Post Covid-19 strategies to reduce the vulneralibity of supply chains

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Highlights of the reports:

- '*Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy'* published by the EU Policy Department for External Relations in March 2021,
- Elisa Martinelli, G.Tagliazucchi (2018). Resilience and Enterprise. The impact of natural disasters on small retail businesses. Milan: Franco Angeli.
- '*World Investment Report 2020 focused on International Production Beyond the Pandemic'* issued by Unites Nations Conference on Trade and Development (UNCTAD),
- McKinsy Global Institute: '*Risk, resilience and rebalancing in global value chains', August 2020,*
- Reshoring Initiative[1] 2020 Data Report,
- '*Executive Order on America's Supply Chain'* The White House, February 24, 2021 Presidential Actions,
- Building Resilient Supply Chain, Revitalizing American Manufacturing, and Fostering Broad-Based Growth 100-day Reviews under Executive Order 14017 June 2021 (focused on semiconductors manufacturing and advanced packaging, large capacity batteries, critical minerals and materials, pharmaceuticals and active pharmaceutical ingredients),

prepared and integrated by the Research and Development Committee of ADACI, the Italian Association of Procurement and Supply Management.

1. US non-profit organisation whose mission is to bring jobs back to Unites States by assisting companies to more accurately assess their total cost of offshoring.

Content:

1. **Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy**

- requested by the International Trade (INTA) Committee of the European Parliament,
- published on March 2021, and
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Definition of reshoring and offshoring

As the term '**reshoring'** also known as onshoring, inshoring or backshoring is the **opposite of offshoring**, which is given different definitions, it is advisable to consider the most common ones, knowing in advance that each of them implies a different implementation process.

Nobuo Kiriyama 2011 (OECD Paper n° 115)

Global sourcing: the acquisition of an input from a foreign supplier rather than a domestic one. The boundaries of the buying firm are not altered. The only change is in the location of the supplier.

International outsourcing: relocation of a production input manufactured by the buying firm in the domestic market to a foreign firm abroad (independent supplier).

Offshoring: relocation of a production input manufactured by the buying firm in the domestic market to an affiliate firm abroad.
Change in the geographic location but non in the firm's boundaries.

Offshoring: Marin 2006 'relocation of an activity abroad, which however remains inside the firm'

In the following definitions, offshoring includes international outsourcing

Offshoring: Jensen and Petersen 2009, Massini 2011
Relocation of business activities from home country to a foreign country. The firm may establish its own subsidiary (captive offshoring) or form joint ventures abroad or it could outsource the activities to unaffiliated external suppliers abroad (offshore outsourcing).

Offshoring CIPS

The process of transferring in-house business functions or processes to another country in order to leverage benefits, e.g., cost reductions or specialist skills. This may be through relocation of a business function, or via selecting an already in-country supplier to perform the services.

Offshoring OECD

The term is sometimes used as a synonym of "outsourcing". However, outsourcing means acquiring services from an outside (unaffiliated) company or an offshore supplier. In contrast, a company can source offshore services from either an unaffiliated foreign company (offshore outsourcing) or by investing in a foreign affiliate (offshore in-house sourcing).

ADACI does not enter into the merits of the definitions, but simply points out that the term offshoring can be interpreted in different ways.

Introduction to the EU Study

Against the background of supply shortages due to the COVID-19 pandemic, and the renaissance of the geopolitics, with its conflicting strategies and tensions, reshoring of production has become a topical issue in the recent EU policy debate. **Reshoring refers to the process of bringing productive activities 'home' to a specific location, while nearshoring refers to manufacturing being relocated to a country closer to 'home'.** This can be motivated both by concerns on security of supplies and by the need to increase the strategic autonomy of the EU economy in response to the above shift in the international order.

The study contributes to this debate by assessing the pros and cons of employing reshoring as an economic policy tool and discusses its role with respect to broader EU objectives concerning the supply security of critical products and its 'open strategic autonomy'[1].

With the rise of trade, facilitated by the global value chains (GVCs), the nature of commerce has changed significantly, and companies make goods differently today than in the past. **In the 21st century, products are 'made in the world'**, as firms combine raw materials, inputs, labour, and ideas sourced from different countries according to specific cost-benefit tradeoffs for every component of the value chain.

1. The addition of 'openness' shows that the EU will be open to trade and will promote stable rules in order to be strong economically and have geopolitical influence. Open Strategic Autonomy means cooperating multilaterally wherever possible and appropriate, and acting autonomously wherever strategically necessary.

This phenomenon has been made possible by innovations in communications and transportation technologies, together with institutional and market reforms that have allowed many countries to join the global economic landscape.

Although consolidated over the last decade, GVC-based production is vulnerable to exogenous shocks, for instance caused by pandemics, extreme weather events, political conflict and cyber-attacks or man-made events such as the blockage of the Suez canal. If shocks or lockdowns are to become part of a 'new normal', **the resilience of the GVCs has to be improved**.

> *President JOSEPH R. BIDEN, in his Executive Order on America's Supply Chains, says: 'The United States need resilient, diverse, and secure supply chains to ensure our economic prosperity and national security.*

Besides its relationship with the security of supplies, reshoring can also be an option vis-à-vis the national or company autonomy strategy. Industrial and technological capabilities and capacities are considered crucial elements for the international competitiveness of the EU economy, and an answer to the increasing geopolitical strategies of the US and China.

Such technological capabilities are essential to overcome the challenges of the green transition as outlined in the European Green Deal.

Technological sovereignty in high-tech industries, and in particular in digital technologies, is increasingly considered a critical element of the strategic autonomy, as the competitive position of EU companies is generally regarded as lagging behind that of the US and increasingly also of Chinese competitors.

In their quest for technological supremacy, these two countries have recently engaged in ring-fencing battle of key technologies starting from semiconductors through, amongst other options, reshoring policies. The EU has only just started to react to these developments, arguably with policies that are modest in scope and scale.

In the last 15 years, China has become the dominant producer (more than 50% of imports of a single product) in electronic, machinery and other products, and **such dependency could lead multinational corporations to rethink how to build resilience into their supply chains**, with an initial focus on building inventory.

The empirical evidence on reshoring in the last decade highlights that reshoring processes are on the rise, with larger firms and medium to high-tech industries exhibiting the greatest reshoring propensity. However, these processes remain so far limited in scale and thus have exerted only small effects on the EU economy as a whole.

Highlights of the EU study

The study:

- has the merit to frame the theme of reshoring into the ongoing transformation of the world production system, and prior to analyse its insights and operating implications, it **provides a macroeconomic framework of the global production structure and world trade**, describing the path and the drivers that characterised them since their birth,

- links the reorganisation of the world production to the **crisis of the liberal international order and to the renaissance of the geopolitics** with its rivalries, conflicting strategies, increased protectionism, and tensions,

- analyses and debates the logics of the regionalisation strategy declared by many countries and points out that, with some exceptions related to the national autonomy and security, a '**more regulated and better governed globalisation' should be the preferred solution**',

- illustrates the role played by foreign direct investment (FDI) in the development of the international trade, and explains the reasons which have led to their constant reduction over last decade (the authors use the term 'slowbalisation' conceived by the Economist),

- provides a detailed picture of the growing vulnerability of the global value chains, stresses the need to review the supply chain strategies, and **presents the options available to the CPOs or SCMs,**

- debates how to improve the **resilience or the robustness** of supply chains pointing out that the risk management approach based on resilience may differ from that based on robustness,

- assesses the **impact of digitalisation on the world production** and verifies the existence of a correlation between digitalisation and reshoring,

- explores the likely impact on the international production processes of **economic, technological and political drivers,**

- presents the concept, policy framework and constraints of reshoring and nearshoring, specifying when it is appropriate to reshore or nearshore,

- discloses empirical records on reshoring, confirming that **until today it remains an empirical phenomenon of limited relevance,**

- debates the EU policy framework on the reshoring, and analyses the potentials for reshoring of selected economic sectors,

- introduces the 'open strategic autonomy' of the EU, specifying the correlation between openness and autonomy,

- presents four significant case studies on pharmaceuticals, medical products, semiconductors and solar energy, exploring for each of them the possible business strategies and government policies. Their analysis highlights the complexity and difficulties associated with the reshoring of capital-intensive processes,

- makes an overview of the reshoring policies of the USA, UK and Japan.

In addition to the above macro and micro analysis the study:

- points out that global pandemic is about to end and that all CPOs or SCMs have to prepare a **relaunch programme** ensuring the continuity and competitiveness of their supplies,

- highlights that the lack of attention to the security of supplies will become a reputational risk for companies,

- debates over the possible options, pointing out that **a unique solution valid for all situations does not exists.** CPOs or SCMs have to decide on a case by case basis, taking into account that the best solution for one product might be inappropriate for another,

- given the relevance of the European Green Deal, for which sustainability has become the central pillar of trade policy, it points out the need to start to consider the costs of the environmental externalities of long-distance transport, hoping that WTO will define within 2030 the price of the carbon emissions, by introducing, for example, a global carbon tax,

- recommends the CPOs and the SCMs to carefully consider the constraints listed below, prior to define their medium-long term strategies.

Economic Drivers of Reshoring

The economic drivers of reshoring are diverse and often related to factors of flexibility, quality and the importance of proximity to specific markets. However, **literature and best practices usually focus on microeconomic motivations, while other factors such as macroeconomic crises or changes in economic policy are often not considered**.
The four sector case studies on medical products, pharmaceuticals, semiconductors and solar energy analysed, highlight that the impact of economic and tecnological factors upon reshoring will likely remain limited, for the time being. Reshoring dynamics will depend heavily on political developments as well as on the willingness and ability of policy makers to promote reshoring via targeted policies.

The Reshoring Initiative 2020 Data Report has listed the negative offshore factors and those in favour of the reshoring.

Reshoring Initiative 2022 Report			
Rank	Negative offshore factor	Rank	Positive domestic factor
1.	Quality/rework/warranty	1.	Proximity to customer / market
2.	Freight cost	2.	Government incentives
3.	Supply chain interruption risk/natural disaster risk, political instability	3.	Skilled work-force availability – training
		4.	Eco-system synergies
4.	Total cost	5.	Image /brand
5.	Tariff	6.	Impact on domestic economy
6.	Green considerations	7.	Infrastructure
7.	Delivery	8.	Lead time / time to market
8.	Inventory	9.	Automation / technology
9.	Rising wages	10	Customer responsiveness improvement
10	Loss of control	11	Higher productivity
11	Intellectual property risk	12	Under utilised capacity
12	Travel cost /time	13	Manufacturing / engineering joint innovation
13	Communications	14	US price of natural gas, electricity, chemicals
14	Currency variation		
15	Difficulty of innovation/product differentiation	15	Customisation, flexibility
16	Social /ethical concern	16	Lean, other business process improvement techniques
17	Product liability		
19	Regulatory compliance	17	3D printing / additing manufacturing
19	Employee turnover		
20	Onsite audit cost		
21	Reputation risk		

In the short term, reshoring for most of offshored products is unlikely for the following reasons:

a. higher wages in western economies (see benchmark at pag. 75)
b. the significant advantages associated with Chinese economies of scale,
c. complex established regional supplier networks (impact of cluster specialisation and productivity),
d. more sophisticated European sustainability standards that make inshore production more expensive.

The EU report also presents a review of reshoring-related policies implemented by the US[1], the United Kingdom (UK) and Japan. With the exception of Japan, policies that explicitly promote reshoring are rare. Instead, reshoring and nearshoring activities are politically desirable for industrial and commercial products that may promote production in or near the domestic market. In the US, the confrontational trade policy of the Trump administration has been a key potential driver of reshoring. **In the UK, policymakers focused more on innovation and industrial policies,** aiming to support the local manufacturing sector and, as a consequence, also reshoring activities. **The Japanese government specifically supports reshoring or nearshoring production capacity in the form of subsidies in its COVID relief program.** Overall, we find that while a few individual success stories of reshoring of major production capacity exist, the overall success of reshoring policies has remained limited. **Large-scale reshoring will depend on strong(er) policy support and the outcome of major geopolitical events such as Brexit and the conflict between the US and China.**

With respect to policy recommendations, we argue that security of supply-related policies need to employ a combination of measures. These could include in particular:

(i) increasing GVC-resilience through obligations on monitoring and due diligence requested by lead firms;
(ii) stockpiling obligations for producers and traders of critical products; and
(iii) safeguarding and establishing minimum EU manufacturing capacities for specific critical products, including targeted reshoring.

Policies to promote strategic autonomy will be mostly oriented towards supporting research and innovation (R&D) in high-tech and other strategic sectors. They should, however, be complemented by safeguarding the manufacturing base in the EU, both through reinforced and harmonised investment screening policies and by promoting the

1.US policy has been updated on Feb 24, 2020 with the Executive Order of the President, see Para 3.

establishment of manufacturing capacities for newly developed products and technologies, for example, thin-film solar panels, that are deemed essential for tackling the green transition and other grand societal challenges. Finally, nearshoring to the EU Eastern and Southern Neighbourhood could be actively supported by EU Trade Policy.

Constraints and risk of global supply chains

a. New geopolitical environment

Unlike the first phase of the globalisation 1970-1990, in the current geopolitical scenario, there are big players such as United States, China, Russia, but also medium ones, like India, Indonesia, Turkey, Iran, and Brazil. **Each of them acts independently favouring its interests, and generating, sometimes a critical systemic rivalry** (intense geopolitical competition). The more key players there are, the more complex and unpredictable the game becomes. We are witnessing a gradual decoupling of big economies or a trend towards more regionalised production structures. The Economist called it 'slowbalisation'. In this global stage, Europe should be a player and not a playing field and should have more courage and geopolitical ambitions (President of the European Council).
All this is generating uncertainty, instability and difficulty in obtaining accurate forecasts.

b. Supply chain shock

According to McKinsey Global Institute, the main types of shocks to global value chains are: acute and chronic climate change, macroeconomic/financial crisis, trade disputes, pandemics, cyberattacks, terrorism, and supplier bankruptcy. As the world temperatures rise, the frequency of and losses resulting from severe weather events will likely increase.
According to the UNCTAD World Investment Report 2020, the estimated global cost of the Covid19 pandemic amounts to $ 3.6 trillion or to the 4.2% of the global GDP.

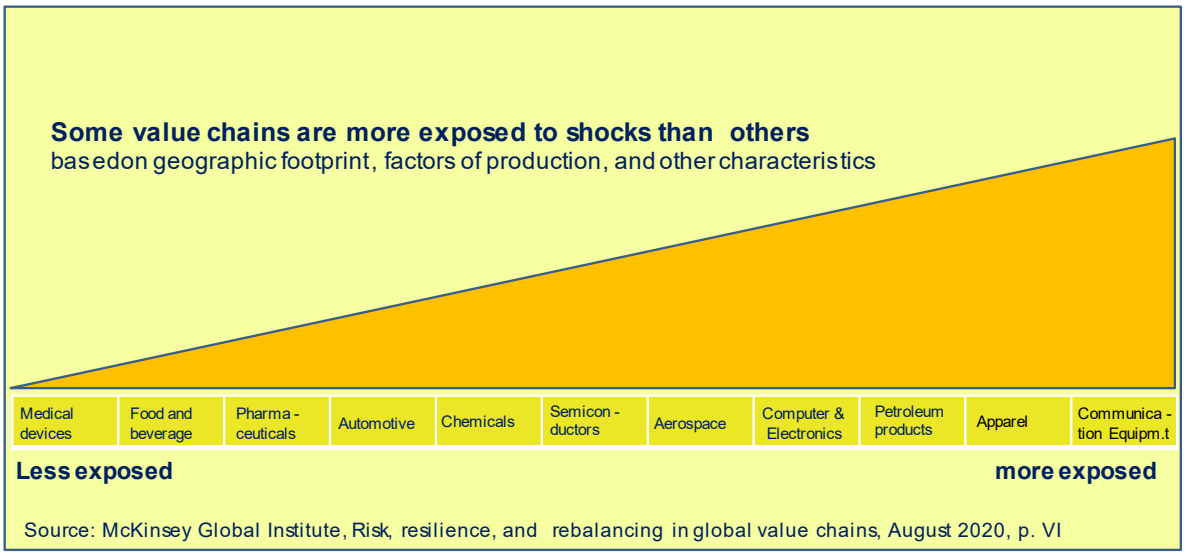
The WorldRiskIndex 2020 indicates the disaster risk for 181 countries in the world. The Pacific island state of Vanuatu leads the index as the country with the highest disaster risk (49.74). Qatar has the lowest risk (0.31).
The disaster risk is very heterogeneous worldwide, but geographically highly concentrated. In 2020, the hotspot regions of risk are still located in Oceania, South-East Asia, Central America and West and Central Africa. Comparing the continents, Oceania ranks first in terms of disaster risk, followed by the Americas, Asia and Europe.
+ Oceania is also the continent with the highest exposure to extreme natural events. It is followed by the Americas, Africa, Asia and Europe (Tables at page 14-17).

Figure 4: Types of shocks to GVCs and their frequency

Source: own elaboration based on McKinsey Global Institute, Risk, resilience, and rebalancing in global value chains, August 2020, p. VI.

$4.4 trillion in global trade flows through the five most exposed value chains.

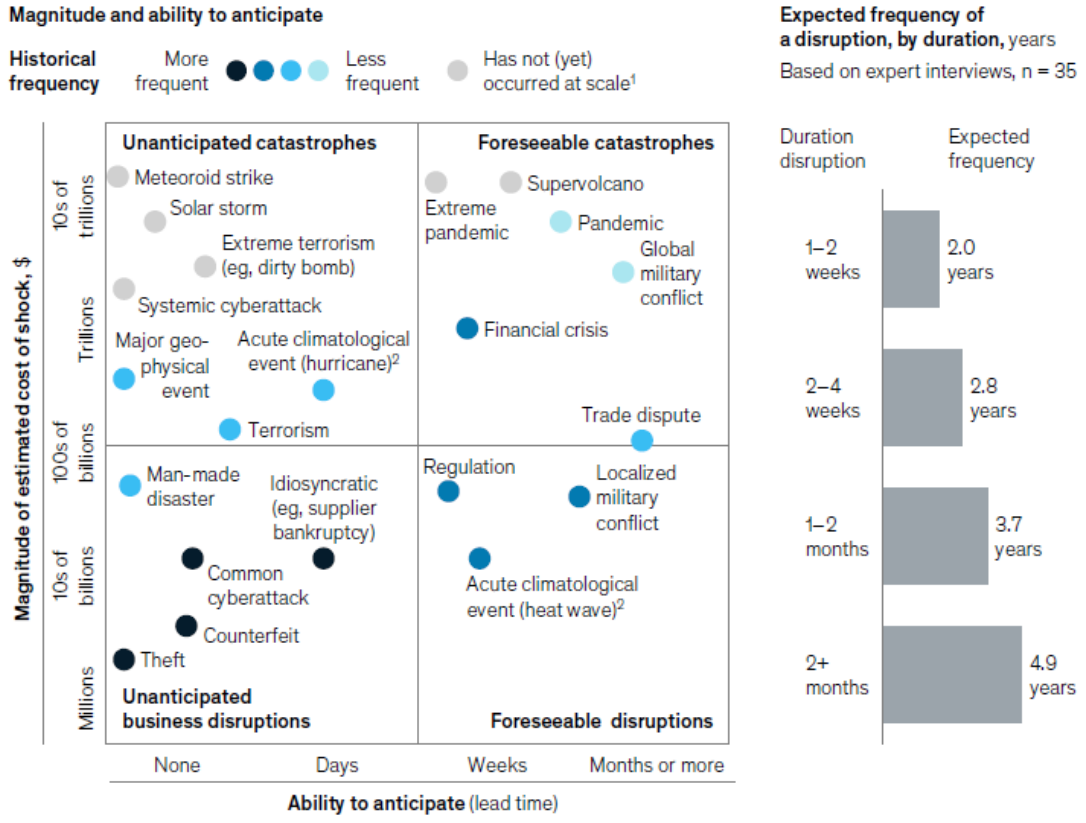
(McKinsey Global Institute, Risk, resilience and rebalancing in global value chains, August 2020, p.7.)



Source: McKinsey Global Institute, Risk, resilience, and rebalancing in global value chains, August 2020, p. VI

Exhibit E1

Disruptions vary based on their severity, frequency, and lead time—and they occur with regularity.



1. Shocks that have not occurred either at scale (eg, extreme terrorism, systemic cyberattack, solar storm) or in modern times (eg, meteoroid strike, supervolcano).
2. Based on experience to date; frequency and/or severity of events could increase over time.

McKinsey Global Institute, Risk, resilience, and rebalancing in global value chains, August 2020, p.4.

Aerospace and semiconductors, are susceptible to cyberattacks and trade disputes because of their high level of digitalisation, R&D, capital intensity, and exposure to digital data flows. However, both value chains have relatively low exposure to the climate-related events we have assessed here (heat stress and flooding) because of the footprint of their production. By contrast, agriculture, textiles, apparel, and, to a lesser extent, food and beverage, are labor-intensive. As a result, these value chains are highly exposed to heat stress. Much of their activity also takes place in regions that face disruption due to flooding. Pandemics, for example, have a major impact on labor-intensive value chains. In addition, this is the type of shock for which we assess the effects on demand as well as on supply. Cyberattacks are more likely to affect value chains with a high degree of digitalisation, such as communication equipment. Heavily traded labor-intensive value chains, such as apparel, are highly exposed to pandemic risk, heat stress (because of their reliance on labor), and flood risk. In contrast, the value chains including glass and cement, food and beverage, rubber and plastics, and fabricated metals have much lower exposure to shocks; these are among the least traded and most regionally oriented value chains.

In addition to observing variations in exposure across industry value chains, it is important to note that risk exposure varies for individual companies within those value chains. Similarly, each company has unique vulnerabilities. Some have developed far more sophisticated and effective supply chain management capabilities and preparedness plans than others[1].

WorldRiskIndex 2020 Overview

Classification	WorldRiskIndex	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
very low	0.31 – 3.29	0.91 – 9.55	22.81 – 34.13	8.32 – 16.75	37.36 – 59.21	14.59 – 24.65
low	3.30 – 5.67	9.56 – 12.13	34.14 – 42.38	16.76 – 20.97	59.22 – 71.76	24.66 – 34.35
medium	5.68 – 7.58	12.14 – 14.64	42.39 – 48.12	20.98 – 27.93	71.77 – 78.01	34.36 – 40.64
high	7.59 – 10.75	14.65 – 19.69	48.13 – 61.49	27.94 – 45.13	78.02 – 85.20	40.65 – 52.72
very high	10.76 – 49.74	19.70 – 86.77	61.50 – 76.34	45.14 – 70.83	85.21 – 93.80	52.73 – 69.72

Max. value = 100, classification according to the quintile method

Rank	Country	WorldRiskIndex	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
1.	Vanuatu	49.74	86.77	57.32	38.81	52.42	80.73
2.	Tonga	29.72	61.21	48.56	28.76	37.08	79.85
3.	Dominica	28.47	62.74	45.38	26.12	38.82	71.21
4.	Antigua and Barbuda	27.44	68.92	39.82	23.33	32.83	63.31
5.	Solomon Islands	24.25	40.04	60.56	45.75	54.73	81.21
6.	Guyana	22.73	44.92	50.60	27.13	47.13	77.55
7.	Brunei Darussalam	22.30	57.61	38.70	14.75	33.35	67.99
8.	Papua New Guinea	21.12	30.79	68.58	55.66	63.85	86.23
9.	Philippines	20.96	42.30	49.55	28.97	39.32	80.37
10.	Guatemala	20.09	36.52	55.02	33.09	46.76	85.21
11.	Cape Verde	17.73	37.23	47.61	29.35	40.65	72.84
12.	Costa Rica	17.25	43.49	39.67	20.03	30.08	68.89
13.	Bangladesh	16.40	28.28	57.98	33.21	54.91	85.81
14.	Djibouti	16.23	26.79	60.60	37.81	59.59	84.39
15.	Fiji	16.00	34.63	46.21	21.98	40.40	76.24
16.	Cambodia	15.76	26.80	58.82	38.94	50.57	86.94
17.	El Salvador	15.33	31.69	48.39	24.67	42.44	78.05
18.	Kiribati	14.94	26.05	57.36	39.27	50.04	82.77
19.	Comoros	14.88	23.77	62.60	46.02	57.34	84.45
20.	Nicaragua	14.67	25.67	57.15	32.00	56.18	83.26
20.	Timor-Leste	14.67	25.85	56.74	42.33	51.41	76.49
22.	Haiti	14.62	21.43	68.23	51.15	63.15	90.40
23.	Niger	13.85	19.26	71.90	60.64	67.19	87.87
24.	Guinea-Bissau	13.32	18.86	70.64	60.23	62.26	89.43
25.	Nigeria	13.09	19.66	66.56	49.50	61.95	88.22
26.	Cameroon	12.97	20.34	63.79	47.71	54.97	88.70
27.	Uruguay	12.54	36.29	34.56	19.23	30.60	53.85
28.	Gambia	12.44	19.70	63.14	43.66	62.44	83.32
29.	Jamaica	12.08	26.05	46.39	25.14	39.50	74.52
30.	Chile	12.05	33.41	36.07	17.83	28.02	62.35
31.	Chad	11.83	15.71	75.32	64.54	68.94	92.49
32.	Dominican Republic	11.57	24.85	46.57	24.03	37.46	78.23
33.	Benin	11.46	17.50	65.48	55.20	60.03	81.20
34.	Burkina Faso	11.19	16.54	67.67	57.63	61.16	84.22
35.	Honduras	11.02	20.25	54.43	32.11	46.45	84.74
36.	Togo	10.97	16.59	66.11	55.74	56.25	86.34
37.	Mali	10.76	15.68	68.65	49.90	67.34	88.70

Rank	Country	WorldRiskIndex	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
38.	Madagascar	10.51	15.12	69.48	65.68	56.21	86.55
39.	Angola	10.40	15.74	66.10	53.29	58.21	86.80
40.	Indonesia	10.39	20.97	49.54	26.03	44.56	78.02
40.	Kenya	10.39	16.47	63.10	52.14	50.89	86.28
42.	Burundi	10.34	14.74	70.14	62.20	57.53	90.68
43.	Viet Nam	10.30	22.02	46.76	23.88	39.78	76.63
44.	Cote d'Ivoire	10.00	15.54	64.33	47.57	59.76	85.65
45.	Senegal	9.74	16.51	58.97	44.37	54.45	78.09
46.	Japan	9.64	38.67	24.93	17.76	17.83	39.20
47.	Trinidad and Tobago	9.60	23.39	41.05	24.17	34.57	64.42
48.	Sierra Leone	9.44	13.69	68.99	55.80	65.60	85.57
49.	Liberia	9.43	13.56	69.52	56.27	65.02	87.26
50.	Ghana	9.37	16.38	57.18	42.64	49.75	79.15
51.	Zimbabwe	9.32	14.62	63.76	54.37	48.15	88.76
52.	Mozambique	9.18	13.31	68.97	62.61	56.44	87.85
53.	Mauritius	9.17	23.84	38.47	17.46	38.56	59.40
54.	United Rep. of Tanzania	8.96	14.01	63.95	56.78	51.68	83.38
55.	Malawi	8.89	13.22	67.24	59.28	57.80	84.65
56.	Democratic Rep. of Congo	8.77	11.80	74.28	67.78	62.12	92.95
57.	Afghanistan	8.69	12.99	66.93	49.10	59.61	92.09
58.	Uganda	8.63	12.82	67.29	62.55	51.34	87.98
59.	Guinea	8.62	12.70	67.88	51.48	63.34	88.82
60.	Albania	8.46	20.14	42.00	20.03	30.97	74.99
61.	Sudan	8.45	13.13	64.39	45.14	56.21	91.82
62.	Ecuador	8.42	17.96	46.88	25.16	39.53	75.96
63.	Panama	7.96	18.03	44.13	23.85	36.29	72.25
64.	Belize	7.95	16.82	47.24	27.94	40.26	73.53
65.	Netherlands	7.89	31.72	24.87	14.80	17.19	42.63
66.	Bolivarian Rep. of Venezuela	7.88	16.12	48.90	25.50	35.27	85.94
67.	Mauritania	7.85	12.55	62.51	38.87	61.51	87.15
68.	Ethiopia	7.82	11.68	66.93	56.77	57.49	86.52
68.	Uzbekistan	7.82	16.17	48.39	29.48	39.87	75.83
70.	Zambia	7.81	12.15	64.30	61.54	47.92	83.44
71.	Central African Republic	7.79	10.20	76.34	70.83	67.32	90.88
72.	Malaysia	7.71	19.05	40.46	16.90	33.59	70.89
73.	Fed. States of Micronesia	7.59	14.95	50.77	31.79	48.39	72.13
74.	Sri Lanka	7.57	15.99	47.32	22.82	41.83	77.30
75.	Rwanda	7.56	12.30	61.50	52.28	52.38	79.85
76.	Algeria	7.55	16.51	45.75	20.97	39.30	76.97
77.	Suriname	7.40	15.41	48.04	28.66	42.50	72.96
78.	Kyrgyzstan	7.30	16.46	44.33	25.23	32.14	75.63
79.	Equatorial Guinea	7.26	12.77	56.83	40.48	43.64	86.37
80.	Greece	7.25	22.89	31.66	17.15	17.04	60.79
81.	Myanmar	7.18	12.96	55.39	28.97	51.38	85.82
82.	Montenegro	6.93	18.12	38.24	18.71	27.59	68.42
83.	Republic of Congo	6.81	10.65	63.91	53.92	49.24	88.58
84.	Eritrea	6.77	9.65	70.17	61.46	59.53	89.51
85.	Gabon	6.73	13.00	51.74	32.07	47.28	75.88
86.	Lesotho	6.71	11.16	60.17	44.48	54.23	81.79

Rank	Country	WorldRiskIndex	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
87.	Pakistan	6.68	11.74	56.89	33.13	52.73	84.81
88.	Colombia	6.65	14.65	45.38	22.73	35.97	77.45
89.	India	6.62	12.51	52.94	32.08	48.60	78.15
90.	Thailand	6.54	14.81	44.13	17.52	36.25	78.63
91.	Swaziland	6.42	11.12	57.72	41.73	48.38	83.05
92.	Peru	6.37	14.14	45.08	26.39	32.83	76.03
92.	South Africa	6.37	13.37	47.65	30.75	39.38	72.82
94.	Namibia	6.21	11.36	54.66	42.50	47.36	74.13
95.	Syrian Arab Republic	6.03	10.80	55.87	27.47	49.13	91.02
96.	Iraq	5.99	10.78	55.59	26.60	52.44	87.72
97.	Mexico	5.97	14.09	42.39	20.96	32.30	73.91
98.	Samoa	5.87	12.19	48.13	25.40	39.33	79.66
99.	Romania	5.86	15.41	38.03	19.49	30.00	64.60
100.	Cuba	5.84	16.53	35.34	19.48	32.86	53.67
100.	China	5.84	14.30	40.85	20.98	29.50	72.07
102.	Tajikistan	5.83	11.99	48.63	32.00	36.81	77.09
103.	Morocco	5.82	12.14	47.91	24.70	40.00	79.02
104.	North Macedonia	5.81	14.48	40.12	18.88	31.25	70.23
105.	Armenia	5.73	14.55	39.37	20.21	28.67	69.22
106.	Azerbaijan	5.72	14.31	39.98	17.80	30.71	71.43
106.	Georgia	5.72	14.58	39.23	22.56	31.36	63.77
108.	Tunisia	5.70	13.06	43.67	17.73	37.82	75.46
109.	Yemen	5.68	8.13	69.87	46.10	69.72	93.80
110.	Turkmenistan	5.66	12.25	46.22	27.29	38.18	73.18
111.	Seychelles	5.31	12.53	42.39	18.07	41.97	67.13
112.	Lebanon	5.27	11.43	46.08	20.31	38.95	78.98
113.	Serbia	5.25	13.41	39.17	22.01	27.71	67.80
114.	New Zealand	5.11	17.73	28.81	16.16	21.70	48.57
115.	Hungary	5.07	15.24	33.28	16.01	25.19	58.65
116.	Islamic Republic of Iran	5.03	10.96	45.85	19.78	34.53	83.24
116.	Turkey	5.03	12.29	40.96	18.17	31.80	72.92
118.	Brazil	4.91	11.33	43.33	22.57	31.14	76.28
119.	Bosnia and Herzegovina	4.80	11.18	42.95	18.65	35.95	74.24
120.	Plurinational State of Bolivia	4.78	9.56	50.01	32.36	37.71	79.97
121.	Nepal	4.77	8.62	55.28	33.70	48.81	83.34
122.	Italy	4.75	15.17	31.29	17.25	17.41	59.22
123.	Saint Lucia	4.70	10.24	45.88	24.22	37.74	75.67
124.	Australia	4.54	18.08	25.10	15.61	16.17	43.53
125.	Ireland	4.50	16.68	26.96	15.74	17.64	47.49
126.	Kuwait	4.48	12.43	36.01	13.04	24.63	70.36
127.	Lao People's Democratic Rep.	4.47	8.02	55.76	33.26	51.23	82.79
128.	Bahamas	4.38	11.77	37.25	18.24	35.07	58.45
129.	Botswana	4.20	8.82	47.59	31.46	39.35	71.97
130.	Bulgaria	4.17	11.88	35.12	21.18	24.81	59.38
131.	Croatia	4.13	12.11	34.14	17.06	22.46	62.91
131.	Jordan	4.13	9.18	45.04	23.57	43.28	68.27
133.	Republic of Moldova	4.04	9.59	42.10	22.96	34.36	68.98
134.	United States of America	3.90	12.99	30.06	15.97	21.67	52.54
135.	Portugal	3.66	11.62	31.54	16.76	23.17	54.68

Rank	Country	WorldRiskIndex	Exposure	Vulnerability	Susceptibility	Lack of coping capacities	Lack of adaptive capacities
136.	Spain	3.61	11.74	30.77	16.07	18.82	57.42
137.	Kazakhstan	3.58	9.54	37.54	17.09	28.92	66.62
138.	Russian Federation	3.55	9.59	37.04	18.43	27.80	64.88
139.	Argentina	3.50	9.55	36.70	20.78	30.41	58.91
140.	United Kingdom	3.46	12.58	27.53	16.42	19.09	47.07
141.	Libyan Arab Jamahiriya	3.41	7.38	46.23	21.93	34.25	82.50
141.	Slovenia	3.41	11.39	29.91	14.72	19.27	55.73
143.	Paraguay	3.38	7.04	47.99	24.04	40.79	79.15
144.	Slovakia	3.37	10.10	33.33	14.54	24.66	60.79
145.	United Arab Emirates	3.30	10.99	30.01	9.55	25.86	54.61
146.	Republic of Korea	3.14	11.32	27.74	13.52	20.29	49.41
147.	Austria	3.06	13.19	23.18	14.08	15.35	40.10
148.	Poland	3.04	9.45	32.14	15.34	22.27	58.82
149.	Czech Republic	3.00	10.77	27.89	14.77	20.83	48.08
150.	Cyprus	2.99	8.42	35.57	15.15	24.40	67.16
150.	Latvia	2.99	8.81	33.90	18.60	23.48	59.63
152.	Bhutan	2.97	6.27	47.40	24.17	45.20	72.82
152.	Mongolia	2.97	6.89	43.15	28.40	35.62	65.43
154.	Israel	2.95	8.35	35.27	18.54	22.57	64.70
155.	Bahrain	2.91	7.33	39.64	15.57	27.36	76.00
156.	Canada	2.79	10.36	26.89	15.17	18.77	46.73
157.	Oman	2.76	6.70	41.18	22.49	34.48	66.58
158.	Ukraine	2.75	6.91	39.76	19.65	32.19	67.43
159.	Denmark	2.74	11.85	23.12	14.91	15.31	39.13
160.	Belarus	2.67	7.96	33.50	16.49	25.33	58.67
161.	Belgium	2.66	11.38	23.37	14.79	14.59	40.74
162.	Germany	2.63	11.52	22.81	14.98	16.08	37.36
163.	Sao Tome and Principe	2.58	4.55	56.74	46.44	47.13	76.64
164.	Singapore	2.57	8.87	28.97	11.29	21.60	54.03
165.	Norway	2.52	10.83	23.25	13.92	17.34	38.49
166.	Luxembourg	2.50	9.56	26.18	12.40	20.03	46.10
167.	France	2.47	9.62	25.66	16.61	16.22	44.14
168.	Lithuania	2.26	7.37	30.71	17.98	21.04	53.11
169.	Sweden	2.20	8.82	24.96	15.60	18.08	41.19
170.	Switzerland	2.15	9.01	23.90	13.91	19.32	38.46
171.	Maldives	2.12	4.77	44.40	17.45	39.23	76.51
172.	Estonia	2.03	6.52	31.11	16.44	21.68	55.21
173.	Finland	1.96	8.22	23.80	15.66	15.93	39.81
174.	Egypt	1.78	3.72	47.98	22.01	39.54	82.39
175.	Iceland	1.69	7.12	23.79	14.10	14.94	42.32
176.	Barbados	1.39	3.66	37.94	20.56	32.65	60.62
177.	Saudi Arabia	1.04	2.89	36.07	13.62	26.57	68.03
178.	Grenada	0.97	2.21	43.80	26.83	35.67	68.90
179.	St. Vincent and the Grenadines	0.81	1.85	43.79	28.20	31.39	71.77
180.	Malta	0.66	2.26	29.01	14.91	20.44	51.67
181.	Qatar	0.31	0.91	34.33	8.32	30.08	64.58

c. Location of global growth in the next decade

Eighty-fine percent of global growth in next decade will take place outside Europe. Growth in Asia continues to outplace global growth[1]. This makes some countries very interesting in terms of exports, and could impact the import volumes of intermediate and finished products. Multinationals with production facilities in countries such as China, India, and other major emerging economies are typically there to serve local consumer markets, whether or not they also export from those places. As prosperity rises in these countries, they will become key sources of global growth that corporates have interest in keeping.

d. The impact of new technologies on the international production structure

The study expresses doubts about the possibility of the new tecnologies to play a decisive role in overthrowing the internationalisation of production processes. Digital technologies in fact are also adopted by developing countries[2]. Nevertheless, it points out that automation can be a reshoring driver for:

- high-tech complex products, especially in the case of product innovations,
- capital-intensive GVC

or when

- the new technologies allow the verticalisation of production (robots and additing manufacturing enable the integration of production steps),
- there are requirements of strategic autonomy and security.

High technology-intensive industries and other sectors are more likely to backshore to the EU, but governments are somehow expected to financially support at least a portion of the relevant cost.

e. The impact of the sustainability imperative on future products and services

The need to pursue by 2030 the U.N. Sustainable Development Goals could impact the shape and composition of future products. The phase out of combustion engine cars in favour of the electrical vehicles is just an example.

1. For further details read the study: 'Risk, resilience and rebalancing in global value chains' published by McKinsey Global Institute August 2020.
2. Through the programme "China Standards 2035", China aims to innovate the technology sector, wishing to surpass the United States.

The future of reshoring

McKinsey[1] estimates that in next five years **16 to 26 percent of exports, worth $2.9÷ $4.6 trillion in 2018, could be in play** - whether that involves reverting to domestic production,

nearshoring, or new rounds of offshoring to new locations. According to the Reshoring Initiative 2020 Data Report, if companies analyse imported goods and materials from a TCO (Total Cost of Ownership) perspective they shall reshore from 20% to 30% of what is now imported. EU and US policy to reduce national dependence on imports of key products could reduce in five years the import by 18%÷22%.

Possible trend of imports of Western economies from Asian countries

Sources: U.S. Reshoring Initiative 2020, Post Covid-19 value chains: options for reshoring back to Europe (March 2021), and McKinsey Global Institute, *Risk, resilience and rebalancing in global value chains, August 2020*

Candidates for reshoring 2020-2030	Permanent import
Semiconductors and critical electronic components (if subsidised by governments to bolster national security, and a greater coverage of domestic needs)	Semiconductors and critical electronic components
Medium quality of apparel, textile products	Medium-low quality apparel, textile products, footwear
Electronic devices and instrumentation (safeguard of technologies with dual-use)	Standard mechanical, electrical and electronic components
Medical equipment and supplies	Active pharmaceutical ingredients Chemicals, rubber and plastic
Advanced components for automotive applications (high capacity batteries)	Metals, raw materials and rare earths
Thin film solar panels	Consumables
Cosmetics and Hygienic products	Ordinary machines, equipment, castings and forgings
Advanced machinery and equipment	Small appliances
Complex molds and machined parts	Toys and electronic games
Critical raw materials	Smartphones

McKinsey Global Institute, *Risk, resilience and rebalancing in global value chains, August 2020 p. 8*

Semiconductors, textile and apparels, phamaceuticals and automotive industry value chains

Semiconductors[1]. While the United States designs advanced chips, their manufacturing is highly concentrated in places like South Korea and Taiwan. Overall, Asia accounts for more

than 95 % of outsourced semiconductor assembly and testing capacity. This concentration brings potential risks. McKinsey Global Intitute research has found that companies sourcing advanced chips from South Korea, Japan, Taiwan, or other hubs in the western Pacific can expect that hurricanes, severe enough, to disrupt suppliers will become two to four times more likely by 2040.

Other dynamics can also invite potential complications. A single firm leads production of lithographic machines, which place circuits on the wafers. Economies of scale and high barriers to entry leave very little room for semiconductor production to move on its own. A semiconductor fabrication plant can cost $10 billion or more to build, and the industry requires specialized engineers. But geopolitical and trade tensions could reshape the value chain in ways that market forces alone might not. National security and competitiveness concerns could lead governments to take action, potentially shifting an estimated 9 to 19 percent of trade flows.

Between 2015 and 2018, the top three countries specialised in semiconductors and mobile communications increased their share of trade markedly. Highly capital-intensive value chains are harder to move for the simple reason that they represent hundreds of billions of dollars in fixed investments. These industries have strong economies of scale, making them more costly to shift. Value chains with high knowledge intensity tend to have specialised ecosystems that have developed in specific locations, with unique suppliers and specialised talents. Deciding to move production outside of this ecosystem to a novel location is costly and takes time.

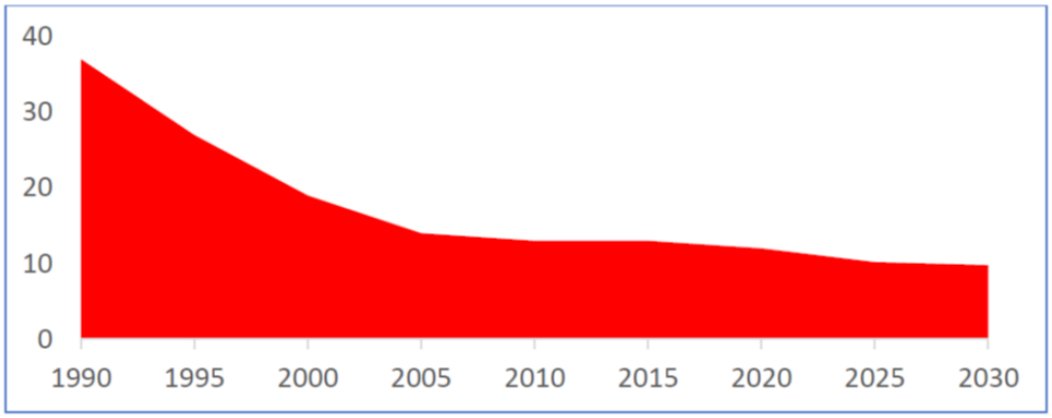
Semiconductor fabrication: current resilience[2]

The vast majority of semiconductor manufacturing – by IDMs (Integrated Database Management System) and pure-play foundries – takes place in: Taiwan, South Korea, Japan, China, and the United States. U.S. installed semiconductor production capacity accounts for approximately 12% of the global total, down from 37 percent in 1990. In 2019, Taiwan accounted for 20% of global installed capacity, followed closely by South Korea with 19 %. Japan accounted for 17 percent, China for 16 percent of capacity; and Europe nine percent. The remaining six percent of capacity is in Singapore, Israel, and the rest of the world.

1. McKinsey Global Institute, *Risk, resilience, and rebalancing in global value chains, August 2020, p.16.*
2. Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021

U.S. Semiconductor Manufacturing Capacity as a Percent of Global Capacity

1990-2021 and 2030 Forecast



Source: SEMI, VLSI and BCG[67]

Integrated Circuit Market Share Leaders, 2020						
Logic				Memory		Analog
PC CPU	Mobile CPU	GPU	FPGA	DRAM	NAND	
Intel - 78%	Qualcomm - 29%	NVIDIA - 82%	Xilinx - 52%	Samsung - 42%	Samsung - 33%	Texas Instruments - 19%
AMD - 22%	MediaTek - 26%	AMD - 18%	Intel - 36%	SK Hynix - 30%	Kioxia - 20%	Analog Devices - 10%
	HiSilicon - 16%		Microchip Technology - 7%	Micron - 23%	Western Digital - 14%	Infineon - 7%
	Samsung - 13%		Lattice - 5%		SK Hynix - 12%	Skyworks - 7%
	Apple - 13%				Micron - 11%	ST - 6%
					Intel - 9%	NXP - 5%
Based on data from Mercury Research, Counterpoint Research, Jon Peddie Research, Gartner, TrendForce, Mordor Intelligence, and IC Insights						

Risk Assessment[1]

The semiconductor manufacturing supply chain is so broad and includes so many materials and processes that identifying risks to the semiconductor supply chain is virtually synonymous with identifying all risks to manufacturing in general. The SIA (Semiconductor Industry Assoiation) notes, for example, that one of its members has over 16,000 suppliers, more than half outside the United States, and that a semiconductor may cross international borders as many as 70 times before reaching its final destination.

1. Ibidem

Textiles and apparel[1] Apparel and textiles are highly traded, labor-intensive value chains that are already moving. China has long been the dominant player, and it still accounts for some 29% of apparel sold globally. But its wages are rising, and Chinese producers are now more focused on meeting domestic demand. In 2005, China exported 71% of the finished apparel goods it produced. By 2018, that share was just 29 percent.
Relative to all other value chains, textiles and apparel feature the highest proportion of trade that could feasibly shift due to purely economic factors (36 to 47 percent in apparel, and 23 to 45% in textiles). While some apparel production may nearshore to US and EU markets, most would likely shift to Southeast Asian countries due to their comparative advantage in labor and overhead costs. As China's exports have plateaued, more apparel manufacturing for export has moved to places such as Bangladesh, Vietnam, and Ethiopia. Turkey is also a major producer of clothing that is exported to Europe. But companies will need to mitigate against natural disasters and future pandemics in these geographies. National needs for PPE (personal Protective Equipment) could cause some footprint changes as well.

Pharmaceuticals[2]**.** Overall, the pharmaceutical value chain has become less concentrated and more globally dispersed over the past 20 years. But the manufacture of some specific products is highly concentrated. While China and India export a relatively small share (3 percent each) of overall pharmaceutical products by value, they are the world's key producers of active pharmaceutical ingredients and small-molecule drugs. In some categories, such as antibiotics, sedatives, ibuprofen, and acetaminophen, China is the world's dominant producer, accounting for 60 % or more of exports.

India is the world's leading provider of generic drugs, accounting for some 20 % of global exports by volume, but it relies on China for most of the active pharmaceutical ingredients that go into them. When the flow of these ingredients dried up in the early stages of the COVID pandemic, India temporarily placed export controls on dozens of essential drugs, including antibiotics.

Based on economics alone, there is little reason to believe that pharmaceutical production will shift unless companies respond to the rise of new consumers in developing countries. But many governments are weighing whether to boost domestic production of some key medicines (as well as medical equipment). As a result, we estimate that 38 to 60 % of the pharmaceutical value chain could shift geographically in the coming years. However, production of small-molecule drugs would likely need to be highly digitized and automated to be viable in advanced economies; otherwise, the higher cost of doing business might lead to higher drug prices.

1. McKinsey Global Institute, *Risk, resilience, and rebalancing in global value chains, August 2020, p.16.*
2. McKinsey Global Institute, *Risk, resilience, and rebalancing in global value chains, August 2020, p.15.*

Risks of Pharmaceutical Supply Chains[1]

Multiple factors can cause vulnerability in the drug supply chain, including:

- the complexity, vastness, and multinational nature of drug supply chains and corresponding overdependence on foreign entities who may prioritize national interests above trade in an emergency,
- effect of economic pressures and other market influences,
- reduced incentive for existing manufacturers to invest in upgrading equipment, improving supply chains, or expanding capacity,
- lack of redundant capacity in manufacturing,
- just-in-time inventory management practices that limit inventory and reduce the ability to respond to surges in demand,
- geographic concentration of manufacturers that puts production at risk from natural disasters or climate change that can quickly affect an entire region,

In addition, consolidation of generic drug manufacturing is driven by multiple factors, including:

- low volume and margins for many generic drugs, resulting in difficult economic conditions for new entrants.
- anticompetitive actions by certain countries to obtain market share.
- more manufacturers exiting the market than entering it.

Promoting Quality

Most shortages have been related to manufacturing quality. The prescription drug market, especially for generic drugs but also for brand-name drugs, often does not provide incentives for manufacturers to invest in current manufacturing technologies and improvements in quality management.

Continual technical improvement and updating is needed because facilities age, routine operations require updates to maintain a state of control, technology evolves, suppliers change, and scientific expectations may also change. A failure to implement such updates and improvements can lead to quality problems.

The European Commission recently issued a Pharmaceutical Strategy for Europe. In addition to being described as a plan to increase access to affordable medications, the strategy is also characterised as “complementary to the European Green Deal and more particular the Zero Pollution ambition for a toxic free environment, notably through the impact of pharmaceutical substances on the environment.

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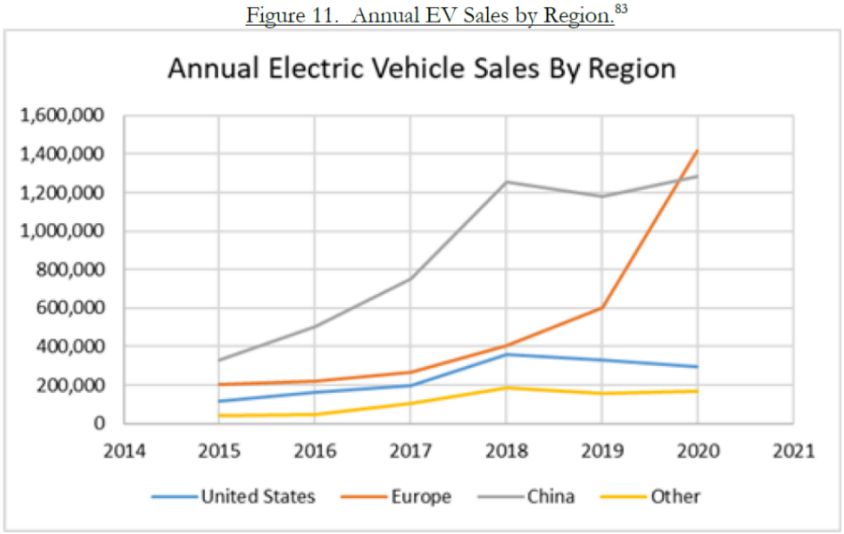
Automotive[1]

The auto industry has the most intricate value chains in the global economy, and the most regionalised. Most exports of intermediate parts circulate within three broad regions: Asia, Europe, and North America. The US auto industry is integrated with Mexico and Canada; Germany has production networks in Eastern Europe; and Japan and South Korea source from China, Thailand, and Malaysia. Despite the largely regional nature of automotive production, OEMs rely on some imported Chinese parts, and the initial Covid outbreak centered in Hubei Province quickly produced global ripple effects in the industry.

Automotive is a key industry from the standpoint of jobs, innovation, and competitiveness, and nations have historically enacted tariffs, trade restrictions, and local content requirements to try to attract and retain auto manufacturing. Trade disputes are an ongoing concern, leading companies to build in more flexibility and redundancy. McKinsey estimates that a relatively modest share of auto exports, between 15% and 20% by value, has the potential to shift in the medium term, driven predominantly by noneconomic factors.

The growing demand of electrical vehicles increases the consumption of large capacity batteries. Lithium batteries are an essential element of the EV market, accounting for up to half of the consumer cost of an EV. Batteries also play an important role in the transition to renewable electricity by providing storage for power used during periods of lower electricity generation. The high-capacity battery supply chain consists of five main value chain steps including: 1) raw material production, 2) material refinement and processing, 3) battery material manufacturing and cell fabrication, 4) battery pack and end use product manufacturing, and 5) battery end-of-life and recycling. Coordinated government and private sector action is required across all five stages, as gaps can undermine efforts to secure the supply chain.

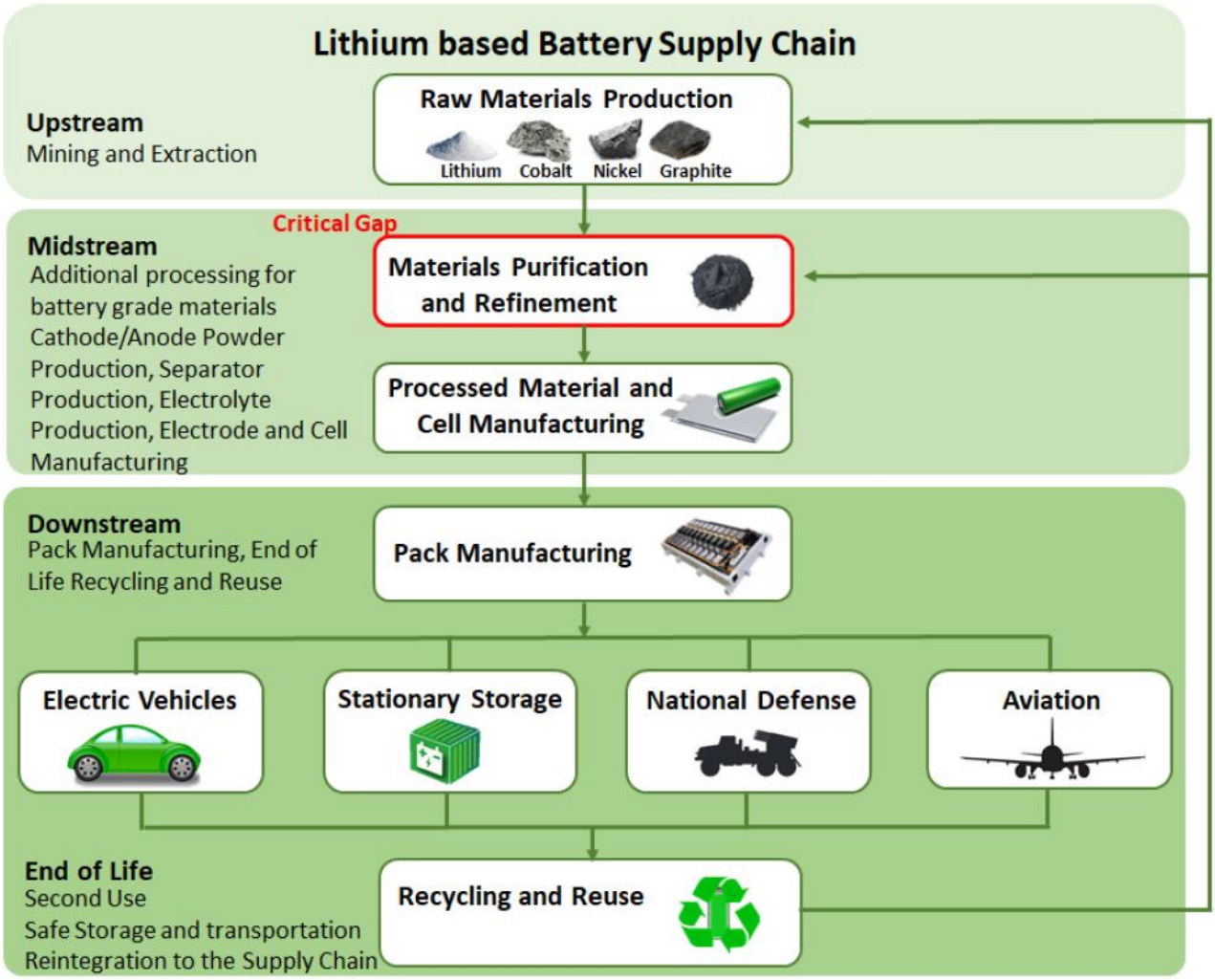
Figure 11. Annual EV Sales by Region.[83]



Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p 115.

1. McKinsey Global Institute, *Risk, resilience, and rebalancing in global value chains, August 2020, p.15.*

Figure 3. Lithium-Based Battery Supply Chain



Source: DOE Vehicle Technologies Office (VTO)

Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p. 95.

The report prepared for the White House[1] highlights critical materials for high-capacity lithium-ion batteries – particularly Class I nickel, lithium, and cobalt – as primary upstream supply chain vulnerabilities.

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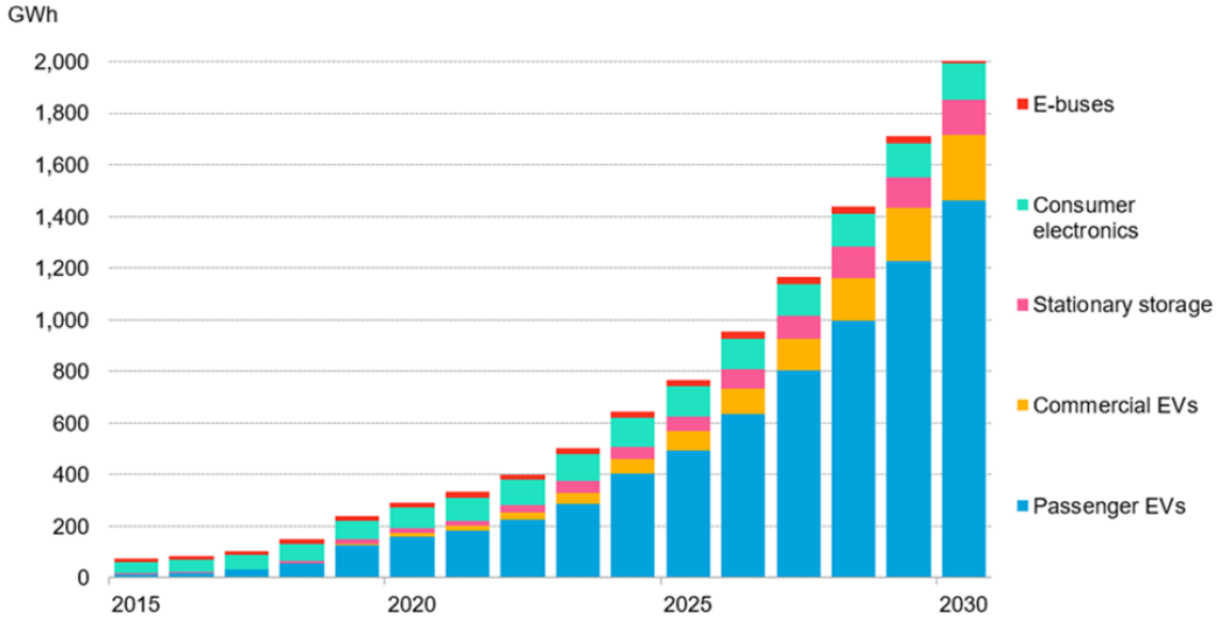
Figure 1. Worldwide anticipated use applications of lithium-ion batteries.[9]

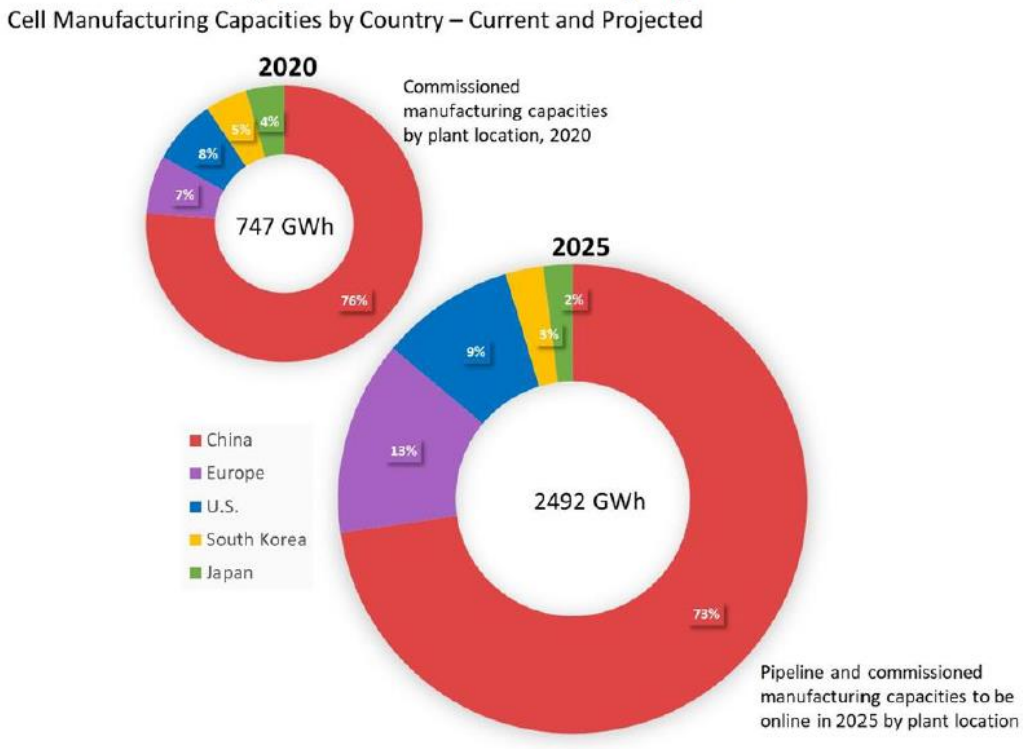


Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p. 91.

CURRENT RESILIENCE

Existing manufacturing capacity

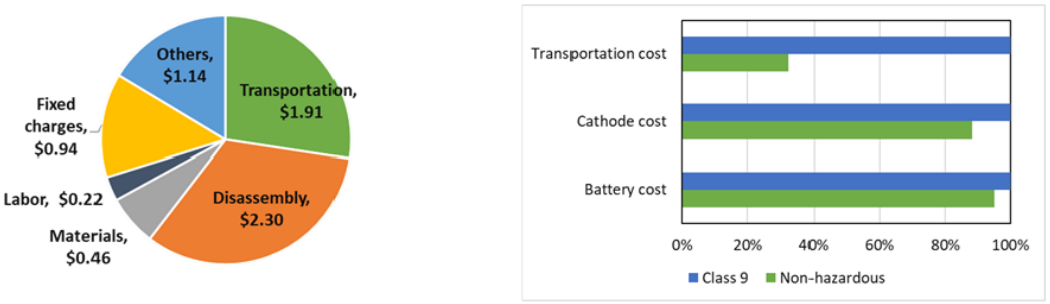
Figure 12. Cell manufacturing capacities.[91]



Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p. 117.

Resilient supply chains will require new programs for the recycling and recovery of critical materials from products at the end of their life, as well as other unconventional sources, like minerals extracted from coal and other mine waste, that can minimize the need for new mining operations.

Figure 9. Cost breakdown of recycling for lithium-ion batteries based on 1000 miles from collection site to the recycling centers.[73]

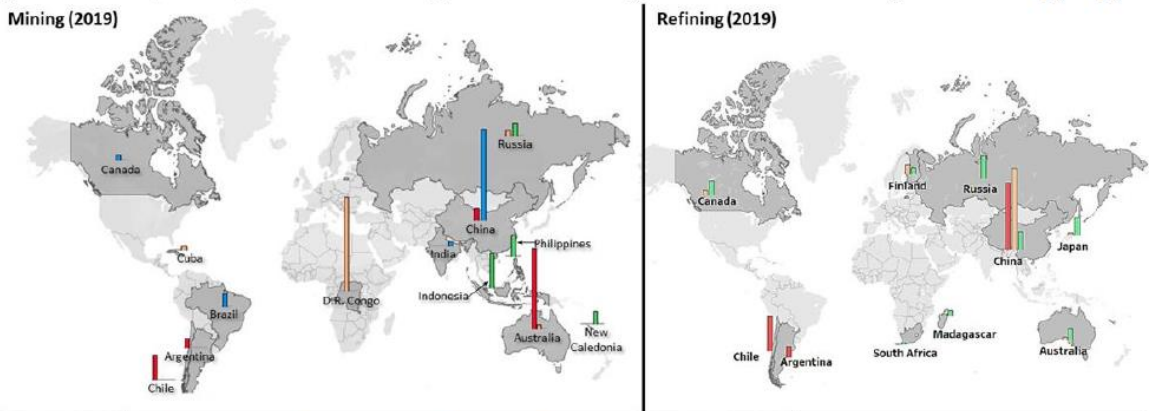


Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p. 110.

Dependence on single source nation

Global production for lithium, cobalt, and graphite are primarily dependent on a single nation. Figure 13 shows that for each of these materials, a single country controls over 60 percent of the global production.

Figure 13. Top four producers of highest risk battery materials for mining and refining stages.



Percent of Global Production (%)	Lithium	Cobalt	Nickel	Graphite
1st Highest	60% - Australia	70% - D.R. Congo	26% - Indonesia	68% - China
2nd Highest	19% - Chile	5% - Russia	16% - Philippines	10% - Brazil
3rd Highest	9% - China	4% - Cuba	10% - New Caledonia	4% - Canada
4th Highest	7% - Argentina	4% - Australia	10% - Russia	4% - India
Total metric tons in 2019	84,700	128,700	2,133,000	930,000

Percent of Global Production (%)	Lithium	Cobalt	Class 1 Nickel
1st Highest	60% - China	72% - China	21% - Russia
2nd Highest	30% - Chile	9% - Finland	16% - China
3rd Highest	10% - Argentina	4% - Canada	15% - Japan
4th Highest	---	4% - Norway	13% - Canada
Total metric tons in 2019	66,100	162,900	1,171,300

Source: Building Resilient Supply Chains, Revitalize American Manufacturing, and Fostering Broad-Based Growth 100-Day Reviews under Executive Order 14017 June 2021, p. 121.

2. European Open Strategic Automomy

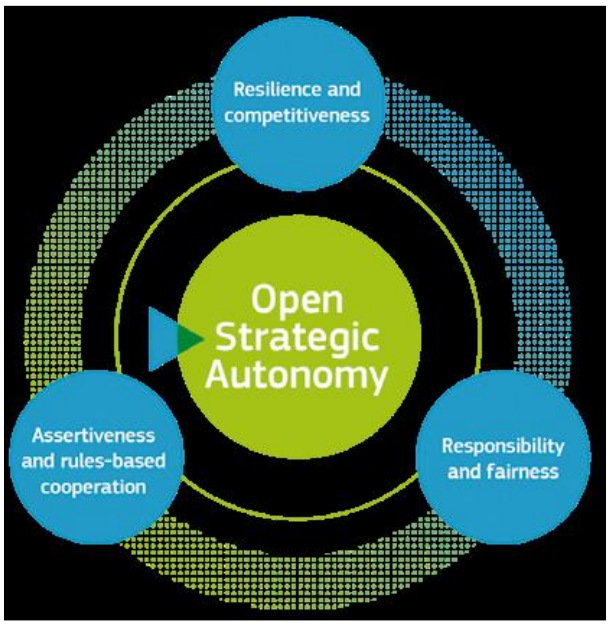
Repair and Prepare for the Next Generation – Commission Communication, 27 May 2020

'Global trade and its integrated value chains will remain a fundamental growth engine and will be essential for Europe's recovery. With this in mind, Europe will pursue a model of **open strategic autonomy**. This will mean shaping the new system of global economic governance and developing mutually beneficial bilateral relations, while protecting ourselves from unfair and abusive practices.'

Open Strategic Autonomy enables the EU to be stronger, both economically and geopolitically, by being:

- **open** to trade and investment for the EU economy to recover from the crisis and remaining competitive and connected to the world;
- **sustainable and responsible** to lead internationally a greener and fairer world, reinforcing existing alliances and engaging with a range of partners,
- **assertive** against unfair and coercive practices and ready to enforce its rights, while always favouring international cooperation to solve global problems.

The term 'strategic autonomy' comes from defence/military planning and refers to the EU's ability to chart its own course in line with its interests and values. This does not mean going it alone, but rather accepting and managing its interdependence in the best possible way. The addition of 'openness' shows that the EU will be open to trade and will promote stable rules in order to be strong economically and have geopolitical influence. Open Strategic Autonomy is a compass for EU trade policy at a time of economic transformation and geopolitical instability.



Actions:

- **Prioritise reforms of WTO and support multilateralism** for sustainable development, the green and digital transformations and global solutions,
- Rebuild the transatlantic partnership and engage with a range of partners to promote dialogue and cooperation and address common challenges together,
- Make use of all policies and measures to bring real benefits to EU companies and workers, implement and enforce trade agreements, and level the playing field
- Propose and adopt an anti-coercion instrument to respond to coercive practices by non-EU countries.

Should we bring back production to the EU to be more autonomous?

The crisis tested supply chains, giving rise to calls for more autonomy. But things are not so simple. Tthe shortage was mainly due to a huge rise in demand that global supply could not satisfy. The result would have been the same even if production were in Europe.
In fact, supply chains within the EU faced the same challenges and did not fare any better during the crisis. Even if supply chains to a large extent delivered during the crisis, there are still lessons to be drawn, and businesses are already revising their risk management strategies. Trade policy can help by making it easier to diversify sources of supply. Transparency at all levels proved to be key during the crisis and continues to be important for the global distribution of vaccines.

3. Executive Order on America's Supply Chain

February 24, 2021 Presidential Action

> In recent years, American households, workers, and companies have increasingly felt the strain of shortages of essential products—from medicine to food to computer chips. Last year's shortages of personal protective equipment (PPE) for front-line healthcare workers at the beginning of the COVID-19 pandemic were unacceptable. **Recent shortages of automotive semiconductor chips have forced slowdowns at car manufacturing plants, highlighting how shortages can hurt U.S. workers.**
> While we cannot predict what crisis will hit us, we **should have the capacity to respond quickly in the face of challenges.** The United States must ensure that production shortages, trade disruptions, natural disasters and potential actions by foreign competitors and adversaries never leave the United States vulnerable again. Today's action delivers on the President's campaign commitment to direct his Administration **to comprehensively address supply chain risks.**
>
> The order refers to vulnerabilities in the supply chains of four key products.

1. **APIs** (Active Pharmaceutical Ingredients – Pirncipi attivi) are the part of a pharmaceutical product that contains the active drug. In recent decades, more than 70 percent of API production facilitators supplying the U.S. have moved offshore.
2. **Critical minerals** are an essential part of defense, high-tech, and other products. From rare earths in our electric motors and generators to the carbon fiber used for airplanes.
3. **Semiconductors and Advanced Packaging**. The United States is the birthplace of this technology, and has always been a leader in semiconductor development. However, over the years we have underinvested in production—hurting our innovative edge—while other countries have learned from our example and increased their investments in the industry.
4. **Large capacity batteries**, such as those used in electric vehicles: As we take action to tackle the climate crisis, we know that will lead to large demand for new energy technologies like electric vehicle batteries. By identifying supply chain risks, we can meet the President's commitment to accelerate U.S. leadership of clean energy technologies. For example, while the U.S. is a net exporter of electric vehicles, we are not a leader in the supply chain associated with electric battery production. The U.S. could better leverage our sizeable lithium reserves and manufacturing know-how to expand domestic battery production.

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Policy. The United States needs resilient, diverse, and secure supply chains to ensure our economic prosperity and national security.

Pandemics and other biological threats, cyber-attacks, climate shocks and extreme weather events, terrorist attacks, geopolitical and economic competition, and other conditions **can reduce critical manufacturing capacity and the availability and integrity of critical goods,** products, and services. **Resilient American supply chains will revitalize and rebuild domestic manufacturing capacity**, maintain America's competitive edge in research and development, and create well-paying jobs.

They will also support small businesses, promote prosperity, advance the fight against climate change, and encourage economic growth in communities of color and economically distressed areas.

More resilient supply chains are secure and diverse — facilitating greater domestic production, a range of supply, built-in redundancies, adequate stockpiles, safe and secure digital networks, and a world-class American manufacturing base and workforce.

Moreover, close cooperation on resilient supply chains with allies and partners who share our values will foster collective economic and national security and strengthen the capacity to respond to international disasters and emergencies.

Therefore, it is the policy of my Administration **to strengthen the resilience of America's supply chains.**

Sec. 2. Coordination. The Assistant to the President for National Security Affairs (APNSA) and the Assistant to the President for Economic Policy (APEP) shall coordinate the executive branch actions necessary to implement this order through the interagency process identified in National Security Memorandum 2 of February 4, 2021 (Renewing the National Security Council System). In implementing this order, the heads of agencies should, as appropriate, **consult outside stakeholders — such as those in industry, academia, non-governmental organizations, communities, labor unions**, and State, local, and Tribal governments — in order to fulfill the policy identified in section 1 of this order.

Sec. 3. 100-Day Supply Chain Review

(a) To advance the policy described in section 1 of this order, the APNSA and the APEP, in coordination with the heads of appropriate agencies, as defined in section 6(a) of this order, **shall complete a review of supply chain risks**, as outlined in subsection (b) of this section, within 100 days of the date of this order.

(b) Within 100 days of the date of this order, the specified heads of agencies **shall submit the following reports to the President**, through the APNSA and the APEP:

> (i) The Secretary of Commerce, in consultation with the heads of appropriate agencies, shall submit a report identifying **risks in the semiconductor manufacturing and advanced packaging supply chains and policy recommendations to address these risks. …**
>
> (ii) The Secretary of Energy, in consultation with the heads of appropriate agencies, shall submit a report identifying **risks in the supply chain for high-capacity batteries, including electric-vehicle batteries, and policy recommendations to address these risks.** …
>
> (iii) The Secretary of Defense (as the National Defense Stockpile Manager), in consultation with the heads of appropriate agencies, shall submit a report identifying **risks in the supply chain for critical minerals and other identified strategic materials, including rare earth elements** (as determined by the Secretary of Defense), and policy recommendations to address these risks. …

(iv) The Secretary of Health and Human Services, in consultation with the heads of appropriate agencies, shall submit a report identifying **risks in the supply chain for pharmaceuticals and active pharmaceutical ingredients and policy recommendations to address these risks.**
The report shall complement the ongoing work to secure the supply chains of critical items needed to combat the COVID-19 pandemic, including personal protective equipment, …

(c) The APNSA and the APEP shall review the reports required under subsection (b) of this section and shall submit the **reports to the President in an unclassified form**, but may include a classified annex.

(d) The APNSA and the APEP shall include a cover memorandum to the set of reports submitted pursuant to this section, **summarizing the reports' findings and making any additional overall recommendations for addressing the risks to America's supply chains**, …

Sec. 4. Sectoral Supply Chain Assessments

(a) Within 1 year of the date of this order, the specified heads of agencies shall submit the following reports to the President, through the APNSA and the APEP:

(i) The Secretary of Defense, … shall submit a **report on supply chains for the defense industrial base** that updates the report of 2017: ….'Assessing and Strengthening the Manufacturing and Defense Industrial Base and Supply Chain Resiliency of the United States'. ….

(ii) The Secretary of Health and Human Services…shall submit a **report on supply chains for the public health** and biological preparedness industrial base. ..

(iii) The Secretary of Commerce and the Secretary of Homeland Security ..**shall submit a report on supply chains for critical sectors and subsectors of the information and communications technology (ICT) industrial base**.

(iv) The Secretary of Energy shall submit a report on **supply chains for the energy sector industrial base**.

(v) The Secretary of Transportation, shall submit a **report on supply chains for the transportation industrial base**.

(vi) The Secretary of Agriculture, shall submit a **report on supply chains for the production of agricultural commodities and food products.**

(b) The APNSA and the APEP shall, as appropriate and in consultation with the heads of appropriate agencies, recommend adjustments to the scope for each industrial base assessment, including digital networks, services, assets, and data ("digital products"), goods, services, and materials that are relevant within more than one defined industrial base, and add new assessments, as appropriate, for goods and materials not included in the above industrial base assessments.

(c) **Each report** submitted under subsection (a) of this section **shall include a review of**:

(i) the critical goods and materials, as defined in section 6(b) of this order, underlying the supply chain in question;

(ii) other essential goods and materials, .. including digital products;

(iii) **the manufacturing or other capabilities necessary to produce the materials** identified in subsections (c)(i) and (c)(ii) of this section, including emerging capabilities;

(iv) **the defense, intelligence, cyber, homeland security, health, climate, environmental, natural, market, economic, geopolitical, human-rights or forced-labor risks or other contingencies that may disrupt**, strain, compromise, or eliminate the supply chain — including risks posed by supply chains' reliance on digital products that may be vulnerable to failures or exploitation, and risks resulting from the elimination of, or failure to develop domestically, the capabilities identified in subsection (c)(iii) of this section — and that are sufficiently likely to arise so as to require reasonable preparation for their occurrence;

(v) **the resilience and capacity of American manufacturing supply chains and the industrial and agricultural base** — whether civilian or defense — of the United States to support national and economic security, emergency preparedness, and the policy identified in section 1. In the event any of the contingencies identified in subsection (c)(iv) of this section occurs, the report should include an assessment of:

(A) the manufacturing or other needed capacities of the United States, **including the ability to modernize to meet future needs;**

(B) **gaps in domestic manufacturing capabilities,** including nonexistent, extinct, threatened, or single-point-of-failure capabilities;

(C) **supply chains with a single point of failure, single or dual suppliers**, or limited resilience, especially for subcontractors, as defined by section 44.101 of title 48, Code of Federal Regulations (Federal Acquisition Regulation);

(D) **the location of key manufacturing and production assets**, with any significant risks identified in subsection (c)(iv) of this section posed by the assets' physical location;

(E) **exclusive or dominant supply of critical goods and materials** and other essential goods and materials, … **or are likely to become, unfriendly or unstable;**

(F) **the availability of substitutes or alternative sources for critical goods** and materials and other essential goods and materials.

(G) **current domestic education and manufacturing workforce skills for the relevant sector and identified gaps, opportunities, and potential best practices in meeting the future workforce needs for the relevant sector;**

(H) the **need for research and development capacity** to sustain leadership in the development of critical goods and materials.

(I) the **role of transportation systems** in supporting existing supply chains and risks associated with those transportation systems; and

(J) the **risks posed by climate change to the availability, production, or transportation of critical goods and materials.**

(vi) **allied and partner actions**, including whether United States allies and partners have also identified and prioritized the critical goods and materials and other essential goods and materials identified in subsections (c)(i) and (c)(ii) of this section, and possible avenues for international engagement. In assessing these allied and partner actions, the heads of agencies shall consult with the Secretary of State;

(vii) **the primary causes of risks** for any aspect of the relevant industrial base and supply chains assessed as vulnerable pursuant to subsection (c)(v) of this section;

(viii) **a prioritization of the critical goods and materials** and other essential goods and materials, including digital products….

(ix) **specific policy recommendations for ensuring a resilient supply chain for the sector.** Such recommendations may include sustainably reshoring supply chains and developing domestic supplies, **cooperating with allies and partners** to identify alternative supply chains, building redundancy into domestic supply chains, ensuring and enlarging stockpiles, developing workforce capabilities, enhancing access to financing, expanding research and development to broaden supply chains, addressing risks due to vulnerabilities in digital products relied on by supply chains, addressing risks posed by climate change, and any other recommendations;

(x) **any executive, legislative, regulatory, and policy changes and any other actions to strengthen the capabilities** identified in subsection (c)(iii) of this section, and to prevent, avoid, or prepare for any of the contingencies identified in subsection (c)(iv) of this section; and

(xi) **proposals for improving the Government-wide effort to strengthen supply chains,** including proposals for coordinating actions required under this order with ongoing efforts that could be considered duplicative of the work of this order or with existing Government mechanisms that could be used to implement this order in a more effective manner.

(d) The APNSA and the APEP shall review the reports required under subsection (a) of this section and shall submit the reports to the President in an unclassified form, but may include a classified annex.

Sec. 5. General Review and Recommendations

As soon as practicable following the submission of the reports required under section 4 of this order, the APNSA and the APEP, in coordination with the heads of appropriate agencies, shall provide to the President one or more reports reviewing the actions taken over the previous year and making recommendations concerning:

(a) **steps to strengthen the resilience of America's supply chains;**

(b) **reforms needed to make supply chain analyses and actions more effective, including statutory, regulatory, procedural, and institutional design changes.**

(c) **establishment of a quadrennial supply chain review,** including processes and timelines regarding ongoing data gathering and supply chain monitoring;

(d) diplomatic, economic, security, trade policy, informational, and other actions that **can**

successfully engage allies and partners to strengthen supply chains jointly or in coordination;

(e) **insulating supply chain analyses and actions from conflicts of interest, corruption**, or the appearance of impropriety, to ensure integrity and public confidence in supply chain analyses;

(f) **reforms to domestic and international trade rules and agreements needed to support supply chain resilience, security, diversity, and strength**;

(g**) education and workforce reforms needed to strengthen the domestic industrial base**;

(h) **steps to ensure that the Government's supply chain policy supports small businesses**, prevents monopolization, considers climate and other environmental impacts, encourages economic growth in communities of color and economically distressed areas, and **ensures geographic dispersal of economic activity across all regions of the United States**; and

(i) **Federal incentives and any amendments to Federal procurement regulations that may be necessary to attract and retain investments in critical goods and materials** and other essential goods and materials, as defined in sections 6(b) and 6(d) of this order, including any new programs that could encourage both domestic and foreign investment in critical goods and materials.

Sec. 6. Definitions. For purposes of this order:

(a) "Agency" means any authority of the United States that is an "agency" …

(b) **"Critical goods and materials**" means goods and raw materials currently defined under statute or regulation as "critical" materials, technologies, or infrastructure.

(c) "**Critical minerals**" has the meaning given to that term in Executive Order 13953 of September 30, 2020 (Addressing the Threat to the Domestic Supply Chain From Reliance on Critical Minerals **From Foreign Adversaries** and Supporting the Domestic Mining and Processing Industries).

(d) "**Other essential goods and materials**" means goods and materials that are essential to national and economic security, emergency preparedness,.. not included within the definition of "critical goods and materials."

(e) "**Supply chain**," when used with reference to minerals, includes the exploration, mining, concentration, separation, alloying, recycling, and reprocessing of minerals.

….. PH R. BIDEN JR. THE WHITE HOUSE, February 24, 2021.'

This policy confirms and strengthens the change occurred in the geopolitical system. The use of the term: ' foreign adversary' confirms the decoupling of the great powers in the R&D, production and exchange of critical goods and materials needed for their national economic security and autonomy. Such document confirms the downgrading of the economic multilateralism to the exchange of simple goods that can be made anywhere, and of raw materials not available on domestic markets. Biden policy goes beyond the EU 'open strategic autonomy', even if it is necessary to see if and how it will be implemented. Does the United States intend to work alone or with their allies, as it appears from the text of the executive order?

Regardless of the geopolitical imprint of this policy, after a careful reading of Biden's requests, I am tempted to call him the executixe CPO of the USA. Likewise to a great manager of the P&SC in fact, he is asking:

- the analysis of the risks relating to four key products,
- reccomendations for overcoming or managing such risks,
- to update the list of critical raw materials indicating:
  - assets and production processes necessary to make them,
  - the list of risks associated with their production and product support,
  - the gaps in domestic manufacturing capabilities,
  - the resilience and production capacity of their US suppliers and their ability to modernize to meet future needs,
  - the list of supply chains with a single point of failure,
  - the list of unique or dominant suppliers or suppliers that are likely to become, unfriendly or unstable,
  - the need for research and development capacity, and
  - the role of transportation systems in supporting existing supply chains.

While reading this executive order, I remembered a sentence pronounced by Prof. Arian Van Weele[1] at the 14th World Procurement Congress held in Beijing in September 2005 at the presence of over 900 CPOs: ' Procurement is too important to be left to procurement'. He meant that given the importance of procurement, it was obvious that the related strategies should have been shared with the corporate board. After 16 years, choice and location of supply chains of critical materials, become a factor of geopolitics and, formally both the EU Commission and the US White House define the supply chain management strategies.

1.NEVI-Chair of Purchasing and Supply Management, at Eindhoven University of Technology, Faculty of Industrial Engineering and Innovation Sciences (IE&IS). He acts as an independent boardroom consultant to many large companies on procurement strategy and governance issues.

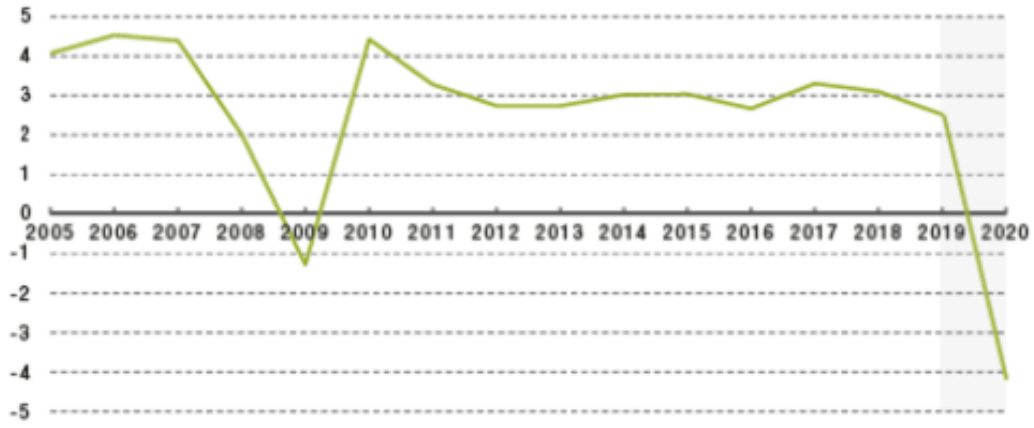
4. World Trade in goods[1]

Source: World Trade Report 2019 WTO
UNCTAD 2019 and 2020 Handbook of Statistics

4.1 **Key figures related to world trade in goods and services**

Since GDP and World Trade are interrelated, it is useful to have a picture of the GDP trend over the last 15 years. Due to Covid-19 pandemic, 2020 data cannot be considered statistically significant, consequently our analysis is based on 2019 figures.

Figure 3.1.1 World real gross domestic product, annual growth rate
(Percentage)

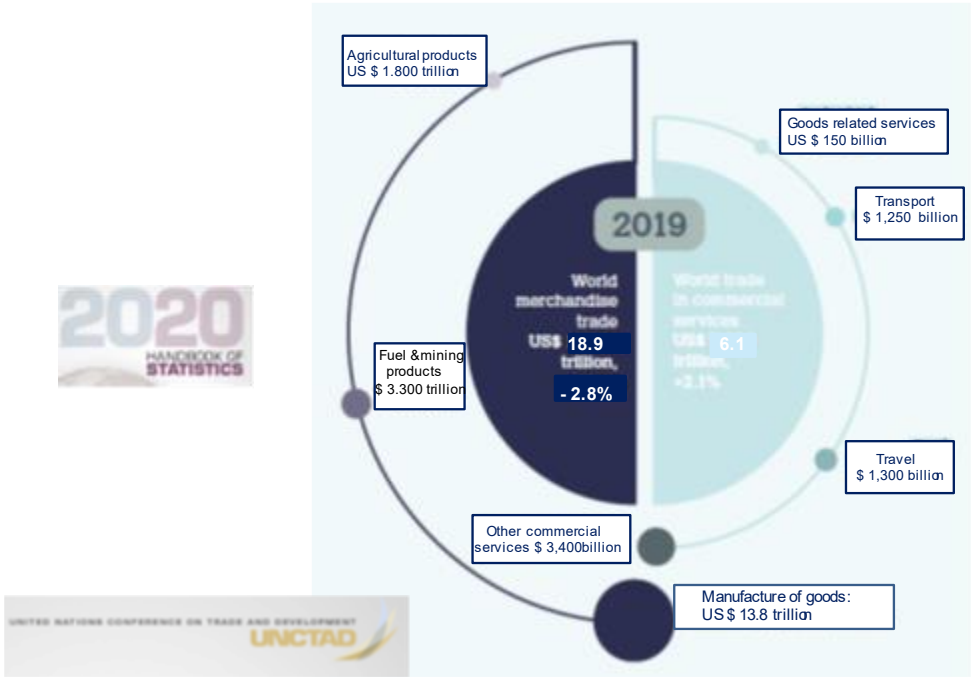


Note: In constant 2015 United States dollars. The shaded area indicates UNCTAD nowcasts for the year 2020 (UNCTAD, 2020b).

Global GDP at current prices in 2019 has been $ 87.345 trillion
World trade in goods and services in 2019 has been $ 25[2] trillion of which:

- Merchandise / Goods 18.9 (minus 2.8% on 2018)
- Commercials Services 6.1 (plus 2.1% on 2018)
- 70% managed by GVC[3] and specifically:
  - 55% by producer driven[4] GVC through FDI (foreign direct investments)
  - 15% by buyer-driven GVC.
- about 59% composed by intermediate products/services.

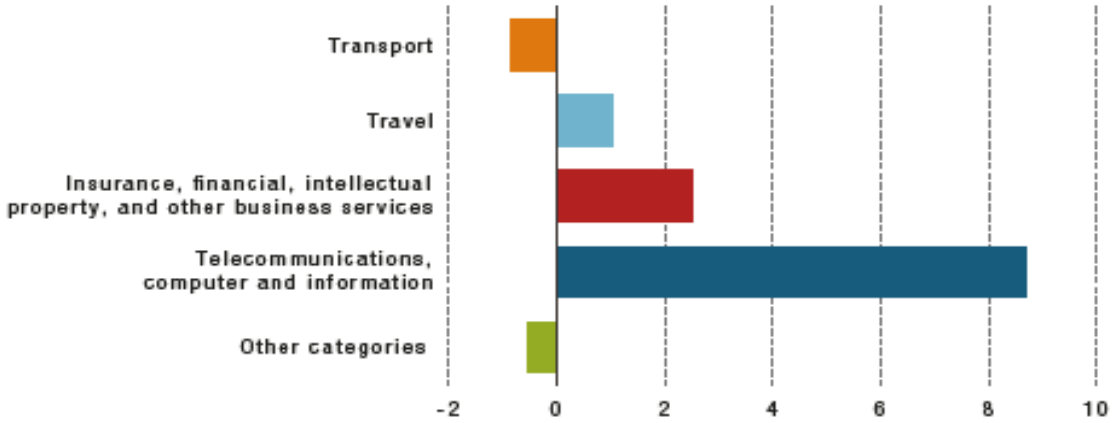
1. The data in this paragraph are taken from UNCTAD Handbook of Statistics 2020.
2.GVCs are responsible for the growing significance of “double counting” in global trade figures. The new data shows that some 22% of gross exports consist of value added that is first imported by countries only to be incorporated in products or services that are then exported again. Thus some $ 5.5 trillion out of the $ 25 trillion in global gross exports is actually double counted. Ref. Global Value Chains and Development, Investment and Value Added Trade in the Global Economy - United Nations
3. Global Value Chains and Trade OECD (Organisation for Economic Cooperation and Development).
4. Producer-driven and buyer-driven GVC are described in next paragraph.



60% of Asia's trade is intra-regional
80% of global trade involves nations with declining political stability (McKinsey-World Bank)

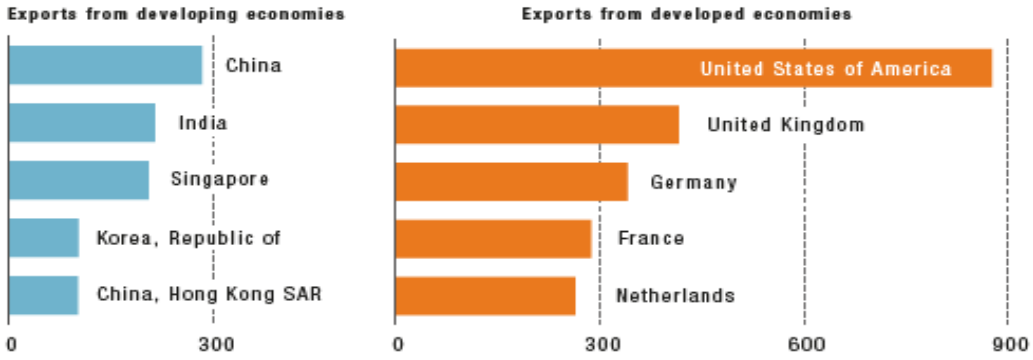
In Asia, exports of telecommunication, computer and information services grew by 9.7% over the last 5 years.

Figure 2.2.1 **Annual growth rate of services exports, 2019**
(Percentage)



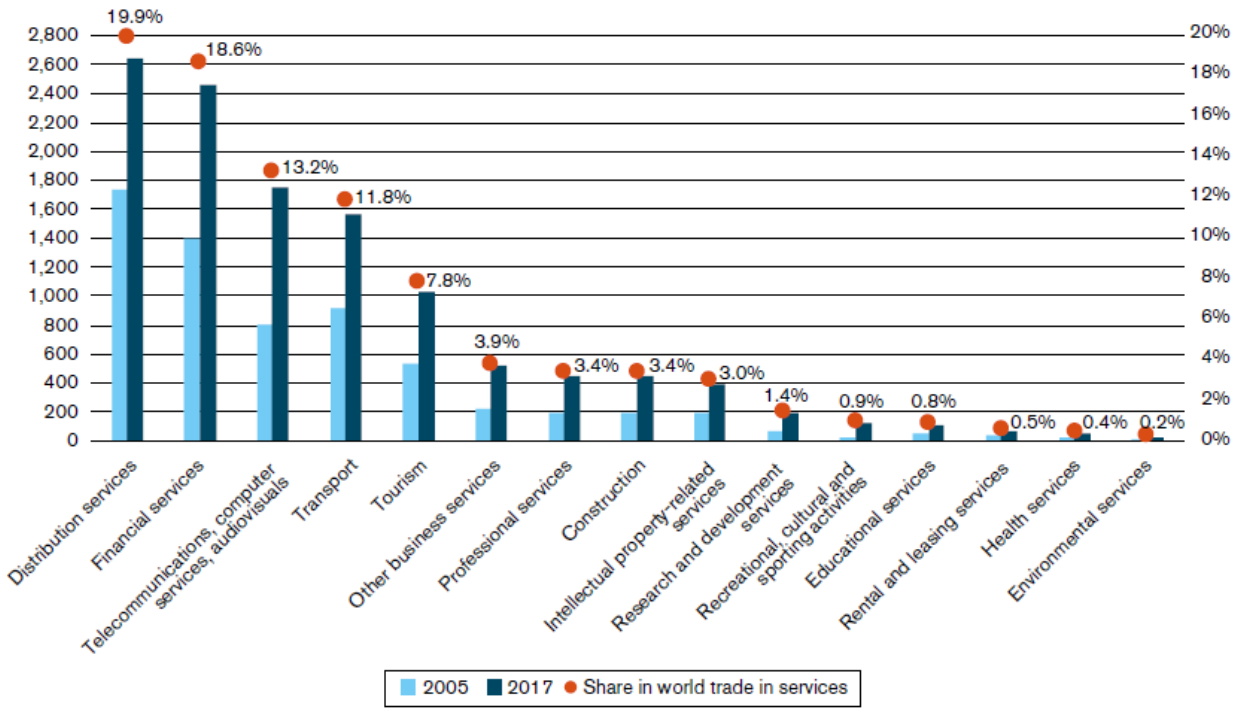
UNCTAD 2019 Handbook of Statistics p. 38

Figure 2.1.3 Top 5 services exporters, 2019
(Billions of United States dollars)



UNCTAD 2019 Handbook of Statistics p. 35

Figure B.2: Distribution and financial services are the most traded services[3]
World trade in commercial services by sector, 2005 and 2017



Source: WTO estimates (2019).
Note: World trade is calculated as the average of world exports and world imports.

World Trade Report 2019 WTO p. 25

4.2 **Trade in goods and global value chains**

The traditional view of international trade is that each country produces goods and offers services that are exported as final products to consumers abroad. However, in today's global economy, this type of trade only represents around 30% of all trade in goods and services. In reality, about 70% of international trade today involves global value chains (GVCs), as services, raw materials, parts, and components cross borders (often) numerous times. Once incorporated into final products they are shipped to consumers all over the world. Global value chains (GVCs) have become a dominant feature of world trade, encompassing developing, emerging, and developed economies. The whole process of producing goods, from raw materials to finished products, is increasingly carried out wherever the necessary skills and materials are available at competitive cost and quality. Exports from one country to another often involve complex interactions among a variety of domestic and foreign suppliers.

Even more than before, trade is determined by strategic decisions of firms to outsource, invest, and carry out activities wherever the necessary skills and materials are available at competitive cost and quality.

For example, a smart phone assembled in China might include graphic design elements from the United States, computer code from France, silicone chips from Singapore, and precious metals from Bolivia. Throughout this process, all countries involved retain some value and benefit from the export of the final product. But a good portion of this value added is invisible in traditional trade statistics, which attribute the full value of a good or service to the last country in the chain that finalised production. Countries that become efficient at the assembly or production stage can generate greater total value from becoming a globally competitive supplier of these activities, especially if they pursue trade-facilitating measures such as the convergence or interoperability of standards and certification requirements.

Success in international markets today depends as much on the capacity to import world class inputs as it does on the capacity to export.

(Global Value chain and trade OECD)

4.3 Import content of export

Import content of export is defined as the share of imported inputs in the overall exports of a country, and reflects the extent to which a country is a user of foreign inputs. It is considered as a reliable measure of international 'backward linkages' in analyses of global value chains.

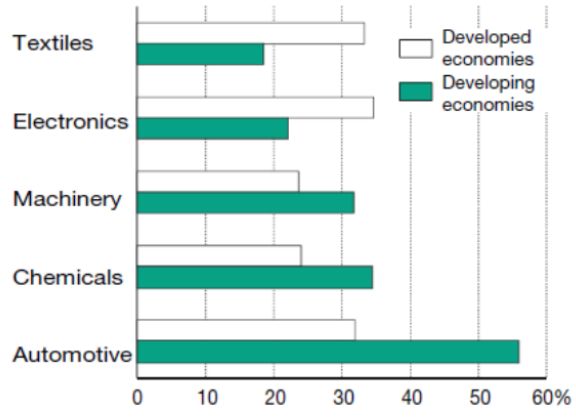
OECD: total % of gross exports, 2016 or latest available

G20	4.2%	Italy	22.0%	Czech Rep.	37.7%
Argentina	6.9%	France	22.1%	Singapore	39.5%
OECD total	7.1%	South Africa	22.5%	Ireland	41.7%
US	9.0%	Philippines	23.4%	Vietnam	43.6%
Australia	10.1%	Hong Kong China	24.8%	Hungary	44.1%
Russia	10.2%	Finland	25.9%	Slovak Rep.	44.5%
Indonesia	11.3%	Austria	26.6%	Malta	59.3%
Japan	11.4%	Poland	26.9%	Luxemburg	67.4%
EU 28 countries	11.6%	Netherlands	27.0%		
UK	15.4%	Portugal	28.0%		
India	16.1%	Denmark	28.1%		
EU 19 countries	16.4%	Lithuania	29.4%		
Turkey	16.5%	Chinese Taipei	29.8%		
China	16.6%	Korea	30.4%		
Croatia	19.2%	Slovenia	31.6%		
Sweden	19.7%	Thailand	32.5%		
Germany	20.3%	Belgium	33.9%		
Canada	20.6%	Estonia	34.5%		
Greece	21.5%	Malaysia	36.1%		
Spain	21.6%	Messico	36.4%		

Which industries have the most segmented value chains?

The average foreign value added share of exports provides a rough indication of the extent to which industries rely on internationally integrated production networks (intermediate goods and services cross borders until final consumption of the industry's output). The electronics and automotive industries, where products can be broken down into discrete components that can be separately produced, easily transported, and assembled in low-cost locations, have led the way in shaping GVCs and consequently rank highest by share of foreign value added in trade.

Figure 6. Share of foreign value added in exports, developed and developing economies, selected industries, 2010



Source: UNCTAD-Eora GVC Database.

A value chain for a given product may span many different industries and incorporate value added from raw materials to component manufacturing to services. Trade flows are dominated by products that are not consumed but further used in the production of other goods and services. With the fragmentation of production and the increasing importance of outsourcing, trade in intermediate inputs has been steadily growing between 1995 and 2006 at an average annual growth rate of 6.2% for goods and 7% for services (in volume terms). Intermediate inputs are not restricted to material goods; they can also consist of services.

Sourcing strategies[1]

In order to operate, firms make choices on

(i) locations for the production of intermediate inputs and on the
(ii) ownership structure of their production.

Headquarters are always located in the so-called 'home country'. Intermediate inputs on the other hand, can be produced at home, or in a foreign country. The production of intermediates can also be owned by the final-good producer or by an independent supplier. In other words, inputs can be produced and used within the same firm; or produced by one firm, and then sold to and used by another one.

5. Global Value Chains (GVC)

Sources: Mapping Global Value Chains 2013 OECD Trade Policy Papers
World Investment Report 2020: International Production Beyond the Pandemic UNCTAD
Global value chain development report 2019 – Technological innovation, supply chain trade and workers in a globalized world[2]

Introduction (Ref. Foreward of the Global Value Chain Development Report 2019)

There are different ways to analyse the global economy. One is to view it through the lens of growth and structural change in individual economies, developed and developing. A second is to use the lens of global value chains (GVCs), the complex network structure of flows of goods, services, capital and technology across national borders. Both are useful and they are complementary to one another.

1. OECD Trade Policy Working Papers No. 93 Trade in Intermediate Goods and Services
2. Co-publishing partners: World Trade Organization, the Institute of Developing Economies (IDE-JETRO), the Organisation for Economic Co-operation and Development, the Research Center of Global Value Chains headquartered at the University of International Business and Economics (RCGVC-UIBE), the World Bank Group, and the China Development Research Foundation

As shown in the previous paragraph **more than two-thirds of world trade occurs through global value chains in which production crosses at least one border**, **and typically many borders, before final assembly.** The growth in GVC-related trade has translated into significant economic growth in many countries across the globe over the last two decades, fueled by reductions in transportation and communication costs and declining trade barriers.
The rise of GVCs has significantly changed the nature and structure of the world economy. The increasing complexity of GVCs also brings great challenges to policy making in both developed and developing countries.

The impact of new digital technologies on GVCs is uncertain: they may reduce the length of supply chains by encouraging the re-shoring of manufacturing production, thus reducing opportunities for developing countries to participate in GVCs, or they may strengthen GVCs by reducing coordination and matching costs between buyers and suppliers. While small and medium-sized enterprises (SMEs) are under-represented in GVCs, the digital economy provides new opportunities for SMEs to play a more active role.

Concept of global value chains

World trade and production are structured around “global value chains” (GVCs): a series of stages that firms undertake to bring a product or a service from its conception to its end use by final consumers. Each stage adds value, **and at least two stages are made in different countries.** Technological progress, cost, access to resources and markets and trade policy reforms have facilitated the geographical fragmentation of production processes across the globe according to the comparative advantage of the locations. In today’s economy, companies can find and engage partners anywhere in the world.

Unlike traditional international trade whose transactions involve only two countries (exporting and importing country), GVC trade crosses borders multiple times. For example, a bike assembled in Finland with parts manufactured in Italy, Japan, and Malaysia and exported to Denmark.

This international fragmentation of production is a powerful source of increased efficiency and firm competitiveness. In 2019, about 59% of world manufactured imports were intermediate goods (primary goods, parts and components, and semi-finished products) and services. Typically, a value chain include: design, manufacturing, assembly, marketing, distribution and support to the final customer. The concept of GVC was introduced in the early 2000s and has been successful in capturing several characteristics of the world economy:

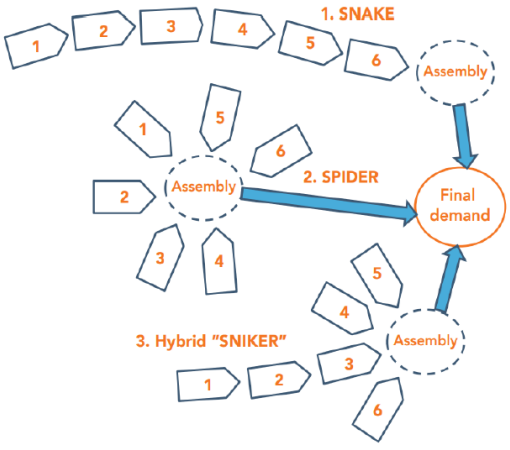
- the increased fragmentation of production across countries,

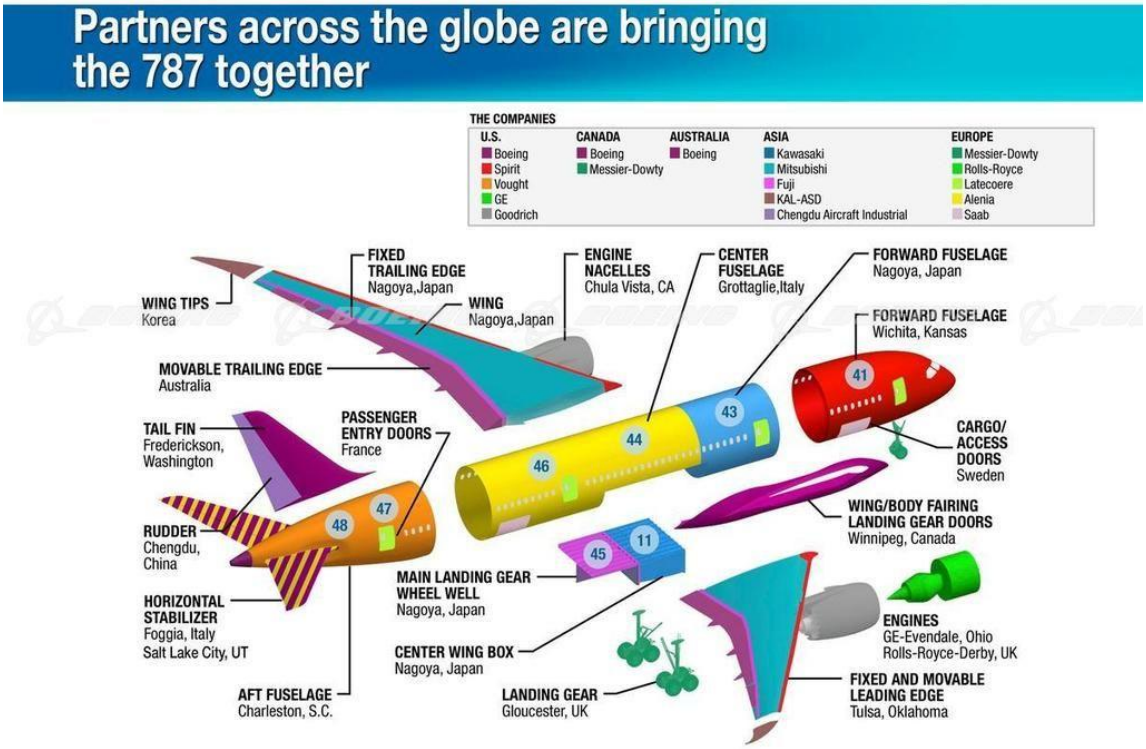
● the specialisation of countries in task or business functions rather than in entire products,

● the role of networks, global buyers and global suppliers.

Global value chain analysis gives insights on economic governance and helps to identify firms and actors that coordinate and control activities in the international production network.

The concept of global commodity chain was introduced by Gary Gereffi in 1994 by describing the apparel commodity chain, from the raw materials such as cotton, wool or syntetic fiber, to the final product (garments). In the 2000 there was a shift in terminology from ‘global commodity chain’ to ‘global value chain’, the latter coming from the analysis of trade and industrial organisation as a value added chain in the international business literature (Porter, 1985). In 2007 Coe and Hess put emphasis on the concept of ‘network’ rather than ‘chain’. In practice there are three types of supply chains: sequential or snake, network or spider (see Boeing 787 below) and hybrid or sniker.





Development and types of global value chains[1]

From 2000 to 2007, global value chains (GVCs), especially complex ones, expanded at a faster rate than GDP. During the global financial crisis of 2008-9 they suffered some slow down, followed by quick recovery in 2010-2011, but since then growth has mostly slowed. The pace of GVC activities picked up in 2017. Value chains remain largely regional but they are not static. Between 2000 and 2017, intra-regional GVC trade increased in “Factory Asia” reflecting, in part, upgrading by China and other Asian economies. In contrast, intra-regional GVC trade in “Factory Europe” and “Factory North America” has slightly decreased reflecting stronger linkages with “Factory Asia”. **China has emerged as an important hub in traditional trade and simple GVC networks, but the United States and Germany remain the most important hubs in complex GVC networks**. In Wang et. al. (2017), production activities are divided into 4 broad types depending on whether they involve production sharing between two or more countries, and specifically:

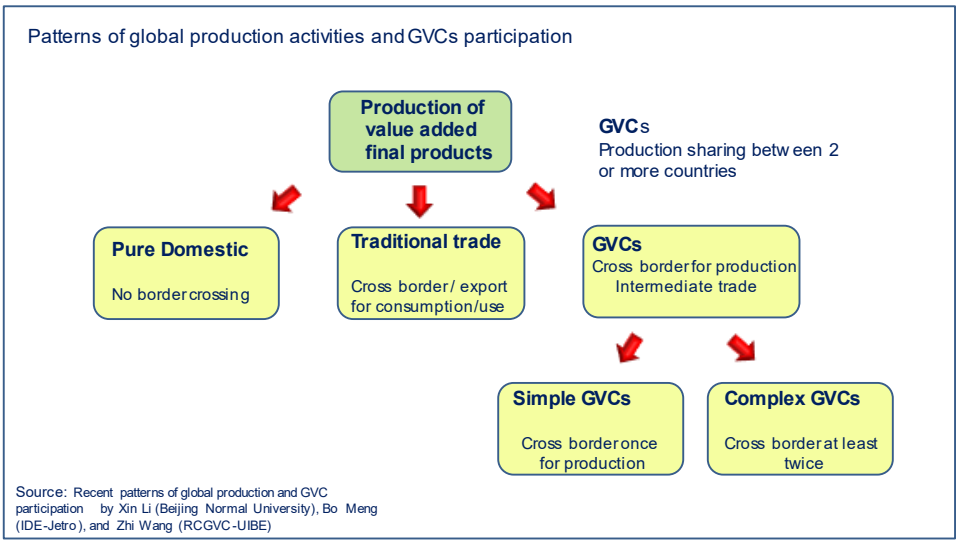
- Pure Domestic
- Traditional Trade
- GVCs: simple and complex.
-

1. Global Value Chain Development Report 2019: Technological innovation, supply chain trade, and workers in a globalized world. WTO, IDE-JETRO, OECD, UIBE, WORLD BANK GROUP

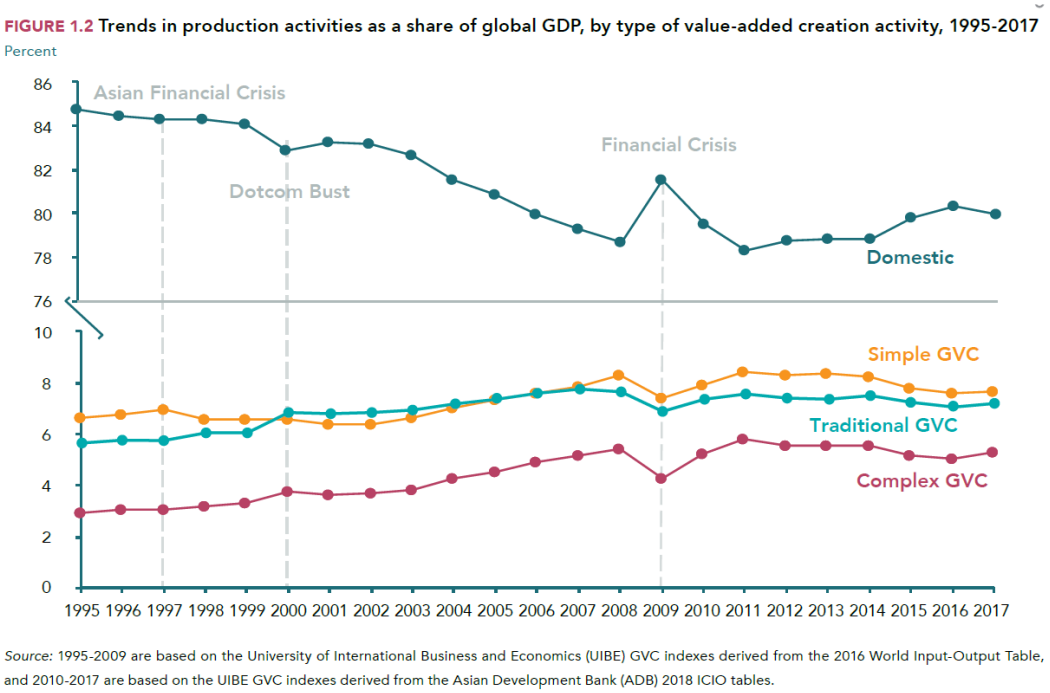
“Pure domestic” means domestic value-added to manufacture final products for domestic final demand without involving cross border trade and production sharing activities, it can also be phrased as “not traded internationally”.

“**Traditional trade**” is final goods and services produced for exports with only domestic factor content, it can also be phrased as “Trade in final products” or “Ricardian Trade”.

“**GVCs**” are basically “trade in intermediate products”. The distinction between simple and complex GVC activities are determined by the number of national border crossing, not the differences in technology or the complexity of actual production process (although there is a correlation between them), so they can be phrased as “value-added activities cross one or more than one national borders”.

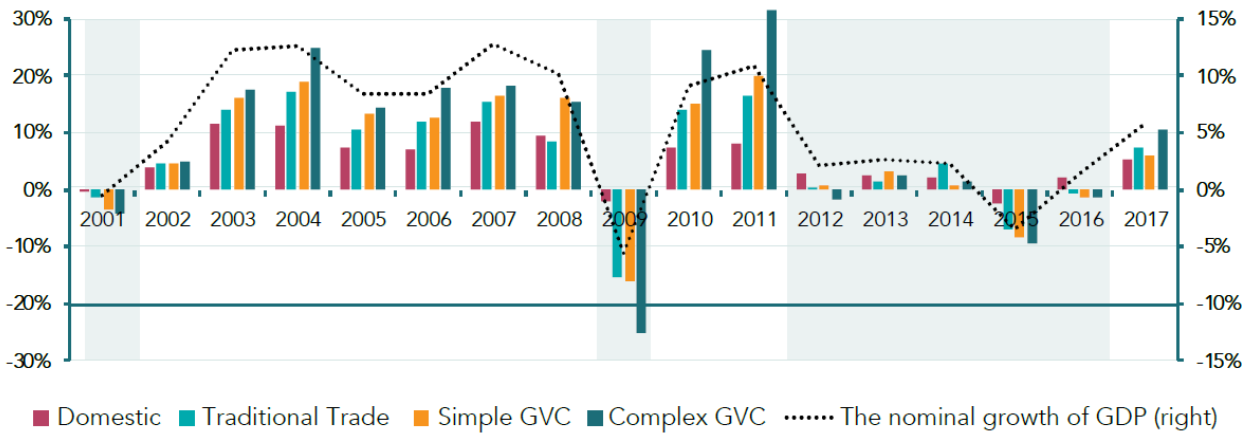


The following two figures show the development trend of each of the four types of production activities.



Source: 1995-2009 are based on the University of International Business and Economics (UIBE) GVC indexes derived from the 2016 World Input-Output Table, and 2010-2017 are based on the UIBE GVC indexes derived from the Asian Development Bank (ADB) 2018 ICIO tables.

FIGURE 1.3 Nominal growth rates of different value added creation activities, global level, 2000-2017



GVCs can be **producer-driven or buyer-driven** gvc.

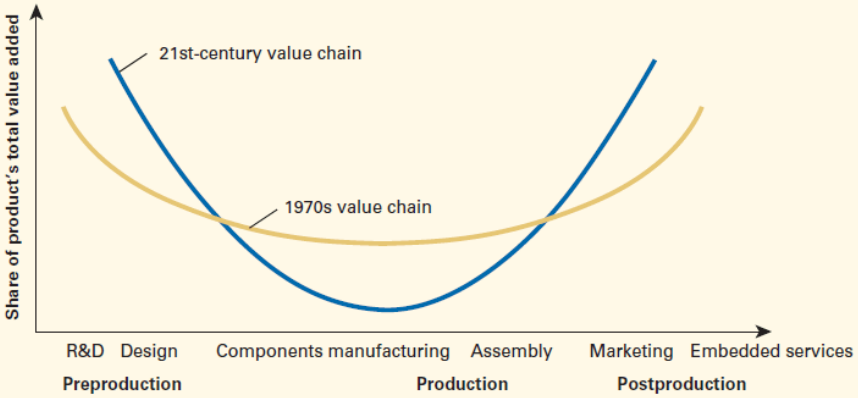
Producer-driven GVCs are those where the producers themselves are powerful players with competences and resources to organise global production networks and to assure that the products manufactured adhere to a complex set of public and private standard. It is the case of high-tech and capital intensive products such as personal computers, iPad, semiconductors, pharmaceutical products and medical devices.

In **buyer-driven GVCs**, the buying enterprise arrange and controls the fabrication of products or services which are partially oursourced by CPOs in various countries. Investments, if any, are limited to the payment of customised productions and quality control tooling.

Producer-driven chains have linkages between affiliates of multinational firms, while buyer-driven chains have linkages between legally independent firms. Producer-driven GVCs:

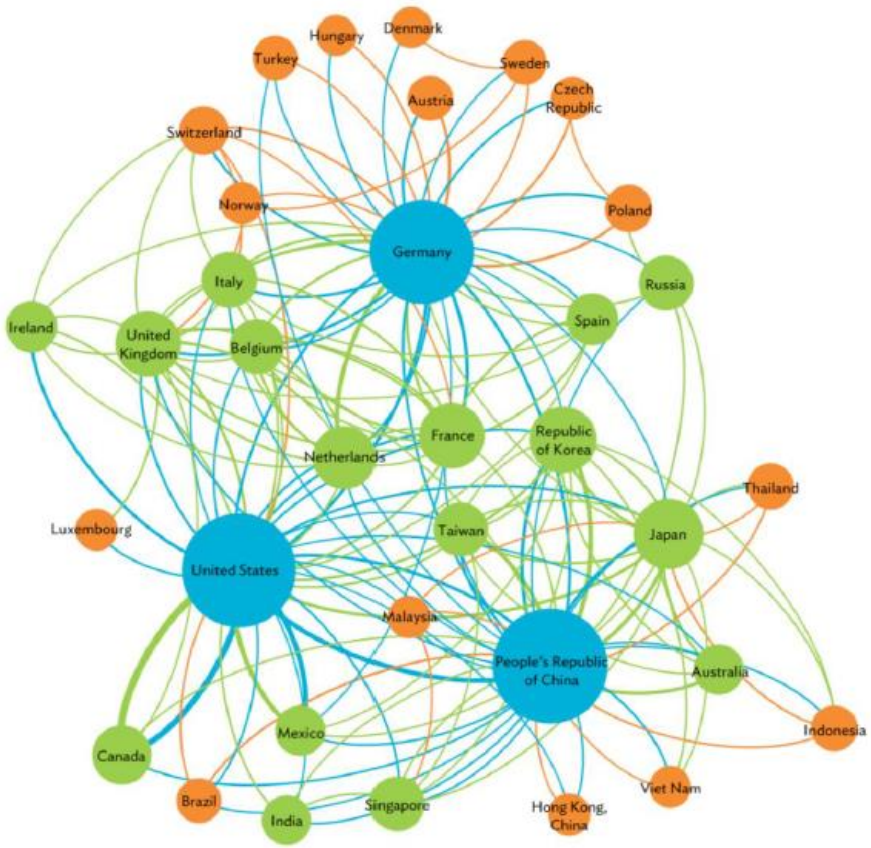
- rely on technology and R&D, are placed upstream and control the design and IPR of products as well their distribution,
- through the adoption of foreign direct investment (FDI) strategies, they relocate production plants to low-cost countries (fragmentation), increasing their profit and narrowing the smiling curve as illustrated below.

Figure 1.2 Value Added of Services in Manufacturing, 1970s versus 21st Century

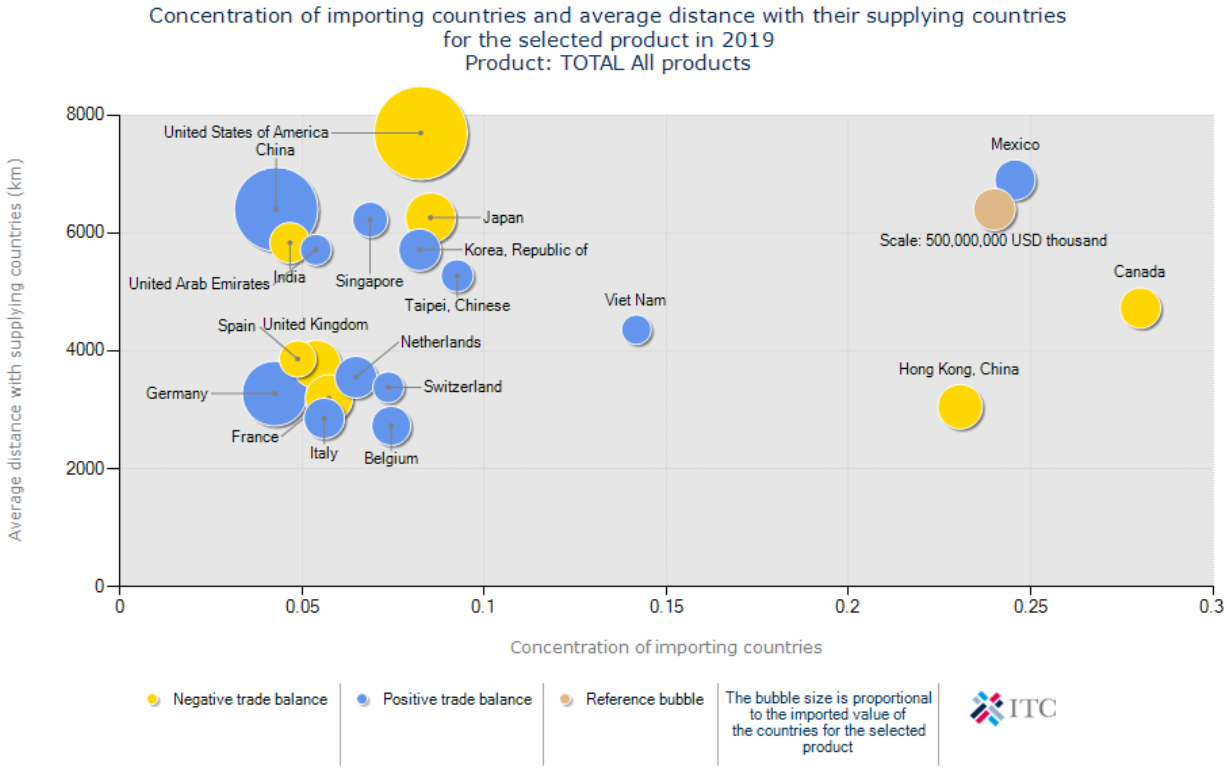


Note: Figure adapts the "smile curve" depiction of how value added changes across different stages of bringing a manufactured product to market, as first proposed circa 1992 by Acer Inc. founder Stan Shih; for a more detailed discussion, see Baldwin (2012). R&D = research and development. "Embedded services" refers to services delivered through the manufactured good (for example, apps on a mobile phone).

Geography of supply chains. While the image of a chain implicitly projects a succession of sequential steps, most supply chains are not linear but are defined by a hub and spoke pattern (source ADB Asian Development Bank)



Lenght and composition are two of the key dimensions of global value chains. The following two tables provide peculiar information on the matter.



Box table IV.1.1. Global supply chains of automotive OEMs

Tesla	BMW	Toyota	Nissan	Audi
• 300 suppliers (Model S) • Production in few countries (e.g. United States, China, Germany) • Few key suppliers in batteries and key system parts	• 4,500 suppliers • Production locations in 50 countries • Suppliers account for 70 per cent value added	• Production locations in 28 countries • Suppliers account for 65 per cent of value added	• 5,000 suppliers • Sunderland (United Kingdom) plant: 224 suppliers in 22 countries	• 1,000+ suppliers • Production plants in 18 locations in 13 countries

Source: UNCTAD, based on company websites.

Global Value Chains and digital technologies

"Supply Chain 4.0" is the re-organisation of supply chains – design and planning, production, distribution, consumption, and reverse logistics – using technologies that are known as "Industry 4.0".

They are often implemented by firms that are at the frontier of supply chain management in high-income countries. The most frequently mentioned supply management techniques are

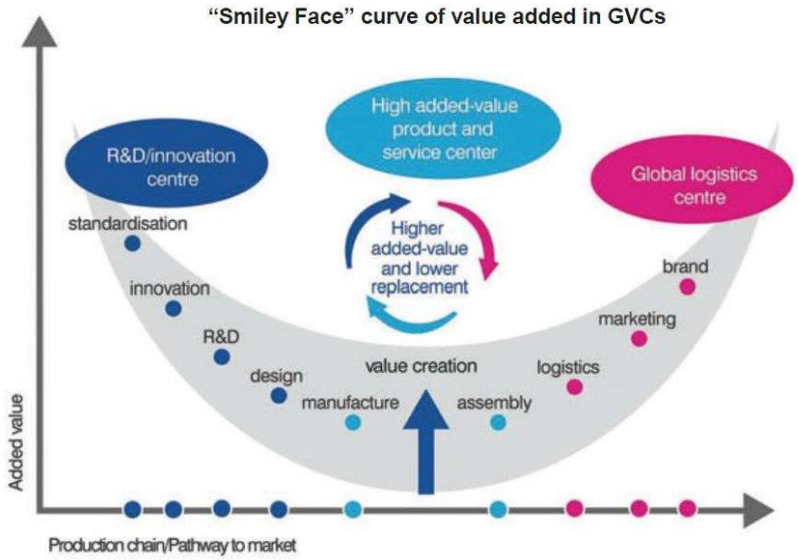
the IoT, big data analytics, 3D printing, advanced (autonomous) robotics, smart sensors, augmented reality, artificial intelligence, and cloud computing. “Supply Chain 4.0” is about transforming the linear model of supply chain management in which instructions flow from supplier to producer to distributor to consumer, and back, to a more **integrated model in which information flows in multiple directions.** While lead firms are increasingly monitoring and analysing this information through supply chain control towers or digital platforms, the end effect of **this development is making the goods economy more responsive to consumer demand.**

In “Supply Chain 4.0”, the internet makes the warehouse visible to the customer and some technologies such as autonomous logistics and robotic transport can improve the pick-up and the transport traceability. To rapidly assess and respond to changes in customer demand, tracking and tracing throughout the supply chain is enabled through sensing technologies underlying the IoT, including radio frequency identification (RFID), Bluetooth, and global system for mobile communication (GSM).

6. The smile Curve

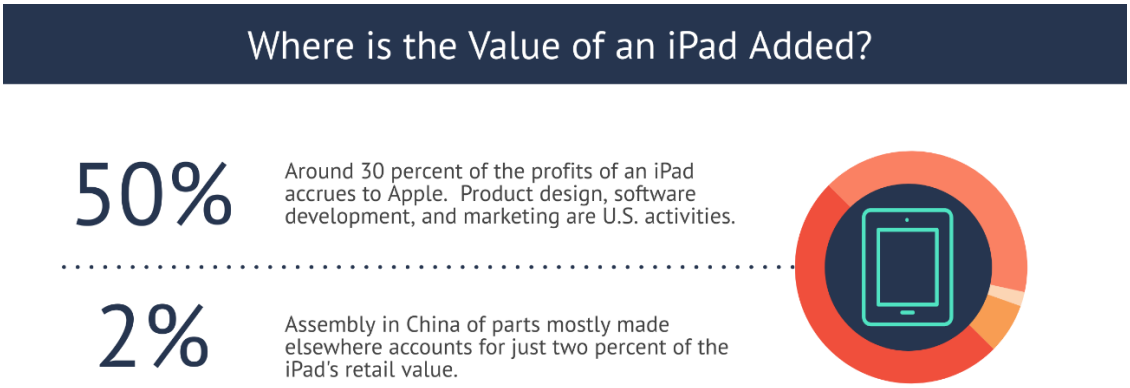
Source: Americans can smile about their place in the global economy by Andrea Durkin 17 Nov. 2017 - Hinrich foundation – Advancing Sustainable Global Trade

According to the logic of the smile curve, **R&D represents the highest value-added stage of the value chain, whereas, in most instances, manufacturing delivers the lowest value-added**. Typically, R&D departments are located in high-income economies providing the necessary human capital and the benefit of knowledge spillovers from universities or related companies. In business management theory, the smiling curve is a graphical depiction of how value added varies across the different stages of bringing a product on to the market.



The concept was first proposed around 1992 by Stan Shih, the founder of Acer Inc., an IT company headquartered in Taiwan. According to Shih's observation, in the personal computer industry**, the two ends of the value chain – conception and marketing – command higher values added to the product than the middle part of the value chain**: the manufacturing. If this phenomenon is presented in a graph with a Y-axis for value-added and an X-axis for value chain (stage of production), the resulting curve appears like a "smile".

The Apple's iPad assembled in China, for example, might be valued around $275 when it is imported in final form into the United States, but the value added and retained in China amounts to just $10. Companies like Apple might source components and contract manufacturing from suppliers around the world, but keep the majority of their most valuable professional jobs in-house, including product design, software development, product management and marketing.



7. World trade and foreign direct investment (FDI)

Source: World Investment Report 2020: International Production Beyond the Pandemic UNCTAD

As seen in the second paragraph, in **2019 the world trade in goods and services amounted to $ 25 trillion of which 70% managed by GVC and specifically:**

55% by producer driven GVC through FDI (foreign direct investments)
15% by buyer-driven GVC.

In the analysis of the reshoring option, it is important to distinguish between producer-driven GVCs and buyer-driven GVCs. In the first case, in fact, the decision to verticalise the

production process by closing plants abroad, is crucial and impacts the geographical distribution of the operations with all the relevant financial, legal and fiscal constraints. In the latter case instead, the reshoring decision does not alter the production structure of the company, and is usually coordinated by its CPO or the SCM. Given the importance of the foreign direct investment (FDI) in the structure of the international production, some information on the subject may be useful.

FDI takes place when an investor stablishes foreign business operations or acquires business assets in a foreign country.

FDI includes mergers and acquisitions, building new facilities, reinvesting profits earned from overseas operations, and intra company loans. In a narrow sense, foreign direct investment refers just to building new facilities in an economy other than that of the investor.

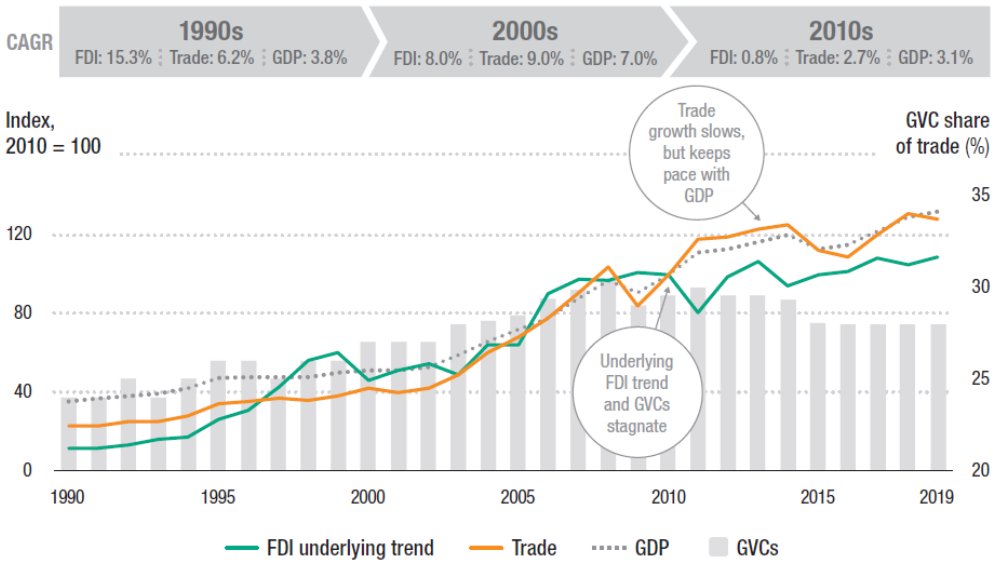
FDI usually involves participation in management, transfer of technology and expertise.

FDIs reduce the manufacturing cost of the producer-driven GVCs and, at the same time, play an important role in the economic development of the host country. The capital inflow of foreign investors in fact allows strengthening infrastructure, increasing productivity and creating employment opportunities.

The 30 years of international production ranging from 1990 to 2020, have seen two decades of growth followed by one of stagnation (figure IV.2 below). A similar trend has also affetcted the FDIs which reached their pick on 2007 with 3 trillion of US dollars. As illustrated in figure I.1, the COVID-19 crisis has increased the fall in FDI. However, this is due to the reduction of the world trade and not to the reshoring practices, and this statement is confirmed by:

- the findings of the study published on March 2021 by the EU INTA Committee,
- the FDI flow of 2019 in South-East Asia,
- the rise of Asian exports in 2019.

Figure IV.2. **FDI, trade, GDP and GVC trends, 1990–2019**
(FDI, trade and GDP indexed, 2010 = 100; GVCs, per cent)

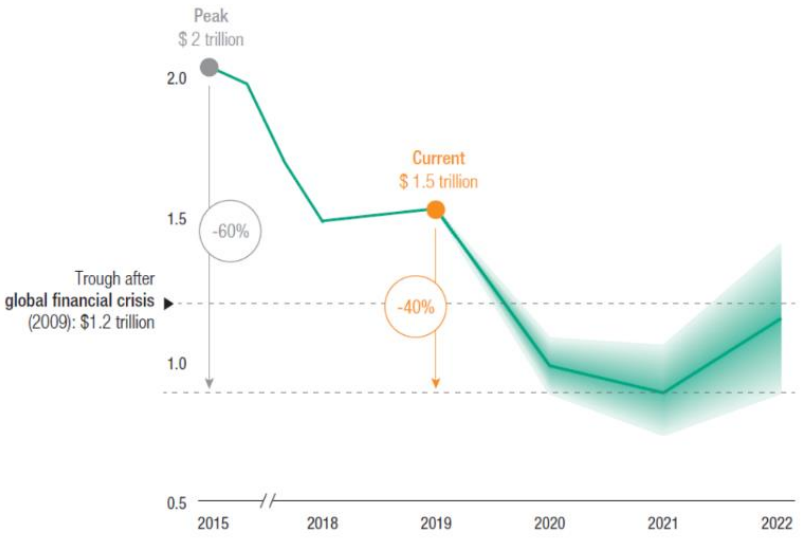


Source: UNCTAD.
Note: Trade is global exports of goods and services. GVC share of trade is proxied by the share of foreign value added in exports, based on the UNCTAD-Eora GVC database (see Casella et al., 2019). The underlying FDI trend is an UNCTAD indicator capturing the long-term dynamics of FDI by netting out fluctuations driven by one-off transactions and volatile financial flows.

World Investment Report 2020, International Production Beyond the Pandemic UNCTAD, p.141

In the '90s the FDI increased on average by 13.3%, the world trade by 6.2% and the world GDP by 3.8%. In the first decade of 2000, the FDI increased on average by 8%, the world trade by 9% and the GDP by 7%. In the second decade of 2000 instead, the FDI increase was limited to 0.8% against an increase of global trade of 2.7% and a GDP rise of 3.1%.

Figure I.1. **Global FDI inflows, 2015–2019 and 2020–2022 forecast**
(Trillions of dollars)

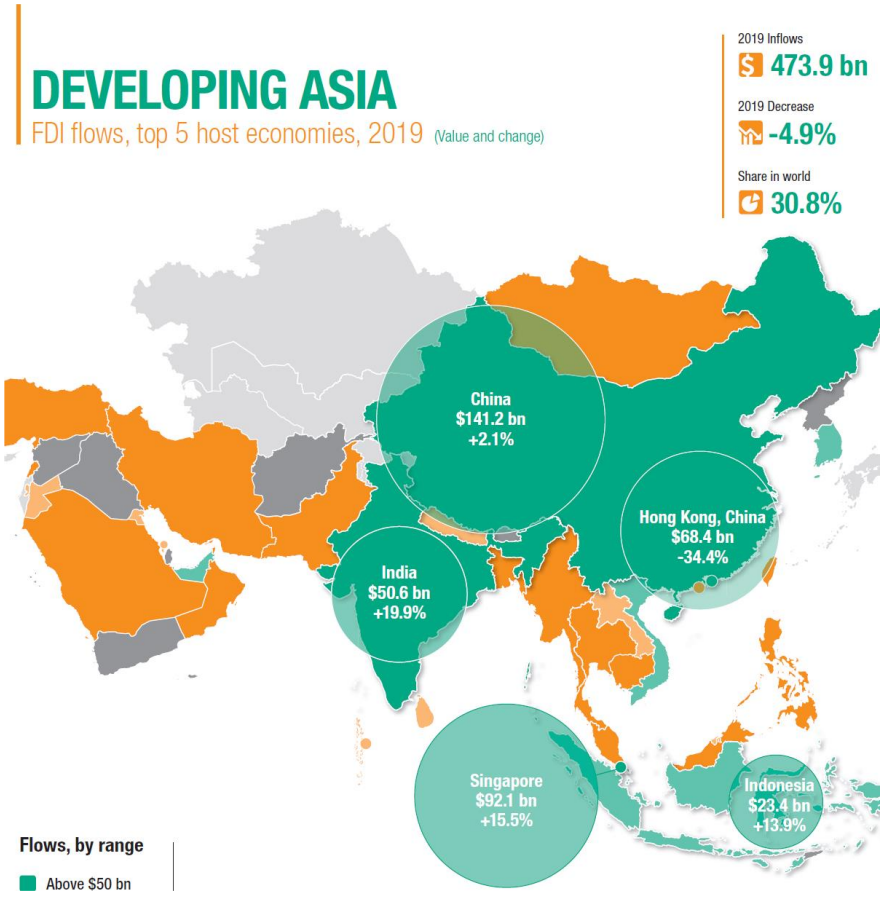


Source: UNCTAD.

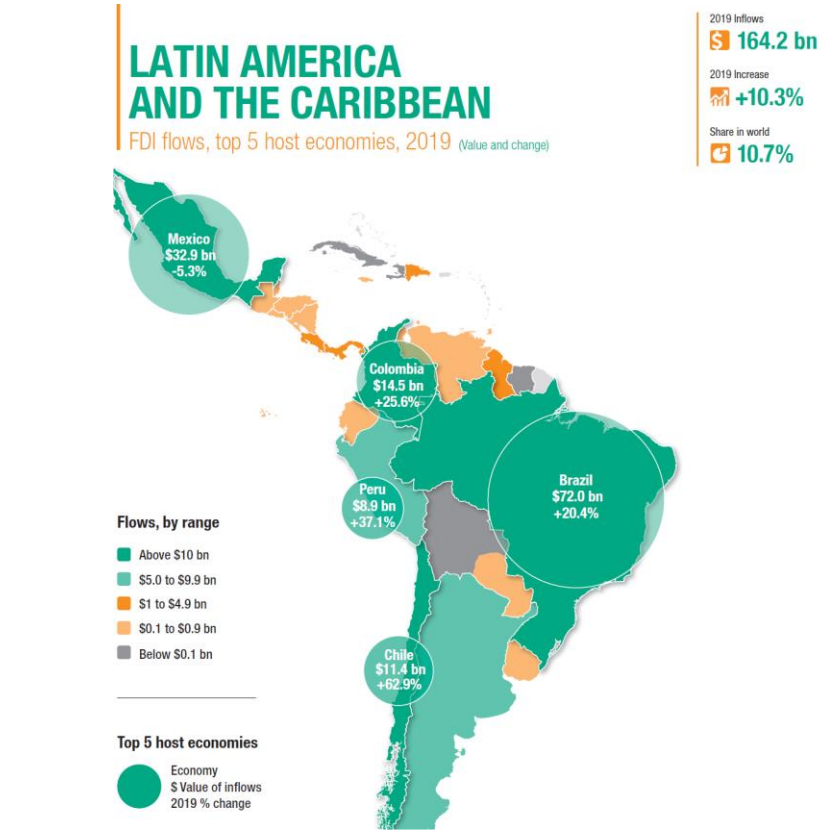
World Investment Report 2020, International Production Beyond the Pandemic UNCTAD, p.20

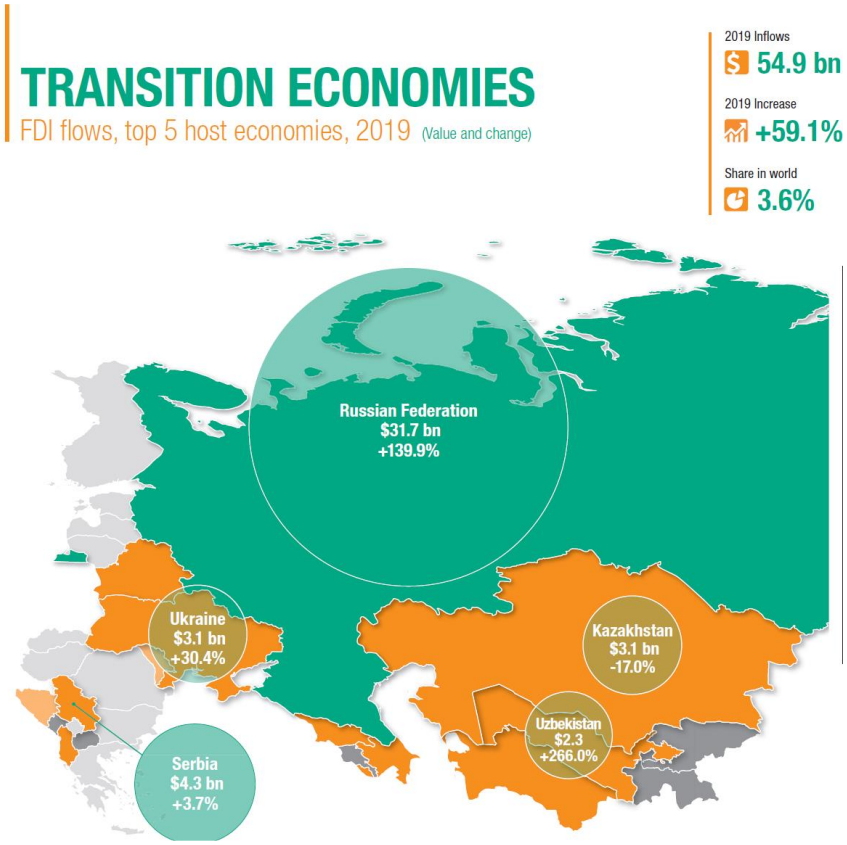
In 2019, except for Hong Kong, the FDI inflow in the developing ASIA did not suffer reductions. Inflows to Vietnam rose marginally, reaching an all-time high of $16 billion, with robust inflows into manufacturing. Strong investments have been made by Japan and the Republic of Korea. As can be seen from the graph hereunder reported, a similar situation affected the inflow of FDI in South America and Russia.

FDI is projected to decrease by a further 5 to 10 per cent in 2021 and to initiate a recovery in 2022 (UNCTAD report 2020).



World Investment Report 2020, International Production Beyond the Pandemic UNCTAD, p.54 and 64





World Investment Report 2020, International Production Beyond the Pandemic UNCTAD, p.72

8. Resilience: the concept and its evolution

Prof. Martinelli, E., Tagliazucchi, G. (2018). Resilience and Enterprise. The impact of natural disasters on small retail businesses. Milan: Franco Angeli.
Prof. Martinelli E., De Canio, F., Tagliazucchi G. (2019). Bouncing back from a sudden-onset extreme event: exploring retail enterprises' resilience capacity. International Review of Retail, Distribution & Consumer Research. Vol. 29 n° 5.

Introduction

Risk has always been a dimension of business, and every company has tried and tries in different ways **to be prepared to unpredictable and harmful events to minimise their impact**. The increased frequency of disruptive shocks requires organisations and communities to be resilient, and the resilience strategy has entered the agenda of governments and transnational organisations. Since it has become a key target of all organisations, it is advisable to have an adequate knowledge of the concept of resilience, its dimensions and attributes.

Concept and its evolution (different authors' studies and approaches)

The term resilience has been around since the 1620's and comes from the Latin term 'resilire' meaning 'to recoil or rebound'. By the 19th century it had evolved to include a sense of elasticity (MacMillan Dictionary, 2017). When looking within academic literature, the term resilience has been used since 1973 when Holling, an ecology scholar, classified two aspects of resilience: the Engineering Resilience defined as the time it takes to return to a state of equilibrium, and the Ecological Resilience defined as the amount of shock a system can absorb before it breaks down (Holling, 1973).

Resilience not only enables organisations **to continue with business as usual, but also to learn, progress and develop**. Resilience research has been conceptualised in different ways, depending on the context considered. Part of the problem in drawing out organisational resilience is the wide range of potential variables that can influence it. "Entrepreneurs who have resilience are willing to work hard to achieve their goals, to adapt to changes in order to take advantage of the new situation and are able to learn from their mistakes" (Cooper, Estes & Allen, 2004).

There are many definitions of resilience. It is in fact a dynamic concept that varies in relation to

- the entity to which it refers (person, company, supply chain)
- the context considered, and
- the type of risk/change (e.g. cyber attack).

In 2002 Fred Luthans, Professor of Management at University of Nebraska, has defined resilience as “the capability of individuals to cope successfully in the face of significant change, adversity, or risk’’ and as ‘’the positive psychological capacity to rebound and ‘bounce back’ from adversity, uncertainty, conflict, failure or even positive change”.

Resilience is a dynamic and evolving process through which entrepreneurs acquire the knowledge, abilities and skills to help them face the uncertain future with a positive attitude, creativity and optimism, and by relying on their own resources. Resilience is a multidimensional construct that comprises a network of favourable attitudes and behaviours. (Cooper, Estes & Allen, 2004).

Manzano and Ayala (2010) has shown that resourcefulness, robustness and optimism are distinct factors in the entrepreneurs’ resilience. Resourcefulness refers to the resources, capabilities and skills the entrepreneur possesses to cope with adverse situations. Another component of resilience is optimism. It refers to the capacity of the entrepreneur to maintain a positive attitude in difficult circumstances, situations where there is great uncertainty regarding the outcomes. It is the **capacity of the entrepreneurs to learn from mistakes and see them as an opportunity rather than a failure.**

Individuals build resilient abilities through everyday developments that are the product of remarkable or unforeseen life happenings. People who start businesses under dire circumstances often have to change the status quo and forge new paths. Without resilience, individuals would be less capable of engaging in the necessary entrepreneurial behaviours required to start or pursue new ventures.
Resilience generally has been used to describe organisations, systems, or individuals that are “able to react to and recover from duress or disturbances with minimal effects on stability and functioning” (Linnenluecke, 2015). Wildavsky in 1990 suggested that resilience is one strategy for dealing with uncertainty and risk and defined it as “the capacity to cope with unanticipated dangers as they become manifest, learning to bounce back” (Wildavsky, 1990). Absent such resilience, an organisation can lose its position on the market.

Resilience is:

- **a dynamic adaptation process** that allows entrepreneurs to continue to look towards the future despite harsh market conditions and despite the destabilising events they continually face;

- the capacity an entrepreneur has in order to overcome particularly difficult circumstances. This capacity for adaptation and “bouncing back in the face of adversity depends on the individual’s culture and resources and their interaction with the environment” (Windle, Bennert & Noyes - 2011).

Organisational Resilience

In highly volatile and uncertain times, organisations need to develop a resilience capacity which enables them to cope effectively with unexpected events such as natural disasters, terrorist attacks, technical malfunctions or human errors (Suez Canal blockade) **and bounce back from crises, and even foster future success.** They need to adequately react and to capitalise on events that could potentially threaten their survival. Although academic interest in organisational resilience has steadily grown in recent years, there is little consensus about what resilience actually means and how it is composed[1].Everybody talks about resilience but we still know little about it. The study of resilience in business management is recent. The relevant analyses are mainly qualitative with little possibility of generalisation of results emerged. **The pandemic has amplified and made 'real' the need for resilience**. Resilience "is more than mere survival; it involves identifying potential risks and taking proactive steps to ensure that an organisation thrives in the face of adversity".

Excellence in resilience implies:

- Organisational resilience
- Resilience strategies
- Individual attributes/skills consistent with company's resilience objectives.

According to Elisa Martinelli[2] organisational resilience is

- the capacity that characterises systems, individual and organisations **capable of resisting, reacting and recovering from a critical event that put stability and processes at risk, minimising its effects** (bouncing back).

  *«…not only about being persistent or robust to disturbance. It is also about the **opportunities** that disturbance opens up in terms of recombination of evolved structures and processes, renewal of the system and emergence of new trajectories. In this sense, resilience provides **adaptive capacity** that allow for **continuous development**, like a **dynamic** adaptive **interplay** between sustaining and developing with change*" (Folke, 2006).

- **the possibility of developing new skills and creating new opportunities** (Sutcliffe and Vogus, 2003; Lengnick Hall and Beck, 2003; Lengnick Hall et al., Martenelli et al., 2018), configuring itself as the **ability to relate dynamically with the reference environment** (bouncing forward).

1. Organisational resilience: a capability-based conceptualization Stephanie Duchek – Business Research 13/2020

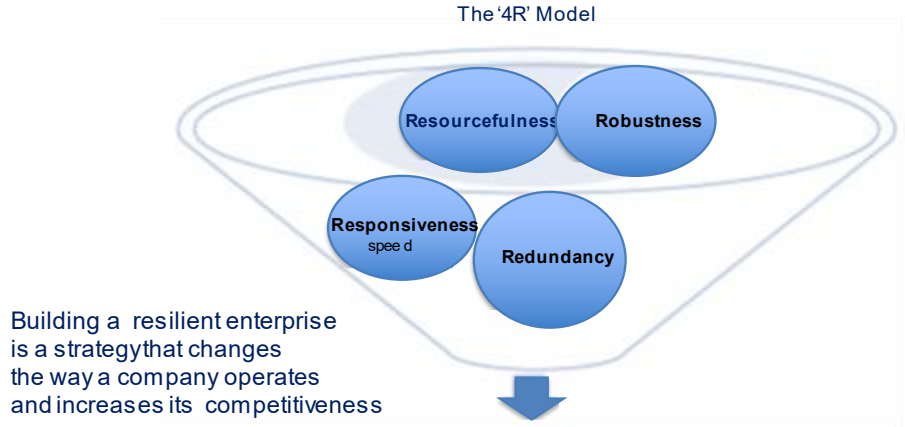
2.Full Professor of Management, Head of the Master Degree Course in International Management, Delegate for International relations of Department of Economics Marco Biagi (DEMB), University of Modena and Reggio Emilia.

Each organisation is unique. The way organisational resilience is implemented is also unique, however studies have shown that there are common attributes and behaviors demonstrated by organisations that have survived and thrived during times of change and uncertainty.

The organisational attributes or dimensions of resilience are:

- resourcefulness
- responsiveness
- robustness
- redundancy

Organisational attributes/dimensions of resilience



Source: Prof. Elisa Martinelli UNIMORE

Resourcefulness: In addition to the ability to be innovative and consider different ways of coping with situations, this is the **capacity of individuals to generate different approaches to dealing with challenges** and setbacks as well as to resiliently recover from them. If first approaches are ineffective, resourceful individuals typically come up with alternative approaches that work for them; and this often depends on formulating an effective course of action aimed at going from the current situation to a better one.

Robustness: the ability of a system to maintain functions despite disruptions (Kitano 2004). Well-conceived, constructed and managed organisation are able to withstand the impacts of hazard events without significant damage or loss of function. Anticipate potential failures in systems, making provision to ensure failure is predictable, safe, and not disproportionate to the cause is a purpose of resilience. In procurement, it avoids the over-dependence from a sole source (choosing double or multiple sources).

Responsiveness: capacity to react quickly, appropriately, and positively. To be responsive means to be alert and aware and to react adequately and consistently to the evnt occurred.

Redundancy refers to the deployment or provisioning of duplicate devices or systems in critical areas to take over active operation if the primary device or system fails.

Supply Chain Resilience

Firms that are **better able to minimize the duration and severity of disruptions to their supply chains** relative to the competitors are more resilient (Christopher and Peck, 2004;Scholten et al., 2020) **and are able to use it as a strategic weapon to achieve competitive advantage** (Scholten et al., 2020).

Avoiding a customer disruption can be thought of in terms of the level of "shock absorption" between stages in the supply chain.

Supply chain resilience is defined as 'the capacity to handle a disruption without significant impact on its ability to achieve its mission. Resilience is about handling the consequences of a disruption, not about preventing a disruption from occurring. However, the effort to create a resilient system is made before a disruption occurs (Berleet al., 2011a).

Datta, Christopher and Allen (2007)	*SCR is not just the ability to recover from mishaps, but is a proactive, structured and integrated exploration of capabilities within the supply chain to cope with unforeseen events.*
Falasca, Zobel and Cook (2008)	*SCR is the ability of a supply chain system to reduce the probabilities of a disruption, to reduce the consequences of those disruptions once they occur, and to reduce the time to recover normal performance.*
Ponomarov and Holcomb (2009)	*SCR is the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function.*

The supply chain attributes or dimensions of resilience are: agility, responsiveness, resourcefulness, robustness, visibility, flexibility, redundancy and collaboration.

Fundamentally, companies can bolster their resilience by either building in redundancy and flexibility. Redundancy means to keep some resources in reserve to be used in case of a disruption. The most common forms of redundancy are safety stock, the deliberate use of multiple suppliers even when the second supplier has higher costs, and deliberately low

capacity utilisation rates. **The incremental cost of safety stock, additional suppliers or backup sites is effectively an insurance premium**. Information technology resources are in separate category as IT backup is relatively inexpensive and failing to do backups has such severe consequences that they are standard practice.

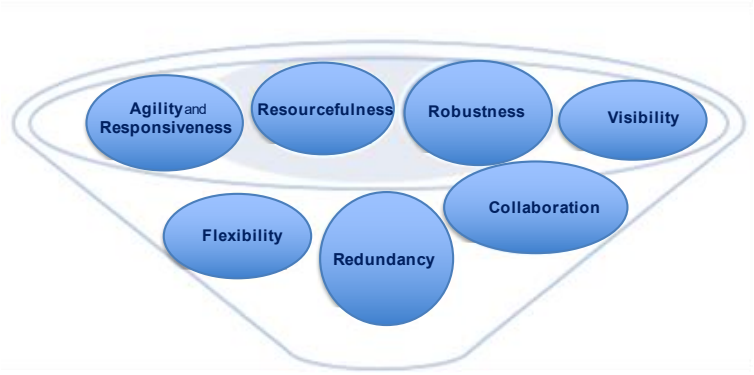
Responsiveness: companies must be able to respond quickly to customer's needs or requirements.

Flexibility: companies build flexibility in order to quickly respond to demand and supply volatility. Flexibility also amounts to building organic capabilities **that sense threats and respond to them quickly**. Conversion flexibility measures a company's ability to respond to a disruption in one of its own manufacturing facilities. While investing in redundancy represents a pure cost increase, investing in flexibility yields many additional benefits for day-today operations.

Collaboration: alignment of the corporate-supplier relationship with the procurement strategy. If a company chooses to work with a single supplier, it must develop deep relationships and work closely with it. Developing such relationships is expensive and requires constant vigilance; some companies instead may choose to have less deep relationships with multiple suppliers, so they can spread the risk of losing critical capacity.

Visibility and control systems - In order to detect supply chain disruptions quickly, many enterprises are using visibility systems The two principal functions of control systems are to detect a disruption quickly and to foster speedy corrective actions.

Supply chain attributes / dimensions of resilience



Resilience capacity

Source: Prof.Elisa Martinelli UNIMORE

Sheffi (2005) has identified three practices for developing resilience into supply chains

- increased redundancy
  - double or multiple source

- increased inventory (safety stocks)
- not eccessive capacity utilisation rate (max. 80%÷85%).

▪ production flexibility
- standardised processes (use of standard processes allows a firm to operate in another facility when one is disrupted)
- concurrent/simoultaneous processes
- postpoment planning
- aligment between procurement strategies and relationship with suppliers

▪ change of corporate culture

- gauging the magnitude of a disruption early requires a specific mindset
- continuous interaction between management and employees
- sharing of power (empowerment)
- passion for work.

Source: Elisa Martinelli University of Modena and Reggio Emilia Italy

The organisational resilience process

Resilience can be seen as a meta-capability composed by three sequential stages: anticipation, coping and adaptation. Resilient organisations are capable of resisting, reacting and recovering from a critical event that put stability and processes at risk, minimising its effects. The resilience cycle or process is characterised by:

1. Anticipation / preparation

Organisations must recognize early signals of crisis to respond quickly and, thus, avoid escalation.
It refers to the **ability to detect critical developments** in the organisation or the environment and to adapt proactively (making the organisation more resilient), to possible

disrupting events before they happen. This does not mean that resilient organisations can prevent every failure or crisis. However, some firms are able to see the unexpected faster than others, and are able to immediately react to it while others “wait and see”. Companies need anticipation capabilities to avoid threatening situations or at least to minimize potential negative consequences.

In its report: “**Advancing Cyber-Resilience**: Principles and Tools for Boards”, the World Economic Forum underlines that:

- **the risks due to the technologies and their scale must be understood**,
- the identification of the cyber risk portfolio should consider legal, operational, financial, reputational and strategic implications.

2. Cope with the event

In addition to the anticipation of and preparation for critical events, resilience also means coping “with unanticipated dangers after they have become manifest. When a crisis occurs, organisations must put their crisis plans into action, and develop ad hoc solutions.

The ability of coping with the unexpected can be separated into different single capa-bilities: the capability to accept a problem, the capability to search a solution, and the capability to implement a solution. All these capabilities imply promt action in response to unexpected events. Resilience is a capacity to respond productively to disruptive events without engaging in an extended period of regressive behavior

3. Adaptation (possible changes to the organisation)

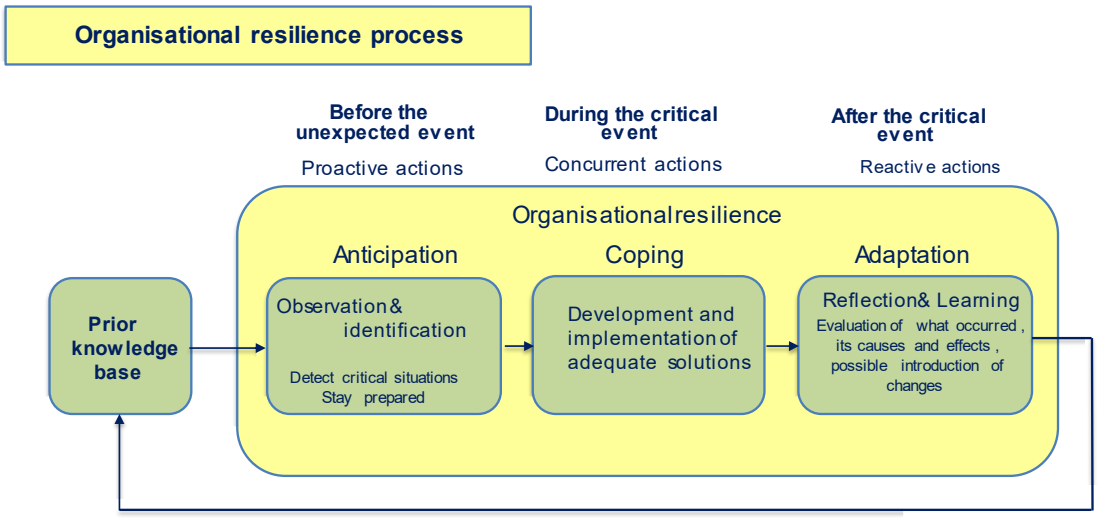
Company’s ability to engage in transformative activities to capitalize on disruptive events that potentially threaten organisation survival. Adaptation implies learning from past experiences. Learning starts with the analysis and evaluation of the crisis situation, its causes, and effects. Subsequently, the gained experiences can be incorporated in the existing knowledge base.

Organisations must be able to reflect on the crisis situation and to incorporate the gained insight into the existing knowledge base. On the other hand, they must be able to act on this knowledge and produce changes.

With reference to the **Cyber-Resilience** the report of the World Economic Forum underlines the need for:

- **Continuous improvement of controls**: the board recommends that the responsible cyber risk officer continuously evolves cyber resilience by performing frequent assessment of the controls used to manage risk associated with emerging technologies and by improving the process in accordance with an effective asset protection strategy.

- **Ability to quickly adapt to change:** the board should be aware of the organisation's cyber resilience capabilities with regards to supporting the business without hindering time-to-market strategies. As market conditions rapidly change and organisations react to these conditions, cyber resilience programmes must have the correct foundations in place to adjust quickly while effectively managing risk.



Elisa Martinelli, adapted from S.Duchek 'Organisational resilience: a capability-based conceptualisation' Business Research 2019

Anticipation, coping, and adaptation are the 3 stages of the process

British Standard Resilience 65000/2014

The norm BS 65000/2014 defines organisational resilience as **'the ability to anticipate, prepare for, respond and adapt to events – both sudden shocks and gradual change'**. That means being **adaptable, competitive, agile and robust**. This standard recognises that it is essential to build resilience not only within the organisation but across networks and in partnership with others.

The organisational resilience requires the **commitment of the whole enterprise**. It implies a top-down direction by the management, and a bottom-up commitment by the employees, through a clear communication and a shared will among all members.

BS 65000:

- clarifies the meaning of resilience
- highlights the key components of resilience
- helps an organisation to measure its resilience and to make improvements.

The essential elements of organisational resilience for the BSI model are:

- the excellence of the product
- the reliability of the production process
- the behaviours and competences of the member of the organisation.

Product excellence

Product refers to whatever product, service or solution an organisation brings to market to generate revenue. The starting point is to ask which markets an organisation serves. Do its capabilities and products match the market requirements and comply with regulatory requirements, and if not, how does it adapt to them?

Process reliability

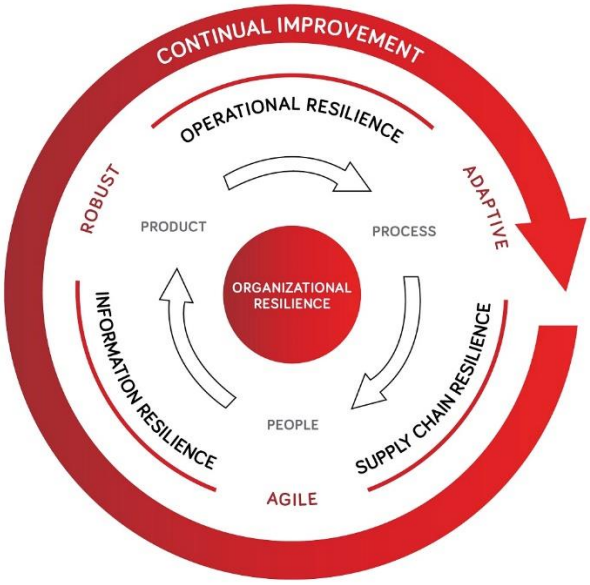
Organisations need a systematic approach to quality in the broadest sense of the word. They must ensure they 'do the basics right' consistently through the strength and reliability of their processes, while still leaving scope for innovation and creativity.

People behaviours

An organisation's people, culture and values determine the business success.
'People do business with people' may be a cliché, but it remains true that we often judge an organisation by the personal experience we have with it. This includes how its employees serve us, and how we observe the company interacting with the environment, civil society and its supply chain partners on ethical and social responsibility issues. If our experience is positive we, and many others like us, will cumulatively reinforce the brand's reputation.

The BSI model thus identifies three domains of fundamental importance for achieving organisational resilience in small and large companiesO

- operational resilience
- supply chain resilience
- information resilience



BSI 65000 2014: Essential elements and domains of organisational resilience

ISO 22316/2017 Security and Resilience – Organisational resilience – Principles and attributes,

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The above ISO standard:

- comprises 3 dimensions, 9 strategies, and 16 behaviors,
- explains the nature and the scope of resilience, which helps organisations to enhance resilience in a world that is changing every day,
- provides a framework to help organisations future-proof their business, detailing key principles, attributes and activities that have been agreed on by experts from all around the world.

James Crask, Convenor of ISO/TC 292's working group WG 2, the group of experts that developed the standard, says '**improving the resilience of organisations ensures they are not only better placed for anticipating and responding to potential risks, but can harness opportunities as well'.**

Organisational Resilience is the **organisation's ability to anticipate, respond and adapt to unexpected disruption, while continuing to deliver the expected outcome.**

Becoming ISO 22316 certified will empower people to help their organisation in achieving a unique culture, **which enables them and their organisation to survive and succeed even after an unexpected event happens.**

The above framework is consistent with ISO 22316/2017

3 Dimensions: Leadership & Strategy, Culture and Behaviour, and Preparedness & Managing Risks.

9 Strategies: Shared Vision, Understands Context, Effective Leaders, Healty Culture, Shares Information, Continually Improves, Available Resources, Manages Risk, Manages Change.

Each strategy can be implemented on its own or in combination as part of the overall organisational resilience strategy.

16 Behaviors: Adaptive, Aware, Collaborative, Committed, Creative, Prepared, Innovative, Inclusive, Flexible, Effective, Diverse, Reflective, Resourceful, Respected, Responsive and Robust.

The identified behaviors describe how more resilient organisations behave. These behaviors are considered to be important in preventing breakdown or failure; or enabling appropriate

and timely action to be taken. They distinguish a more resilient organisation from one that is simply well-run, successful, or prosperous.

1. Leadership and Strategy

Organisational resilience is increased and enhanced when the organisation demonstrates leadership qualities and intentionally implements strategies.

A Shared Vision: the members/employees of the organisation clearly understand the purpose, vision, and values of the organisation.
Understands Context: there is a comprehensive understanding of both the internal and external dimensions of the organisation.
Effective Leaders: leaders are effective and empowered, are trusted and respected, and leadership is distributed throughout the organisation.

2. Culture and Behaviour

Organisational resilience is increased and enhanced when there is an intentional effort to ensure a healthy culture throughout the organisation.

Healthy Culture: the existence of core values and behaviors that support the health and welfare of its members/employees, foster creativity and empower embers/employees to communicate effectively.
Shares Information: information and knowledge is shared to enable effective decision-making, learning from experience and from others is encouraged and valued, and is recognized as a critical resource of the organisation.
Continually Improves: performance is continually monitored and a culture of continuous improvement is encouraged.

3. Preparedness & Managing Risks

Organisational resilience is increased and enhanced when the organisation intentionally manages risk and prepares for the unexpected.

Available Resources: resources are adequate and available when needed in order to provide the ability to adapt to changing circumstances.
Manages Risk: risk is managed throughout the organisation and the use of management systems used as appropriate.
Manages Change: ability to anticipate, plan, and respond to changing circumstances and incidents.

16 Behaviour (skills)

Adaptive and Flexible

Flexibility implies the ability to change, evolve and adapt in response to changing circumstances. Flexibility can be achieved through the introduction of new knowledge and technologies, as needed. The ability to be flexible and adaptive during a disruption might be demonstrated by developing new plans, taking new actions or modifying behaviors so that you are better able to withstand and recover from it. Adaptability: ability to apply existing resources to new purposes or for one thing to take on multiple roles.

Aware

The ability to constantly assess, learn and take in new information on strengths, weaknesses and other factors through sensing, information gathering and robust feedback loops.

Collaborative

With a collaborative effort, a job can be completed in less time. Collaboration helps to bring teamwork.

Committed

Availability to give time and energy to planned objectives/activities. Commitment increases the resilience of the organisation.

Creative

Increased resilience requires creativity. Ability to make new things or think of new ideas. Creativity is characterized by originality of thought and having imagination.

Ability to transcend traditional ideas, roles, patterns, to create meaningful new ideas.

Diverse

Capability to operate successfully under a diverse set of circumstances, beyond what is needed for everyday functioning. Recognition of the diverse nature and characteristics of different people needed for organisational resilience and the diverse nature and characteristics of organisations.

Inclusive

Inclusion implies the need for broad consultation and engagement or other people, organisations, and communities. Addressing the shocks in isolation is contrasting the notion of resilience. An inclusive approach contributes to a sense of shared ownership or a joint vision to build resilience.

Integrated

Being integrated means that individuals, organisations and communities have the ability to bring together disparate thoughts and elements into cohesive solutions and actions. It considers horizontal and vertical integration between individuals and organisations.

Integration and alignment between individual, organisations, and community systems promotes consistency in decision making and ensures that all investments are mutually supportive to a common outcome.

Prepared

To be prepared means to be ready beforehand and to work out the details of a plan of action in advance. Being prepared means the organisation has taken efforts to be equipped with the necessary resources to manage change and to meet unforeseen circumstances. It means having

thought out beforehand any incident or situation that might occur so that you know the right thing to do at the right moment and are willing to do it. Being prepared is the opposite of being reactive.

Redundant

Redundancy refers to spare capacity purposely created within systems so that they can accommodate disruption, extreme pressures or surges in demand. It includes diversity: the presence of multiple ways to achieve a given need or fulfil a particular function.

Reflective

Accepting of the inherent and ever-increasing uncertainty and change in today's world. They continuously evolve, implying the modification of standards or norms, rather than seeking permanent solutions based on the status quo. As a result, people and institutions examine and systematically learn from their past experiences, and leverage this learning to inform future decision-making.

Resourceful

Resourcefulness (initiative) implies that people, organisations and communities are able to rapidly find different ways to achieve their goals or meet their needs during a shock or when under stress. This may include investing in capacity to anticipate future conditions, set priorities, and respond, for example, by mobilising and coordinating wider human, financial and physical resources.

Respected

The organisation is respected by others for its qualities or achievements. In more resilient organisations, there is respect between not only the different parts of the organisation but between the different personnel who make up the organisation. It means acting in a way that you are aware of and approve of others' rights, wishes, and opinions.

Responsive

To react quickly, appropriately, and positively. To be responsive means to be alert and aware and to react in a way that is needed, suitable, and right for a particular situation.

Robust

Well-conceived, constructed and managed organisation that is able to withstand the impacts of hazard events without significant damage or loss of function. Anticipates potential failures in systems, making provision to ensure failure is predictable, safe, and not disproportionate to the cause. Actively avoids an over-dependence on a single asset/supplier.

Self-regulated

Self-regulated implies that an individual, organisation, or community can deal with hazardous or stressful events without significant malfunction, collapse, or cascading disruption. This ensures any failure is discrete and contained.

The list of activities to be implemented (Resilience Plan) to make the supply chain resilient is shown in next paragraph.

9. Strategies to reduce the vulnerability of supply chains

Sources: Post Covid-19 Value Chains: options for reshoring production back to Europe in a globalised Economy; McKinsey Global Institute: '*Risk, resilience and rebalancing in global value chains'* August 2020; ADACI R&D Committee.

COVID-19 pandemic has disrupted most businesses and challenged supply chains reliability. In a world where hazards are occurring more frequently causing ever greater damage, and political instability generates uncertainty and makes every forecast less likely, **making global value chains more resilient and managing procurement risks and costs has become vital.**

When companies understand the magnitude of the losses they could face from supply chain disruptions, they can weigh how much to invest in mitigation. **McKinsey asserts that a single prolonged production shock could jeopardise between 30% and 50% of one year EBITDA.** On top of this, they face the risk of losing market share to competitors that are able to sustain operations or recover faster, not to mention the cost of rebuilding damaged physical assets.

Customers demand and preferences are changing and companies must understand how their needs may have shifted. In the future, responses will need to be hours, not weeks, as time is critical. Decision-making processes must now be twice as fast as before. Covid-19 is over and the preparation of business recovery plans becomes the key priority for many organisations. Several procurement leaders consider the need to reimagine the procurement function and the structure of their supply chains both to succeed in recovery efforts and **to transition to a new operating model that's fit for the new normal.**

To cope with the new economic environment, CPOs have to reshape sourcing and procurement functions and manage disruption response plans or relaunch programmes to reduce the vulneralibily of the supply chains, improving at the same time their agility, competitiveness and contribution to innovation. In addition, they have to reduce their complexity, achieving visibility in the immediate and extended supply network. To realise earnings improvements, procurement leaders are expected to find new ways to create value, including resource redirection to boost supply-chain resilience, financial difficulties among suppliers, and major shifts in both demand and supply volumes.

Procurement organisations can reimagine their business model across four enablers:

- new operating model;
- better resilience of their supply chains;
- digitalisation or robotic process automation;
- reshoring strategies.

New operating model. The role of the buyer has to become more strategic, proactive and aimed at the continuous search for added value. He is expected to have a better understanding of the supply markets and geopolitical trends, and must have scenario planning and scenario review capabilites. **Risk analysis, assessment and mitigation have to be managed quarterly through sophisticated models**. Procurement is expected:

- to promote an effective cross-functional collaboration and coordination to open untapped sources of value creation, such as product improvement and reconfiguration (category management plans);
- to improved planning capabilities and adopt agile metodologies;
- to have a solid data infrastructure, and data analysis capabilities to allow data-driven decisions;
- to have cost, value analysis and continuous improvement competences;
- to foster integrated long-term relationship with key suppliers based on trust and not on opportunistic negotiation;
- to launch joint innovation programmes with partners to unlock new opportunities;
- to have a programmatic approach to developing capabilities that addresses key skill gaps through intensive training and education programmes;
- to pay due attention to all stakeholders, starting from customers.

Resilience Plan

Companies need an understanding of their exposure, vulnerability, and potential losses to define and apply resilience strategies. Resilience measures could more than pay off over the long term and might include some of the following actions:

- strengthening risk management capabilities and risk mitigation plans (improved risk assessment metrics and frequent checks of vendor's financial and operations status, especially in the cases of sole-source and geographical concentration):
- improving planning capabilities and agile metodologies (analysis of supply market scenarios, material-requirements planning, and integrated supply chain planning where appropriate);

- establishing business continuity plans;
- strike a different balance between just-in-time and “just in case”;
- creating the capacity to flex /move production across sites;
- reducing product complexity and range of materials used;
- strengthening organisational effectiveness (internal and within the supplier network);
- improving the company’s data infrastructure with real-time links with key supplier databases, and overall transparency;
- building redundancy in supplier and transportation network (multi-sourcing strategy or suppliers diversification), choosing suppliers with multiple production sites (centrally coordinated and possibly close to points of consumption;
- improving the procurement and supply chain governance system
- extending and digital connectivity with key vendors through digital business platforms;
- strengthening to adoption of anti-earthquake and specific monitoring systems if vendor’s plants are located in earthquake-prone areas;
- monitoring work in progress and materials availability of key vendors through specific indicators, and accelerating response times (including tier 2 suppliers where appropriate);
- holding more inventory, especially for sole-source parts, and arranging ‘on consigment agreements’ (it allows companies to meet sudden spikes in demand);
- improving transportation and logistics organisation (trace and tracking materials delivered);
- promoting supplier financing through buyer's credit, as appropriate;
- facilitating more-collaborative remote-working models, in emergency situations;
- preparing a monthly report on risks detected, and resilience measures adopted.

Today much of the discussion about resilience in advanced economies moves around the idea of increasing domestic production. But the interconnected nature of value chains limits

the economic case for making large-scale changes in their physical location. Value chains often span thousands of interconnected companies, and their configurations reflect specialisation, access to consumer markets around the world, long-standing relationships, and economies of scale. One way to achieve supply chain resilience is to design products with common components, cutting down the use of custom parts in product offerings. Auto manufacturers are perhaps the most advanced in this regard, having implemented modular manufacturing platforms that share components across product lines and production sites.

Becoming more resilient does not mean sacrificing efficiency. McKinsey research highlights the many options for strengthening value chain resilience, including opportunities arising from new technologies. Where companies cannot directly prevent shocks, they can still position themselves to reduce the cost of disruption and the time it takes to recover. Companies have an opportunity to emerge from the current crisis more agile and innovative.

According to Gartner[1] Resilience in the supply chain is the ability to adapt to structural changes by modifying supply chain strategies, products and technologies. In a recent survey of more than 1,300 supply chain professionals (see the table below), Gartner found that 87% of respondents plan investments in supply chain resiliency within the next two years, and 60% admit that their supply chains have not been designed for resilience, but cost-efficiency.

Geraint John, vice president of the Gartner Supply Chain said that many organisations are investing in diversifying their supply base, redesigning products to mitigate risk, and looking for more collaborative relationships with key customers and suppliers. About 30% of survey respondents reported that they intended to shift from a global to a more regionalized supply chain model. Fifty-six percent think that automation will enable them to make onshore manufacturing economically viable. However, costs are an overriding factor in that 45% of survey respondents think that **their customers favor low pricing over domestic sourcing and production, particularly in industries with ferocious price competition**, such as retail and fashion. Shifting to onshore is difficult for a variety of reasons. The regulatory burden of moving already established supply chains to a different location and the concentration of key suppliers in certain geographies make it difficult to completely regionalise a supply chain network. Other concerns include both the high cost of labor in developed Western economics alongside a shortage of skilled manufacturing workers.

Cost differentials and cost-efficiency will remain key considerations for these supply chains when evaluating any redesign of their operational networks, Gartner concludes. Almost half of the survey respondents will use lean methodologies, just-in-time systems and low-cost country sourcing as relevant to lower costs in the future.

1. Supply Chain Resiliency to See Major Investment Over Next Two Years, MH&L Staff Feb.16,2021

"Ultimately, the right balance between investments in resilience and agility, and cost-optimisation depends on each organisation's individual circumstances, including their financial strength, market position, appetite for risk and external factors such as regulatory requirements or supply chain constraints.

Digitalisation and Robotic process automation.

In addition to many other benefits, the digitalisation of the supply chain or the use of the enabling technologies, often identified with the term Industry 4.0, improves its resilience. Among the best known digital technologies, it is worth mentioning:

- Advanced manufacturing solutions (robots, cobots, products and process application software and connectivity between machines to allow their remote command and control);
- Additive manufacturing (3D printers)
- Augmented reality and virtual reality
- Horizontal and vertical integration

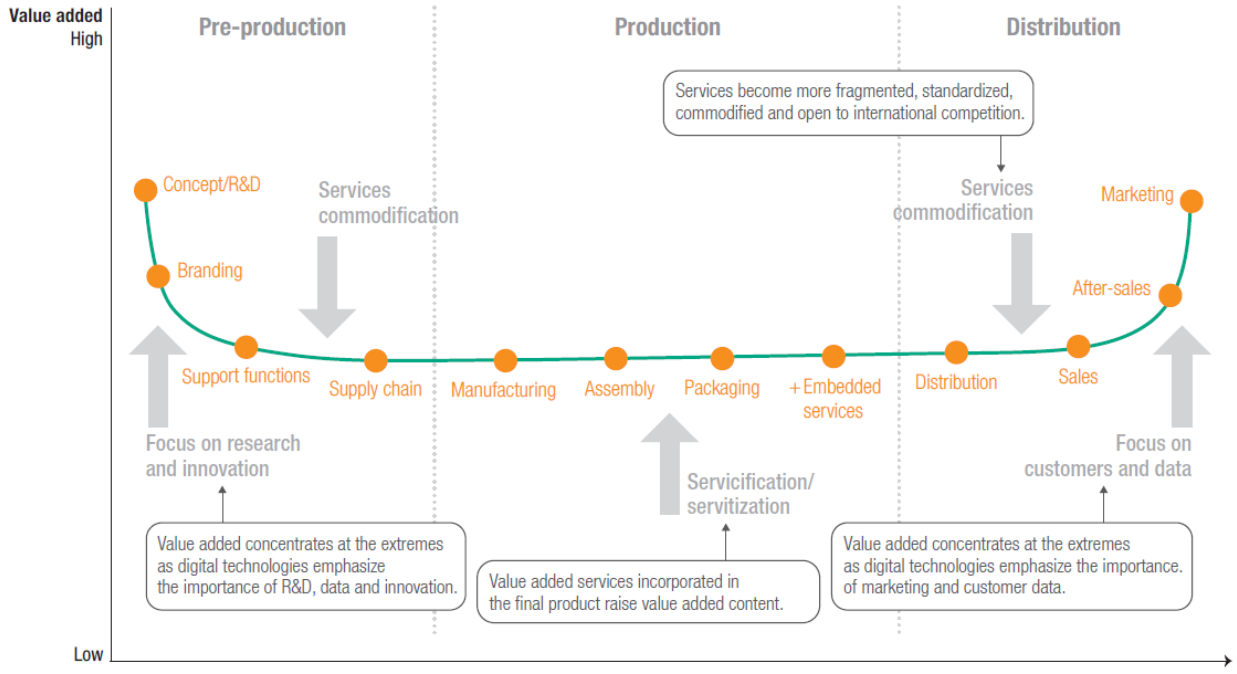
- Internet of things
- Cloud computing and Cybersecurity
- Big data /data analytics (big data: usually not related to procurement processes)
- Blockchain and AI (prototype applications in big organisations).

Digital technologies improve the agility, efficiency and productivity of the organisation, reduce times and costs of its processes and improve product quality[1]. Consequently all companies should adopt some according to their specific operating context and return on investment. In the procurement and supply chain areas, the digitalisation process has two major applications:

- partial or complete automation of the procurement cycle (adoption of digital platforms ensuring realtime connectivity with key suppliers, cloud computing and data analysis);
- automation of supplier's manufacturing departments and logistics.

The World Investment Report 2020, International Production Beyond the Pandemic has analysed the impact of digitalisation and the 3D printing on value added. See Figures IV.9 and IV.11 below

Figure IV.9. Impact of digitalization on value added

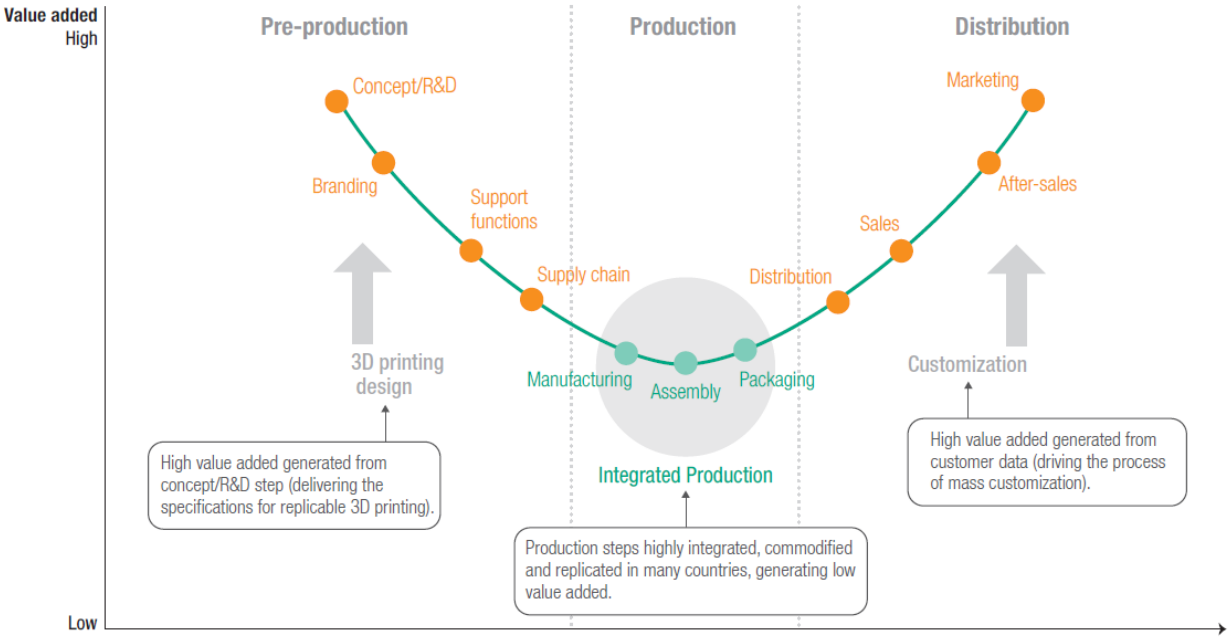


Source: UNCTAD.
Note: Servicification is intended as carrying out manufacturing as a service, in a contract manufacturing relationship. Servitization is intended as the incorporation of embedded services in products.

World Investment Report International Production Beyond the Pandemic UNCTAD 2020, p.143

1. Product quality can be precisely controlled with modern automation and control systems and can be closely monitored during production by using high-resolution analytics

Figure IV.11. Impact of 3D printing on value added



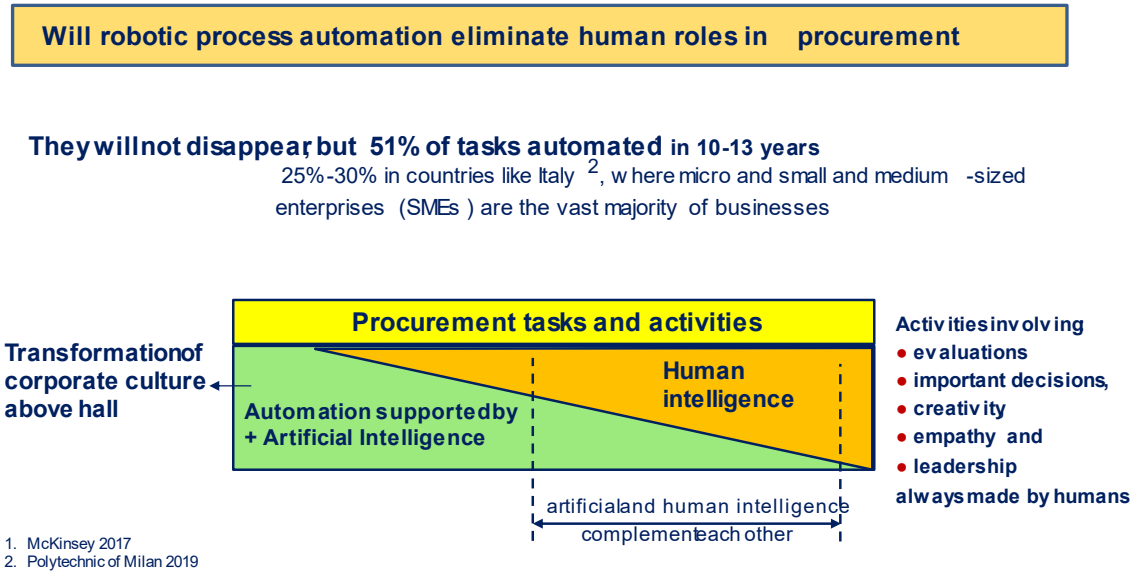
Source: UNCTAD.

World Investment Report International Production Beyond the Pandemic UNCTAD 2020, p.146

Robotic process automation and reduction of procurement tasks

McKinsey and many other qualified experts ensure that robotic process automation shall not eliminate roles in procurement. They will not disappear, but 51% of the activities and tasks performed by the function will be automated in next 10-12 years. This percentage will be limited to 25%-30% in countries such as Italy, where micro and small and medium-sized enterprises (SMEs) represent the vast majority of businesses.

Artificial intelligence or intelligent business platforms will support several decisions related to procurement and supply management but all the activities involving evaluations, important decisions, creativity, empathy and leadership shall always be made by humans.



Status of the application of enabling technologies in the EU manufacturing industry.

Summarizing the results of various surveys and information provided by industrial organisations, it is possible to state that:

- most enabling technologies have been adopted by the vast majority of big enterprises generating a rate of connectivity between machines of 15%÷25% (ability of machines to talk to each other and to be remotely controlled and monitored). Germany, the Netherlands and Denmark lead the group of countries that are making the most extensive use of them;

- in the period 2016-2020, thanks also to the subsidies provided by European governments in various forms, SMEs and businesses up to 1.000 employees, have replaced 13%÷35% of their machinery, robots included (50% more than those replaced in 2010-2015), reaching a rate of connectivity between machines of 5%÷12%;

- in the same period of time, companies with 20-49% employees have replaced only 15% of their machinery reaching a rate of connectivity between machines of 2.5%.

Covid-19 Pandemic has frozen most of Industry 4.0 programmes launched by the manufacturing enterprises. Next generation EU recovery fund (2021-2026) is expected to favour the relaunch of digitalisation, especially within SMEs.

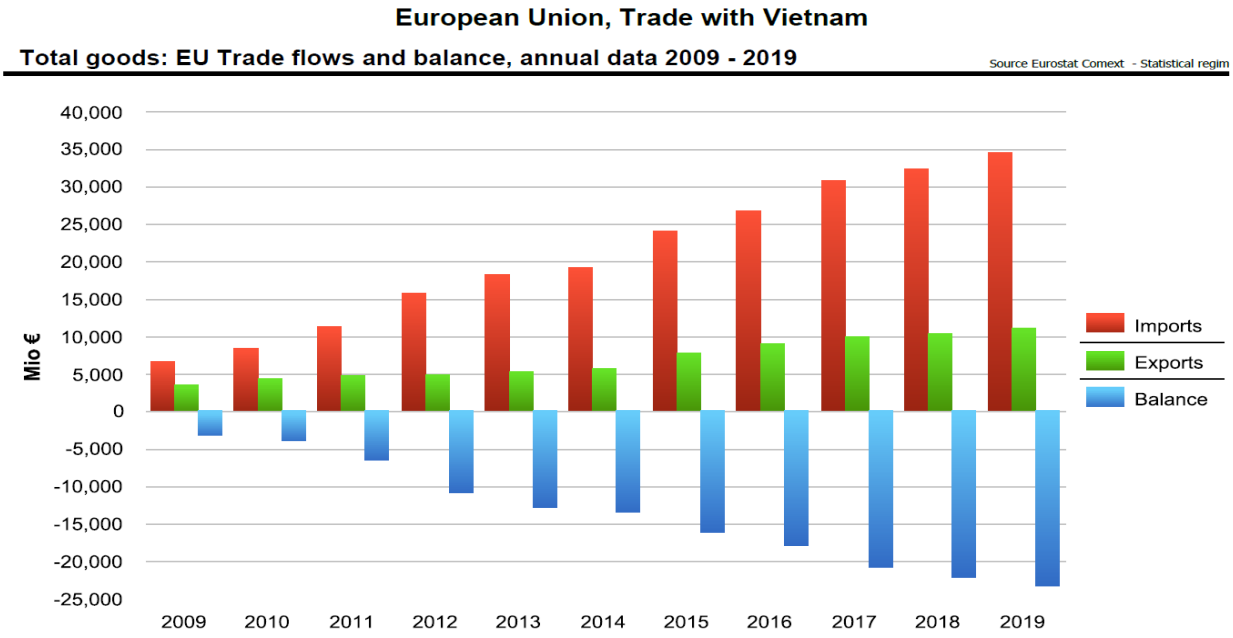
10. Reshoring in Numbers

At the conclusion of the study '*Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy'*, authors say that the empirical evidence on reshoring in the last decade highlights that reshoring processes are on the rise, however, they remain so far limited in scale, with small effects on the EU economy as a whole. The trend of import data of main western economies confirms such conclusion with the exception of the United States that in the last three years have experienced a decline in import volumes from China.

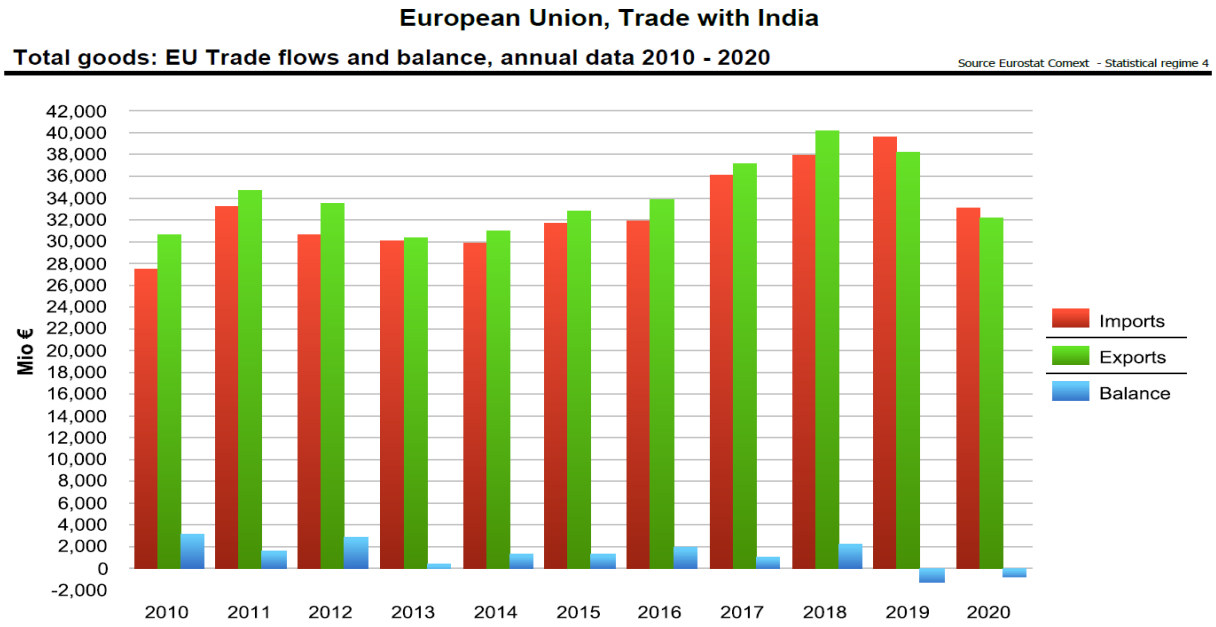
EU Trade in goods with China in billion of euros (Source: Eurostat)

	2010	2012	2014	2015	2016	2017	2018	2019	2020
imports	245.4	250.1	256.5	295.9	298.9	322.8	342.7	363.0	383.4
exports	105.1	132.2	145.1	145.6	153.4	178.8	188.0	198.2	202.6
balance	-140.3	-117.9	-111.4	-150.4	-145.5	-144.0	-154.7	164.8	-180.8

Among EU Member States, the Netherlands was the largest importer of goods from China and Germany was the largest exporter of goods to China in 2020.



Source Eurostat Comex – Statistical Regime 4. 2.6.2021



Source Eurostat Comex – Statistical Regime 4. 2.6.2021

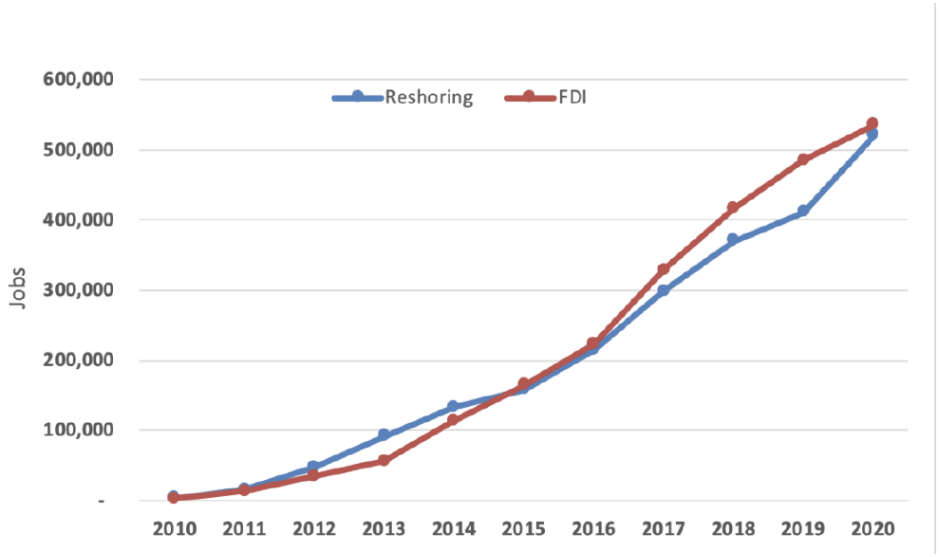
US Trade in goods with China in billion of dollars (Source: US Census Bureau, Sept.2021)

Year	Exports	Imports	Balance
1990	4,806.4	15,237.4	- 10,431.0
1995	11,353.7	45,543.2	- 33,789.5
2000	16,185.2	100,018.2	- 83,833.0
2002	22,127.7	125,192.6	- 103,064.9
2004	34,427.8	196,682.0	- 162,254.3
2006	53,673.0	287,774.4	- 234,101.3
2008	69,732.8	337,772.6	- 268,039.8
2010	91,911.1	364,952.6	- 273,041.6
2012	110,516.6	425,619.1	- 315,102.5
2014	123,657.2	468,474.9	- 344,817.7
2016	115,594.8	462,420.0	- 346,825.2
2018	120,289.3	539,243.1	- 418,953.9
2019	106,447.3	**451,651.4**	- 345,204.2
2020	124,648.5	**435,449.0**	- 310,800.5
2021 Jan-May	58,984.9	**189,689.5**	- 130,704.6

According to the Reshoring Initiative 2020 Data Report, from 2010 to 2020 the reshoring process has brought back about 540,000 jobs[1] in the US. 'When measured by our overall trade deficit of about $500 billion/year, there are still three to four million U.S. manufacturing

jobs offshore at current levels of U.S. productivity, representing a huge potential for U.S. economic growth. Measured by our $900 billion non-petroleum goods trade deficit there are about five million still offshore.' To better understand the above figure one should consider that in 2020 the number of employees of the US private sector manufacturing was 13.884 million (Statista 2021).

Exhibit 1b | **Jobs Announced, Reshoring and FDI, Cumulative 2010-2020**



1. Reshoring from Asia (61%), North America, Europe and Middle East

Based on Reshoring Initiative 2020 Report, reshoring has involved the following industries.

Reshoring + FDI of top 10 industries 2020 vs. 2019						
Rank 2020 by jobs	Industry	Jobs	Companies	Rank 2019 By jobs	Jobs	Companies
1	Transportation equipment	29,185	141	1	38,798	162
2	Medical equipment & supplies	21,421	277	8	3,094	67
3	Chemicals	20,020	224	7	3,630	54
4	Electrical equipment, appliances and components	19,677	122	4	5,534	71
5	Computer and electronic products	13,989	101	3	10,575	114
6	Machinery	10,949	77	2	15.400	126
7	Apparel and textile	7,845	89	6	4,265	21
8	Fabricated metal products	6,438	62	9	3,000	92
9	Food & beverage	4.877	33	5	5,024	53
10	Primary metal products	4,493	36	10	1,529	17

To date most of the reshoring has involved high tech products but the US Commerce Department encourages industry to become competitive on all tech levels to balance the trade deficit. High-Tech products infact represent a relatively small percentage of US imports.

As can be seen from the following tables, the reduction in US imports only affects China and not other Asian countries. This means that the reshoring volumes have been offset by new offshoring. The analysis of the following data has to consider that, due to Covid-19, 2020 figures are not significant.

US Trade in goods with Vietnam in billion of dollars (Source: US Census Bureau, Sept. 2021)

Year	Exports	Imports	Balance
2015	7,100.6	38,014.9	- 30,914.4
2016	10,098.4	42,085.5	- 31,987.1
2017	8,134.1	46,477.4	- 38,343.3
2018	9,675.6	49,158.6	- 39.483.0
2019	10,860.5	66,629.9	- 55,769.4
2020	9,989.4	79,645.0	- 69,655.7
2021 Jan-May	4,872.3	39,734.5	- 34,682.2

US Trade in goods with India in billion of dollars (Source: US Census Bureau, Sept. 2021)

Year	Exports	Imports	Balance
2015	21,452.9	44,782.7	- 23,329.8
2016	21,647.2	46,024.2	- 24,377.0
2017	25,647.8	48,549.4	- 22,901.6
2018	31,191.1	54,282.1	- 21,091.0
2019	34,287.7	57,693.7	- 23,406.0
2020	27,394.6	51,189.7	- 23,795.1
2021 Jan-May	15,408.8	27,697.8	- 12,288.0

US Trade in goods with Thailand in billion of dollars (Source: US Census Bureau, Sept. 2021)

Year	Exports	Imports	Balance
2015	11,228.8	28,622.2	- 17,393.4
2016	10,501.1	29,484.1	- 18,983.0
2017	11,033.5	31,108.5	- 20,075.0
2018	12,524.8	31,872.7	- 19.347.9
2019	13,303.1	33,433.5	- 20,140,4
2020	11,276.5	37,610.8	- 26,334.3
2021 Jan-May	5,350.0	18,538.3	- 13,188.3

US Trade in goods with Indonesia in billion of dollars (Source: US Census Bureau, Sept. 2021)

Year	Exports	Imports	Balance
2015	7,118.1	19,605.2	- 12,487.1
2016	6,024.3	19,184.0	- 13,159.7
2017	6,863,6	20,205.1	- 13,341,5
2018	8,171.0	20,824.5	- 12,653.6
2019	7,731.3	20,108.5	- 12,377.2
2020	7,395.6	20,214.8	- 12,819.1
2021 Jan-May	3,391.3	10,172.8	- 6,271.5

US Trade in goods with Philippines in billion of dollars (Source: US Census Bureau)

Year	Exports	Imports	Balance
2015	7,903.1	10,231.6	- 2,328.5
2016	8,193.7	10,042.4	- 1,848.7
2017	8,450.6	11,622.7	- 3,172.1
2018	8,715.9	12,586.9	- 3,871.0
2019	8,641.0	12.633.8	- 4,022.8
2020	7,738.8	11,139.3	- 3,400.5
2021 Jan-May	3,491.9	5,283.1	- 1,791.2

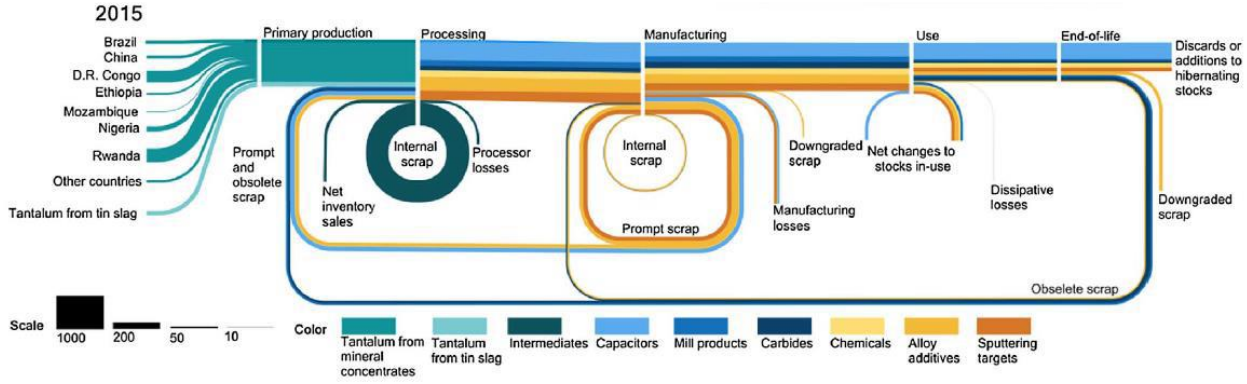
11. Critical Minerals and Raw Materials

Sources: Building Resilient Supply Chain, Revitalizing American Manufacturing, and Fostering Broad-Based Growth under Executive Order 14017 June 2021
Communication from the Commission to the European Parliament, the Council, the European Economic and Social Commitee and the Committee of the Regions
'Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability' COM/2020/474 final.

Strategic and critical materials and their supply chains are the bedrock of value-added manufacturing and the development, production, delivery, and sustainment of essential services, such as telecommunications and computing, food and agriculture, finance, healthcare, education, transportation, and public safety. Their supply chains are at serious risk of disruption from natural disasters or force majeure events.

The supply chain for strategic and critical materials generally begins with mining the raw material. Open pit or underground mining techniques are used to extract ore, which is then crushed and ground into a size that enables its separation into metal oxides and or other chemical forms (e.g., halides). Some strategic and critical materials, such as lithium, may be extracted by in-situe mining and extraction techniques. After this beneficiation or concentration process, the material is smelted or refined using electrolytic or pyrometallurgical processes to produce a purified powder, metal, or other material in a semi-final form. Final steps include further refining, manufacturing, cutting, and polishing into a semi-finished or finished product with unique material properties depending on the material's final use.

Material flow analyses are an important tool to cross-walk the above processing steps to global production and demand for strategic and critical materials from primary sources (e.g., mining) as well as the in-process and post-consumer recycling of strategic and critical materials. Analysis of potential supply shortages, supply diversification and security, resource efficiency, and the potential for future recycling is facilitated by such studies. The flow of materials through the various stages of a supply chain can be illustrated using a Sankey diagram, an example of which is shown in the figure below for tantalum.



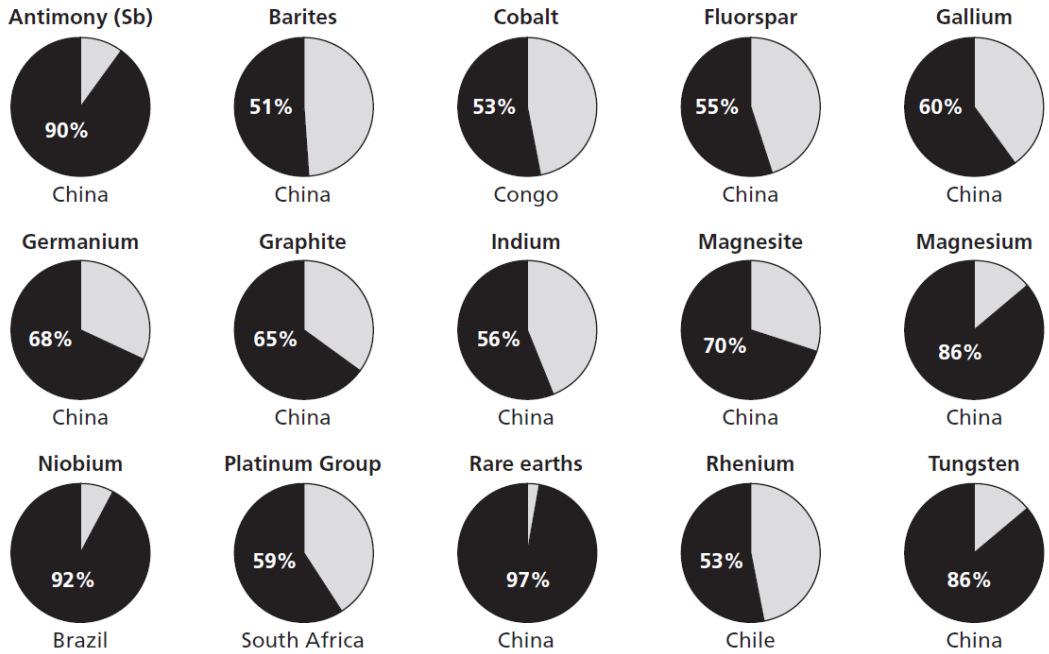
Tantalum is a strategic and critical material used in the electronics market, in the form of tantalum capacitor and wire products, but it is also used in aerospace alloys and electronics.

The need for strategic and critical materials is likely to intensify, in so far as these materials also enhance or enable the performance of many environmentally friendly "green" technologies, such as electric vehicles, wind turbines, and advanced batteries. A recent report by the International Energy Agency (IEA) notes: "A typical electric car requires six times the mineral inputs of a conventional car and an onshore wind plant requires nine times more mineral resources than a gas-fired plant. Since 2010, the average amount of minerals needed for a new unit of power generation has increased by 50 percent as the share of renewables in new investment has risen."
In brief, the challenges and opportunities in strategic and critical material supply chains are emblematic of the intense geopolitical competition of the 21st century.

In 1954 the mineral commonly used were 21, in 1984, 46, and in 2019, 58.

China produces more than 50% of of 11 of these key materials

Figure S.1
Percentage of Global Production (Mining) of Key Materials Within a Single Country



SOURCE: U.S. Geological Survey, *Minerals Commodity Summaries*, Pittsburgh, Penn.: U.S. Government Printing Office, 2012; International Organizing Committee for the World Mining Congresses, *World Mining Data*, Vol. 26, 2011.

RAND *RR133-S.1*

1. Report on: Critical Materials, Present Danger to US Manufacturing by Richard Silberglitt, James T. Bartis, Brian G.Chow, David L.An, and Kyle Brady, 2013.

Figure 5: Downstream Applications for Rare Earth Elements

Element		Major Applications
LREE	Lanthanum	Fluid catalytic cracking for petroleum refining, nickel metal hydride (NiMH) batteries, metallurgical applications, glass and polishing ceramics lighting.
	Cerium	Automobile catalysts and additive, FCC additives, catalysts, metallurgy, polishing, powders and glass and others such as fertilizer, paint drying, and a stabilizer in plastics. Applications often overlap with lanthanum.
	Praseodymium	NdFeB, metallurgical applications, pigments, batteries, and catalysts.
	Neodymium	NdFeB magnets, glass and ceramics applications such as ceramic capacitors, metallurgical applications such as a minor alloying element for iron and steel alloys and magnesium alloys, luminophores, and other applications such as NiMH batteries, catalysts, and lasers. NdFeB magnets are used in products such as computer hard disk drives, magnetic resonance imaging (MRI), precision guided munitions, automotive motors, wind turbines, and loudspeakers.
	Samarium	Samarium cobalt permanent magnets, which are used in electronics (including military systems), automobiles, aerospace, pumps, and medical devices. Other applications include infrared absorption glass, optical glass, fuel cells, for nuclear applications, and capacitors for microwave frequencies.
HREE	Europium	Phosphors and luminophores, which are used in TV and computer screens, compact fluorescent lighting, light emitting diodes (LEDs), and sensors. Other applications include nuclear and medical applications and for some specialty alloys and lasers.
	Gadolinium	Metallurgical applications such as magnetic refrigeration, magnesium alloys, and specialty alloys. Also used in small amounts for samarium cobalt magnets. Other uses include MRI contrasting agent and phosphors for dental and medical applications.
	Terbium	Phosphors (green) for displays, LEDs, and in medical applications, in permanent magnets, and for other applications such as high-temperature fuel cells, lasers, and magnetostrictive alloys for solid-state transducers and actuators used in sonar and other dual use technologies.
	Dysprosium	Neodymium iron boron permanent magnets in which it makes up generally about 0.8 percent to 1.2 percent by weight of the magnet; magnetostrictive alloys.
	Holmium	Magnets, magnetostrictive alloys for sensors and actuators.
	Erbium	Nearly all erbium is used in polishing and in highly specialized glass lens applications and fiber optics.
	Thulium	Portable X-ray devices, research, and a dopant in solid-state lasers and highly specialized fiber optics.
	Ytterbium	Metallurgical applications for rare earth magnesium alloys and specialty aluminum alloys.
	Lutetium	Used in medical equipment and small quantities in phosphors.
	Yttrium	Yttrium-stabilized zirconia (YSZ) ceramics, phosphors, and metallurgy. Some specific applications include thermal barrier coatings, lasers, oxygen sensors, and solid electrolytes for solid oxide fuel cells (SOFCs). Phosphors, optical glasses, rotary-wing aircraft alloys, and nickel-metal hydride (NiMH) batteries.
	Scandium	Solid oxide fuel cells (SOFC), aluminum alloys for aerospace and sporting goods, scandium-sodium lamps for outdoor venues, laser, optoelectronic materials, LEDs.

Three of these materials (rare earths [REs], antimony, and tungsten) are difficult to substitute without significantly increasing the cost or decreasing the performance of the products they are used to make. REs are used in lasers and many components of electronic devices and defense systems, antimony is critical to flame retardant plastics and textiles, and tungsten is used to produce cemented carbides for cutting tools used in many industries.

The increases in export restrictions initially focused almost solely on REs and tungsten, but in 2007 and 2008 broadened to include other materials. The combined effect

of export restrictions and worldwide demand for these materials has contributed to significant increases in their price and, in some cases, volatility on the world market. For example, the price of rare earth metals doubled from 2010 to 2011, while prices of some elements, such as lanthanum and cerium (both REs), reportedly rose as much as 900 percent. Prices of antimony and tungsten more than doubled over this same period.

The supply chain impact of deploying clean technologies at scale are significant and will require secure, reliable access to strategic and critical materials materials. Examples of mineral-based clean technologies include rare earth elements for permanent magnets in electric vehicles and wind turbines; battery grade cobalt, lithium, manganese, nickel, and graphite for vehicle batteries and grid storage; gallium and many other materials for semiconductors used in LEDs and power electronics used in wind and solar systems; and magnesium and aluminum for vehicle lightweighting.

Since 2011 the European Commission has underlined the importance of a reliable and not difficult access to certain raw materials and has prepared a list of the critical ones[1]. For the EU Commission, Critical Raw Materials (CRMs) are those which are economically and strategically important for the European economy, but have a high-risk associated with their supply. Used in environmental technologies, consumer electronics, health, steel-making, defence, space exploration, and aviation, these materials are not only 'critical' for key industry sectors and future applications, but also for the sustainable functioning of the European economy. They are classified as 'critical' because:

- they have a significant economic importance for key sectors in the European economy, such as consumer electronics, environmental technologies, automotive, aerospace, defence, health and steel,

- they imply a high-supply risk due to the high import dependence and high level of concentration of such critical raw materials in a few countries,

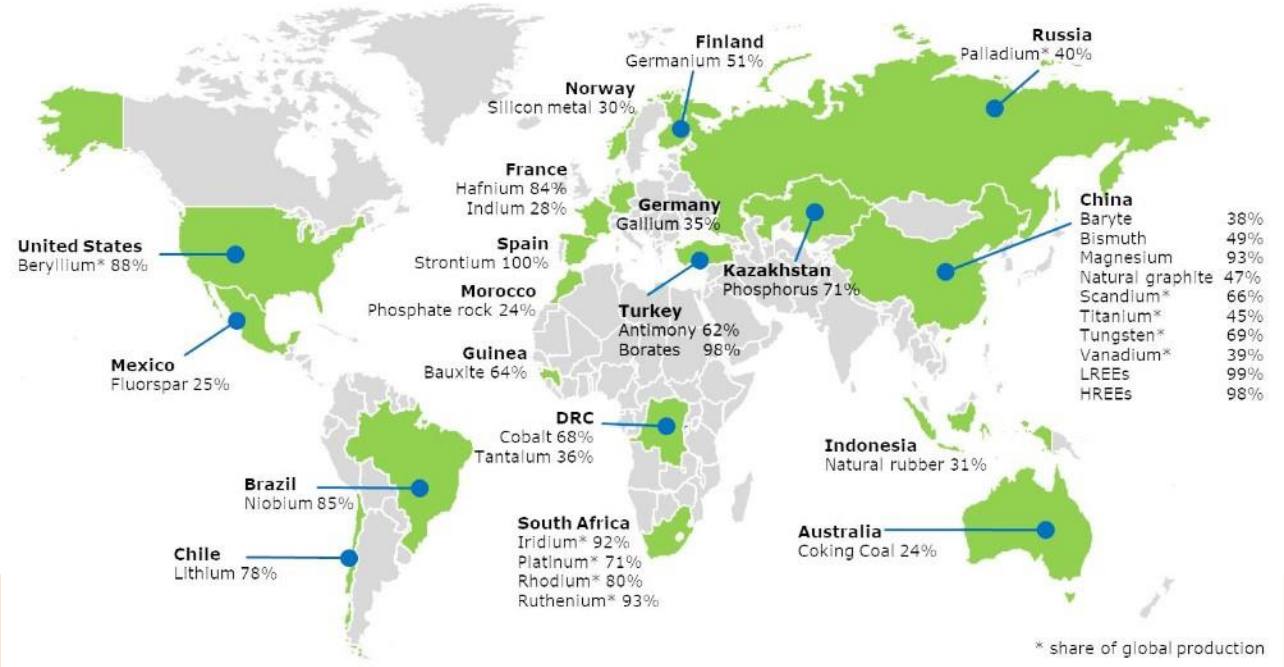
- there is a lack of (viable) substitutes, due to their very unique and reliable properties for existing, as well as future applications.

- CRMs are used for exemple, in: thin photovoltaic cells, wind turbine generators, lithium-ion batteries (hybrid and electric cars).

The supply of many critical raw materials is highly concentrated. For example, China provides 98 % of the EU's supply of rare earth elements (REE), Turkey provides 98% of the EU's supply of borate, and South Africa provides 71% of the EU's needs for platinum and an even higher share of the platinum group metals iridium, rhodium, and ruthenium. The EU relies on single EU companies for its supply of hafnium and strontium.

1. First list of 14 CRMs in 2011, second list in 2014 with 20 CRMs, third list in 2017 with 27 CRMs, forth list in 2020 with 43 CRMs. Last list reproduced in next page.

Biggest supplier countries of CRMs to the EU



EU list of Critical Raw materials

Material		Stage[13]	Main global supplier	Share	Material		Stage	Main global supplier	Share
1	Antimony	P	China	87%	23	Natural graphite	E	China	69%
2	Baryte	E	China	44%	24	Natural Rubber	E	Thailand	32%
3	Beryllium	E	USA	90%	25	*Neodymium*	E	China	95%
4	Bismuth	P	China	82%	26	Niobium	P	Brazil	90%
5	Borate	E	Turkey	38%	27	*Palladium*	P	Russia	46%
6	*Cerium*	E	China	95%	28	Phosphate rock	E	China	44%
7	Cobalt	E	DRC	64%	29	Phosphorus	P	China	58%
8	*Dysprosium*	E	China	95%	30	*Platinum*	P	S. Africa	70%
9	*Erbium*	E	China	95%	31	*Praseodymium*	E	China	95%
10	*Europium*	E	China	95%	32	*Rhodium*	P	S. Africa	83%
11	Fluorspar	E	China	64%	33	*Ruthenium*	P	S. Africa	93%
12	*Gadolinium*	E	China	95%	34	*Samarium*	E	China	95%
13	Gallium*	P	China	73%	35	Scandium	P	China	66%
14	Germanium	P	China	67%	36	Silicon metal	P	China	61%
15	Hafnium	P	France	43%	37	Tantalum	E	Rwanda	31%
16	Helium	P	USA	73%	38	*Terbium*	E	China	95%
17	*Holmium*	E	China	95%	39	*Thulium*	E	China	95%
18	Indium	P	China	56%	40	Tungsten	E	China	84%
19	*Iridium*	P	S. Africa	85%	41	Vanadium	P	China	53%
20	*Lanthanum*	E	China	95%	42	*Ytterbium*	E	China	95%
21	*Lutetium*	E	China	95%	43	*Yttrium*	E	China	95%
22	Magnesium	P	China	87%					

Legend	
Stage	E = Extraction stage P = Processing stage
HREEs	Dysprosium, erbium, europium, gadolinium, holmium, lutetium, terbium, thulium, ytterbium, yttrium
LREEs	Cerium, lanthanum, neodymium, praseodymium and samarium
PGMs	Iridium, palladium, platinum, rhodium, ruthenium

*Global supply calculation based on production capacity.

12. Drivers and pitfalls of globalisation

Source: Post Covid-19 value chains: options for reshoring production back to Europe in a globalised economy
World Investment Report 2020: International Production Beyond the Pandemic
UNCTAD and Research made by ADACI

Liberal economic doctrine has consistently argued that decisions on the place of production should be left exclusively to market actors and ought to be based on considerations of efficiency, thus maximizing the gains from the international division of labour (Slobodian, 2018). Globalisation, driven by the interest of the transnatinal corporations (TNCs) that control the 80% of the global trade, has resulted in reduced employment in the core countries and has impacted the distribution of income (Dorn and Hanson, 2013; Milanović, 2016).

With the renaissance of the geopolitical age, world trade is limited by the national sovereignty and autonomy, and multilateralism needs new governance rules. This is highlighted by the marginalisation of the WTO, the rise of bilateralism in trade policy, and, more recently, by the 'trade war' between the US and China.

The literature on GVCs departs from the assumption that the international division of labour and its forms of governance are ultimately driven by the interests and decisions of the TNCs. The decisions of these corporations, regarded as increasingly transnationalised actors, detached from nation-states, are mainly driven by economic imperatives without considering the social cost of production. **Multilateralism has been experiencing a crisis of legitimacy.** Over the last two decades, the liberal international order, well established until 2000, has begun to show signs of erosion. In the geopolitical age, trade is connected to national security, and exports of advanced technology risk to undermine the superiority of the exporting country.

The renaissance of geopolitics can be considered a consequence of the pitfalls of the globalisation that have evolved within the liberal international order over the last four decades. After the Asian financial crisis of the '90s, the debate about 'the end of globalisation' and the need to review of global production arrangements has become rather strong. To remedy the aforementioned pitfalls, EU commission suggests:

- to reform the WTO and support multilateralism for sustainable development,
- to rebuild the transatlantic partnership and engage with a range of partners to promote dialogue and cooperation and address common challenges together
- the adoptioan of anti-coercion measures to respond to coercive practices by non-EU countries.

13. Convergence of world wages and productivity

Sources: Wage Convergence and Trade by Yixiao Zhou Australian National University and Harry Bloch Curtin University, 2019
The Reshoring initiative USA 2020
Forbes 2017: China Wage Levels Equal To or Surpass Parts of Europe Kenneth Rabosa
ADACI R&D Committee research

The trade liberalisation promoted in the 80s by Ronald Regan and Margaret Thatcher favoured the offshore delocalisation of production. The key drivers of such delocalisation were:

- lower labour cost,
- lower cost of industrial electricity (compared to European cost),
- specialisation and productivity,
- economies of scale,
- custom and fiscal benefits associated to FDI, particularly in the Special Economic Zones (SEZs).

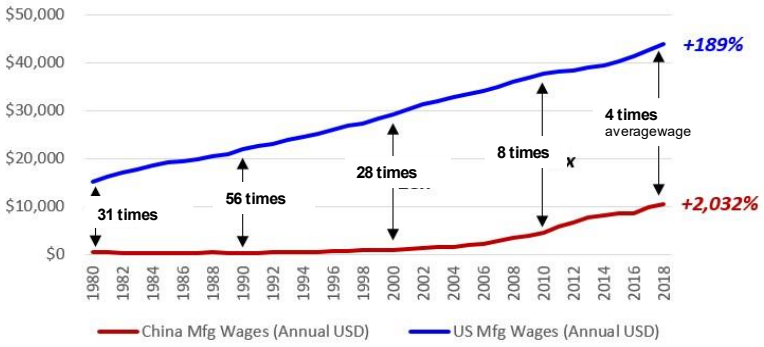
After a few decades the advantages of offshore relocation have diminished, and in particular there has been a remarkable convergence of wages[1].
Convergence of PPP adjusted real wage rates varies in relation to low-skill, medium-skill and high-skill workers and for the different type of services and manufacturing industries. The paper of Yixiao Zhou and Harry Curtin provides evidence of a strong convergence across countries in the wage rates of workers of the same skill group within the same industry classification. Rates of convergence are very similar for workers of all three skill levels, and are in the order of about 4% per annum. There is also evidence of non-convergence for wages of low-skill workers in large late-industrialised countries including the BRIC economies plus Indonesia and Mexico, suggesting comparatively underdeveloped technology or human capital lead to relatively low wages in the long run.

The table reproduced below shows the changes of the average wage in manufacturing that took place in forty years in the USA and China. Based on the data provided by 'The Reshoring Initiative USA'. In 1980 the ratio between American and Chinese blue collar wage was 31 times, while in 2018 it was only 4 times. In addition to the data of the Reshoring Initiative, ADACI has compared the wages paid in the big Chinese cities published by the National Bureau of Statistics of China, with the american ones published by the US Bureau of Labor Statistics, and has realised that in 2021 the above ratio is 2.63 times.

1. In addition, Reshoring Initiative 2020 Data Report highlights awareness of the previously "hidden costs".

Wage convergence USA-China from 1980 to 2020

"The Reshoring Initiative USA"



2021: 2.63 times USA/CHINA

2021: 0.612 ÷ 3.931 EU/CHINA

Average annual blue collar wages in US and China $ 2.9.2021			
USA $ 35,073 working hours 1,767		**China $ 13,341** working hours 1,792	
San Francisco	43,625	Shanghai	17,275
Boston	40,898	Beijing	16,977
Chicago	37,000	Guangzhou	16,623
Philadelphia	36,940	Shenzhen	14,904

USA production costs:

40% higher than China

15% higher than Germany

Reshoring Initiative 2020 Data Report

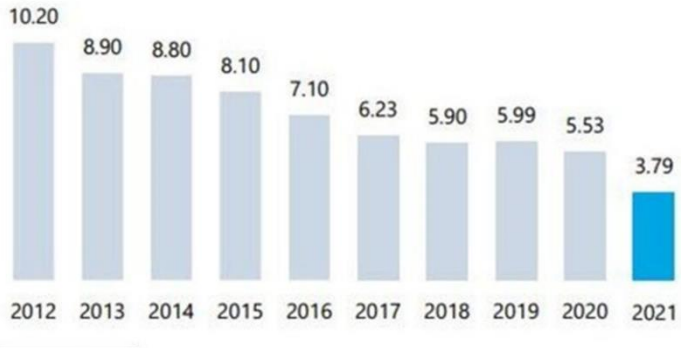
Average annual wage of Chinese urban employee **$ 17,852**

ADACI Sept. 2021

The graph below shows the average wage increase paid to their employees by German companies operating in China from 2012 to 2020. Its magnitude is consistent with the above rate of convergence of 4% per annum.

Expected Wage Growth Development at German Companies in China

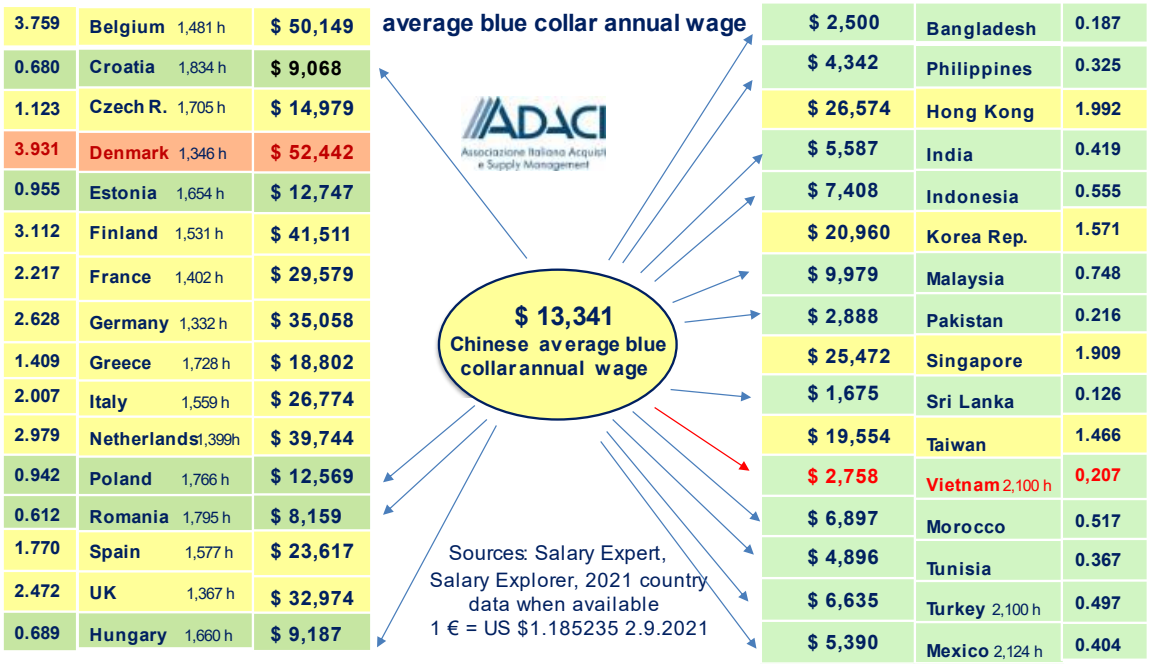
2012-2021, Nominal Growth, in %



In each edition, the expected wage growth is the average of all the individual positions' expected wage growth collected in the survey. In 2020, with a total of 576 companies and 39 different roles, the number of observations collected amounted to 7,307.

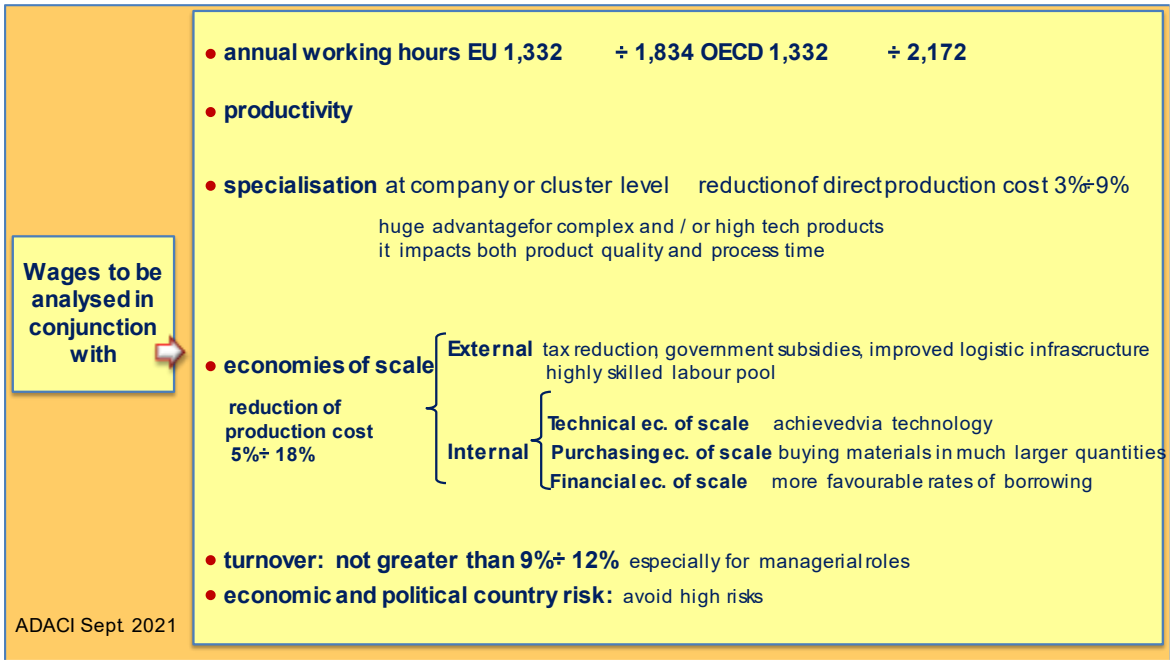
The wage ratio EU-China varies from 0.612 to 3.931. This means that in some European countries wages are lower than the Chinese ones, but they have neither a high internal market demand nor specialised industrial clusters.

In Vietnam the cost of manpower is still very low and the Vietnamese industrial infrastructure gets better every year. Many American companies have recently shifted their supplies from China to Vietnam.



First and last column: wage ratio of the annual salary of the country considered and that of China.Second and fifth column: country considered and annual working hours (when published). Third and fourth column: average blue collar annual wage on sept. 2021 expressed in US dollar.

To get an exhaustive picture of the country's competitiveness, buyers, in addition to the wages, should to consider the average working hours per month, the productivity of the country and of the industrial sector considered, the impact of specialisation and economies of scale.

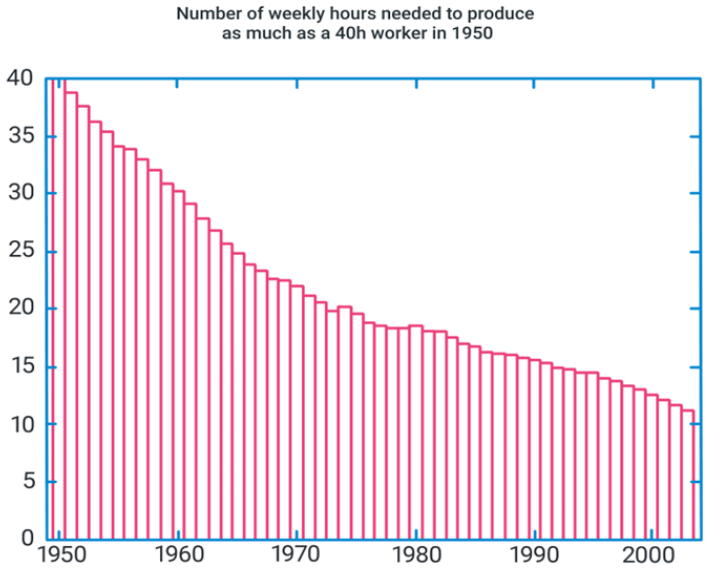


Average usual annual and weekly hours worked in 2020 (OECD.Stat July 2021)

Country	year	week	Country	year	week
Australia	1683	35.7	Luxembourg	1427	37.3
Austria	1400	35.5	Mexico	2124	44.7
Belgium	1481	35.5	Netherlands	1399	29.5
Canada	1644	-	New Zealand	1739	37.8
Chile	1825	42.9	Norway	1639	33.6
Colombia	**2172**	**47.6**	Poland	1766	39.6
Costa Rica	1913	43.9	Portugal	1613	39.3
Czech Republic	1705	39.3	Slovak Republic	1572	39.2
Denmark	1346	32.5	Slovenia	1515	39.3
Estonia	1654	37.9	Spain	1577	36.4
Finland	1531	36.3	Sweden	1424	36.0
France	1402	36.5	Switzerland	1495	34.6
Germany	**1322**	**34.3**	Turkey	-	45.6
Greece	1728	38.7	United Kingdom	1367	36.3
Hungary	1660	39.3	United Staes	1767	38.7
Iceland	1435	39.7	OECD countries	1687	37.0
Ireland	1746	35.6			
Israel	1783	40.6			
Italy	1559	35.5			
Japan	1598	-			
Korea	1908	-			
Latvia	1577	38.9			
Lithuania	1595	39.0			

Productivity

OECD measures productivity in term of GDP per hour worked. According to its records productivity has been increasing exponentially for more than a century. An average worker today needs to work a 11h/week to produce as much as one working 40h/week in 1950. But fast productivity growth has not necessarily reduced work time.



Gross domestic product (GDP) per hour worked in OECD member countries in 2019
(in constant 2010 PPP** U.S. dollars)

Ireland	102.69	Luxembourg	94.75
Norway	84,25	Denmark	74.97
Switzerland	74.44	Belgium	72.00
US	71.78	Sweden	69.91
Austria	68.63	Netherlands	67.63
France	67.52	Germany	66.36
Icelands	64.11	Finland	61.51
UK	58.38	Australia	55.05
OECD total	54.53	Italy	53.46
Canada	52.68	Spain	52.51
Japan	46.78	Turkey	45.38
Slovenia	45.35	Slovakia	43.83
Lithuania	42.83	Israel	42.26
Czech Republic	42.02	New Zealand	41.71
Poland	41.12	Estonia	40.98
Korea	40.49	Portugal	40.07
Hungary	38.06	Latvia	37.13
Croatia	35.13	Greece	33.88
Romania	33.85	Chile	27.09
Russia	26.45	Bulgaria	26.02
Costa Rica	21.86	Mexico	20.31
South Africa	19.94		

The only index that gives an idea of the country productivity of most world countries, is the ‘Global Competitivenss Index 4.0’ published by the World Economic Forum.

The index is an annual yardstick for policy-makers to look beyond short-term and reactionary measures and to instead assess their progress against the full set of factors that determine productivity. These are organised into 12 pillars: Institutions; Infrastructure; ICT adoption; Macroeconomic stability; Health; Skills; Product market; Labour market; Financial system; Market size; Business dynamism; and Innovation capability. Covering 141 economies, it measures national competitiveness, defined as the set of institutions, policies and factors that determine the level of productivity.

The Global Competitiveness Index 4.0 refers to countries and not to their manufacturing industry. In addition, within the same industrial sector of every country, the rate of productivity varies significantly. ADACI believes that this index should be considered when companies arrange joint ventures or long-term agreements for complex supplies. In these

cases in fact most of the twelve pillars that characterise the index may be involved and may impact the timing and the ROI of the project.

Rank economy	score	Rank economy	score	Rank economy	score
1. Singapore	84.8	48. Mexico	64.9	95. Kenya	54.1
2. United States	83.7	49. Bulgaria	64.9	96. Kyrgyz Republic	54.0
3. Hong Kong SAR	83.1	50. Indonesia	64.6	97. Paraguay	53.6
4. Netherlands	82.4	51. Romania	64.4	98. Guatemala	53.5
5. Switzerland	82.3	52. Mauritius	64.3	99. Iran, Islamic Rep.	53.0
6 Japan	82.3	53. Oman	63.6	100. Rwanda	52.8
7. Germany	81.8	54. Uruguay	63.5	101. Honduras	52.7
8. Sweden	81.2	55. Kazakhstan	62.9	102. Mongolia	52.6
9. United Kingdom	81.2	56. Brunei Darussalam	62.8	103. El Salvador	52.6
10. Denmark	81.2	57. Colombia	62.7	104. Tajikistan	52.4
11. Finland	80.2	58. Azerbaijan	62.7	105. Bangladesh	52.1
12. Taiwan, China	80.2	59. Greece	62.6	106. Cambodia	52.1
13. Korea, Rep.	79.6	60. South Africa	62.4	107. Bolivia	51.8
14. Canada	79.6	61. Turkey	62.1	108. Nepal	51.6
15. France	78.8	62. Costa Rica	62.0	109. Nicaragua	51.5
16. Australia	78.7	63. Croatia	61.9	110. Pakistan	51.4
17. Norway	78.1	64. Philippines	61.9	111. Ghana	51.2
18. Luxembourg	77.0	65. Peru	61.7	112. Cape Verde	50.8
19. New Zealand	76.7	66. Panama	61.6	113. Lao PDR	50.1
20. Israel	76.7	67. Viet Nam	61.5	114. Senegal	49.7
21. Austria	76.6	68. India	61.4	115. Uganda	48.9
22. Belgium	76.4	69. Armenia	61.3	116. Nigeria	48.3
23. Spain	75.3	70. Jordan	60.9	117. Tanzania	48.2
24. Ireland	75.1	71. Brazil	60.9	118. Côte d'Ivoire	48.1
25. United Arab Emirates	75.0	72. Serbia	60.9	119. Gabon	47.5
26. Iceland	74.7	73. Montenegro	60.8	120. Zambia	46.5
27. Malaysia	74.6	74. Georgia	60.6	121. Eswatini	46.4
28. China	73.9	75. Morocco	60.0	122. Guinea	46.1
29. Qatar	72.9	76. Seychelles	59.6	123. Cameroon	46.0
30. Italy	71.5	77. Barbados	58.9	124. Gambia, The	45.9
31. Estonia	70.9	78. Dominican Republic	58.3	125. Benin	45.8
32. Czech Republic	70.9	79. Trinidad and Tobago	58.3	126. Ethiopia	44.4
33. Chile	70.5	80. Jamaica	58.3	127. Zimbabwe	44.2
34. Portugal	70.4	81. Albania	57.6	128. Malawi	43.7
35. Slovenia	70.2	82. North Macedonia	57.3	129. Mali	43.6
36. Saudi Arabia	70.0	83. Argentina	57.2	130. Burkina Faso	43.4
37. Poland	68.9	84. Sri Lanka	57.1	131. Lesotho	42.9

38. Malta	68.5	85. Ukraine	57.0	132. Madagascar	42.9
39. Lithuania	68.4	86. Moldova	56.7	133. Venezuela	41.8
40. Thailand	68.1	87. Tunisia	56.4	134. Mauritania	40.9
41. Latvia	67.0	88. Lebanon	56.3	135. Burundi	40.3
42. Slovak Republic	66.8	89. Algeria	56.3	136. Angola	38.1
43. Russian Federation	66.7	90. Ecuador	55.7	137. Mozambique	38.1
44. Cyprus	66.4	91. Botswana	55.5	138. Haiti	36.3
45. Bahrain	65.4	92. Bosnia and Herzegovina	54.7	139. Congo, Dem. Rep.	36.1
46. Kuwait	65.1	93. Egypt	54.5	140. Yemen	35.5
47. Hungary	65.1	94. Namibia	54.5	141 Chad	35.1

1. Due to the impact of Covid-19 Pandemic on global economy, the 2020 index has not been published

Specialisation

As already underlined, the value added brought by the cluster[1] specilisation has to be evaluated on a case by case basis. The more complex and/or high tech a product is, the greater the competitive advantage of specialisation, which impact both product quality and process time. Specialisation has to be seen as the combined added value ensured by the network of integrated companies that form the cluster. It can reduce the direct production costs by 3%÷9%.

Economies of scale

Economies of scale refer to the cost advantage experienced by a firm when it increases its level of output. The advantage arise due to the inverse relationship between per-unit fixed cost and the quantity produced. The greater the quantity of output produced, the lower the per-unit fixed cost.

Economies of scale also benefit from a greater efficiency, more integrated technology and more automated machinery. Also in this case their added value has to be evaluated on a case by case basis. It can reduce the production costs by 5%-18%.

Some industrial clusters benefit from both specialisation and economies of scale.

There are two main types of economies of scale: **external and internal**.

External economies of scale depend on external factors, or factors that affect an entire industry such as: tax reductions, government subsidies, improved transportation network, or a highly skilled labour pool.

1. In Italy we call it industrial ‘distretto’ meaning by such an agglomeration of companies, generally of small and medium size, located in a limited and historically determined territorial area, specialised in one or more production processes and integrated through a complex network of economic and social relationships

Internal economies of scale are controlled by the company. They can occur any time a company cuts costs, from buying in bulk and investing in state-of-the-art machinery to accessing extra financial capital and hiring a specialised workforce. They include:

- **technical economies of scale** achieved via technology. Larger businesses more readily have the capital to invest in newer and better technology, which can bring them cost advantages smaller businesses are otherwise unable to achieve;

- **purchasing economies of scale**, also called buying economies of scale, achieved via buying in bulk. That is, larger businesses more readily have the cash to warrant buying materials in much larger quantities, which can bring them per-unit cost advantages smaller businesses are otherwise unable to achieve,

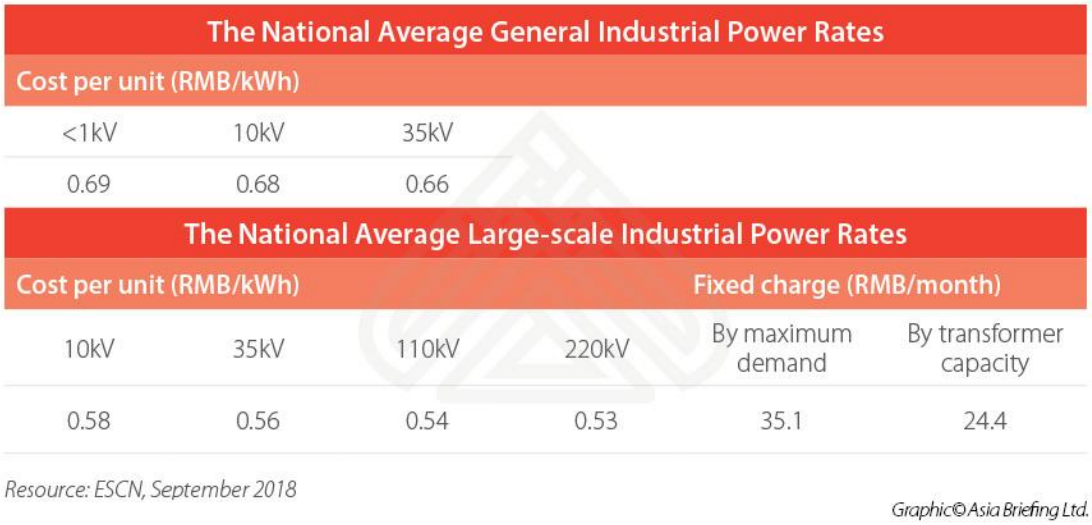
- **financial economies of scale** that enable more favourable rates of borrowing. That is, larger businesses are seen by lenders as more reliable or worthy of credit due to their size, whereas smaller businesses will tend to pay higher rates of interest.

14. Benchmark on industrial electricity costs

In the last three decades, the energy price gap between China and west industrialised countries has remained virtually unchanged. With reference to the data published by: Eurostat, U.S. Bureau of Statistics and China Briefing Dezan Shira & Associates, the price per kwh of elecriticy for industrial consumers in 2019 was:

China: $ 0.0892 USA: $ 0.0665 EU27: $ 0,1524

The table below indicates the Chinese National Average General Power Rates and the Large-Scale Industrial ones.



The National Average General Industrial Power Rates		
Cost per unit (RMB/kWh)		
<1kV	10kV	35kV
0.69	0.68	0.66

The National Average Large-scale Industrial Power Rates					
Cost per unit (RMB/kWh)				Fixed charge (RMB/month)	
10kV	35kV	110kV	220kV	By maximum demand	By transformer capacity
0.58	0.56	0.54	0.53	35.1	24.4

Resource: ESCN, September 2018

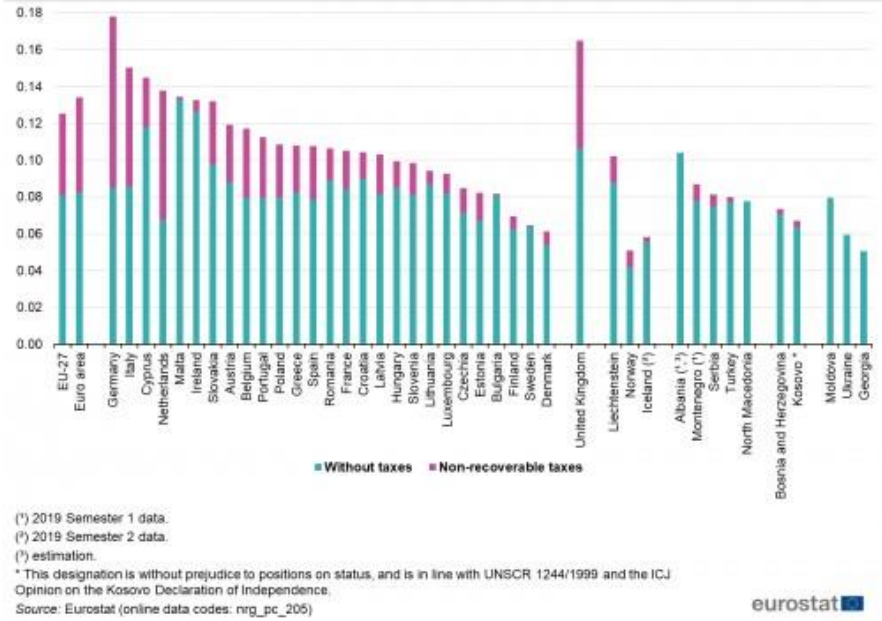
Graphic© Asia Briefing Ltd.

Average USA Price of Electricity to Ultimate Customers (cents per Kilowatt hour)

Year	Residential	Commercial	Idustrial	Transportation	All sectors
2010	11.54	10.19	6.77	10.56	9.83
2011	11.72	10.24	6.82	10.46	9.90
2012	11.88	10.09	6.67	10.21	9.84
2013	12.13	10.26	6.89	10.55	10.07
2014	12.52	10.74	7.10	10.45	10.44
2015	12.65	10.64	6.91	10.09	10.41
2016	12.55	10.43	6.76	10.20	10.27
2017	12.89	10.66	6.88	9.63	10.48
2018	12.87	10.67	6.92	9.68	10.53
2019	13.01	10.68	6.81	9.70	10.54
August 2020	13.31	10.95	7.09	10.20	11.11

The table below indicates the electricity price for industrial use charged by the member countries of the EU and by other countries in the first half of the 2020.

Electricity Price for industrial use, first half 2020 € per kWh



(1) 2019 Semester 1 data.
(2) 2019 Semester 2 data.
(3) estimation.
* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
Source: Eurostat (online data codes: nrg_pc_205)

eurostat

1 RMB = 0.15 US $ 15.11.2020
1 € = US $1.20 27.11.2020

Cina		**$ 0,0892**
USA		**$ 0,0665**
EU-27	€ 0,127	**$ 0,1524**
Germany	€ 0,178	**$ 0. 2136**
Italy	€ 0,152	**$ 0.1824**
France	€ 0,114	**$ 0.1368**
Denmark	€ 0.061	**$ 0.0732**
UK	€ 0.164	**$ 0.1968**

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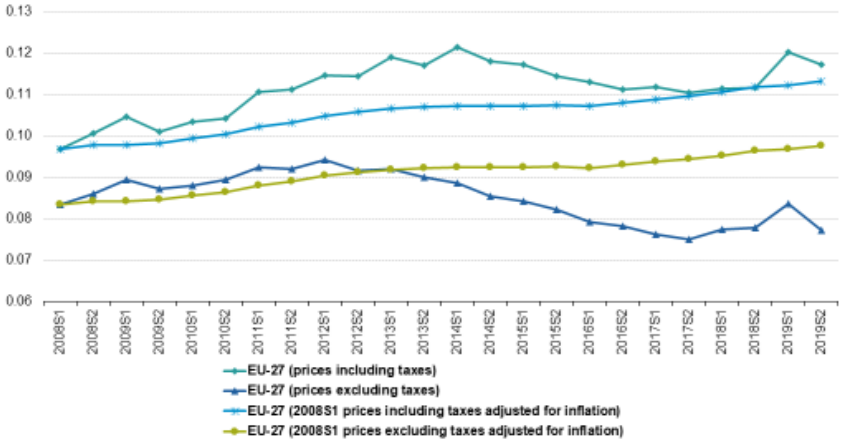
Development of electricity prices for non-household consumers, 2008-2019
(EUR per kWh)



Source: Eurostat (online data code: nrg_pc_205)

eurostat

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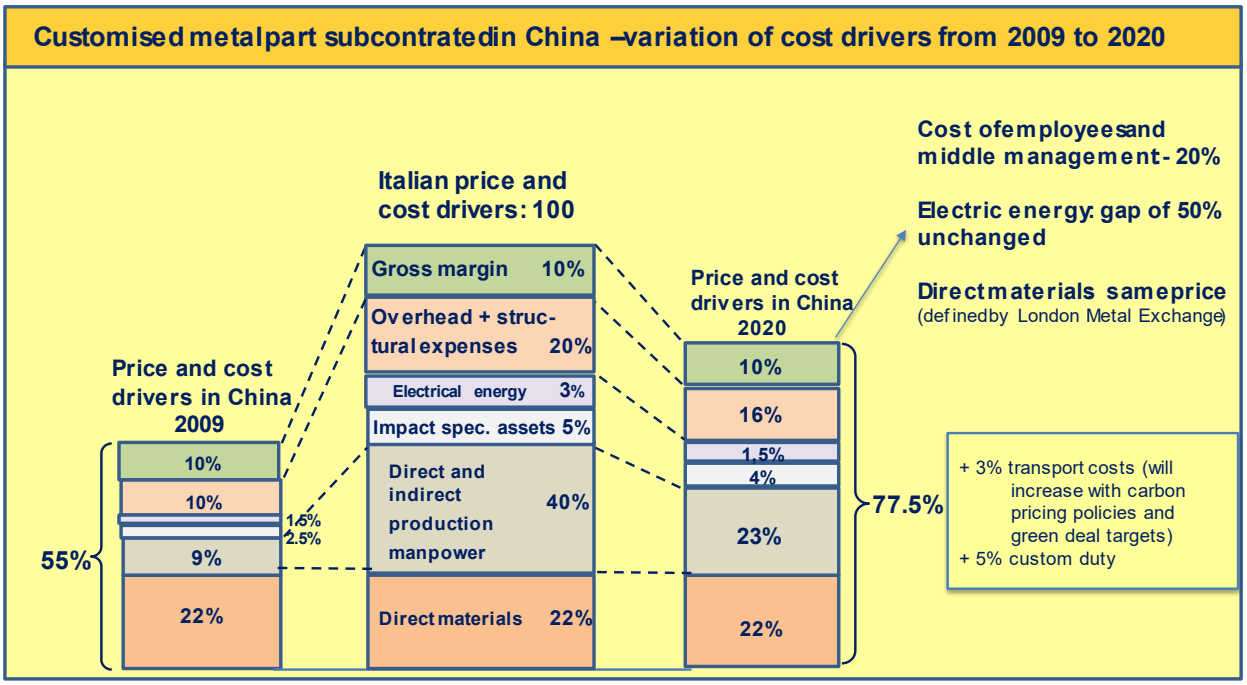
15. Example of the impact of wage convergence on product cost

The table below refers to a real international subcontracting case, and shows the variation of the cost drivers from 2009 to 2020 of a customised machined part subcontracted in China by an Italian company. The central histogram shows the cost drivers of the same part purchased in Italy. In twelve years, the ratio between the Chinese and the Italian cost drivers has moved from 55% to 77.5%.



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