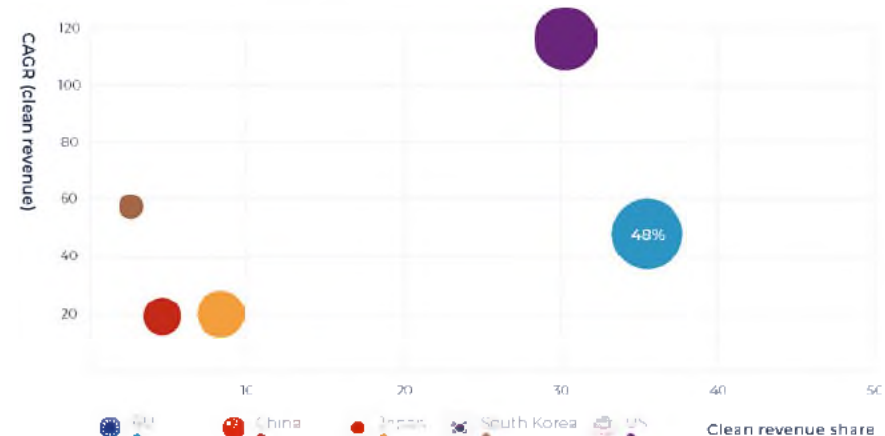


KPI 8

Clean revenue growth performance in perspective

Average annual clean revenue growth 2018-2021, %

Bubble size indicates the number of companies in 2021 list



KPI 9 Enabling environment for economic growth

KPI 10 Private sector friendliness

A growth-enabling regulatory environment: Europe should learn from others

Observation: Although the EU is a global regulatory standard-setter, this has not (yet) translated into an optimal environment for industrial innovation. Companies in South Korea and Japan can draw on highly advanced digital infrastructures and benefit from legal and regulatory frameworks that are quick to adapt to emerging digital business models and to an accelerated energy transition. While rules to ensure fair competition are important, they should not be overly burdensome and stifle entrepreneurship.

Recommendations:

- The EU needs to better implement its Better Regulation agenda.
- Europe's public sector should become more aware of the risks and weight of regulatory overload, e.g. challenges due to administrative barriers and eternal permitting procedures
- We need greater coherence in policymaking and greater ambition to avoid silo-thinking.
- Legislative processes can be accelerated using regulatory sandboxes for trials.

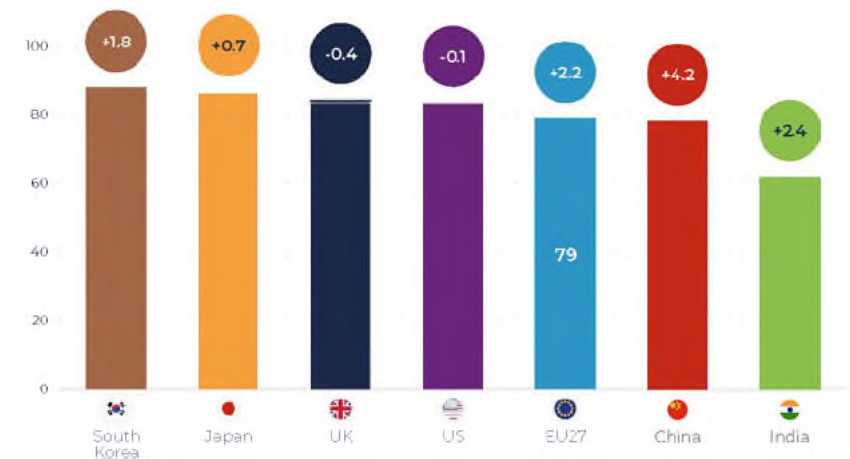
Source (1): WEF enabling environment index. The score measures the extent to which institutions, utilities and infrastructure, monetary policy, and public finances provide an environment conducive to economic growth.

Source (2): World Bank index measures perceptions of the government's ability to develop and implement sound policies that are conducive to private sector development.

KPI 9

Enabling environment for economic growth, 2019

Score from 0 to 100, bubble indicates change since 2017



KPI 10

Private sector friendliness of regulation, 2020

Regulatory quality index from -2.5 to 2.5, with 2.5 being optimum



High time for more Single Market integration

Observation: Measured in trade flows, the integration of the EU Single Market for goods has been stagnant since the global financial and eurozone crises over a decade ago. This could be due to a) increasing barriers to intra-EU trade, b) a lack of enforcement of the Single Market principles, or c) a combination of both.

Intra-EU trade in services is low and was growing slowly until the pandemic; it is too soon to conclude whether the pandemic-induced decline in intra-EU trade represents a new downward trend.

Recommendations:

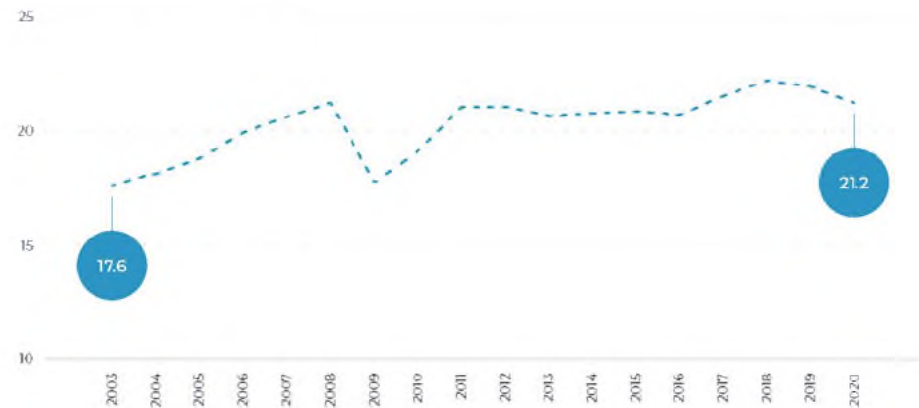
- The European Commission and national governments need to reinstate the idea of a Single Market as an economic union for free trade without internal obstacles and bring the four freedoms back to the top of the political priorities.
- A new all-encompassing programme for deeper integration is needed to develop a true Union for Energy, Environment, Digital, Banking & Capital, Health as well as Defence, amongst others.
- The European Commission should measure progress through a KPI on market integration

Source (1): Eurostat, Global Counsel calculations

Source (2): Eurostat

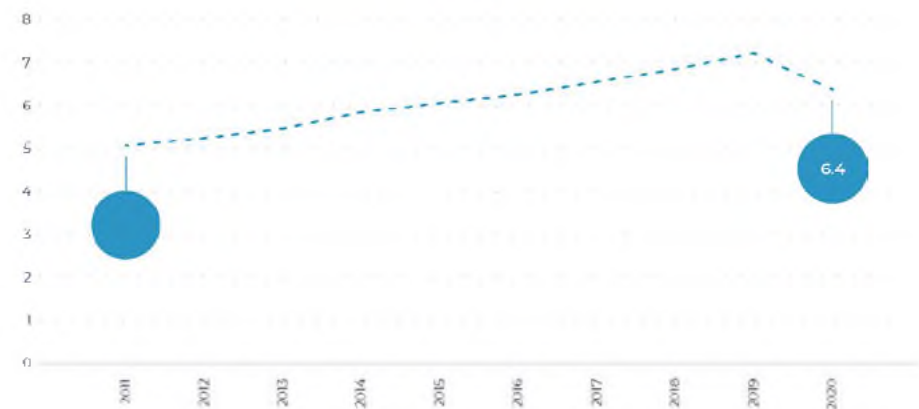
KPI 11

Intra-EU trade in goods % of GDP



KPI 12

Intra-EU trade in services % of GDP



Innovation

At a time of accelerated step change, innovation is the pulse of progress. Our ability to innovate predicts our future competitiveness and prosperity.

In this section, we assess a wide spectrum of qualitative and quantitative KPIs ranging from investment rates, sources of funding, patents and education, to start-up culture and AI investment.

KPI 13 Total R&D spending as a share of GDP

KPI 14 Industrial R&D investment

Europe needs higher public and private investment in R&D

Observation: At 2.2% of GDP in 2019, China is already investing proportionately more than the EU in R&D. European companies have arrested a downward trend in their share of global R&D expenditure, but Chinese companies are now on the verge of overtaking their European peers in industrial R&D investment. China's active state-driven industrial policy contributes to this development. Importantly, although Europe is strong in research, it often fails to commercialise its expertise – also because barriers prevent innovative businesses from scaling up inside the Single Market.

Recommendations:

- Europe should step up public support for R&D; coherent prioritisation is essential – especially for strategic sectors and industries.
- In addition to more budgetary support, it is key to ensure faster approval processes for projects in the “proof of concept” and scale-up phases.

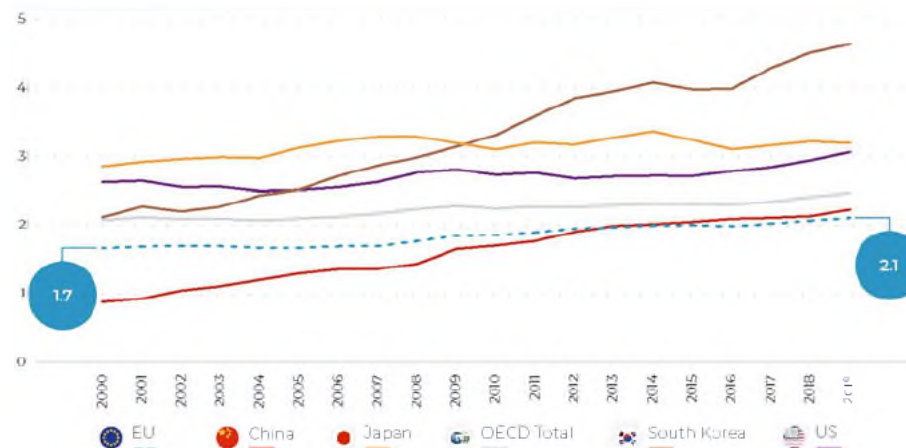
Note (1): Data retrieved covers R&D spending globally made by the 2,500 largest enterprises.

Source (1): 2021 EU Industrial R&D Investment Scoreboard

Source (2): OECD

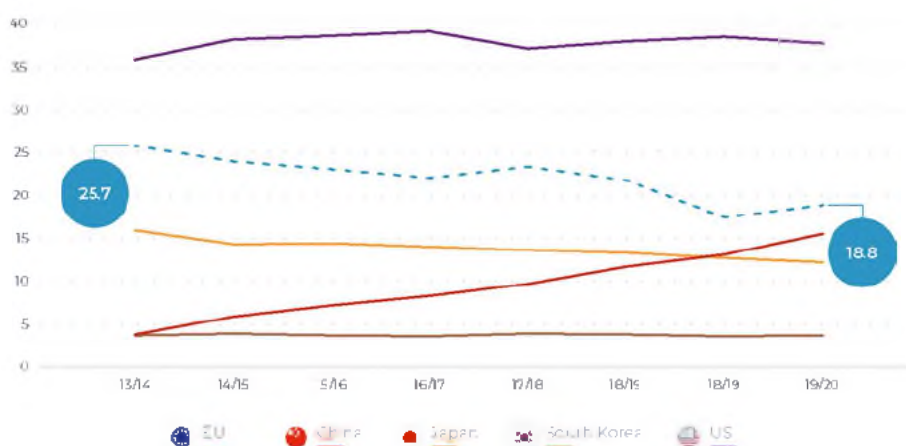
KPI 13

Total R&D spending Share of GDP %



KPI 14

Industrial R&D Investment Global market share, %



KPI 15 Source of R&D funding in academia

KPI 16 Privately funded R&D in research institutes

European R&D needs more public-private partnerships

Observation: In Europe, most R&D funding comes from the public sector, given the structure of our educational system. Nevertheless, at USD 6 billion, funding in the EU private sector is still higher than in most other major economies and concentrated in high-quality research institutes.

Recommendations:

- EU institutions should actively work with the private sector to channel more R&D funding into the development of technologies needed for the twin transitions. If this is done in a targeted way, the highest-performing institutions should receive the highest proportion of funding.
- A common roadmap should reinforce public-private cooperation to strengthen – through innovation – the means to achieve the Commission's digital decade targets.

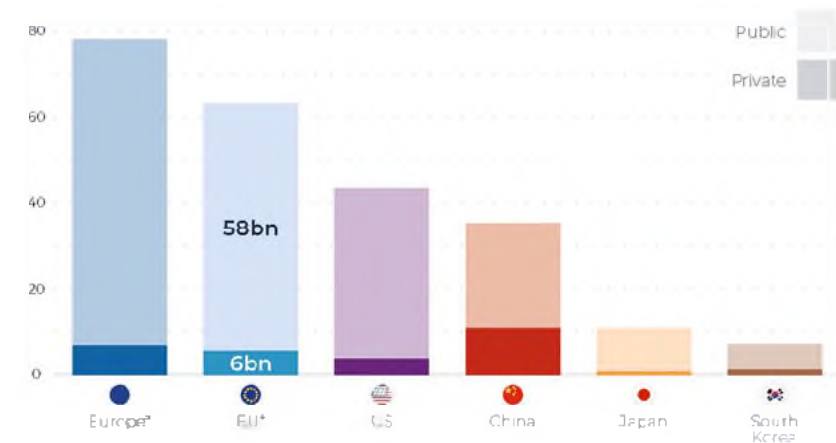
Note (1): EU does not include Austria, Bulgaria, Croatia, Cyprus, Malta, Romania and Sweden, due to data being unavailable. Europe = EU27, Norway, Switzerland and UK. Switzerland data from 2019.

Source (1,2): OECD

KPI 15

Higher education R&D funding by source of funding, 2018

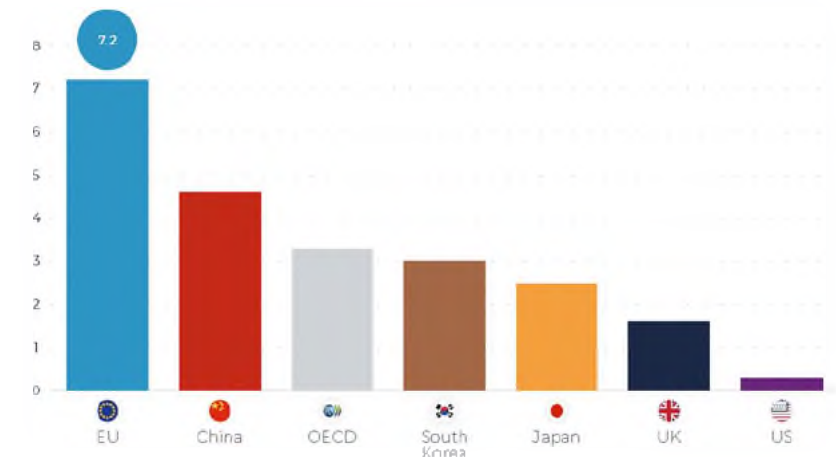
USD billion (constant 2015 prices and PPPs)



KPI 16

Privately-funded R&D in research institutes, 2019

Share of R&D spending in research institutes, %, with bubble referring to EU value



KPI 17 Number of scientific researchers

KPI 18 Number of patent applications

Europe's scientific talent – boost and leverage our strengths

Observation: Europe is a global leader in scientific research. However, the number of scientific researchers in the EU is stagnating and China is now overtaking the EU. Meanwhile, the US are also quickly catching up.

The number of patent applications reveals a decline in Europe's research productivity. In the ICT sector, the number of patent applications from the EU is below Japan's – an economy that employs only around one-third of the number of researchers in the EU.

Recommendations:

- Europe should ensure the best possible conditions for its researchers and research infrastructures.
- The EU should step up support for close and targeted cooperation between industry and research centres across disciplines as well as across borders.
- Europe needs stronger incentives for innovation to ensure that: a) scientific discoveries can leap into market-oriented development of technologies and b) more advanced innovation takes place inside the Single Market.

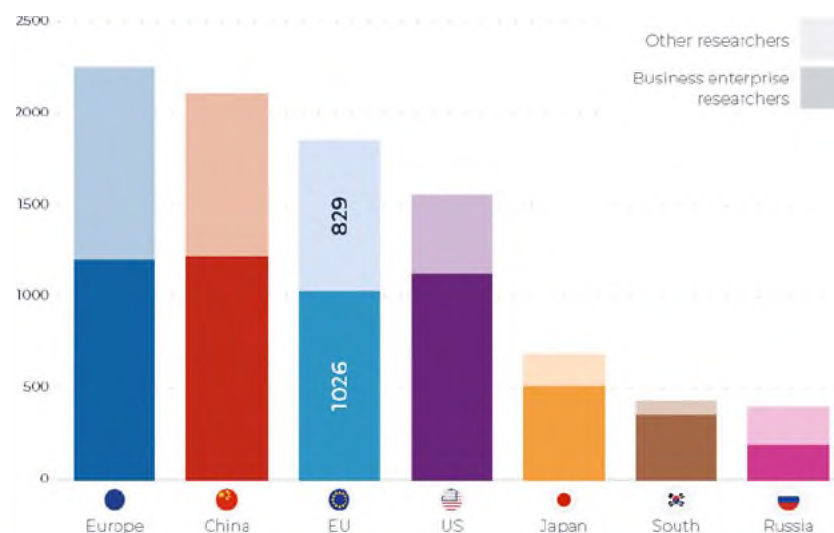
Note: Europe = EU27, Norway, Switzerland, U.K. Switzerland scientific researchers use 2017 data

Source [12], OECD

KPI 17

Number of scientific researchers, 2019

Thousands

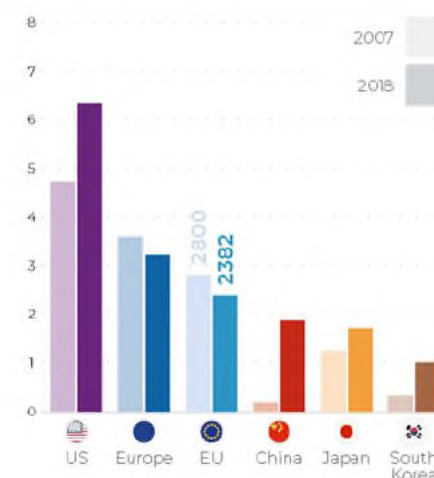
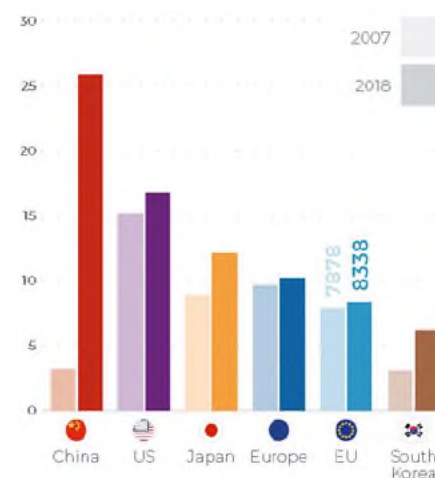


KPI 18

Number of patent applications under the Patent Cooperation Treaty

ICT sector, thousands

Biotechnology sector, thousands



KPI 19 STEM graduates**KPI 20** Adult participation in education and training

Europe's labour force of tomorrow needs more STEM skills

Observation: Europe needs a workforce with the skills to meet the challenges of the twin transitions. Demand for such skills will increase.

Since 2015 STEM graduates make up 25% of the EU's graduate community. In the US the share of STEM graduates has increased by two percentage points. Importantly, relative to peers in Asia, the share of STEM graduates in Europe is substantially lower. In terms of absolute numbers, Europe has more than twice as many STEM graduates as the US, but less than half the number of India.

Recommendations:

- Education policy should motivate more students to seize opportunities in the STEM areas. It should also incentivise universities to increase the share of STEM graduates and attract talent from outside the EU.
- Technical, Vocational, Education and Training (TVET) should be promoted.
- Adults participating in education and training should be promoted further – whether to up- or re-skill for new careers in future-oriented professions.

Note (1): India and Russia show 2018 data. Europe – EU27, Norway, Switzerland, UK. EU22 is shown due to total graduate data not being available for Bulgaria, Croatia, Cyprus, Malta, or Romania. STEM graduates are a share of total graduates for EU27 is 24%. China is not included because of a lack of comparable data. WEF noted in 2016 that China had 4.7m STEM graduates, but that its definition of STEM graduates is wider than elsewhere.

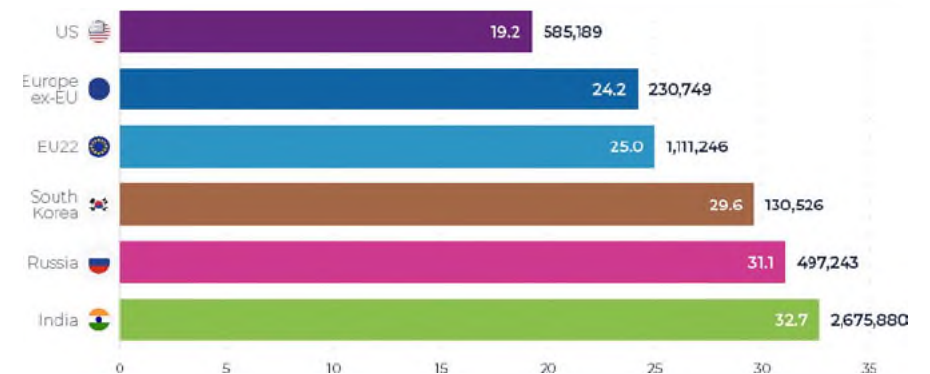
Note (2): For KPI 20, more recent data are expected to become available in summer 2022.

Source (1): UNESCO, OECD, Global Counsel calculations

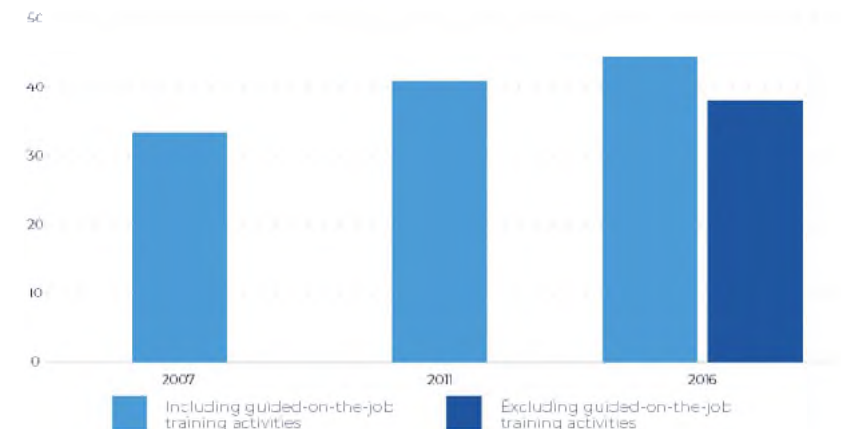
Source (2): Eurostat, Global Counsel calculations

KPI 19**STEM graduates in 2019**

Share of total graduates, %, with label indicating absolute number

**KPI 20****EU adult participation in education and training over the last 12 months**

Share of total, %



Europe must unleash its potential in venture capital and unicorn creation

Observation: European venture capital (VC) investment held up well during the pandemic, rising to over 18% of global invested capital and even surpassing that of China in 2021. Yet, probably due to its low-risk culture and implications for financing of new companies, Europe lags behind the US and China in terms of capacity to support start-ups and early-stage competitiveness. Probably for the same reason, Europe counts only a small number of unicorns, although a sharp uptick in new business creation in 2021 could mark a turning point. The US remain the clear leader in this field, in large part due to lower barriers for entrepreneurship including easier access to capital.

Recommendations:

- It is of key importance to make more risk capital available for entrepreneurs during both the start-up and scale-up phases.
- EU lawmakers should drive forward the completion of the Capital Markets Union (CMU) to make more risk capital available.

Note (1): Europe = EU 27 + all other countries officially part of the European continent.

Note (2): Unicorn is a private company with a valuation of over USD 1 billion. China only includes data for Beijing and Shanghai. Europe ex-EU = Switzerland, UK and Norway

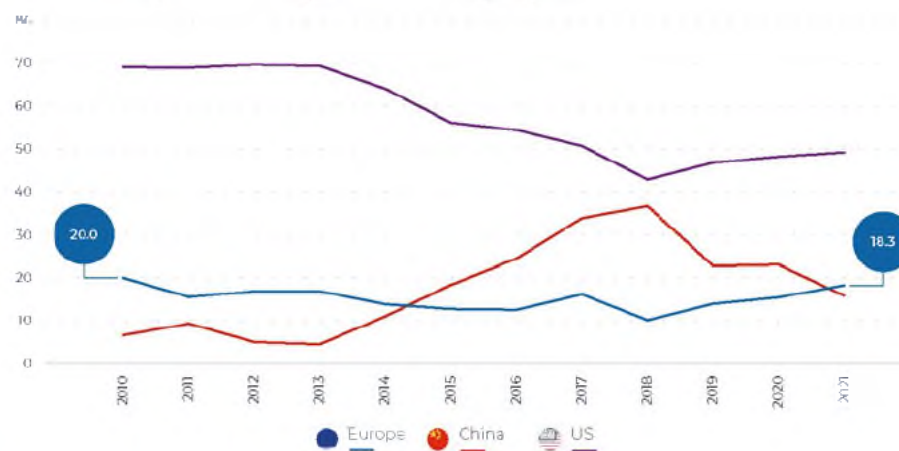
Source (1): KPMG

Source (2): CB Insights

KPI 21

Market share of invested capital

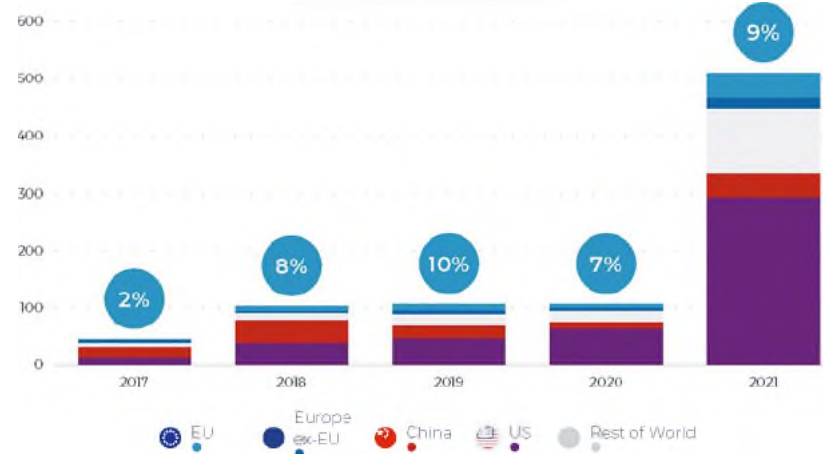
Share of total value of venture capital deals across the world, %



KPI 22

The number of unicorns created by year and by country/region

Bubble refers to EU share



KPI 23 Venture capital investment in Artificial Intelligence**KPI 24** Venture capital investment in robots, sensors and IT hardware

Europe must catch up in the AI development race

Observation: Venture Capital (VC) investment in Artificial Intelligence (AI) has rapidly accelerated in China and the US which now leads unrivalled with USD 45.2 billion. The EU is far behind at only USD 3.5 billion in 2020, whilst non-EU European countries stand at nearly double that amount. Both the US and China have obtained the first-mover advantage – allowing them to foster globally competitive companies in new domains and the use of AI in established industries.

For key technologies such as robots, sensors and IT hardware, China is the clear leader in terms by venture capital invested. In the EU there is no meaningful investment of venture capital.

Recommendations:

- Achieving the European Commission's goal to attract over EUR 20.5 billion of total AI investment per year between 2021-2030 has to be prioritised.
- Europe needs to create an environment conducive to AI innovation. This includes sufficient access to capital and the development of the digital skills and infrastructure to deploy AI technologies.
- EU legislators have to ensure coherence across initiatives. Regulation should not stifle innovation.
- AI Act: EU policymakers need to limit potentially adverse consequences, including administrative burden.

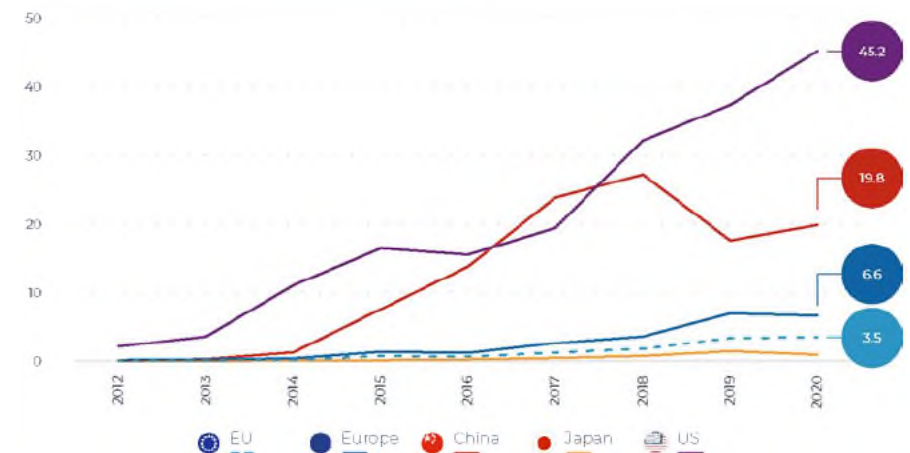
Note: Europe ex-EU = Switzerland, UK and Norway

Sources (12): OECD, Preqin

KPI 23

VC investment in AI by country

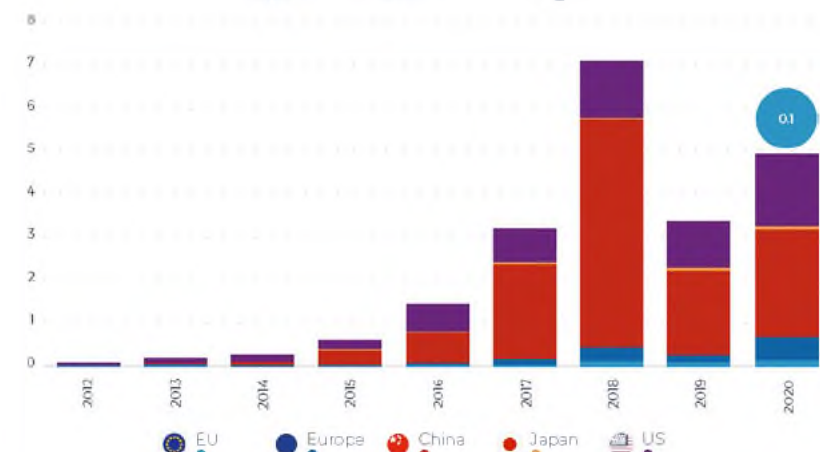
USD billion



KPI 24

VC Investment in robots, sensors and IT hardware

USD billion, with bubble indicating EU value



Critical infrastructure & technology

As the past three decades have shown, the hardware that underscores energy security and connectivity is an indispensable enabler of progress and prosperity. A new dimension of possibilities is unfolding with the rollout of Industry 4.0. The race is on, but without the right infrastructure, Europe cannot gain speed.

In this section, we look at the state of 5G rollout, semiconductor & supercomputer investment and green energy technologies.

KPI 25 5G mobile connections

KPI 26 5G mid-band rollout

Without 5G, Europe cannot enable other key technologies

Observation: Europe's very slow deployment of 5G complicates the digital transition. In terms of mid-band coverage, additional data suggest that the average adoption rate in the EU is below the combined EU-UK rate, specifically for the 5G Pioneer Bands set out by the European Commission in 2016. Robust 5G infrastructure and the technologies it enables – including AI, B2B applications and IoT – promise to transform industries and turbo-charge corporate innovation. 5G is key to Europe's competitiveness and for combatting climate change and the decline in productivity growth.

Recommendations:

- Europe – and especially the EU – has to urgently create favourable conditions for 5G investments
- We have to prioritise the development of a harmonised and investment-friendly framework for 5G spectrum assignment and operation. Key steps: provide regulatory incentives for private investment, cut the cost of spectrum, support voluntary network sharing and promote competition without artificial interventions
- Science-based electromagnetic field (EMF) limits should be harmonised across Europe and disseminated information about the health consequences of 5G countered through better communication.
- To speed up deployment and build confidence in 5G, policymakers should implement the technical and strategic measures laid out in the connectivity and cybersecurity toolboxes using a fact and risk-based approach.

Note (1): As per ETNO's definition, Europe includes EU27, Bosnia and Herzegovina, Iceland, North Macedonia, Norway, Serbia, Switzerland, and the UK

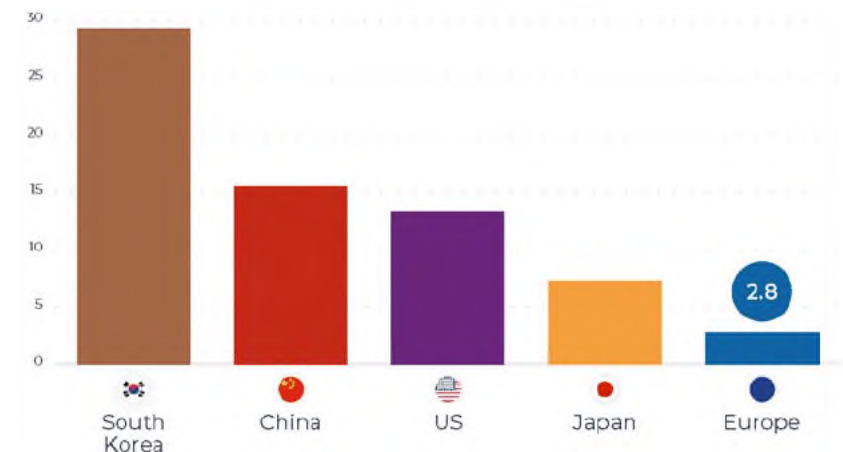
Source (1): ETNO, State of Digital Communication 2022 report

Source (2): Ericsson market analysis

KPI 25

5G connections, Q2 2021

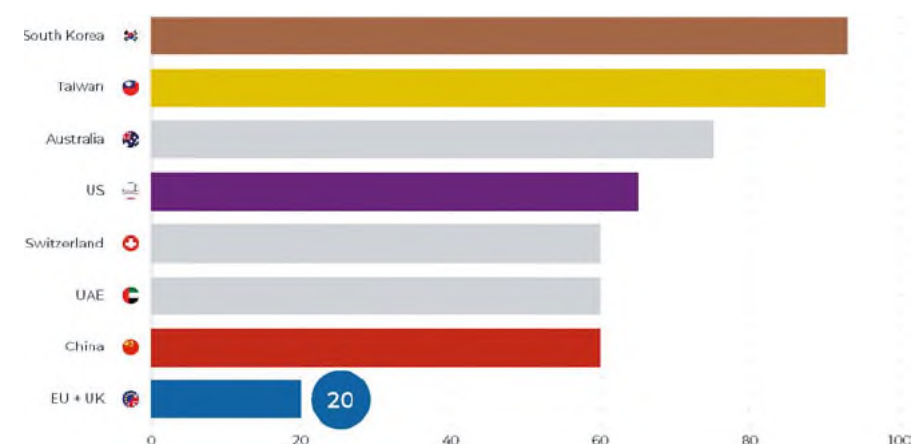
Share of total mobile connections, %



KPI 26

5G mid-band rollout, 2021

Adoption rate, %



Europe needs a strong digital infrastructure

Observation: Very High-Capacity Networks (VHCN), such as fibre, are key to strengthening digital infrastructures. Increasing VHCN deployment is important as a foundational aspect of the connected world. Fibre is also significantly more climate-friendly than other types of fixed broadband, partly because it is more cost- and power-efficient to operate. VHCNs are key for Single Market integration and cohesion due to their potential to close the digital divide and provide all EU citizens with adequate connectivity.

Recommendations:

- The European Commission is pursuing the important target to provide every European household with access to high-speed internet coverage by 2025 and access to gigabit connectivity by 2030. To achieve this:
- EU policymakers need to speed up the implementation of the common toolbox, recommended by the Commission, to cut the cost of deploying very high-capacity networks
- EU policy makers should establish the right incentives for sustainable digital infrastructure investment.
- Europe needs a strategy for international connectivity and submarine cables.

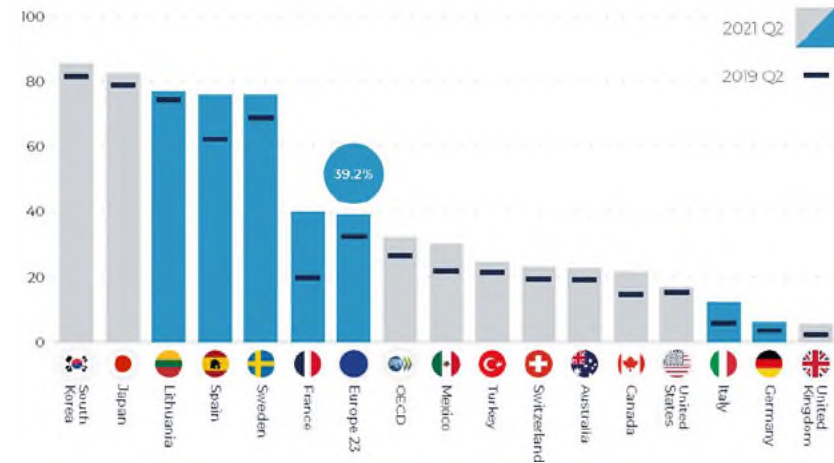
Note (1): Europe 23 includes EU Member States that are also OECD members plus Iceland.

Source (1): OECD

Source (2): Ericsson

KPI 27

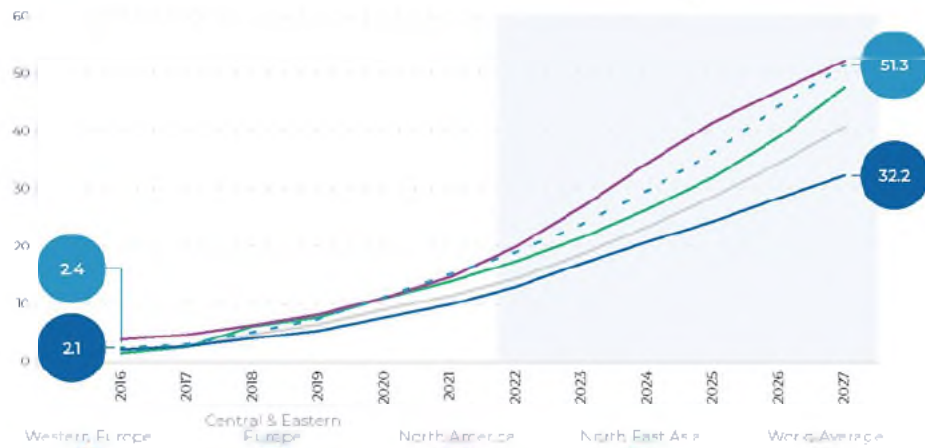
Fibre connections in total fixed broadband, June 2021



KPI 28

Mobile data traffic per device

GB/month, forecasts as of November 2021



Europe needs to develop its own semiconductor industry

Observation: Europe depends on a small number of semiconductor suppliers located in economies that are at risk of natural disasters, geopolitical disruption, or both. This dependency is partly due to Europe's low investment at home. Failure to secure European semiconductor supply chains would jeopardise industrial production in many sectors, as well as the twin transitions. Active industrial policy among peers, such as "Made in China 2025" – which was announced in 2015 – has also led to a widening investment gap for emerging technologies.

Recommendations:

- Policymakers must prioritise the successful implementation of the EU Chips Act in the coming years.
- Emphasis should be placed not only on leading-edge but also on mature nodes which are important for industrial applications in various industries.
- The entire ecosystem should be reinforced – including in-house design and the fabless AI chips industry.
- Europe needs to: a) boost public and private investment, b) promote national initiatives, c) increase the talent pool in the semiconductor industry – especially for design skills, d) promote research, e) establish strong intra-EU public-private partnerships and f) seek close cooperation with trusted partners in Asia and North America.

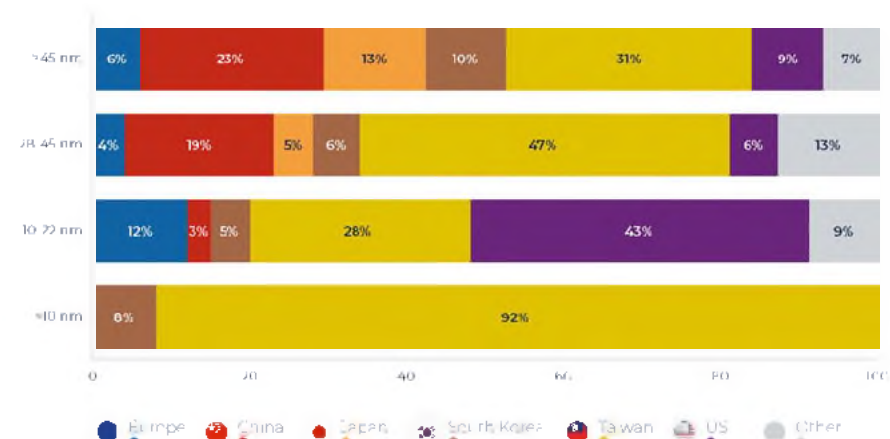
Note: Europe category includes EU-27, United Kingdom, Albania, Armenia, Belarus, Bosnia-Herzegovina, Georgia, Iceland, Israel, Liechtenstein, Macedonia, Moldova, Norway, Russia, San Marino, Switzerland, Turkey, Ukraine, Andorra, Faroe Islands, Monaco, Montenegro, Serbia, Gibraltar, Kosovo.

Source (1): Semiconductor Industry Association

Source (2): PitchBook

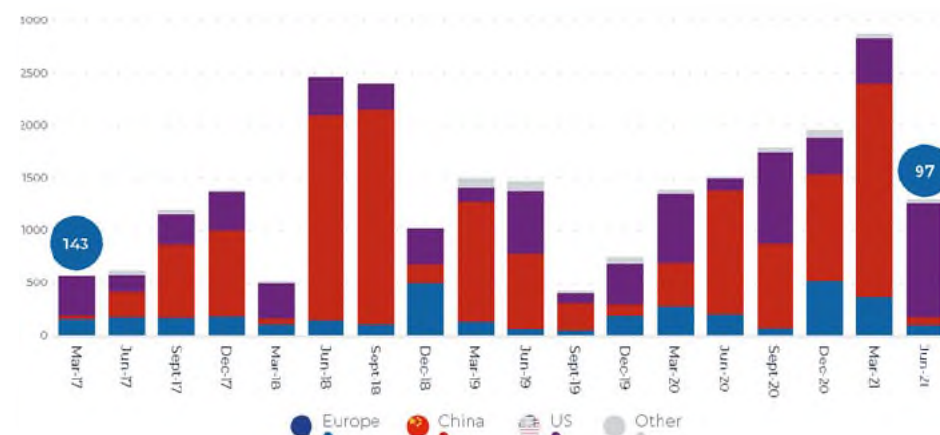
KPI 29

Global market share of semiconductor production by chip size, 2019



KPI 30

VC investment in semiconductor industry USD million



High time to catch up on supercomputers and cloud & edge services

Observation: Over the last ten years China has surpassed both the EU and the US to become the world's leading supercomputer nation by the number of high-performing computers. In terms of computing speed, Europe is also far behind other major economies.

Europe lags in commercialising cloud edge services compared to peers in Asia and North America.

Recommendations:

- It is crucial to realise the European High-Performance Computing Joint Undertaking (EuroHPC JU) and the Important Project of Common European Interest for Next Generation Cloud Services (IPCEI-C S).
- Coordination and speed of European initiatives are key.
- The European Alliance for Industrial Data, Edge and Cloud could serve as a central platform for coordination. It should leverage, as much as possible, the deliverables of Gaia-X and other related initiatives like the AI, Data and Robotics Partnership.
- The EU should also prioritise the building of critical digital infrastructure needed to support higher use rates of cloud and other technologies.

Note (1): Europe ex-EU – Switzerland, UK and Norway

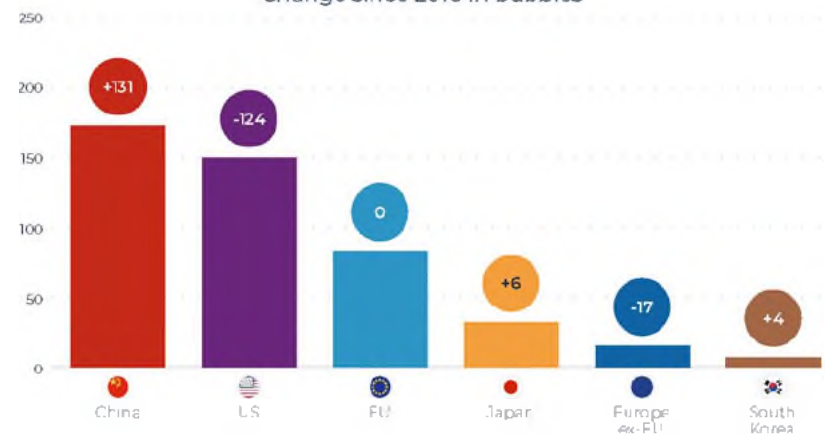
Source (1): Top500

Source (2): Analys Mason

KPI 31

Number of supercomputers in top 500 list by country, 2021

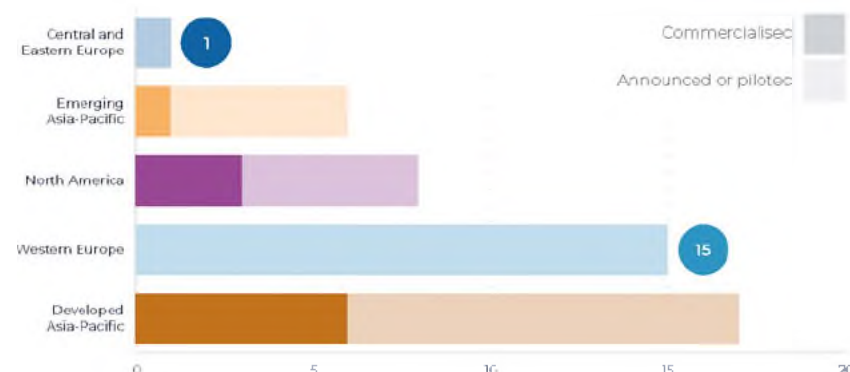
Change since 2010 in bubbles



KPI 32

Number of operators that have announced edge cloud services, Q1 2021

Bubble indicates absolute value



Enabling new technologies in the field of energy should be at the heart of the green transition

Observation: While China remains the global leader in the production of EV and energy storage lithium-ion battery cells, Europe has recently taken steps to increase its capacity. Building on current momentum will be crucial as other major economies, including the U.S., seek to reverse a recent decline in market share.

Europe has been more ambitious than other major economies in launching large-scale green hydrogen projects. Fast completion, supported by a stimulating policy framework, will be important for future energy security.

Recommendations:

- The EU should stimulate more Important Projects of Common European Interest (IPCEIs). Key steps would be to simplify the administrative procedures and invigorate new strategic partnerships, including on critical raw materials.
- Working with industry and other stakeholders through the Battery and Clean Hydrogen Alliances should be placed at the centre of the EU's strategy to develop new energy technologies, including digital solutions.

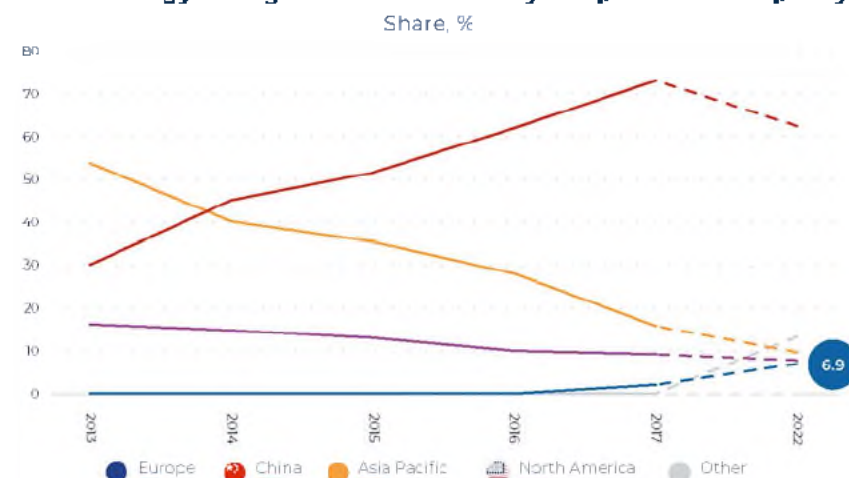
Note (1): As per IEA definition, Europe includes EU27, UK, Turkey, Ukraine, Norway, Belarus, Switzerland, Israel, Serbia, Bosnia and Herzegovina, Iceland, Moldova, North Macedonia, Kosovo, Albania, and Montenegro.

Note (2): European countries placing in the list of 20 largest announced giga-scale green hydrogen projects are Spain, Germany, the Netherlands and Ireland.

Source (1): IEA; **Source (2):** IRENA

KPI 33

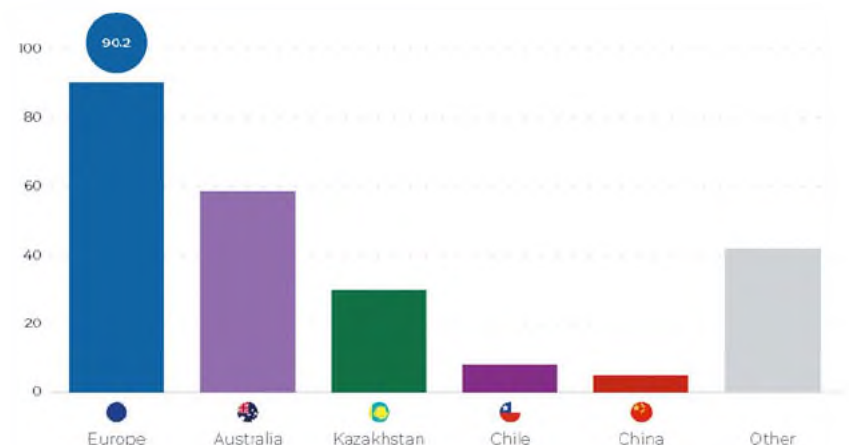
EV and energy storage lithium-ion battery cell production capacity



KPI 34

Projected electrolyser capacity of green hydrogen projects, January 2022

Capacity of 20 largest announced giga-scale projects, GW



Europe must invest in its global leadership in energy infrastructure and clean technologies

Observation: Investment in energy transition technologies has intensified. In Europe, it increased by USD 53 billion during the pandemic, partly due to public policy initiatives. For the EU, it stood at USD 154 billion in 2021. The uptick in electricity network investment, including smart grids, will be crucial for Europe's future energy security.

Recommendations:

- The European Green Deal kickstarts new investment into energy transition technologies. Commission and Member States together should work with investors and industry experts to make sure funding is directed to the projects that can make the biggest difference: projects supporting decarbonisation and making our energy system more resilient, competitive and affordable.
- The green and digital transition should be implemented in symbiosis: encouraging the adoption of digital technologies, investing in infrastructure and securing access to climate-friendly energy are key for the green transformation of European industry.

Note (1): Includes investment in renewables (incl. microgrids), energy storage, electrified transport and heating, nuclear, sustainable materials, energy efficiency and carbon capture, as well as private and public investment in climate-tech firms. Europe = EU27 + all other countries officially part of the European continent.

Note (2): As per IEA definition, Europe includes EU27, UK, Turkey, Ukraine, Norway, Belarus, Switzerland, Israel, Serbia, Bosnia and Herzegovina, Iceland, Moldova, North Macedonia, Kosovo, Albania, and Montenegro.

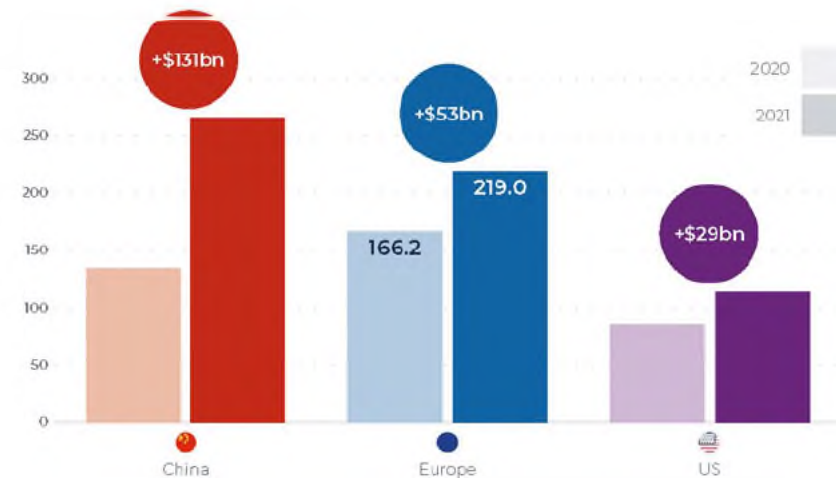
Source (1): Bloomberg New Energy Finance.

Source (2): IEA.

KPI 35

Low carbon energy investment

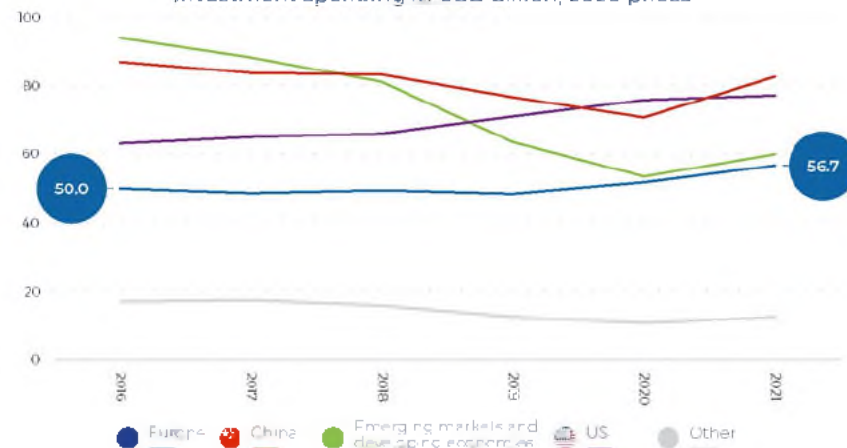
USD billion, bubble indicating year-on-year change



KPI 36

Electricity network investment

Investment spending in USD billion, 2020 prices



Twin transitions

Energy transition is more urgent than ever. In this section, we assess Europe's strengths and vulnerabilities. Digital transition is a 'must' to remain competitive. In several related areas, Europe has to catch up with its peers.

We review the energy & emissions intensity of the EU compared to its peers and the state of play in the EU's dependency on energy imports and the scaling up of renewable energy capacity, consumption and digitally-enabled efficiencies. There is also data revealing whether circularity and digitalisation are on track with the Europe's ambitions.



The EU is one of the least polluting major global economies, but cannot rest on its laurels

Observation: EU industry emission of greenhouse gases (GHG) saw a sharp decline even before the pandemic, down 33% since 1990. Retaining momentum would place the EU on track to meet the goal of a 55% reduction from 1990 levels by 2030.

Recommendations:

- A stable framework of regulation and new incentives would encourage increased investment in renewable energy and clean technologies. In the EU, this can be done through public-private partnerships.
- To incentivise other global economies, climate diplomacy, technological collaboration and a well-designed carbon-border adjustment mechanism (in conformity with the WTO) will be vital.
- Importantly, all GHGs should be considered, not just CO₂.

Note (1): The EEA's classifications of GHG emissions in the industry sector include emissions from fuel combustion in manufacturing industries and construction, industrial processes and product use, fuel combustion in energy industries and fugitive emissions in energy production and waste management.

Note (2): Europe ex-EU = Switzerland, UK and Norway

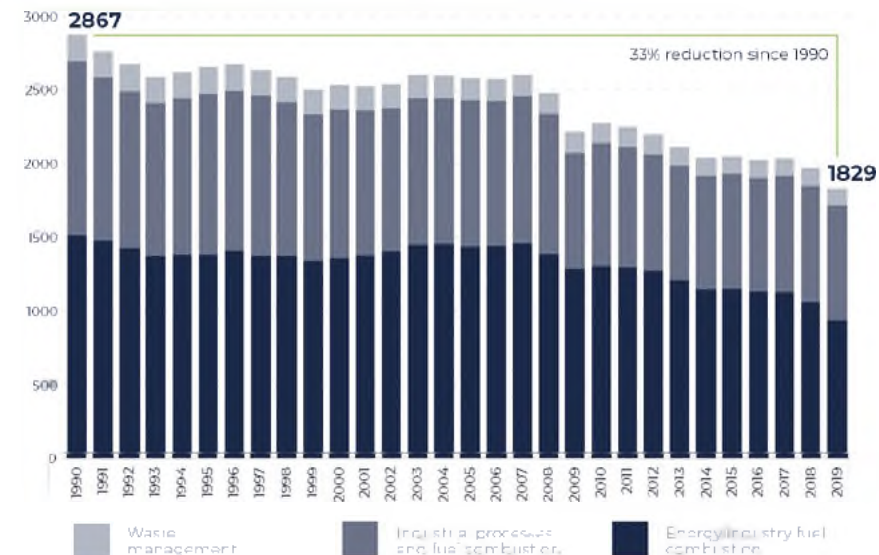
Source (1): European Environment Agency

Source (2): BP, CBIC data, Global Counsel calculations

KPI 37

Industry GHG emissions, EU

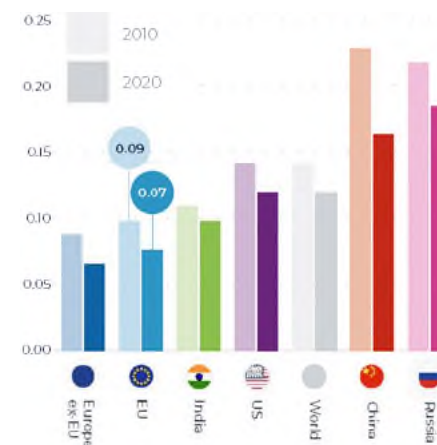
Million tonnes



KPI 38

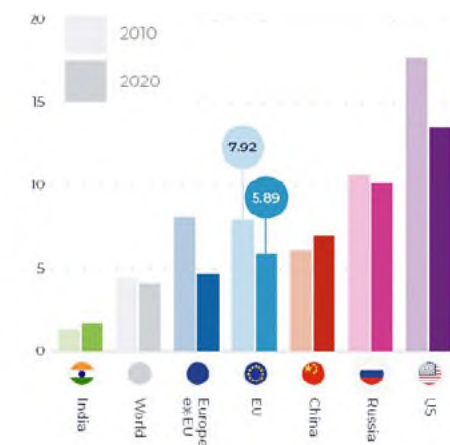
Energy intensity

Million tonnes of oil equivalent of primary energy consumption/GDP (PPP constant 2017 USD billion)



Emissions intensity

CO₂ emissions per capita (tonnes)



KPI 39 Circularity rate
KPI 40 Net exports of recyclable raw materials

The European economy needs to become more circular

Observation: Efforts to support increased circularity in the EU economy are bearing some fruit. The circular material use rate has grown since 2017, even though there is still some way to go before reaching the 22% goal set for 2030. Conversely, exports of recyclable raw materials have been on an upward trajectory since 2015, despite the European Commission's pledge not to export the EU's waste challenges to third countries.

Recommendations:

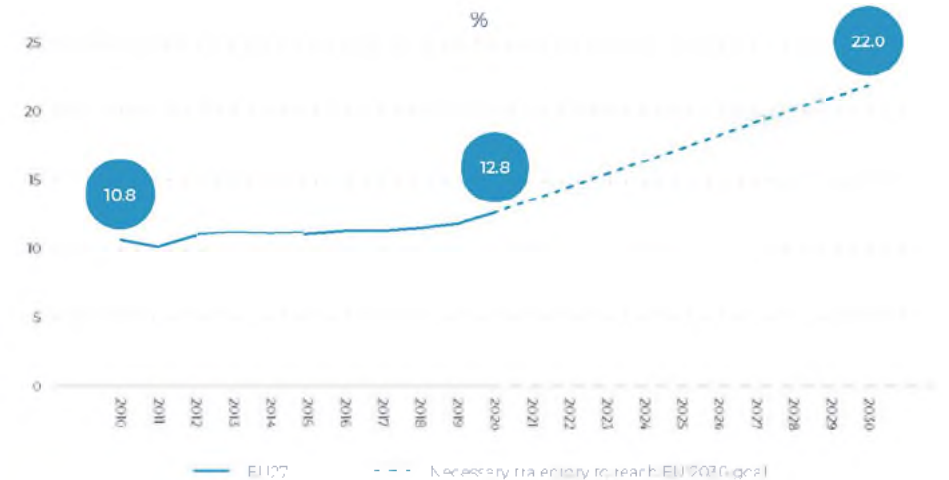
- Strengthening the circular economy is crucial to Europe's ability to secure the necessary supply of raw materials.
- It is important to further improve Europe's waste and recycling capabilities and remove unwarranted hurdles in the trading of waste within the Single Market.
- The use of digital tools should be stimulated, it could make a significant contribution, e.g. identifying secondary materials when dismantling buildings.

Note (2): Data includes waste from plastic, paper & cardboard, precious metal, iron & steel, and copper, aluminium & nickel.

Source (1, 2): Eurostat

KPI 39

Circular material use rate in the EU



KPI 40

Net exports of recyclable raw materials

Total waste to/from EU, million tonnes



Europe needs to diversify – and become less reliant on – imported energy

Observation: Until recently, the EU has been able to develop and sustain global competitiveness and high living standards despite its high dependence on energy imports. Europe now faces a geopolitical context in which its reliance on such energy imports has become compromising and unsustainable. Moreover, this has now become a matter of regional security, meaning accelerated development of large-scale renewable energy sources is more important than ever.

Recommendations:

- The guidance in the REPower EU package regarding the simplification and acceleration of permit-granting procedures needs to be implemented rapidly in the EU Member States
- In line with REPower EU, renewables have to play a greater role in Europe's energy mix to improve energy security and the EU should also diversify energy imports.
- The EU needs a systematic approach to implementing energy efficiency along the entire value chain in energy generation, transmission and distribution. In this, the focus should be put on end-use sectors, such as buildings, transport and industry.

To wean the EU off Russian energy sources, further changes are needed. The EU should move quickly to complete the Energy Union. This requires harmonised rules and regulations and more interconnections between the Member States.

Note (1): Europe ex-EU = Switzerland, UK and Norway. Solid fossil fuels include coal, peat, fuel, brown coal, briquettes, coal tar, peat, and peat products.

Note (2): Europe includes Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Turkey, Ukraine, UK.

Source (1): Eurostat.

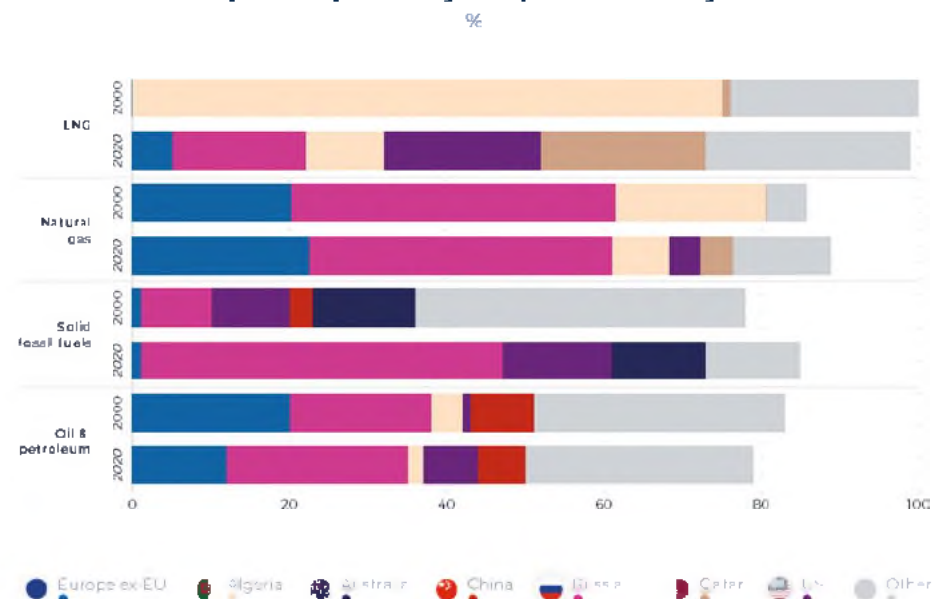
Source (2): BP World Energy Statistical Review 2021

Source (3): Wind Europe

Source (4): European Commission

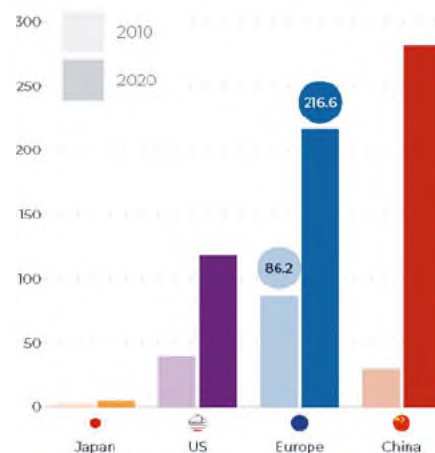
KPI 41

EU Imports dependency and partner country share



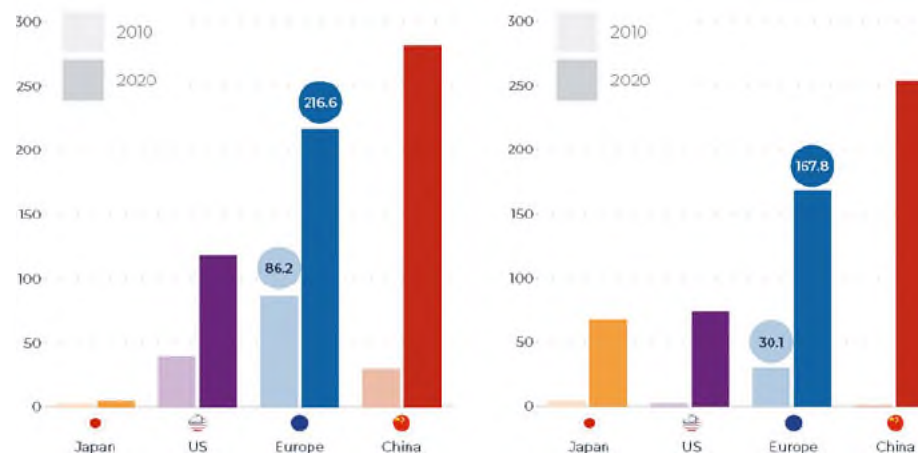
KPI 42

Installed wind power capacity

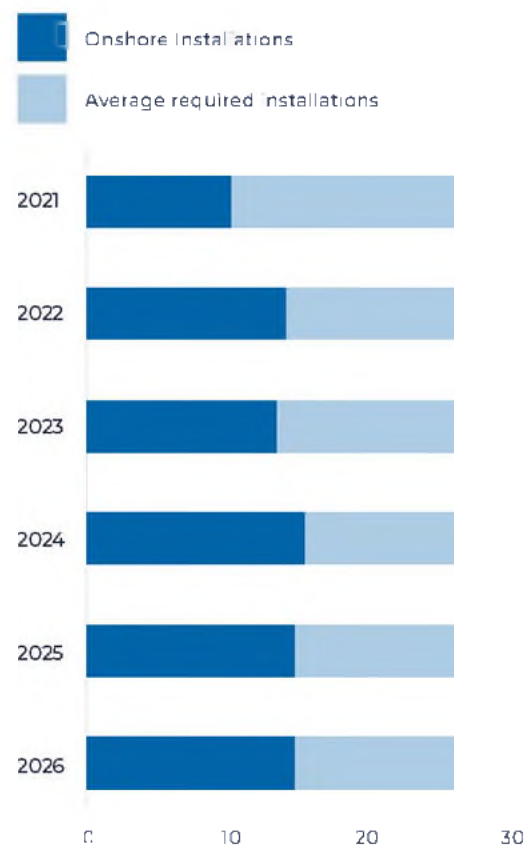


KPI 43

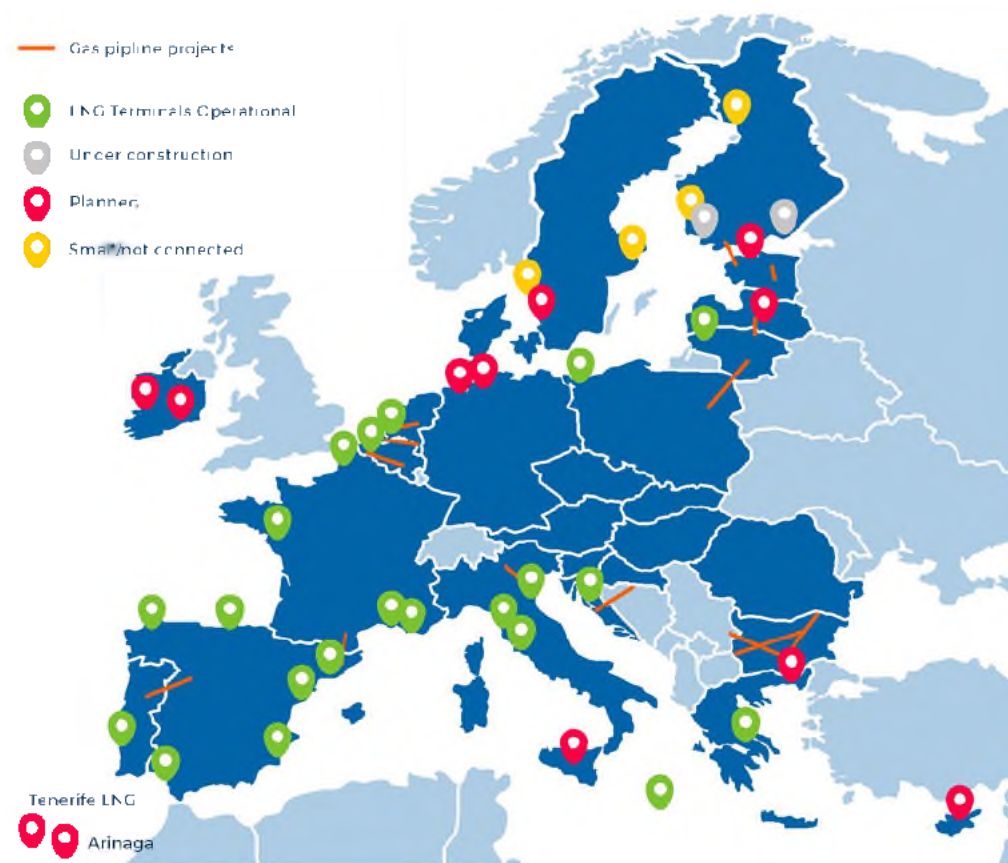
Installed solar power capacity



EU27 expected and required onshore wind installations (per annum)
WindEurope's Realistic Expectations Scenario, GW



Operational LNG port terminals and gas pipeline projects in the EU, February 2022



Wanted: reliable access to competitively priced energy

Observation: Industrial electricity prices are higher in Europe than in many other major economies. While this, in large part, is due to the rising share of taxes and levies in the total price, European industry is also vulnerable to volatile fossil energy prices stemming from geopolitical risk. This has become particularly evident following Russia's invasion of Ukraine. An important way to address this is to increase the share of renewable energy produced within the EU.

Recommendations:

- On top of the measures in the REPower EU package to boost the development of cleaner industrial processes, it will be important to secure the supply of critical raw materials and provide additional support for R&D.
- The EU should also make sure to preserve the competitiveness of European industry. Funding for Carbon Capture and Storage, Carbon contracts for difference and long-term power purchasing agreements (PPAs) will be vital.

Note (1): Europe ex-EU = Switzerland, UK and Norway. Price for China and India shows 2018 data. EU26 excludes EU12, Croatia, Cyprus, Greece, Italy, Malta, and Romania.

Note (3): Renewables include waste-derived fuels

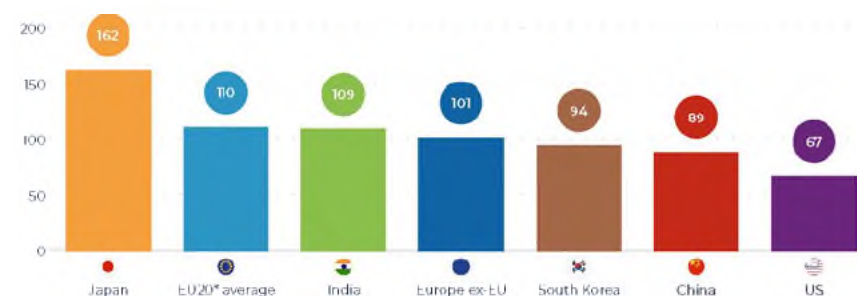
Source (1, 3): IEA

Source (2): Eurostat, Global Counsel calculations

KPI 44

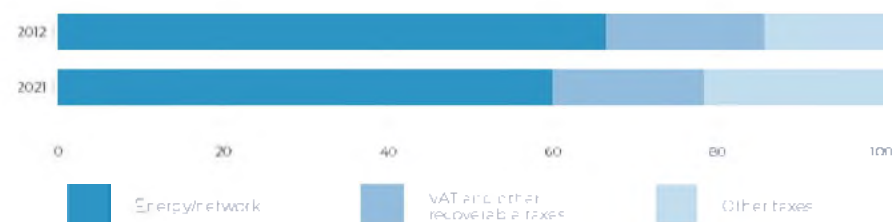
Industrial electricity prices, Q1 2021

USD/MWh, with bubble indicating absolute value



Share of various components of industrial electricity prices in the EU

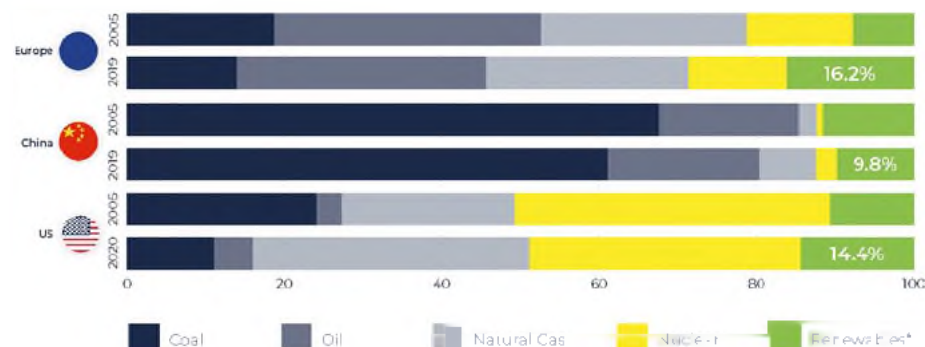
Share of total price, %



KPI 45

Final energy consumption

Share by source, %



KPI 46 Industrial robots
KPI 47 Deployment of IoT

Asia – not Europe – is leading the deployment of Industry 4.0

Observation: The EU has fallen behind in driving industrial automation – with significant implications for future global competitiveness and productivity growth. Some EU Member States remain among the most automated in the world, but such innovation is patchy across the EU. Without a common approach, the bloc risks falling further behind. This is part of a bigger problem: Europe's slow 5G roll-out, a lack of B2B data sharing and cloud and edge adoption – all critical elements of Industry 4.0.

Recommendations:

- Policymakers have to act now. Coordination and acceleration of European initiatives are vital: encouraging investment, promoting open innovation and industrialising the cloud-edge value chain.
- The European Alliance for Industrial Data, Edge and Cloud could serve as a central platform for coordination. It should leverage to the maximum the deliverables of Gaia-X and related initiatives such as the AI, Data and Robotics Partnership.
- The EU should build on encouraging developments for the Important Project of Common European Interest for Next Generation Cloud Services (IPCEI-CIS).

Note (1): *EU11 = Germany, Sweden, Denmark, Italy, Belgium, Netherlands, Austria, Slovenia, Spain, Slovakia, France

Note (2): In process of requesting raw data from Analysis Mason

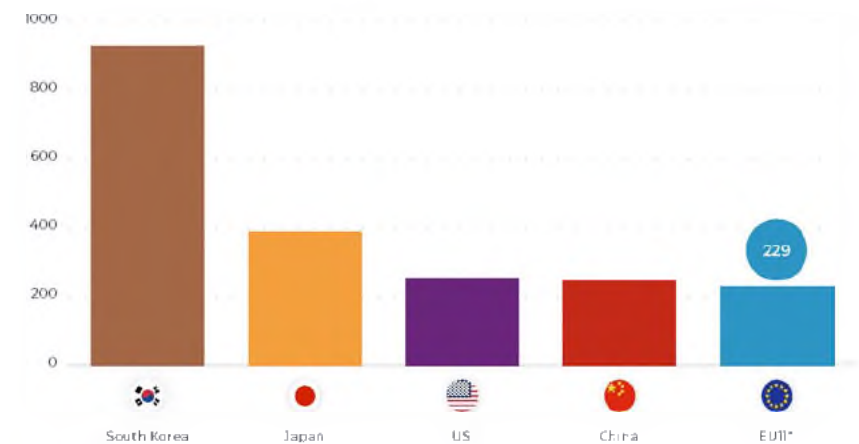
Source (1): International Federation of Robotics

Source (2): Analysis Mason

KPI 46

Installed robots per 10,000 workers, 2020

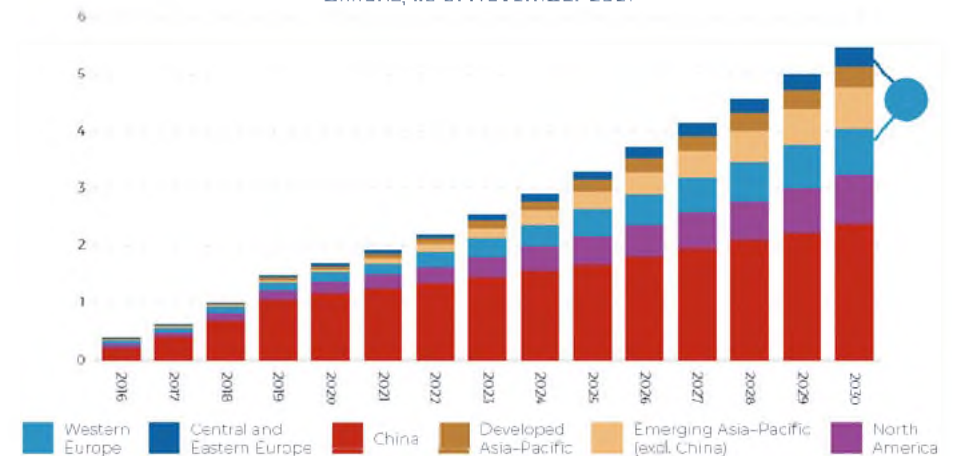
Bubble* showing EU value



KPI 47

Total forecast IoT connections by region

Billions, as of November 2021



KPI 48 Business digitalisation index

KPI 49 ICT use by types of enterprises

KPI 50 Enterprise ICT use for sustainability purposes

Adoption of new technologies is increasing

Observation: European businesses are becoming more digitalised. The pandemic also contributed to increased adoption of cloud services, as businesses moved to remote working. However, many SMEs are not yet adopting the technologies needed for the digital transition. AI and IoT also are not yet sufficiently integrated into the operation of large businesses.

Companies' use of ICT to meet sustainability goals is already widespread but could be enhanced.

Recommendations:

- EU policymakers should step up with a modern and future-proof digital policy agenda. We need a regulatory framework that fosters private investment and accelerates the deployment of high-capacity networks.
- European and national policymakers should embrace the responsibility to ensure that all levels of the workforce have the right skills that can drive the adoption of digital technologies.

Note (2): Big data analysis, 2020 data. Social media use 2019 data.

Source (1): Digital Economy and Society Index

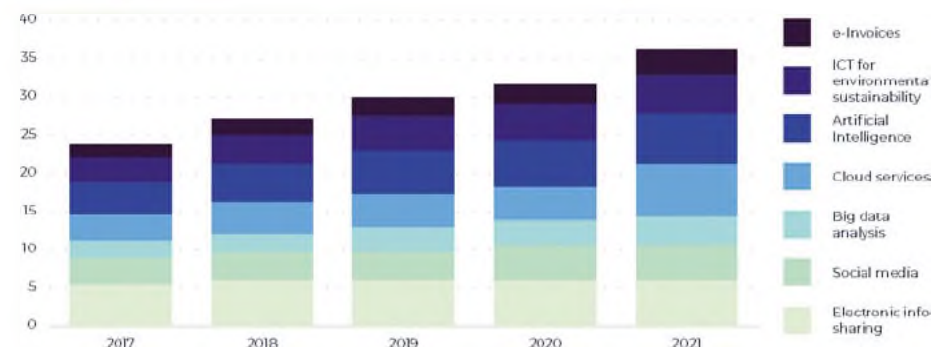
Source (2): Eurostat

Source (3): European Commission

KPI 48

Business digitalisation in the EU

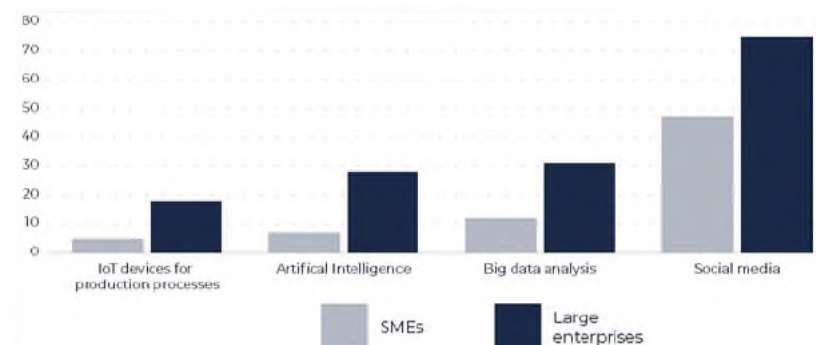
Business digitalisation index, 0-100



KPI 49

ICT use in EU, 2021

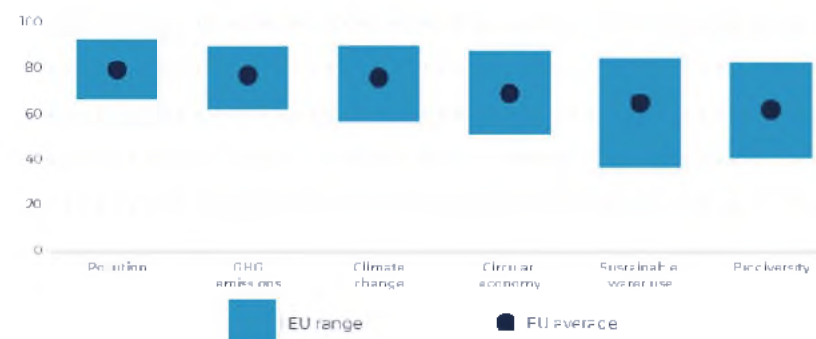
Share of enterprises using selected technologies, %



KPI 50

Impact of enterprise ICT use on sustainability, 2021

Share of businesses using ICT to reduce or address sustainability concerns and goals, %



Global presence & influence

In the past two years, various obituaries of globalisation have been written, but rumours of its death are greatly exaggerated. Yet, globalisation will change as the world becomes increasingly divided. To retain its place and role in the world, it is vital that Europe addresses challenges in several important areas.

In this final section, we look at the KPIs on the interlinkages between Europe and the rest of the world: from foreign direct investment to high technology exports; from participation in global standard-setting to net migration flows of skilled labour.



KPI 51 Manufacturing exports

KPI 52 Exports of high technology manufactured goods

Securing Europe's industrial future: global leadership in high-tech manufacturing

Observation: EU manufactured goods remain in high demand globally, in large part due to Europe's high technology sector. Importantly, in contrast to the US, Europe has retained a leading role despite increasing competition from China. So far, we have maintained our competitive edge and have a solid foundation for future economic growth and for tackling challenges linked to the twin transitions.

But, for Europe's potential to materialise we need to rebound on the weaknesses identified throughout this report.

Recommendations:

- Europe's industry can remain competitive and innovative even in the face of geopolitical and geo-economic challenges. However, we need greater speed and determination to tackle weaknesses and delays on critical issues.
- Moreover, the EU can support industry through an active trade policy based on reciprocity and effective implementation of EU tools to strengthen the level playing field for European companies.

Note (2): World exports have been rebased by subtracting intra-EU trade. High technology exports are products with high R&D intensity, such as aerospace, computers, pharmaceuticals, scientific instruments and electrical machinery.

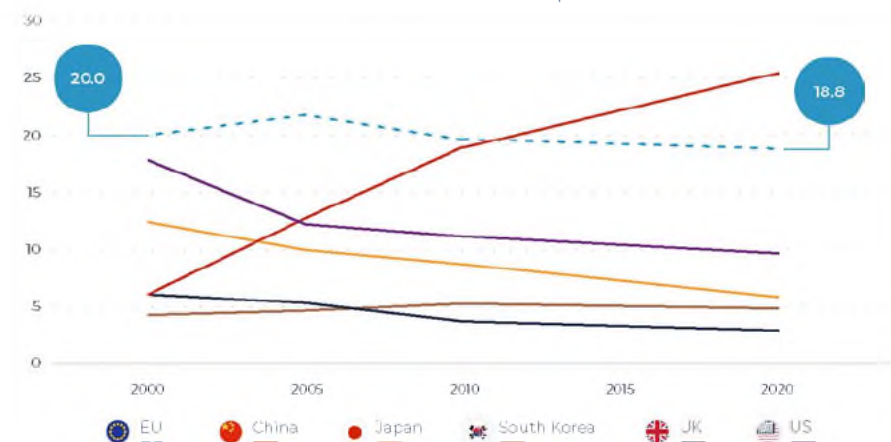
Source (1): World Trade Organization

Source (2): World Bank, Eurostat

KPI 51

Exports by manufacturers

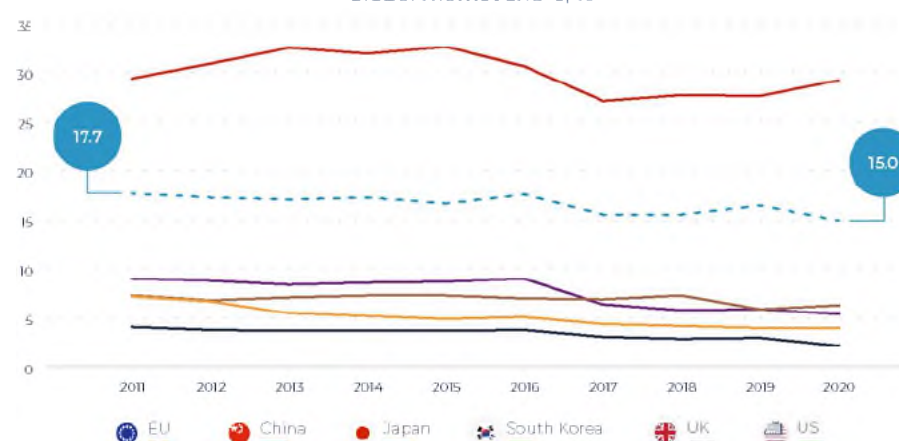
Global market share, %



KPI 52

Exports of high technology manufactured goods

Global market share, %



KPI 53 Reliance on critical raw materials imports

KPI 54 Recycling of critical raw materials

Europe is heavily reliant on imports of critical raw materials

Observation: The EU is 100% reliant on imports of the most critical raw materials (CRMs), it needs for the twin transitions. This puts our economy in a vulnerable position relative to other major economies that control these supply chains.

Recommendations:

- The EU should secure its access to critical raw materials by pursuing a resilience strategy with an emphasis on the diversification of supply chains;
- Strategic partnerships with alternative sourcing countries
- Access to resources in partner countries via trade agreements
- Development of alternative inputs
- Greater ambition for Europe's circular economy

Note (1): The selection of critical raw materials is based on the Commission's 2020 report, "Critical Raw Materials for Strategic Technologies and Sectors in the EU", which ranks the different raw materials based on their supply risks to key technologies and sectors. Risk drivers include global supply risk; European domestic supply; criticality factor in CRM list; importance of reliance; substitution and recycling.

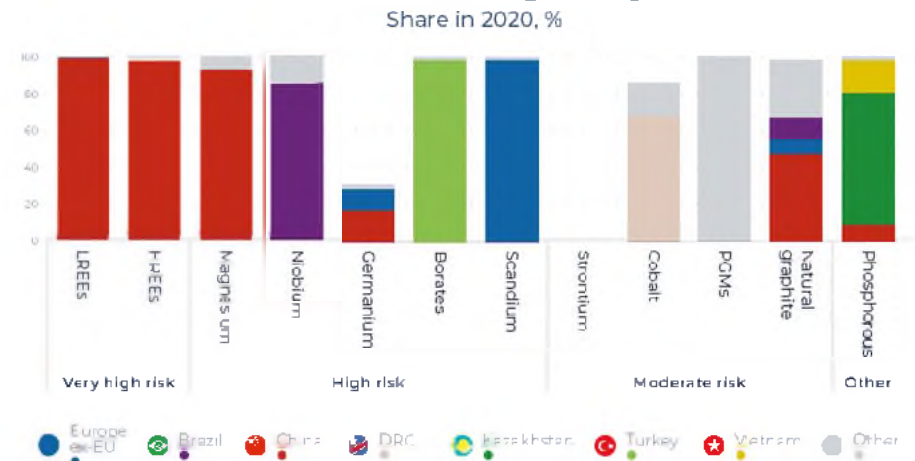
Note (2): HREE = Heavy Rare Earth Elements, LREEs = Light Rare Earth Elements, PGMs = Platinum Group Metals. Import reliance = $(\text{Import} - \text{Export}) / (\text{Domestic production} + \text{Import} - \text{Export})$. The End-of-Life Recycling Input Rate (EOL-IRR) is the percentage of overall demand that can be satisfied through secondary raw materials. Commission does not provide data on PGM sourcing countries. Other category includes sourcing provided by secondary material use.

Note (3): Europe ex-EU = Switzerland, UK and Norway

Source: European Commission

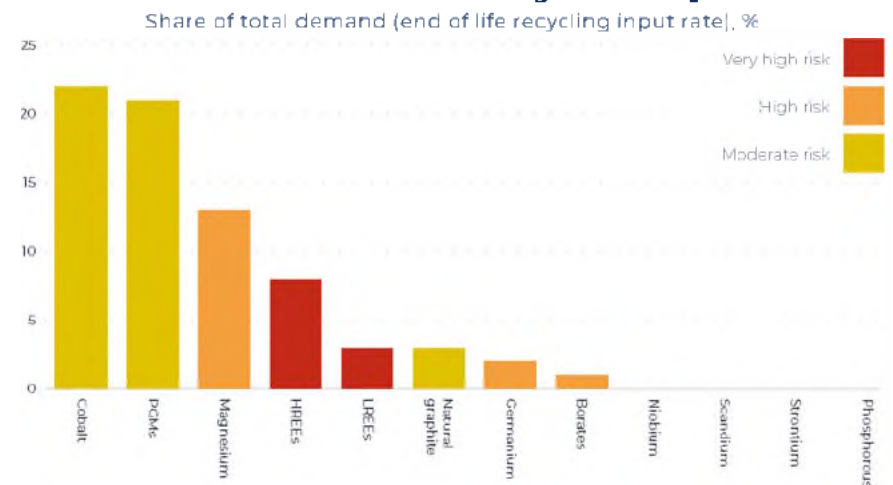
KPI 53

EU import reliance on critical raw materials and main sourcing country



KPI 54

CRM demand that can be satisfied through secondary raw materials



Foreign investment has dropped, due to geopolitical uncertainty and US tax reforms

Observation: The 2017/2018 drop in EU and US foreign direct investment (FDI) is mainly due to changes in American tax legislation and responding asset repatriation. It can partly also be explained by China's increased focus on building its domestic industrial base, and on restrictions on capital outflows. Geopolitics and an increasingly uncertain outlook for the global economy have also prompted European corporates to pause overseas investment.

Recommendations:

- We should safeguard the EU's openness to investment and forge strategic trade and investment relationships with key partners, for example through the Global Gateway initiative.
- Yet, Europe must mitigate risks from foreign investment in critical technologies and infrastructure through increasingly harmonised investment screening tools and mechanisms. Importantly, such tools should be used fairly and proportionately, they should not become a back door for protectionism.

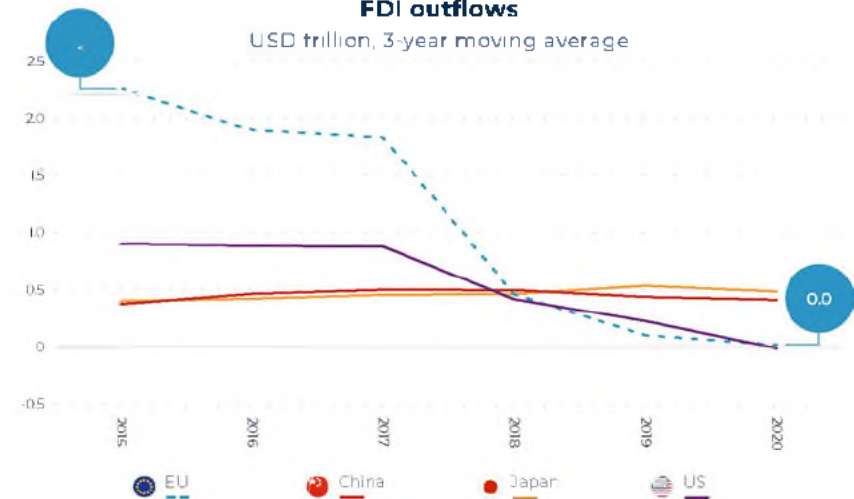
Note (1, 2): EU excludes intra-EU FDI

Source (1, 2): UNCTAD, Eurostat, CEIC Data, Global Counsel calculations

KPI 55

FDI outflows

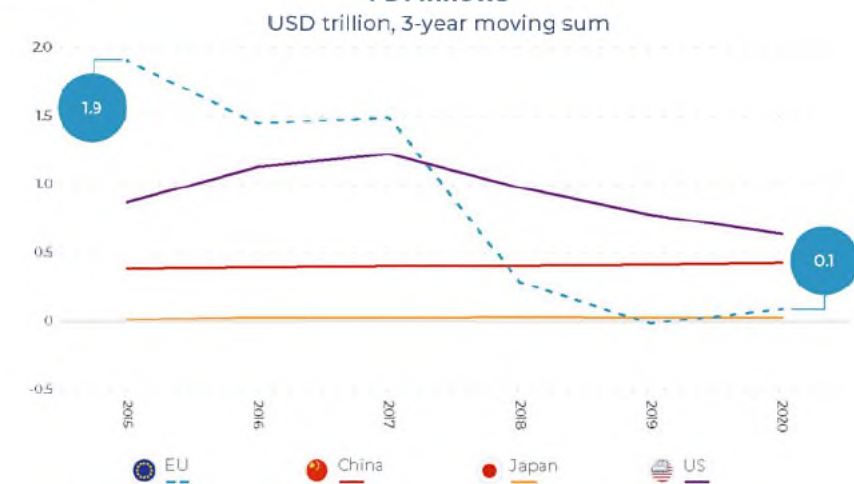
USD trillion, 3-year moving average



KPI 56

FDI inflows

USD trillion, 3-year moving sum



KPI 57 Trade and investment barriers**KPI 58** FDI restrictiveness

Barriers to trade and investment are looming

Observation: Until 2020, we saw a decrease in trade and investment barriers and FDI restrictiveness. Global concern about secure access to food, energy and strategic technologies leads to an increase in protectionism. For strategic technologies, more recent experience indicates that this trend results in more export controls. Some strategic industries that often handle sensitive data are also increasingly restricted for European companies in third countries.

Recommendations:

- The EU and all major economies, especially via the G20 and the WTO, should work together to reverse the trends toward protectionism seen in recent years.
- Barriers that distort competition must be removed and global markets need to be further opened to ensure a level playing field.
- The EU should make the most of new platforms for dialogue with like-minded partners, such as the EU-US Trade and Technology Council.

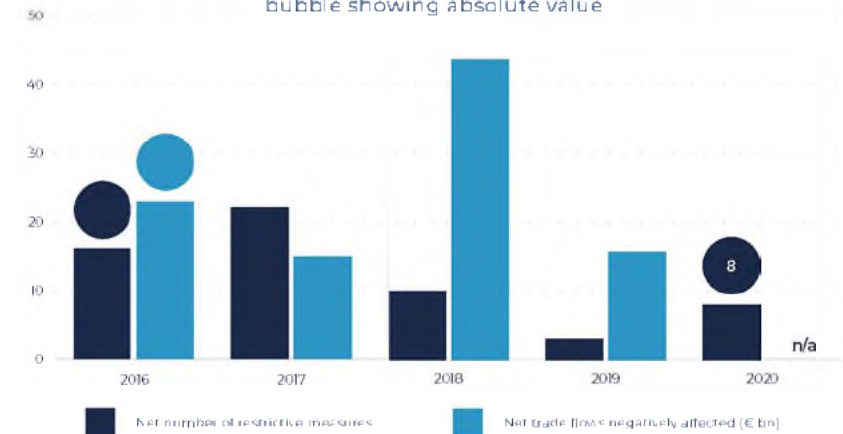
Note (1): Since one full year of data after the barrier is removed is required to establish its impact on trade, the Commission has not yet published data on the impact of new and lifted restrictive measures on trade flows for 2020.

Source (1): European Commission

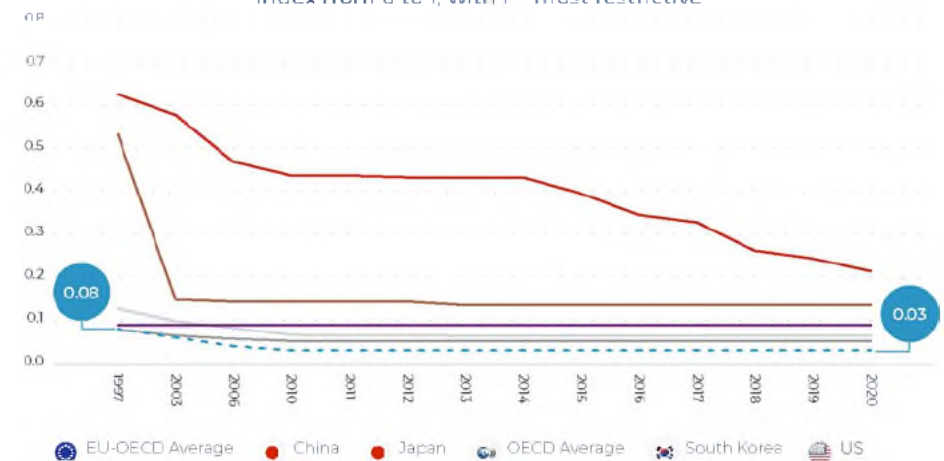
Source (2): OECD

KPI 57**Trade and investment barriers**

New barriers for EU companies abroad, number and EUR billion, bubble showing absolute value

**KPI 58****FDI restrictiveness**

Index from 0 to 1, with 1 = most restrictive



The European market is open for trade and investment

Observation: The EU continues to be the world's most open trading bloc, with trade in goods and services as a share of GDP unchanged since 2013. While this has made the European economy dynamic and highly competitive, it is also exposing its companies to unfair competition from peers in more protected home markets.

Recommendations:

- The EU should remain a standard-setter for fair openness while securing a level playing field, it should work to strengthen the rules-based global trading system, including through WTO reform.
- Investment screening, the foreign subsidies instrument and the international procurement instrument should be used to mitigate risks from foreign investment in critical technologies and to ensure fairness in public procurement.
- Investment screening mechanisms should be harmonised across the Member States, whilst ensuring that screening rules are implemented fairly, consistently and proportionately.

Note (1): Excludes intra-EU trade

Note (2): Europe ex-EU = Switzerland, UK and Norway. EU27 excludes Bulgaria, Croatia, Cyprus, Malta and Romania.

Source (1): Eurostat, World Bank

Source (2): OECD

KPI 59

Economic openness

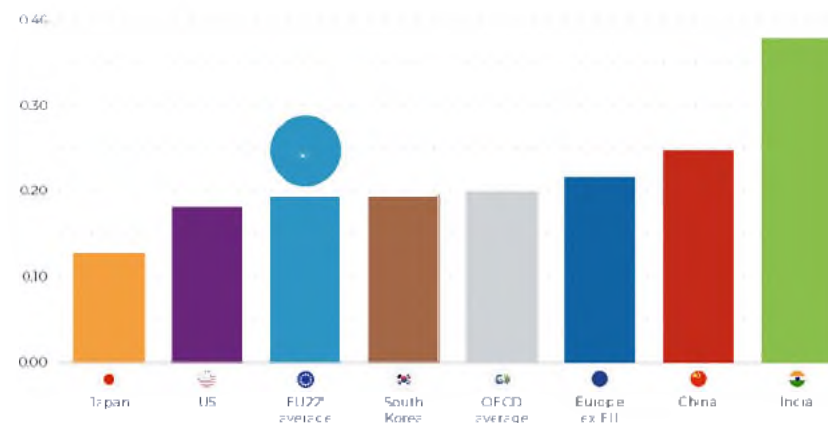
Trade in goods and services as a share of GDP, %



KPI 60

Services trade openness, 2021

Index between 0 and 1, with 1 being the most restrictive and bubble showing EU value



KPI 61 Participation in global standard-setting**KPI 62** Ownership of 5G patents with standard-essential components

Participation in global standard-setting is essential for competitiveness

Observation: Europe has a long history as a leading standard-setter, partly through its participation in global standard-setting bodies. This is a position the EU wants to consolidate. However, it is also important that Europe does not fall behind on patent ownership.

Recommendations:

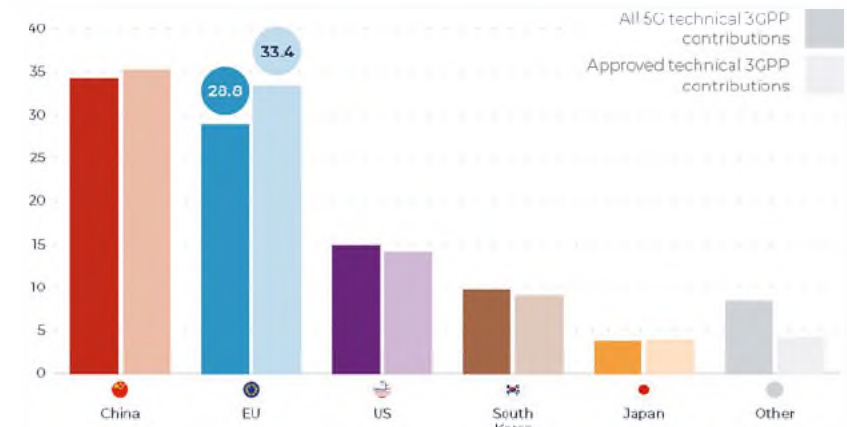
- The European Commission should engage the Member States and allies in Asia and North America to set standards that are conducive to free and fair trade – standards that create a level playing field for European companies to operate in third countries.
- Working with the private sector, the EU should also aim to lead the development of innovation-friendly, open and non-fragmented global standards – including on fair, reasonable and non-discriminatory (FRAND) terms – that will create sustainable growth opportunities and significant value for EU industries.

Source [1, 2], IPIP yt cs

KPI 61

Participation in international 5G standard setting meetings

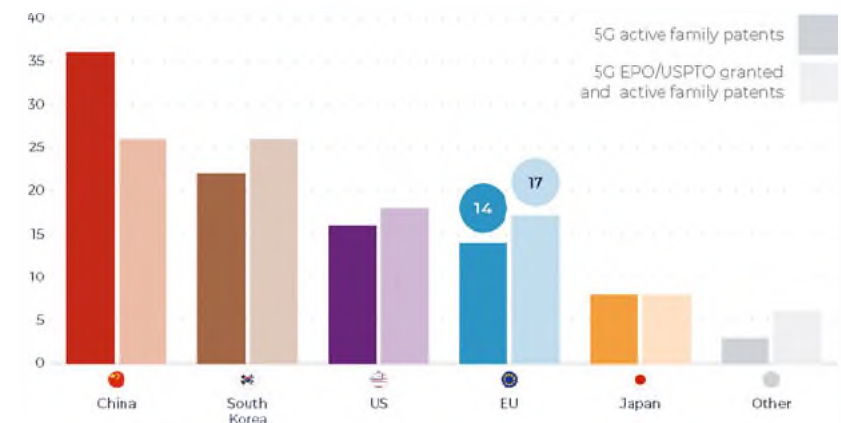
Share of 5G technical contributions by the top standard developing companies submitted to standard setting 3GPP meetings as of October 2021, %, with bubble indicating EU value



KPI 62

Ownership of 5G patents with potential standard-essential components

Share of self-declared 5G patents from top 5G patent owners as of October 2021, %, with bubble indicating EU value



KPI 63 Destination of foreign students

KPI 64 Net migration flows of people with AI skills

Attracting foreign talent is indispensable to future competitiveness

Observation: Promisingly, the EU has almost closed the gap with the US and is on track to become the top destination for foreign students. It is also a net importer of digital transition talent. While geopolitical developments can explain parts of this trend, it is also a testament to improving quality of European education, high living standards and good job prospects upon graduation.

Recommendations:

- Europe's high living standards should be recognised as an asset when governments work towards attracting and retaining talent.
- For students, public institutions must provide necessary support – with minimal bureaucracy. This would also incentivise foreign students to stay and work in Europe after they finish their education.

Note (1): We have excluded intra-EU student movements to assess how the EU compares at a global level taking the EU as a single entity.

Note (2): AI data used due to data constraints, Europe ex-EU = Switzerland, UK and Norway

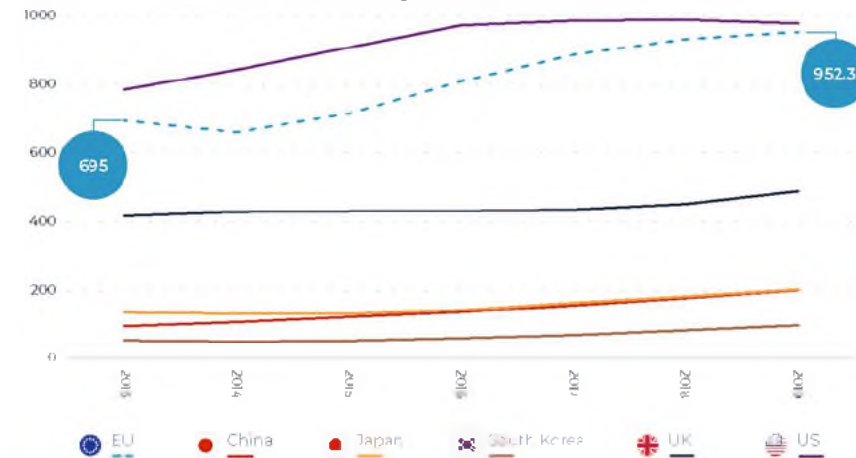
Source (1): UNESCO, CC calculations

Source (2): OECD, LinkedIn, World Bank

KPI 63

Destination of foreign students

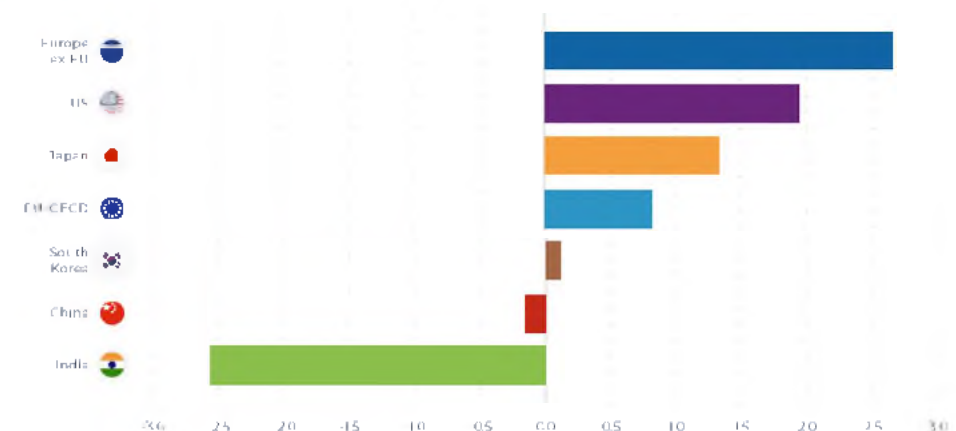
Inbound internationally mobile students, thousands



KPI 64

Between country AI skills migration, 2021

Net migration of persons with AI skills, per 10,000 LinkedIn members



Notes

Notes





The European Round Table for Industry (ERT) is a forum that brings together around 60 Chief Executives and Chairmen of major multinational companies of European parentage, covering a wide range of industrial and technological sectors. ERT strives for a strong, open and competitive Europe as a driver for inclusive growth and sustainable prosperity. Companies of ERT Members are situated throughout Europe, with combined revenues exceeding €2 trillion, providing around 5 million direct jobs worldwide - of which half are in Europe - and sustaining millions of indirect jobs. They invest more than €60 billion annually in R&D, largely in Europe.

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