China or There and Back Again: What has Changed in 13 years and does China Still Make Sense?

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The True Cost of Overseas Manufacture 2004

Could Product Design Make U.S. Manufacturing a More Cost Effective Solution?

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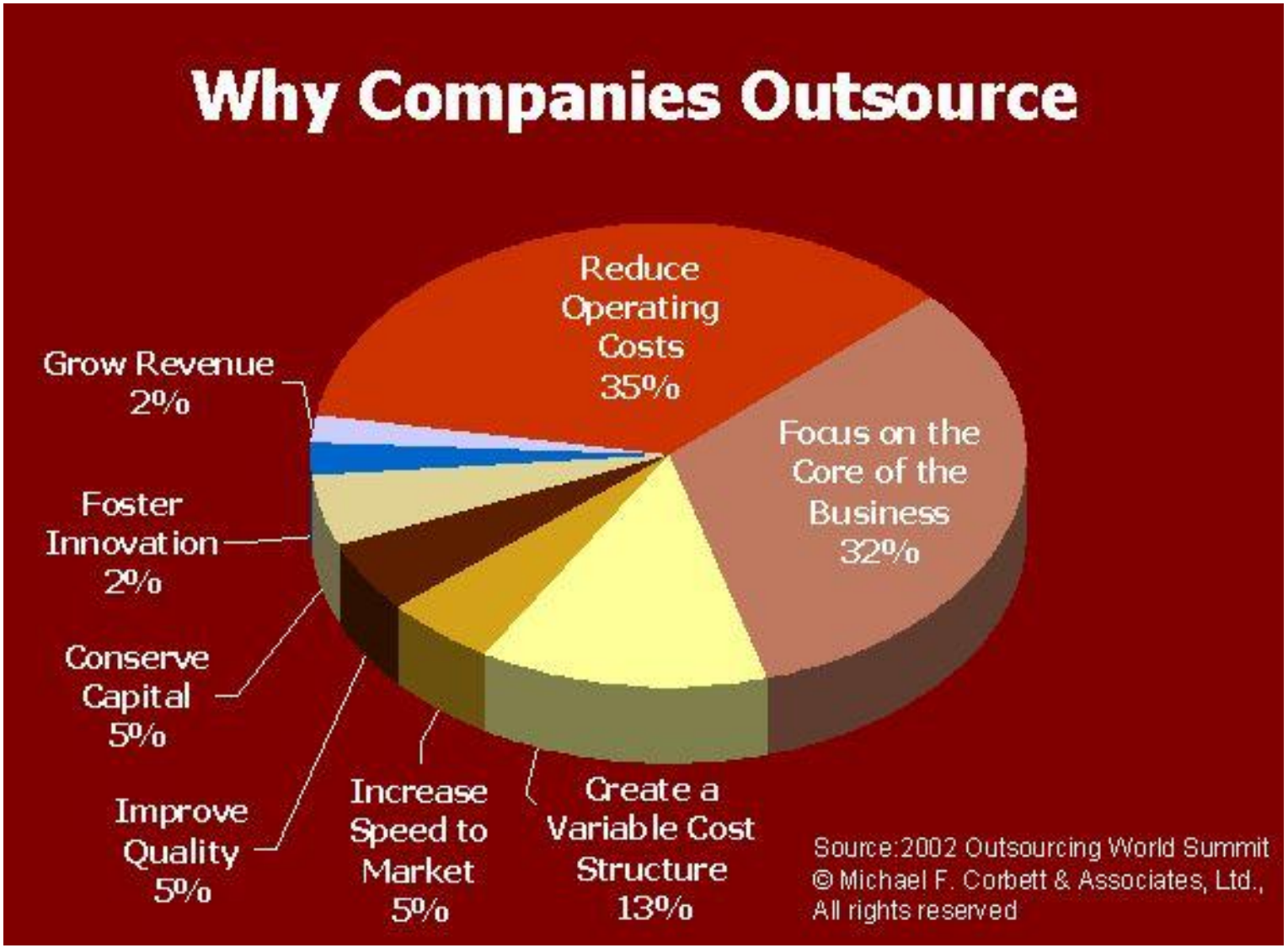
Reasons for Out-Sourcing Pie Chart



2004

Direct Costs - Labor Rates

The U.S. Department of Labor Statistics publishes International Comparison of Hourly Compensation Cost for production Workers in Manufacturing Last report USDL 03-507, September 2003

Data is adjusted and mathematically modeled to be an apples to apples comparison

Country	Hourly wage in (U.S. $) 2002 yr.
United States	$21.33
Hong Kong	$5.83
Singapore	$7.27
Taiwan	$5.41

Direct Costs - Labor Cost

Typical labor rates

- Rates vary from 8/10 of a cent to 35 for unskilled
- Skilled 0.33 cents to $1.00
- Many companies included 2-3 meals a day & a bed in dormitory

How long is the work week?

- Work week is 12-14 hours per day 6 days a week the seventh day off is usually because of power conservation.

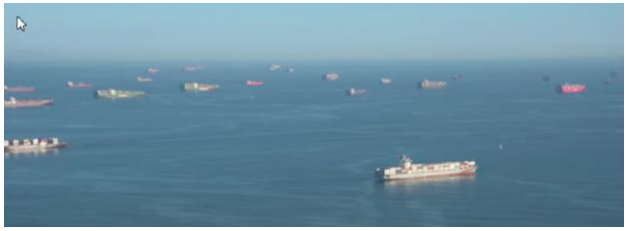
Skill level

- Most labor is unskilled from rural areas. 2004

2004

Don’t forget Pandemics

These past 18 months of global pandemic has reeked havoc with the entire global supply chain across every category you can imagine.



40 foot hi-cube containers costing as much as $20K dollars two yeas ago was only $2500. dollars – assuming you can find one

EVERYTHING from --Electronic components from MCU’s to LED’s, lumber, foam resin, toilets, artificial Christmas trees, Christmas toys, many paper products, natural gas (climbing to all time high), the list goes on and on……..

New F 150’s missing electronic components

Using patty-power to think about and compare exchange rates

The Big Mac index

Country		2000 —— 2023	Under/over valued, %
Switzerland	Franc		43.5
Norway	Krone		25.5
Uruguay	Peso		23.7
Euro area	Euro		3.1
Sweden	Krona		3.1
Costa Rica	Colón		0.4
Britain	Pound		0.4
Denmark	Krone		0.0
United States	US$		BASE CURRENCY
Sri Lanka	Rupee		0.0
Canada	C$		-2.4
Mexico	Peso		-8.7
Colombia	Peso		-10.6
Australia	A$		-10.8
Saudi Arabia	Riyal		-11.0
New Zealand	NZ$		-12.0
Poland	Zloty		-12.7
Singapore	S$		-12.9
Venezuela	Bolívar		-13.3

Sri Lanka	Rupee		0.0
Canada	C$		-2.4
Mexico	Peso		-8.7
Colombia	Peso		-10.6
Australia	A$		-10.8
Saudi Arabia	Riyal		-11.0
New Zealand	NZ$		-12.0
Poland	Zloty		-12.7
Singapore	S$		-12.9
Venezuela	Bolívar		-13.3

None of the values in these chart has done down

Labor Rates 2019

Manufacturing Hourly Wage by Chinese Province

	Hourly Compensation, Manufacturing Sector	Percent of Compensation that Is Benefits	Hourly Wages, Manufacturing Sector
National Total	$ 7.13	41%	$4.20
Beijing Municipality	$ 7.78	41%	$4.59
Shanghai Municipality	$ 7.89	41%	$4.66
Tianjin Municipality	$ 6.50	41%	$3.84
Fujian Province	$ 4.03	41%	$2.38
Guangdong Province	$ 4.83	41%	$2.85
Hebei Province	$ 4.24	41%	$2.50
Jiangsu Province	$ 4.87	41%	$2.87
Liaoning Province	$ 4.02	41%	$2.37
Shandong Province	$ 4.36	41%	$2.57
Zhejiang Province	$ 3.94	41%	$2.32
Chongqing Municipality	$ 4.63	41%	$2.73
Anhui Province	$ 4.94	41%	$2.91
Hainan Province	$ 4.70	41%	$2.77
Heilongjiang Province	$ 3.52	41%	$2.08
Henan Province	$ 3.70	41%	$2.18
Hubei Province	$ 4.47	41%	$2.64
Hunan Province	$ 3.84	41%	$2.27
Jiangxi Province	$ 4.06	41%	$2.40
Jilin Province	$ 3.96	41%	$2.34
Sichuan Province	$ 4.71	41%	$2.78
Gansu Province	$ 4.08	41%	$2.41
Guizhou Province	$ 4.59	41%	$2.71
Qinghai Province	$ 4.47	41%	$2.64
Shaanxi Province	$ 4.19	41%	$2.47
Shanxi Province	$ 3.76	41%	$2.22
Yunnan Province	$ 4.05	41%	$2.39

Global Manufacturing Wage Study

Labor Rates

Country	Hourly Compensation, Manufacturing Sector	Benefits*	Hourly Wages, Manufacturing Sector
NA			
Argentina	$16.24	37%	$10.23
Australia	$38.96	22%	$30.39
Austria	$54.94	44%	$30.77
Bangladesh	$1.17	9%	$1.07
Belgium	$57.54	42%	$33.37
Brazil	$11.29	46%	$6.10
Bulgaria	$6.86	26%	$5.08
Canada	$34.10	22%	$26.60
Chile	$8.80	31%	$6.07
Mainland China	$7.13	41%	$4.20
Colombia	$6.22	41%	$3.67
Czech Republic	$18.98	47%	$10.06
Denmark	$56.18	23%	$43.26
Egypt	$2.37	45%	$1.30
Finland	$49.07	39%	$29.93
France	$46.97	36%	$30.06
Germany	$52.31	39%	$31.91
Hungary	$12.75	40%	$7.65
India	$3.53	23%	$2.72
Indonesia	$2.13	22%	$1.66
Ireland	$45.04	34%	$29.72
Israel	$27.17	22%	$21.32
Italy	$34.69	33%	$23.24
Japan	$27.27	21%	$21.55
Korea, South	$26.03	25%	$19.52
Malaysia	$5.14	18%	$4.21
Mexico	$4.84	36%	$3.10
Morocco	$2.41	30%	$1.68
Netherlands	$51.11	40%	$30.67
Norway	$59.01	26%	$43.67
Pakistan	$1.45	19%	$1.17
Peru	$4.17	31%	$2.88
Philippines	$2.53	21%	$2.00
Poland	$11.40	25%	$8.55
Portugal	$14.51	40%	$8.71
Romania	$8.25	32%	$5.61
Russia	$6.87	33%	$4.58
Saudi Arabia	$11.23	21%	$8.87
Serbia	$4.48	28%	$3.23
Singapore	$27.46	27%	$20.05
Slovakia	$14.73	39%	$8.98
South Africa	$8.84	19%	$7.16
Spain	$33.44	45%	$18.39
Sweden	$49.19	40%	$29.51
Switzerland	$76.59	36%	$49.02
Taiwan	$13.00	28%	$9.36
Thailand	$2.99	19%	$2.42
Turkey	$3.50	30%	$2.45
Ukraine	$4.03	33%	$2.68
United Arab Emirates	$16.01	27%	$11.76
United Kingdom	$33.50	26%	$24.79
United States	$42.58	34%	$28.10
Venezuela	$2.71	37%	$1.70
Vietnam	$3.56	35%	$2.31

Source: IHS Global Manufacturing Wage Study December 2018
* - Percent of Compensation that Is Benefits

Direct Costs - Material

- Material cost differences between US and China
- Some materials are actually more expensive as they are imported, because of tariffs and export restrictions
- Lower quality materials available in some cases

Conclusions about overseas manufacturing costs

TANGIBLE	
Baseline Adder for Shipping and Logistics	17%
Finding a vendor	1%
Quality Issues	4%
Travel and communications	1%
All others (Intangible)	1%

2004

Milwaukee Electric Tool Corporation

Case Study

Milwaukee ½ inch drill model 0238-1

Redesigned to Model 0299-20

Redesigned 0299-20 using DFMA

2004

Milwaukee Electric Tool Corporation

Cost summary show below for the drill and its redesign over time

0283-1 drill cost	$ 100.03
0299-20 drill cost	$ 92.59
0299-20 DFMA Redesign	$ 77.86
0299-20 drill cost (China)	$ 63.62

These numbers are in 2004 dollars and adjusted to mask true cost data
The numbers have also been altered to protect the confidentiality of the data provided by Milwaukee Tool

Milwaukee
(Cost including outsourcing)

Total cost to manufacture in China $63.62

Add to this the costs associated with “outsourcing”

This will add 24% to the final cost which results in…

$78.89

DFMA Redesign cost in USA is $77.86
A cost increase of $1.03 for Outsourcing

2004

Consumer Goods Product Case Study

- The current production cost of this product is $52.28.
- Apply DFMA to existing design to significantly reduce part count.
- The DFMA redesign concept resulted in a should cost of $38.89

Consumer Goods Product Case Study

- The production cost in China is $35.41.
- The true cost of this products manufacture in China should be $43.91when including the hidden costs.

Consumer Goods Product Case Study

Design Variant	Cost
Original Design in U.S.	$53.28
Original Design in China	$35.41
Estimated Cost for China (24% adder)	$43.91
DFMA redesign in U.S.	**$38.89**

Manufacture in China would result in a cost increase of **$5.02** over DFMA redesign manufactured here in the United States

2004

Consumer Goods Product Case Study

- An interesting side note…..

Design Variant	Cost
Original Design in U.S.	$53.28
Original Design in China	$35.41
Estimated Cost for China (24% adder)	$46.11
DFMA redesign in U.S.	**$38.89**

Summary Case Studies

- US Manufacturing can be more competitive by understanding the true costs of outsourcing.
- DFMA can significantly reduce a products total cost enabling US Manufacturing to be more competitive.
- The 24% cost adder that we calculated can be argued to be a conservative estimate.

In Conclusion

We believe that when you add up all the costs of outsourcing and apply them to your product cost in many instances it can be more cost effective to use DFMA to redesign the product and keep its manufacture here in the United States.

Outsourcing:

Case study Revisited Seven Years Later

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2011

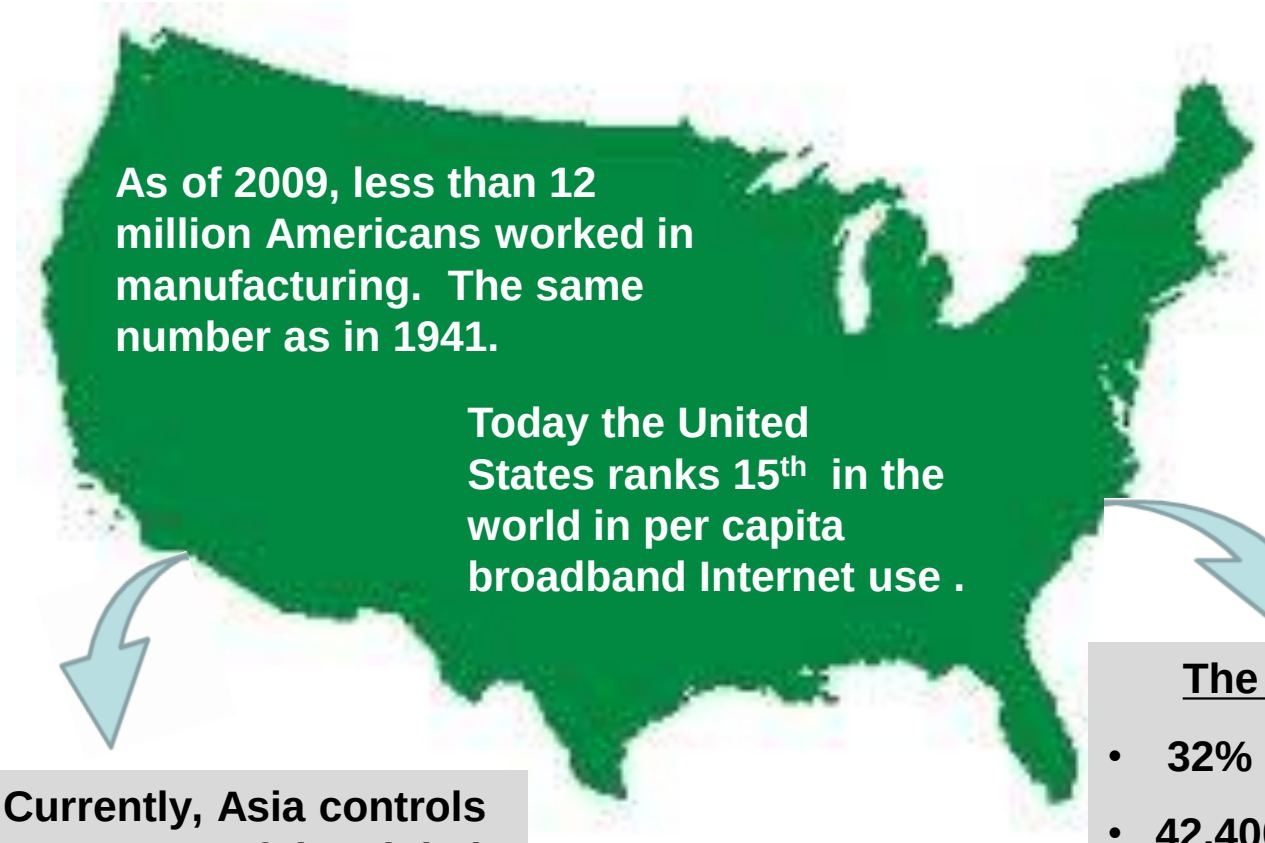
Outsourcing:

Case study Revisited Seven Years Later 2011

Agenda:

1. What's been happening since 2004?
2. Outsourcing challenges
3. The Premise – It's the design
4. Hidden costs – the destroyers of savings
5. The role of material, labor, and logistics costs.
6. Case studies

What has Happened in Seven Years



Currently, Asia controls 84 percent of the global production of printed circuit boards.

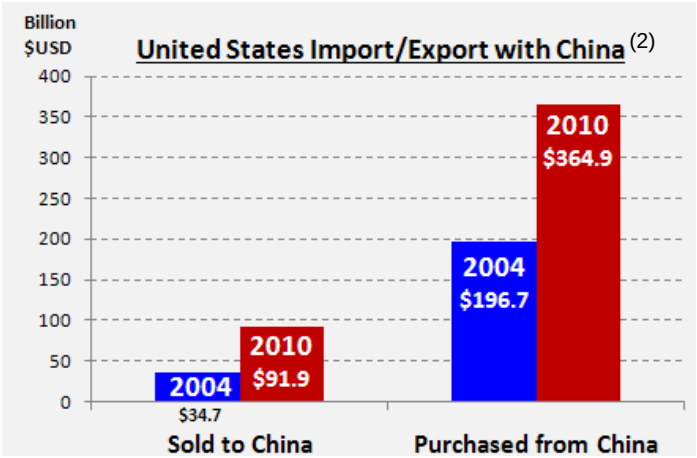
The USA lost nearly

- **32% manufacturing jobs**
- **42,400 factories**

2011

Source: Tyler Durden, "Reminiscences of An American Industrial Nation – How in a Few Short Years America Lost its Manufacturing Sector" , 6 January 2011, <www.zerohedge.com>

What has Happened in Seven Years



Worlds Largest Economies

2004 China ranked 6th

2011 China ranked 2nd

2011

(1) Source IMF. Edited by Emily Cadman. Design & Coded by Caroline Nevitt & Pete Feeney. Fiancial Times Interactives

(2) Source: US Department of Commerce; US International Trade Commission (ITC) Calculated by USCBC. US exports reported on a free-alongside-ship basis; imports on a general customs-value basis.

Our Premise

Product manufacture outsourced to the Far East can often be performed in the U.S. with *as great or greater* savings when two things are done.

1. **Understand** the *true cost* of outsourcing
2. **Redesign** the product using DFMA to leverage the strengths of domestic production

Disclaimer:

Products that have a high semi-skilled or unskilled labor content, over 40%, will most likely have a cost advantage by moving to lower labor cost countries.

Conclusions about overseas manufacturing costs

TANGIBLE	
Baseline Adder for Shipping and Logistics	**17%**
Finding a vendor	**1%**
Quality Issues	**4%**
Travel and communications	**1%**
All others (Intangible)	**1%**

- These are representative rates based on experience.
- If your rates are significantly lower, we recommend:

✓ A review to evaluate potential hidden costs.

✓ Ask the CFO if there has been measurable improvement in free cash flow and the bottom line.

2011

Case study Examples

Accenture a business consulting firm, surveyed 287 manufacturing companies on the topic of outsourcing.

•61% of respondents were considering moving Manufacturing back.

•73 % of the companies have seen significant increases in supplier material costs and component prices.

•57 % have experienced cost increases associated with logistics and transportation; 36% have seen price increases for overhead and administrative functions;

•31% have been impacted by exchange rate differentials;

•26 % have had to increase their inventories as a means to buffer supply chain disruptions; and

•25 % have seen increases in the cost of quality.

Other increasing costs included material handling and warehousing; packaging; VAT, customs and duties; product qualifications; customer service costs; procurement staff costs such as broker fees; and increased tooling costs.

2011

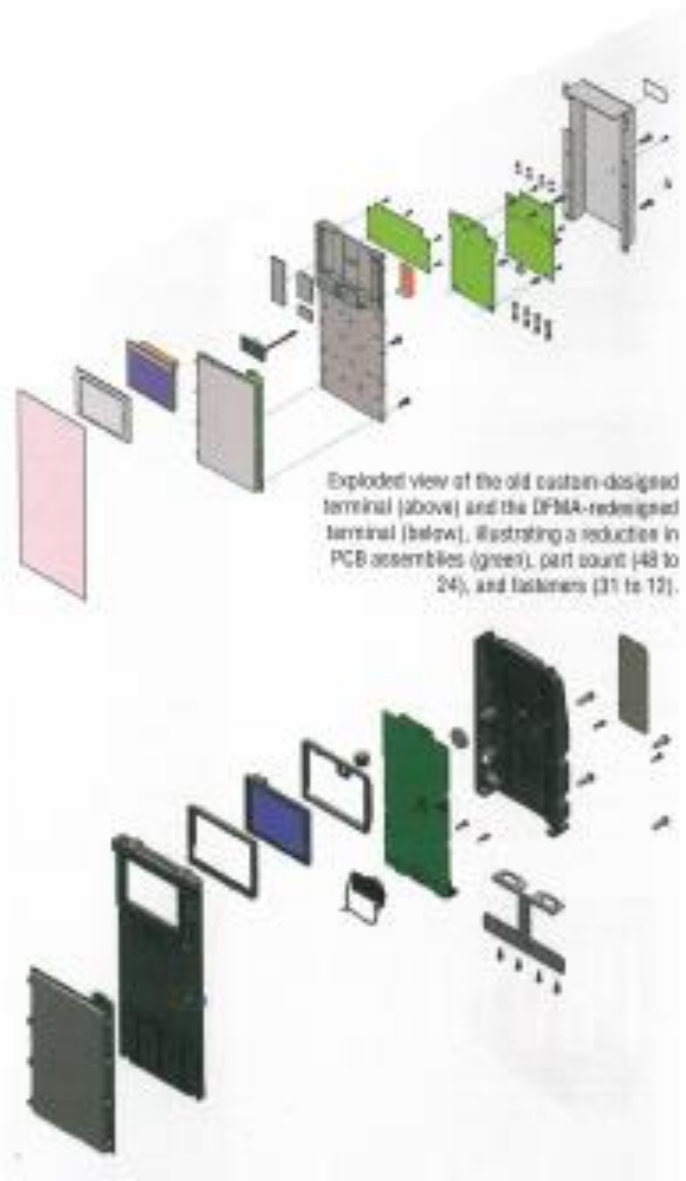
Case Study Examples

Beijer Electronics

Beijer used DFMA to reduce cost while designing mobile data terminals. Designers reduced:

- Part count by 50%,
- Fasteners by 61%,
- Assembly time by 70%.

These savings allowed Beijer to keep product manufacturing in the U.S.[1]



[1] "Keeping Manufacturing Onshore By Design", *Design 2 Part*, February 2011:62-68

2011

Words of Advice

Remember:

Just because you outsourced the plant, people and product, doesn't mean you outsourced the overhead.

Summary Case Studies

- US Manufacturing can be more competitive by understanding the true costs of outsourcing.
- DFMA can significantly reduce a products total cost enabling US Manufacturing to be more competitive.
- The 24% cost adder that we calculated can be argued to be a conservative estimate.

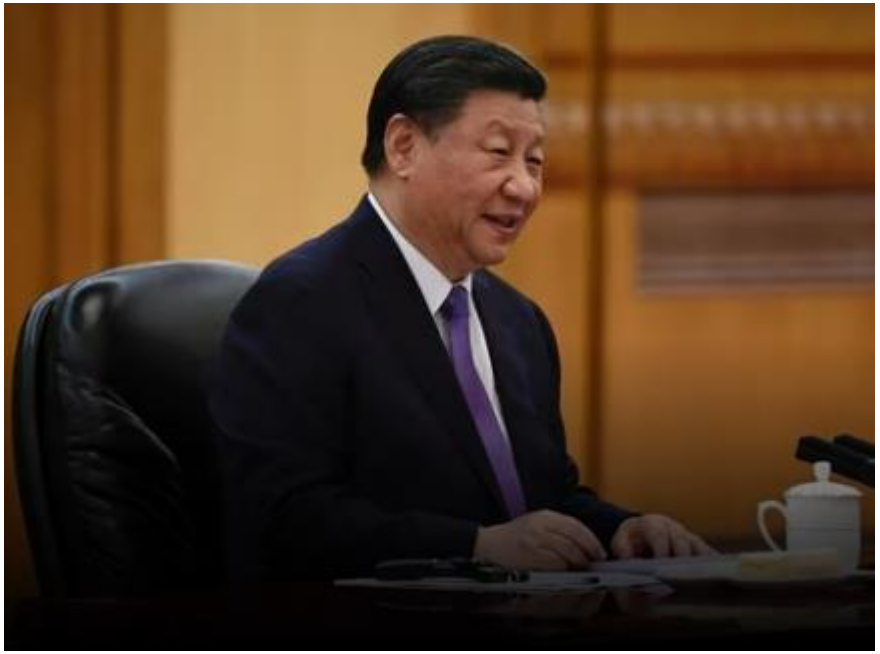
In Conclusion 2011

We believe that the original premise still holds true seven years later:

The effective use of DFMA to redesign a product & eliminate waste can produce a cost equal to or lower than the total cost of outsourcing.

China or There and Back Again: What has Changed in 13 years and does China Still Make Sense? 2024

Political Landscape



China’s President Xi Jinping (AP Photo}

Xi Jinping rise to power started back in 2012. By 2024 Xi Jinping has managed to create an absolute lock on power for now and the foreseeable future.

Political Landscape

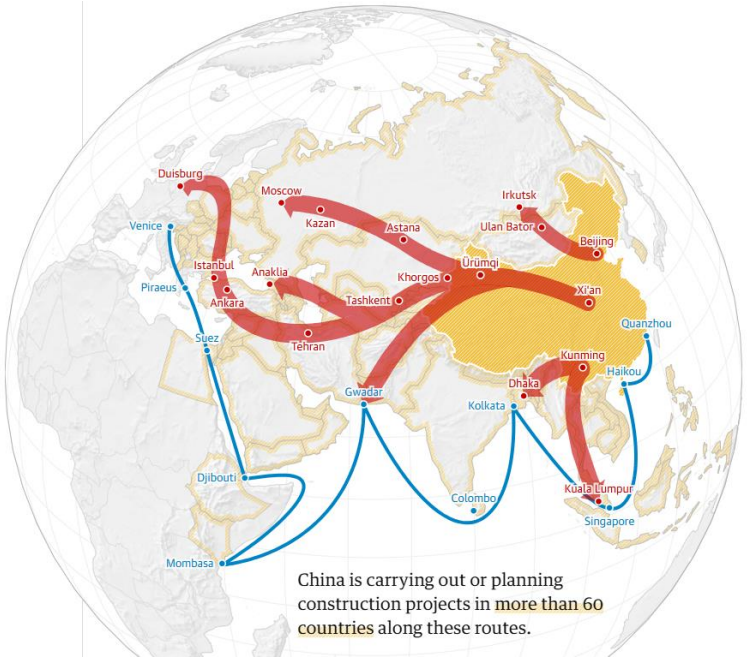
- In 2012, Xi succeeded Hu Jintao as General Secretary of the CCP, becoming the paramount leader of China.
- In 2013, he was elected as President of China by the National People's Congress.
- From 2012 onwards, Xi launched an extensive anti-corruption campaign that purged many officials deemed disloyal or ineffective, allowing him to fill vacant positions with allies.
- He tightened control over the military through sweeping reforms starting in 2015, and brought the domestic security apparatus under his influence.
- In 2017, the CCP constitution was amended to enshrine "Xi Jinping Thought", elevating his ideological contributions to the level of Mao Zedong and Deng Xiaoping.

Political Landscape

- In 2018, term limits on the presidency were abolished, removing a potential obstacle for Xi to rule for life.
- In 2021, the CCP passed a historical resolution praising Xi's leadership and accomplishments.
- In 2022, Xi secured an unprecedented third term as General Secretary, and the new Politburo Standing Committee was filled with his loyalists.
- In March 2023, he secured an unprecedented third term as CCP General Secretary at the 20th Party Congress, cementing his status as China's most powerful leader since Mao Zedong.
- As of 2024, Xi Jinping remains firmly entrenched as China's preeminent leader, holding all major positions of power and shaping both domestic and foreign policy directions for the world's second largest economy.

Political Landscape

What is even scarier are China global activates like Belt and Road Initiative launched in 2013.



Political Landscape

- While promoted as a vehicle for global cooperation and development, the BRI has raised concerns about Chinas growing Influence, potential debit traps for smaller nations, and dual military-civilian use of infrastructure like ports. Critics arque it could allowed China to extract concessions and expand its Military presence abroad (1)
- Claiming 90% of south China sea as Chinese territory and militarizing many of the Shoal, is just another example of expansionistic goals.

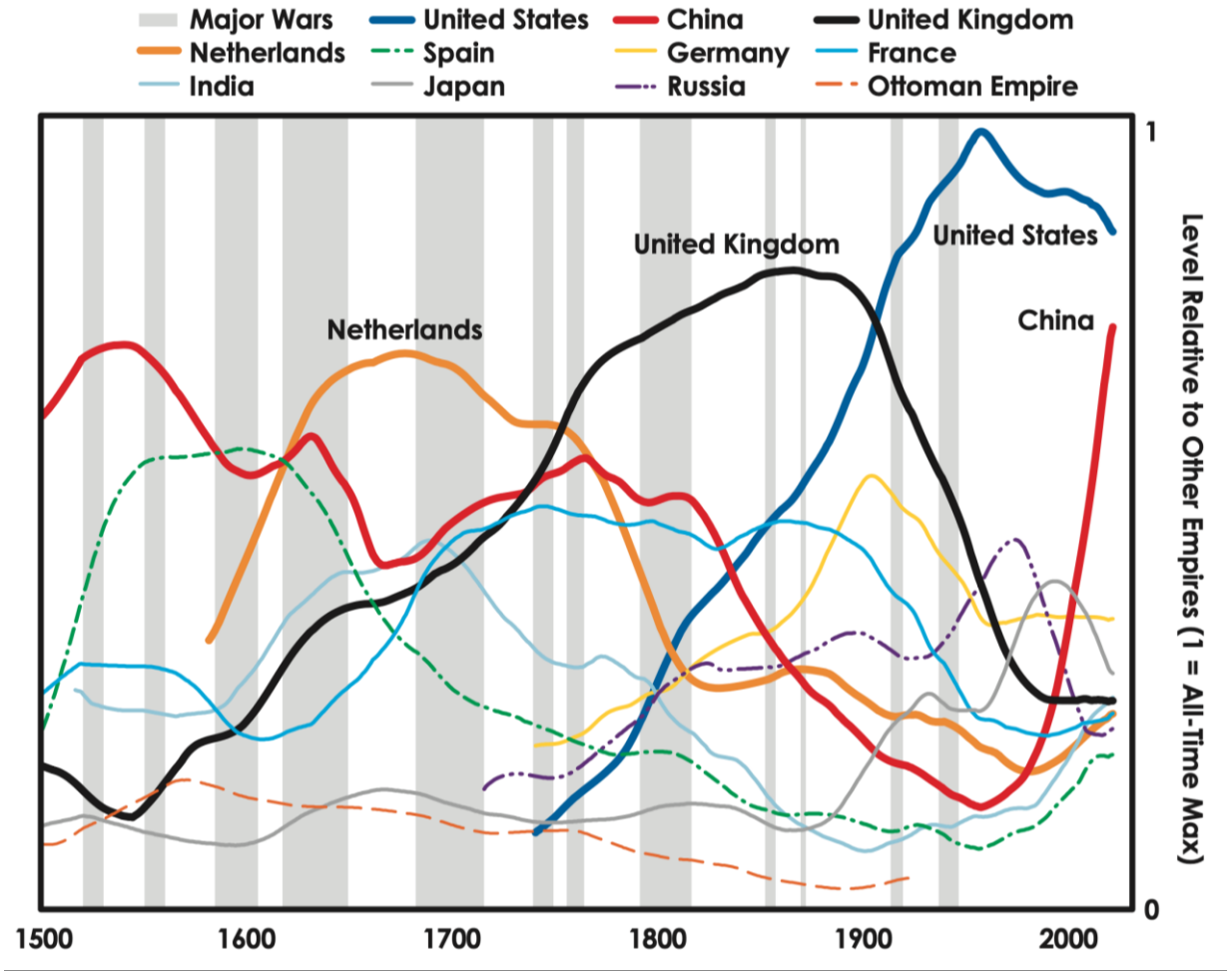
1 What is China Belt and Road Initiative , L.Kuo & N. Kommenda The Guardian 2018

Political Landscape

- China controls or operates terminals at 100 foreign seaports The latest is a mega deep water port being constructed in Peru. (2)
- It is no secret China wants to assimilate Taiwan.
- China actions in Hong Kong should be a cautionary tale of broken promises and dictorial control.
- Recent G7 meeting China sighted 28 times, almost always as a maligning force. (3)

2. Chinese Megaport Poses U.S. Challenge R.Dure, J. Areddy,S. Pearson-WSJ June 13, 2024 Page A7
3 It,s Not Just Russia:China joins the G7's list of Asversaries, David Sanger new York Times June 15, 2024 https://www.nytimes.com/2024/06/15/world/asia/g7-summit-china-russia.html?searchResultPosition=6

Relative Standing of Great Empires

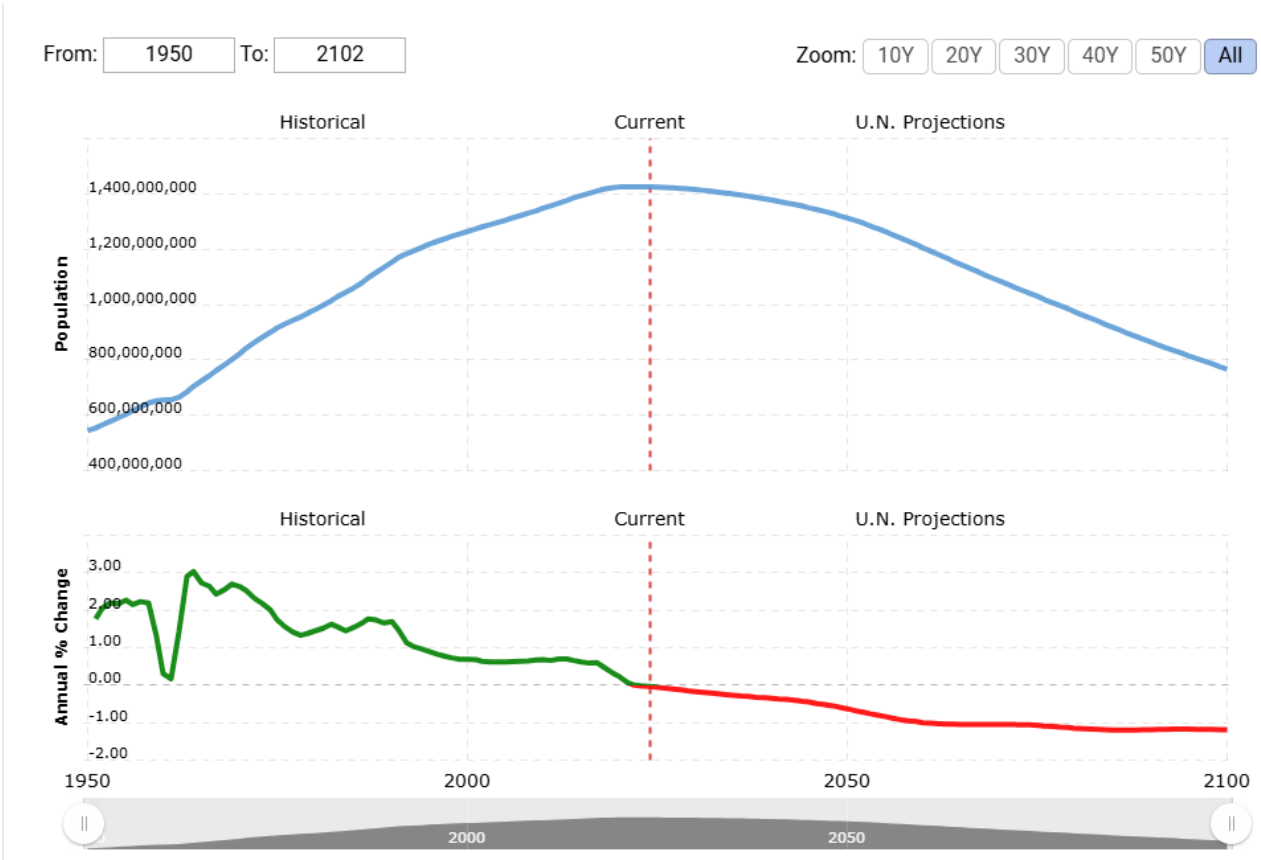


Source: Dalio, R.: Principles for dealing with the changing world order. 2021.

Population

- Chinas population is shrinking as a result of the one child policy.
- The number of births dropped to 9.56 million in 2022 the fewest since 1970.
- The working age population (age16-59) peaked in 2011.
- By 2035 30% of the population will be 60 years or older.
- The shrinking working-age population implies a decrease in the production capacity and labor supply of the economy.
- This reduction in the labor force can hamper economic growth and productivity.

Population



[China Population 1950-2024 | MacroTrends]

Restrictive Business Practices

China is not a level playing field

- Restriction on Monopoly agreements
- Foreign Investment Restrictions
- Mandatory technology transfer rules
- Export Controls
- Data/ Cybersecurity Restrictions
- No real IP controls or protection
- Use of Unreliable Entity List

But to name a few ……

UNRELIABLE Entity List (UEL)

China enforces its Unreliable Entity List (UEL) provisions through the following measures:

Establishment of an interagency "Working Mechanism" headed by China's Ministry of Commerce (MOFCOM) to implement the UEL regime. This Working Mechanism has the authority to:

- Investigate foreign entities suspected of violating the UEL provisions
- Directly designate foreign entities on the UEL when facts are clear
- Consider factors like national security risks, damage to Chinese interests, compliance with trade rules etc. in designating entities

2. Imposing punitive measures on designated "unreliable entities" which can include:

- Restricting or prohibiting the entity from importing/exporting to/from China
- Restricting or prohibiting investment by the entity in China
- Restricting entry of the entity's personnel/transportation into China
- Revoking work permits/visas of the entity's personnel in China
- Imposing fines commensurate with the violation (e.g. twice the value of arms sales to Taiwan)

UNRELIABLE Entity Lis (UEL)

3. Publicly announcing investigations and designations of unreliable entities, warning of risks in dealing with them.

4. Allowing a grace period for designated entities to rectify their conduct before imposing restrictions.

5. Establishing a delisting mechanism where entities can apply for removal from the UEL if they take corrective actions.

So in essence, the broad Working Mechanism has powers to investigate, designate, announce, penalize and delist foreign entities based on the UEL provisions through various trade, investment, personnel and financial restrictions.

Environmental Air

- China has some of the worst air pollution levels in the world, primarily due to its heavy reliance on coal for energy production and rapid industrialization.
- In 2021, no Chinese city met the World Health Organization's air quality standards, with some cities recording PM2.5 levels over 20 times the recommended limit.
- Air pollution is estimated to cause 1.2 million premature deaths annually in China.

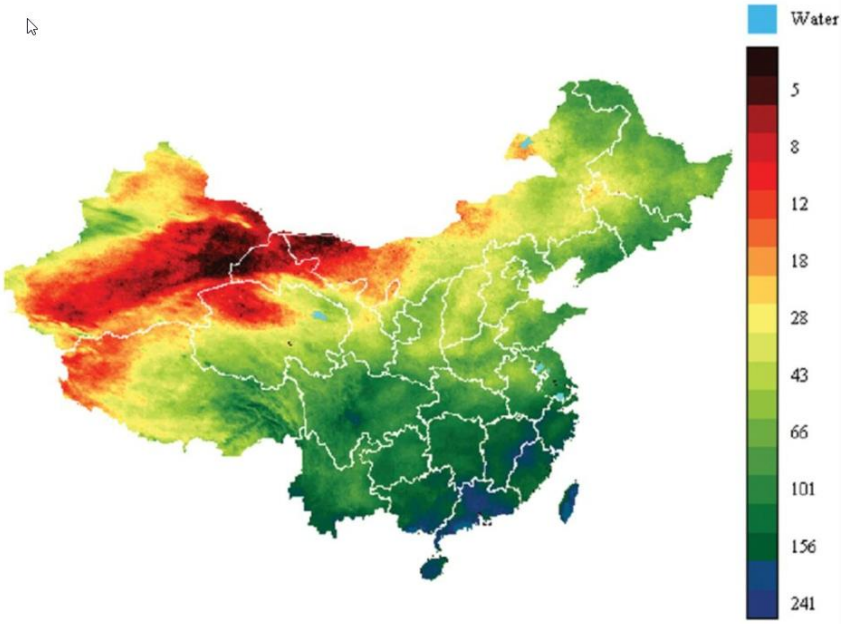
5 Environmental Issues in China in 2024 | Earth.Org

China's Fight Against Climate Change and Environmental Degradation | Council on Foreign Relations (cfr.org)

Environmental land

- China has 6.6 million square kilometers of dryland, essentially deserts.

- Deserts cover 27% of countries land area



- Gobi desert is sixth largest desert in the world with sand dunes less that 50 miles from Beijing.

- Contributing factors include urbanization, poor agriculture practices, use of chemical fertilizers, pesticides, over grazing of live stock, and climate change.

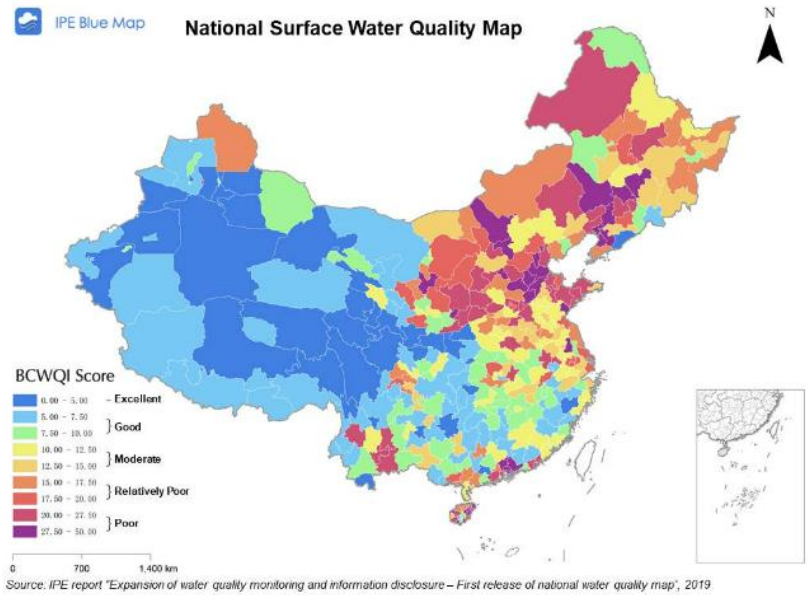
https://desertificationfacts.com/locations/desertification-in-china/

Environmental Water

- Around 90% of China's groundwater is contaminated, and nearly half the population lacks access to safe drinking water.
- Industrial waste, agricultural runoff, and household sewage have polluted over 75% of urban water sources, rendering them unfit for human use.
- China has only 7% of the world's freshwater resources but 20% of the global population, leading to severe water shortages in many regions. (Igini 2024) (Maizland 2021)

Environmental Water

1. National surface water quality map

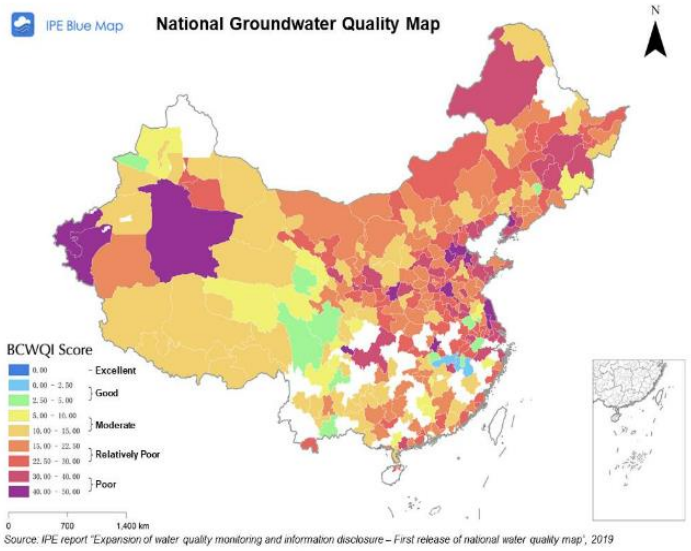


Source: IPE report "Expansion of water quality monitoring and information disclosure – First release of national water quality map", 2019

2. National drinking water quality map

Source: IPE report "Expansion of water quality monitoring and information disclosure – First release of national water quality map", 2019

3. National groundwater quality map



Source: IPE report "Expansion of water quality monitoring and information disclosure – First release of national water quality map", 2019

https://chinawaterrisk.org/opinions/blue-city-water-quality-index/

Environmental Climate & Supply Chain

CLIMATE

- China is the world's largest emitter of greenhouse gases, accounting for around 33% of global emissions in 2021.
- While China has pledged to achieve carbon neutrality by 2060 and invest in renewable energy, it remains heavily reliant on coal and continues to finance coal-fired power plants abroad through its Belt and Road Initiative. (Igini 2024) (Maizland 2021)

Supply Chain

- Michel Roger from Accenture confirms:

“Given that over 60% of carbon emissions are generated by supply chains, the need to rethink where we manufacture and how we transport goods to consumption locations has to be at the center of driving a more sustainable future”

https://www.forbes.com/sites/sap/2022/12/15/2023-supply-chain-predictions-resiliency-sustainability-and-visibility-set-new-expectations/?sh=62109ac752cd

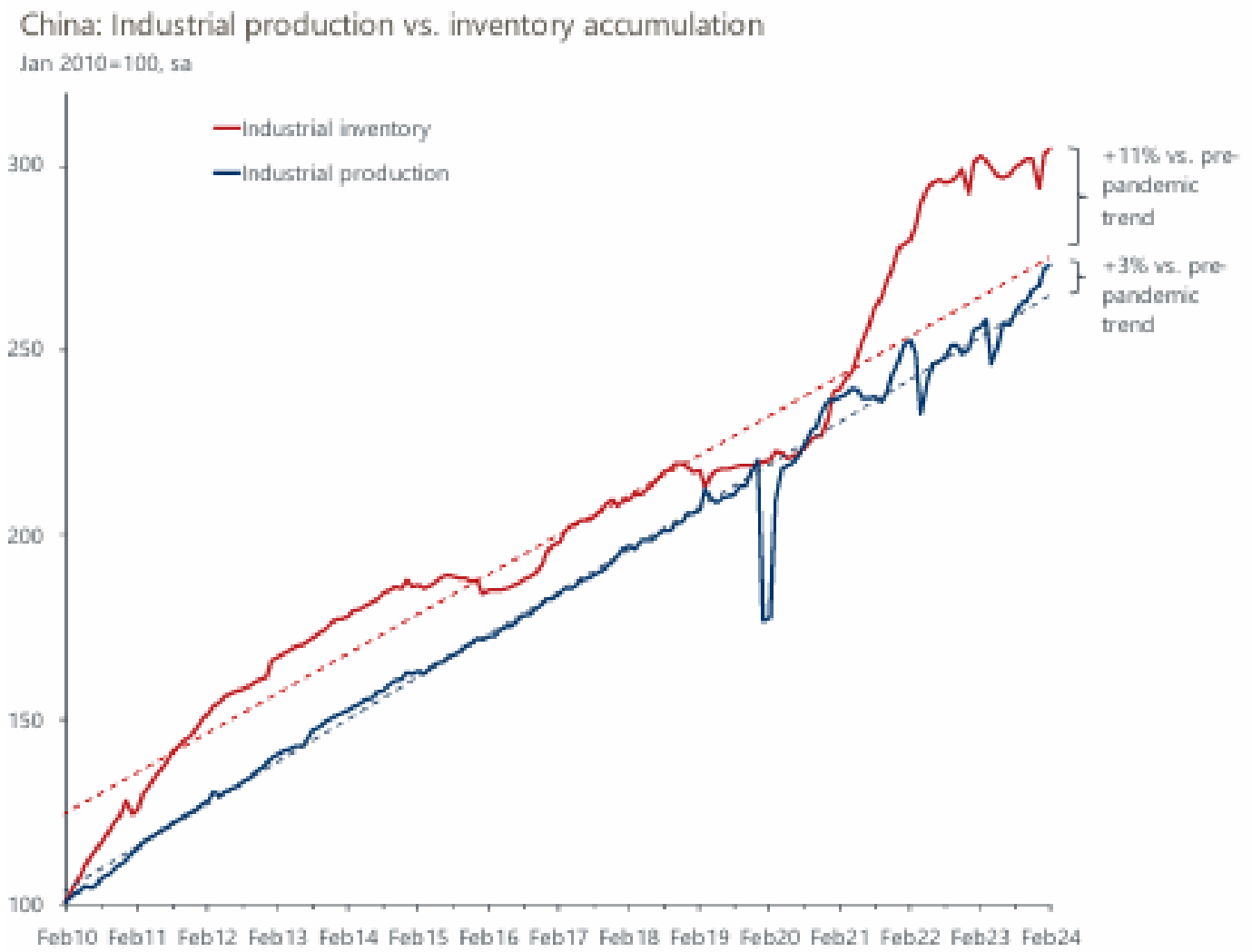
Trade Exports / Trade Tariffs

- For decades China has move methodically to globally dominate world industries such as semiconductors, appliances, solar panels, EV, batteries, and lots of other commodities.
- China now produces a third of the worlds manufactured goods – more than the United States, Germany, Japan, South Korea, and Britian combined. Its trade surplus is equal to a tenth of the entire Chinese economy.
- China's exports rose at quickest rate since may of 2023 – 7.6%. China is rapidly building new factories and expanding new ones as part of national strategy of exporting surplus, which is helping to lift the economy despite a slow down in the very troubled housing market

How China Rose to Lead the World in Cars and Solar Panels, Keith Bradsher NY Times May 14,2024

Cina Exports Surge as Trade Tensions Near Boiling Point Keith Bradsher NY Times June 7, 2024

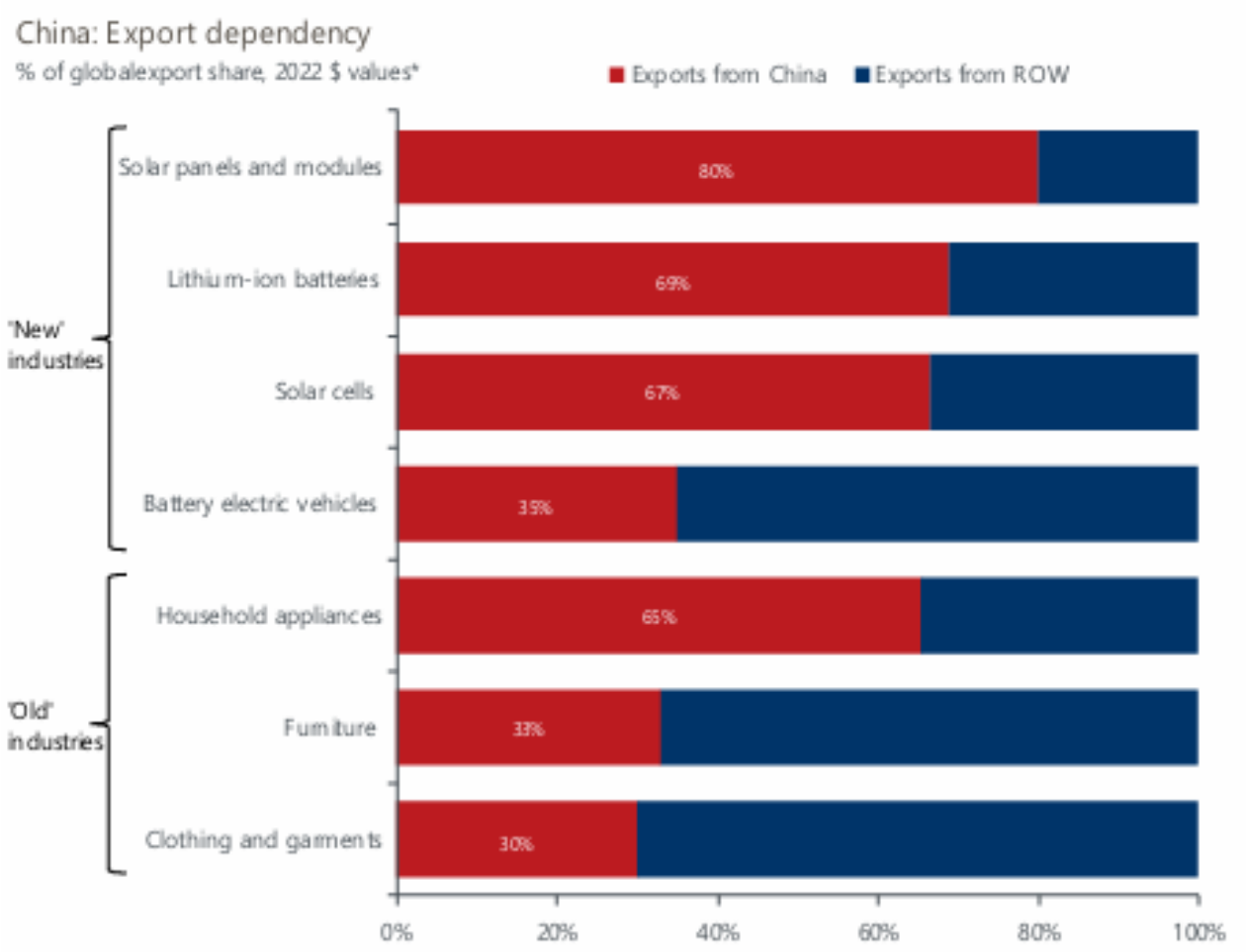
Chart #1: A problem of demand weakness, rather than sharp oversupply



Source: Oxford Economics/NBS

Trade Exports / Trade Tariffs

Chart #4: New industries, but same old reliance on China's factories?



*Source: Oxford Economics/China's Ministry of Industry and Info. Tech., China's Photovoltaic Industry Association, IEA, UN Comtrade, ITC. Note: *Data as of 2022 except solar panels and modules (2023).*

Trade Tariffs / Trade Exports

EV's

- Tariff rate increased from 25% to 100% in 2024. Aims to protect American EV manufacturers from China's unfair trade practices and overcapacity.

Battery Components

•Tariff rate on lithium-ion EV batteries increased from 7.5% to 25% in 2024.

•Tariff rate on lithium-ion non-EV batteries increased from 7.5% to 25% in 2026.

•Tariff rate on battery parts increased from 7.5% to 25% in 2024.

Steel and Aluminmun

•Tariff rate increased from 0-7.5% to 25% in 2024.

•Shields U.S. industries from China's non-market overcapacity and unfair practices.

Trade Tariffs / Trade Exports

Semiconductors

•Tariff rate increased from 25% to 50% by 2025. Aims to promote sustainability of investments under the CHIPS and Science Act.

Minerals

• Tariff rate on natural graphite and permanent magnets increased from 0% to 25% in 2026.

• Tariff rate on certain other critical minerals increased from 0% to 25% in 2024.

Other stuff

• Solar cells: Tariff rate increased from 25% to 50% in 2024.

• Ship-to-shore cranes: New 25% tariff in 2024.

• Medical products like syringes, needles, face masks, and gloves: New tariffs of 25-50% in 2024-2026.

Summary

- Papers in 2004 and 2011 showed that redesigning using DFMA tools you could avoid needing to outsource to China.
- 2024 cost of all the standard items continue to increase, ie; labor, shipping, finding vendor, quality issues, travel, shipping container loss, port issues, …… have continued to go up.

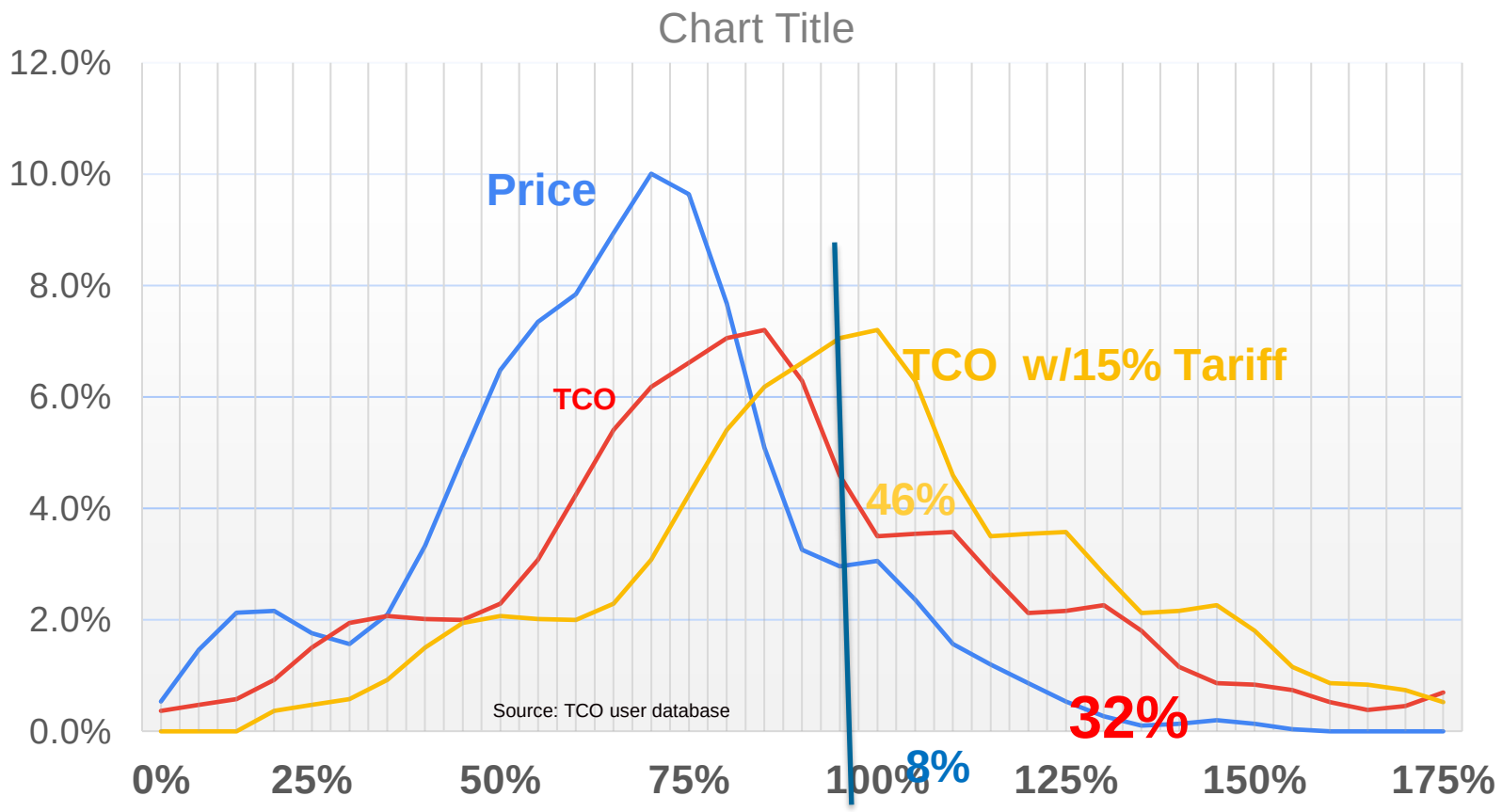
Add to this all the changes occurring on global scale export issues, tariffs, pandemics, geo-political risk relying on just piece part price does not make sense anymore, nor does chasing labor dollars to Malaysia, Vietnam, India ……..

Summary

- What makes sense is to use a Total Cost of Ownership (TCO) model like one found at

Total Cost of Ownership Estimator | Reshoring Initiative (reshorenow.org)

Chinese Price and TCO, % of U.S.



Ride the Reshoring Wave!

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www.reshorenow.org

Useful links:
Total Cost of Ownership Estimator™
Skilled Workforce
Import Substitution Program
Supply Chain Gaps

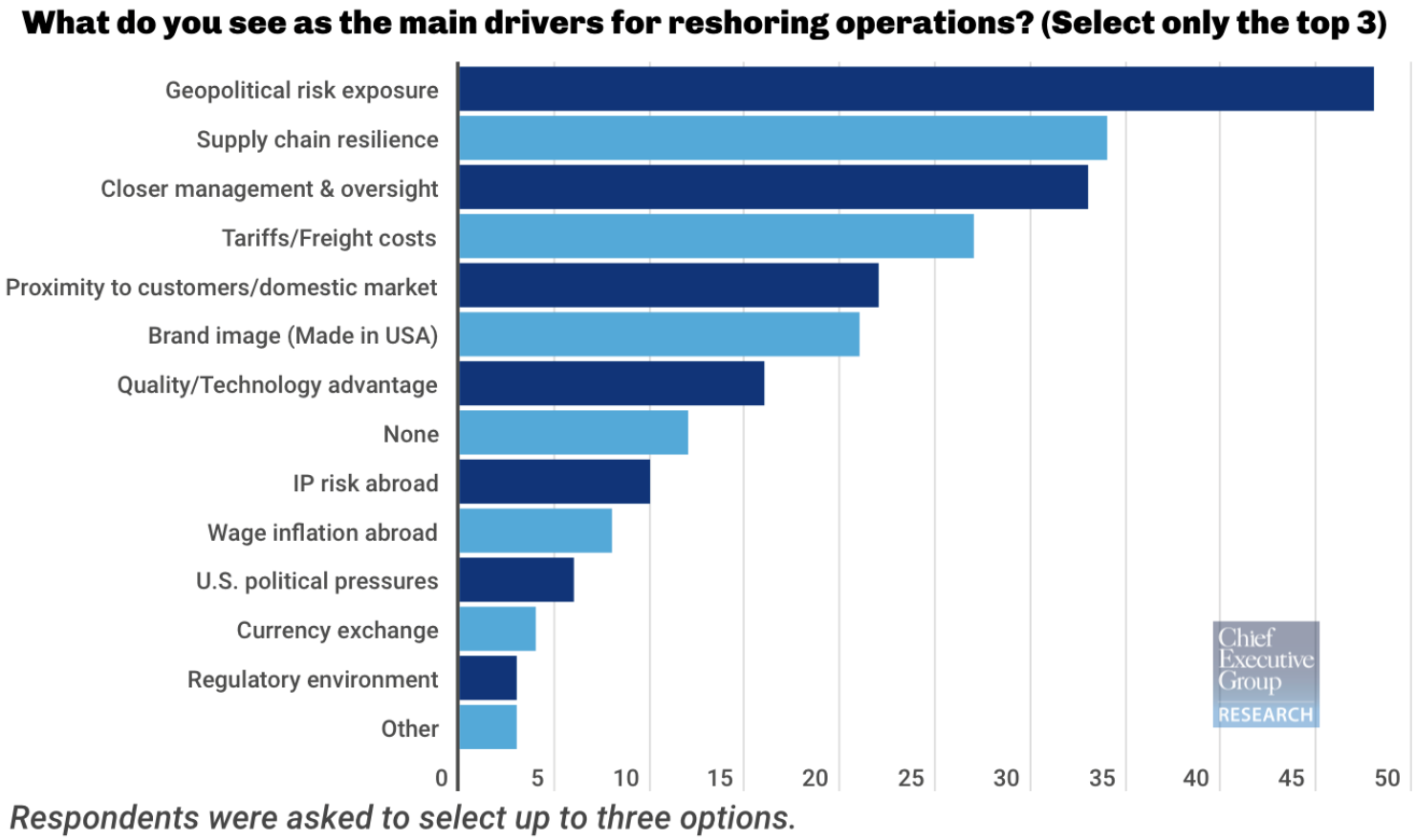
I Keep Six Honest Serving Men

I keep six honest serving-men (They taught me all I knew);
Their names are What and Why and When And How and Where and Who

Rudyard Kipling

Questions

https://www.kiplingsociety.co.uk/poem/poems_serving.htm



Source: Chief Executive, May 2023, “Reshoring Revolution: A Special Report” https://chiefexecutive.net/special-report-reshoring-revolution/