



Members' report 1/2019

CRUMBLING PILLARS

FOUR THREATS TO THE GLOBAL STATUS QUO

SUMMARY

We are living in a time of upheaval. Many of the conditions we have long taken for granted are now changing. The report looks at four trends that threaten the global status quo: Democratic recession, the end of Western technological dominance and Western-led globalisation, and accelerating environmental change.

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PRINT: KLS PUREPRINT A/S

COPENHAGEN INSTITUTE FOR FUTURES STUDIES, MARCH 2019

WWW.CIFS.DK

FOREWORD

Pictet Asset Management has been working with the Copenhagen Institute for Futures Studies (CIFS) for over a decade to establish a deeper understanding of megatrends – the powerful secular forces that are changing the environment, society, politics, technology and the economy.

CIFS is a leading global think tank and consultancy. CIFS uses a wide range of research methods, developed over the last 40 years, which include megatrend analysis, scenario planning, risk management, innovation initiatives and strategy development.

Through our partnership with CIFS, we have devised an investment framework that incorporates CIFS' 14 megatrends. The framework – which includes trends such as Demographic Development, the Network Economy, Focus on Health, Sustainability and Technology Development – enhances our thematic equity capabilities and informs the construction and development of our thematic equities strategies such as Water, Robotics or SmartCity.

As CIFS' partner, Pictet Asset Management has access to research into areas not normally covered by the investment analyst community such as changes in societal attitudes and beliefs, the impact this has on the environment and the business sector, and the acceleration of technological development. We are proud to be associated with CIFS and would like to share some of their research with you. We have sponsored this publication and hope you find it as insightful as we do.

HANS PETER PORTNER

Head of Thematic Equities
Pictet Asset Management

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INTRODUCTION

There are probably few points in world history when people didn't think they were living in a time of upheaval or when changes didn't happen so fast that it felt like standing on a crumbling pillar. The future is changeable and unpredictable. This has always been the case, and this is one aspect of futures studies' *raison d'être*, because it gives us the tools to understand the future as kaleidoscopic and multifaceted rather than one-dimensional and static.

Nonetheless we now see signs that many of the conditions we have long taken for granted are changing. A range of tenacious trends with global reach put the status quo, in a broad sense, under pressure, and in this report, we draw the contours of the new world we are moving towards.

While we talk about Trump and Brexit in the West, rule of law and civil liberties are rolled back all over the world. The wave of democratisation that followed in the wake of the end of the Cold War has turned, and liberal democracy is no longer the strong model for economic and social progress that it has been for the last 30 years. In the first part of the report, we look at the ongoing 'democratic recession', which according to studies by *The Economist* and others has been growing over the last decade. Four out of five of the parameters used to measure the state of democracy are in decline, and the question is if we are heading for a future where liberal democracy will only be found in a handful of countries – and where sham democracy is the new global norm. What will such a world look like, and how should citizens, companies and organisations navigate in it?

Western-led globalisation and Western technological and scientific dominance are two other conditions that have been stable for a long time, but which are now under threat. The Chinese government has launched several 'moonshot' initiatives that aim to consolidate the country's status as a global power. *The Belt and Road* initiative will connect Eurasia in a gigantic, Chinese-led infrastructure

project that will tie the involved regions and countries together economically and give China an unprecedented opportunity to exercise ‘soft power’ across Asia and Europe. The *Made in China 2025* initiative is another example where China reaches for leadership – here, in technology and science. The project aims to put China in a leading position in the development of new technology, including IT, robots, infrastructure and transport, farming technology, biotechnology, and materials science. China is also catching up with the West in other fields, including research output and education. In parallel with this, we see a Western world that is increasingly closing in on itself and that the Western-led international institutions designed to govern the 20th century world no longer possess the same power and universal legitimacy in the 21st. The overall picture drawn in parts 2 and 3 of the report is one of a new status quo where Asian, and especially Chinese-led globalisation and technological dominance may be the norm.

Compared to the political, technological, and economic balance shifts outlined in the report’s first three parts, the changes to our world’s climate and ecosystems are far more serious and far-reaching. A consequence of industrialisation, urbanisation, high population growth, and unsustainable consumption patterns is that the climate becomes more changeable, with extreme weather as the new norm. Part four of the report considers the consequences of accelerating environmental change in four areas: the destruction of future value, new migration patterns, challenges for future farming and food production, and increased pollution. We also look at the question of whether there is a real risk of a comprehensive systemic collapse – and how we may achieve a more appropriate pricing of nature that doesn’t just include its short-term usefulness to us. We conclude the report with a summary of its main points and offer our perspectives on the world to come.

Happy reading!

PART 1

DEMOCRATIC RECESSION



Surveys of the state of democracy show signs of a global democratic recession, with civil liberties, the division of power, and a strong rule of law being rolled back across the globe. What are the causes of this development, and what does the future of democracy look like?

After the end of the Cold War, liberal democracy – based on a strong rule of law, extensive division of power, the gradual expansion of civil liberties, and a focus on basic human rights – had its moment of triumph. In 1992, Francis Fukuyama published his seminal book *The End of History and the Last Man*, which posited that Western liberal democracy was the final step in mankind’s socio-cultural evolution. Eastern Europe, which since the end of World War II had suffered under authoritarian Communist rule, underwent a democratisation process. Democracy had its ‘Third Wave’, and the number of countries moving towards stronger democratic institutions far surpassed the number moving in the opposite direction. Western liberal democracy stood as the only legitimate model for how to build a successful state and an affluent society.

Since then, other less liberal societal models, with ‘hybrid’ models that combine market economy with centralised, semi-democratic or outright authoritarian forms of government, have been gaining ground. These hybrid regimes exist in the grey area between democracy and autocracy. They aren’t dictatorships of the sort we know from the 20th century. To varying degrees, they guarantee their population some liberties, and in most of them, democratic elections are held, though they in practice are heavily weighted in favour of the incumbent government.

Nations like Singapore, Brazil, Turkey, Poland, the Philippines, and Hungary are examples of states that all experience a gradual erosion of the institutions, norms, and standards that support liberal democracy – and which hence move towards the hybrid model and possibly on towards the purely authoritarian. Even

the United States has been classified by The Economist and others as a so-called ‘flawed democracy’.

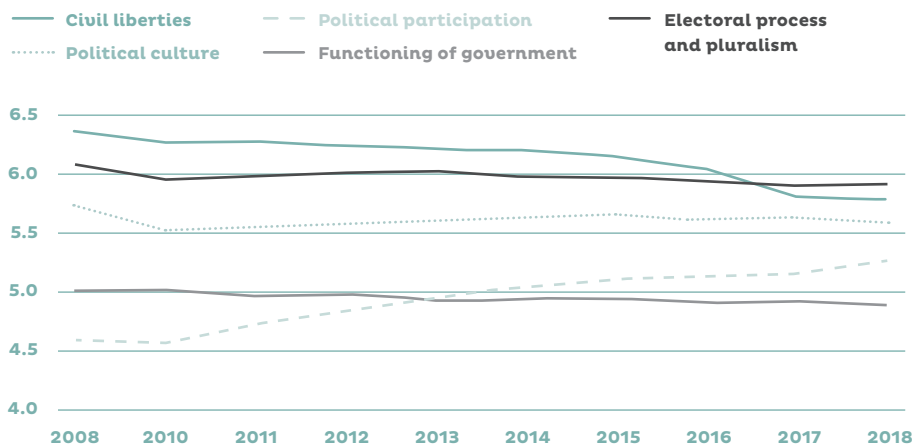
The trend of ‘democratic recession’ is a threat towards the long-term future of liberal democracy the world over, both in nations with strong democratic traditions as well as nations that are relatively new to democracy.

GLOBAL BACKSLIDE

To understand this development over time and where it could be headed in the future, a good place to start is The Economist’s Democracy Index, an annual study that measures a range of parameters that together provide an image of how strong democratic institutions, and what we could call ‘democratic culture’, are across the world (see figure 1.1).

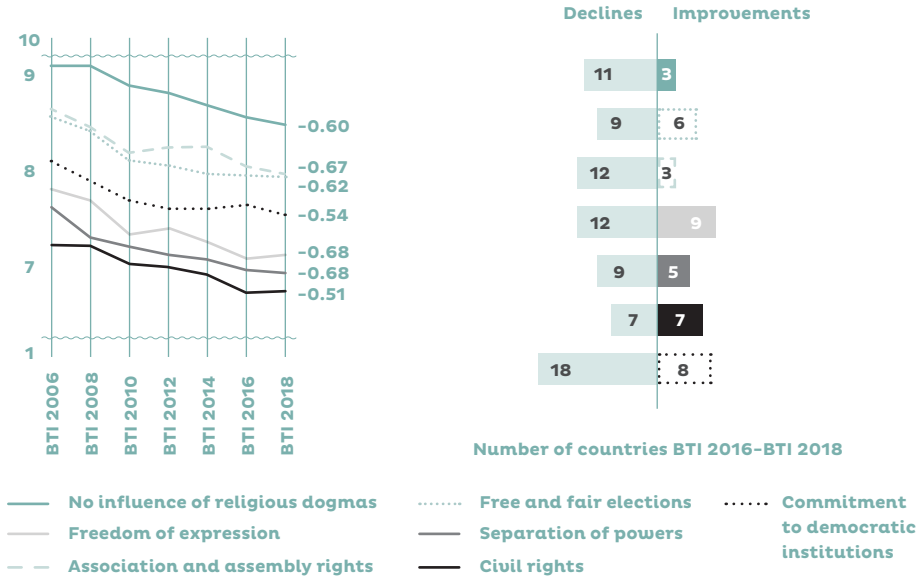
The index shows that political participation in elections is on the rise and has been for the last decade, except in North Africa and the Middle East. Women especially are participating in the democratic process more than before. Paradoxically, this is happening in a time where trust in organisations – including

FIGURE 1.1: EVOLUTION OF DEMOCRACY BY CATEGORY



Source: The Economist Intelligence Unit (2018).

FIGURE 1.2: POLITICAL AND CIVIL RIGHTS INCREASINGLY RESTRICTED IN DEMOCRACIES



Source: Bertelsmann Stiftung Transformation Index (2018).

democratic and state institutions – is in decline, according to Edelman’s major annual trust survey.¹ At the 2018 US midterm elections, voter turnout was the highest in more than a hundred years, in a year when trust in US political institutions was historically low.² In South America, where many nations have been plagued by political corruption, voter turnout has also been rising. This shows that democratic participation and strong democratic institutions don’t necessarily go hand in hand. Increased democratic participation is the only good news in The Economist’s 2018 index, as all four other indicators are in decline.

The civil liberties indicator has seen the sharpest decline in recent years, mainly because freedoms of speech and the press have been rolled back many places across the world. The growing use of torture against political opponents and eroding human rights are other factors. The remaining indicators, political culture, functioning of government, and electoral process and pluralism, have all seen

steady decline since 2008, though they have been relatively stable over the last three years.

Another major annual democracy study, Bertelsmann Stiftung's *Transformation Index*,³ paints a similar picture. The study shows that 40 states, including some of the most developed democracies, have rolled back some rule of law in recent years, and that 50 states have introduced limitations on civil liberties. The study points to nations that used to be showpieces for democratic progress – Brazil, Poland, and Turkey – where publicly elected leaders of state now limit civil liberties and weaken democratic institutions to strengthen their grip on power. Bertelsmann Stiftung's study shows a world of growing political instability and negative developments for democratic principles such as division of power, coupled with widespread corruption, and the gradual rollback of rule of law and civil liberties in many places in the world.

The combined image painted by the two above studies is one of a liberal democracy in crisis, both in countries with strong democratic traditions as well as in countries where democracy is a relatively new thing.

CAUSES AND DRIVERS

Studies like The Economist's *Democracy Index* and Bertelsmann Stiftung's *Transformation Index* provide indicators for the direction that democracy is moving. When we seek to explain the causes of this democratic recession, it is harder to paint a clear picture. Even so, we can point to at least four strong drivers:

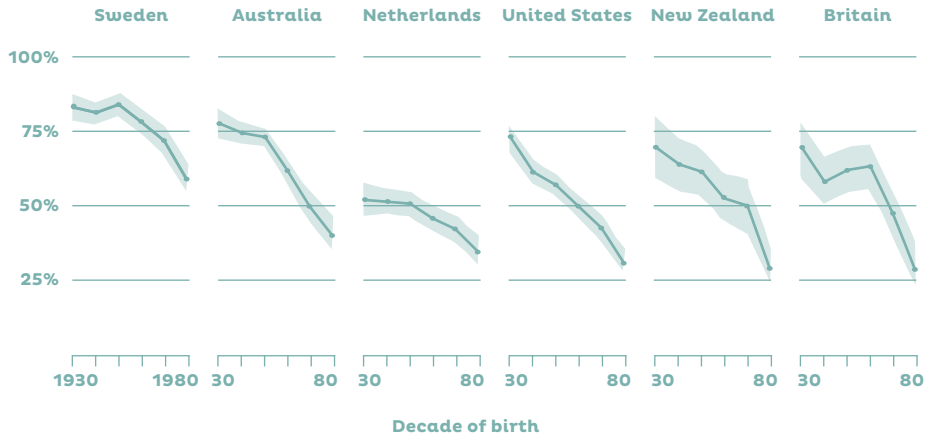
1. A stronger counternarrative to liberal democracy

“The most popular topic in thinking today is trying to understand how systems that are not Western, not liberal, not liberal democracies, and perhaps not even democracies, can nevertheless make their nations successful.”⁴ – Viktor Orbán

Since Viktor Orbán became known as a democratic reform politician after the end of the Cold War, the present-day Hungarian prime minister has taken steps to centralise the legislative and executive power, limit freedom of speech, and weaken the Hungarian legal system;⁵ and today he is a self-declared opponent of Western liberal democracy. Orbán's evolution from democratic to authoritarian leader of state is symptomatic for the general shift that has taken place worldwide in not just politicians', but also the populations' attitude to democracy in general.

A lot of things suggest that this narrative finds particular favour among the young.

FIGURE 1.3: PERCENTAGE OF PEOPLE WHO SAY IT IS “ESSENTIAL” TO LIVE IN DEMOCRACY



Source: New York Times (2016).

A research article published by the University of Melbourne and Harvard University shows that the share of young people especially who support having “a strong leader who doesn’t have to worry about parliaments or elections” has grown the world over during the last 25 years, and significantly so in many places.⁶ Other studies show a similar picture. A survey carried out by *New York Times* shows that the share of young citizens in polled Western countries who don’t find it essential to live in a democracy is far higher than for older generations (see figure 1.3). This shows that liberal democracy isn’t as strong a role model for parts of the population as it used to be. In the more extreme cases, it is seen as failed, decadent, weak, or paralysed.

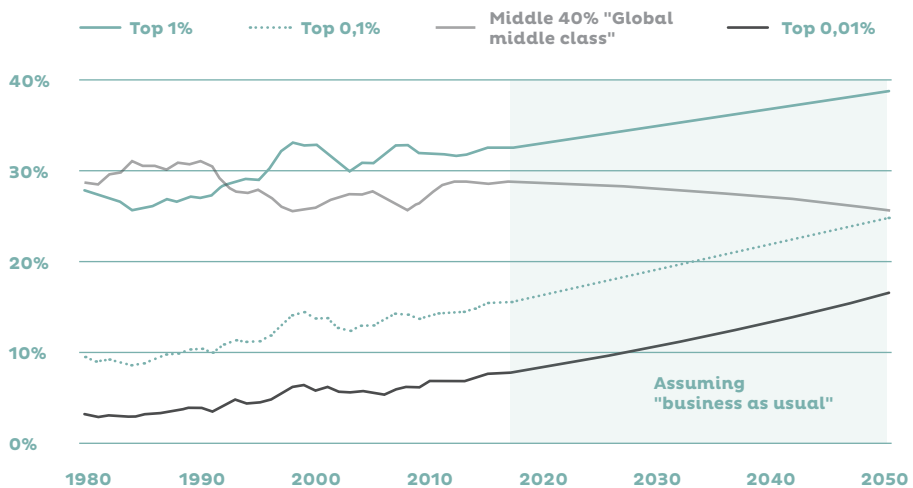
On top of this, the fact that China is challenging the West on a growing number of parameters – including globalisation (as shown in part 3) and technology (as shown in part 2) – makes it clear that liberal democracy is no prerequisite for the economic and technological competitiveness of a state.

2. Growing economic polarisation

Increasing economic polarisation (measured in the distribution of income and wealth) has grown at different speeds globally in recent decades. Nevertheless,

overall inequality has grown steadily since the 1980s – especially in North America, China, Russia, and India, and to a lesser degree Europe.⁷ In a “business as usual” scenario, where the political effort to reduce economic polarisation isn’t strengthened, the think tank Global Inequality Lab expects that the trend towards greater inequality will continue towards 2050 on a global level (see figure 1.4).

FIGURE 1.4: SHARE OF GLOBAL WEALTH



Source: WID world (2017).

It is not a law of nature that economic inequality leads to ‘illiberal’ politics, but several economists and political scientists, including Robert Putnam and Joseph Stiglitz, point to the correlation between economic inequality and lower inter-citizen trust, which is a critical element in a well-functioning democracy.⁸ The annual *World Inequality Report* sums this up in a similar way: “if rising inequality is not properly monitored and addressed, it can lead to various sorts of political, economic, and social catastrophes”.⁹ The platform economy’s ‘winner takes all’ dynamic and the coming wave of automation may further fuel growing economic polarisation if the enormous increase in productivity continues to channel still higher income and wealth shares to those who own the technology and the capital.

3. A growing sense of cultural displacement

Economic inequality explains some of the widespread dissatisfaction with the status quo. But it doesn't necessarily explain why this dissatisfaction has so far led to the global rise of anti-liberal right-wing populism and not, for example, left-wing populism. Part of the explanation is that apathy or animosity toward liberal democracy isn't only driven by growing material inequality, but also by a growing sense of cultural displacement and polarisation. Identity politics have rooted themselves at both ends of the political spectrum, and on the anti-liberal wing, a new 'oppressor/oppressed' paradigm has arisen, where it isn't so much economic inequality, but rather a combination of 'globalist' politicians, an out-of-touch elite, immigrants, and refugees that are seen as the main threats to a successful society. In a European context it is difficult to disregard events like the 2015 refugee crisis and its political aftermath that have given impetus to populist and anti-liberal forces.

4. The internet as an alternative news source

We can't overlook the significance of the internet when we seek to explain the crisis of liberal democracy. The internet has become ubiquitous as our primary source of information, communication, and participation in the public debate. Fake news and the use of disinformation on social media as a political weapon is by now old news but no less relevant. Add to this the growing popularity of alternative digital media platforms and the associated convergence of opinions and messages in echo chambers and filter bubbles that we have seen in recent years. Today, 18-29-year old Americans are four times as likely to seek out news on social platforms as those aged 65 or older.¹⁰ On these platforms, news is curated by algorithms that cater to the user's preferences and biases. This leads to increased plurality in the news sources the user is presented with, but also means that serious news content is presented side by side with content from highly biased or even misleading sources, which makes it harder to separate truth from fiction.

On the alternative digital news channels, especially YouTube, we see the rise of what the think tank Data & Society Research Institute has defined as 'the Alternative Influence Network' – a growing subculture of opinion-makers and intellectuals who maintain a strong self-image as being outside of the narratives of the mainstream media.¹¹ Here, unpopular views or marginal ideas are presented as 'forbidden', and an underdog narrative is nurtured about the repression of truth in traditional media channels. If we move farther out in this spectrum, we find forums like 4chan, which was once the home of the cyber-anarchist Anonymous movement but now has become a breeding ground for anti-liberal web culture.

CONSEQUENCES

According to aforementioned Economist study, only 20 so-called ‘full democracies’ exist today, with robust rule of law, extensive civil liberties, a strong democratic culture, and politically diverse and independent media. These 20 countries only make up about 4.5 % of the world’s population. If we focus narrowly on these figures, it may look as if liberal democracy is highly endangered. However, today’s situation is far from being unprecedented. To put the numbers in perspective, in 1941 there were only 11 democracies in the world. In the early 1920s, the number had been far higher. Any observer at that time would probably have concluded that the future belonged to fascism and communism. It took a World War to reverse this trend, but that is not the only example of how waves of democratisation have been followed by ‘de-democratisation’ – a countertrend of sorts to democratisation as a megatrend. Nevertheless, the future of democracy does look more muddled than its immediate past. Democracies are not disappearing, but many of them are changing fundamentally, becoming less ‘full’ and more ‘hybrid’.

For companies and organisations that need to navigate globally in a more illiberal and politically turbulent world, it may become necessary to take a more clearly defined stand on issues that perhaps did not play a role in the past. This includes the question of whether democratic ideals are part of the company’s DNA, similarly to how many companies today must actively consider if sustainability is an important principle for them. One could object that this sort of luxury consideration will mostly be made if it is already convenient. All else being equal, for these concerns to seep into the corporate world will require as strong a public awareness about the preservation of liberal principles in the future as there is today about climate change. Whether this is a realistic prospect is highly debatable.

From a societal perspective, we can expect the digital social media platform owners to play a growing part in maintaining (or weakening) democracy through their newfound role as public or semi-public spaces. Taken to an extreme, this will mean that issues like negotiating freedom of speech online will not fall to governments in the future, but instead to privately owned companies.

Finally, it is worth mentioning that the democratic recession, at least as it looks in the West, can probably also be tied to the idea that Western dominance in a range of fields is being weakened internationally and that the anti-liberal movements may be a reaction to this crisis of self-confidence. We will take a closer look at how the West is losing terrain when it comes to technology and globalisation – and what this will mean – in the following two parts of the report.



PART 2

THE END OF WESTERN TECHNOLOGICAL DOMINANCE

Since the industrial revolution, the Western world has dominated the development of science and technology. Asian nations, with China in the lead, are now challenging the Western hegemony in several areas, including R&D spending and within the IT, Transport and Biotech sectors.

Throughout history, new inventions and scientific discoveries have been made by different civilisations across the world. The ancient Egyptians built massive monuments and invented the steam engine (though it wasn't used for much else than having massive temple doors seemingly open on their own accord). The Greeks excelled in ship design, the Romans invented the dome, advanced siege engines, and a type of concrete that has lasted millennia. The Chinese invented paper, the mechanical clock, paper money, gunpowder, rockets, movable type for printing, and the magnetic compass. The Arab world has also made numerous inventions, including windmills, algebra, advanced surgery, and optics, as well as other impressive advances in science. The world's first university was founded in Fez, Morocco, and the world's first hospital was founded in Cairo, Egypt.

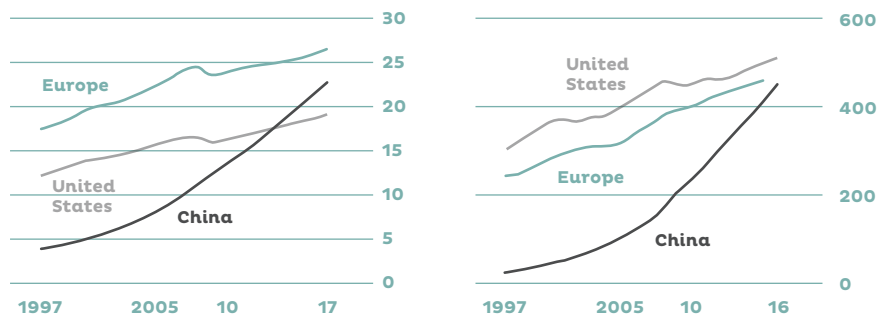
Since the Industrial Revolution, the West has maintained global technological dominance. While it can be argued that most of the inventions made in Europe during the Renaissance and early Industrial Age had been made before in other parts of the world, Europeans certainly made more effective use of them, arguably because Europe consisted of several diverse, competing nations rather than being a single empire.¹ Europe and the United States have been world leaders in the development and use of new technology for more than two centuries, and we can argue that the growth paradigm that has characterised Western civilisation is largely based on the development and commercialisation of new technology in competition between companies.²

It looks, however, as if the West soon may be losing out in the battle for techno-

logical dominance, with the East (particularly China) in ascendance. China isn't the only non-Western technological superpower. South Korea is a world leader in consumer electronics and cars, and Japan is the world leader in robotics, with four of the global top six robotics companies by revenue, including the biggest, Mitsubishi.³ China, however, looks to be the dominant Eastern technological superpower by far, and hence, the focus is on China in this part of the report.

According to *The Economist*, China is rapidly overtaking the United States, as well as Europe (including Russia) in spending on research and development (R&D), measured as purchasing power parity (ppp). Chinese R&D spending in fact grew tenfold between 2000 and 2016. Though Chinese R&D spending as a share of GDP still is lower than in advanced countries like the US or Germany, the share is growing, and with a much faster growing GDP, overall GDP spending looks to quickly surpass any competitors. China isn't set to lead just in terms of spending, either; China also produces more doctoral degrees than the US and more than three times as many people with degrees in engineering and natural science – and these numbers grow faster than in the US or the EU. In 2008, China launched a successful program to attract talented researchers, particularly Chinese who studied at foreign universities and decided to stay there.⁴ All this means that China is well suited to maintain its fast pace of technological development – and while so far, this development has mainly been one of catching up, we may

FIGURE 2.1: GDP AND R&D SPENDING (PURCHASING POWER PARITY, 2016 PRICES)



Source: *The Economist*, 2018.

MADE IN CHINA 2025

An indicator of how China seeks to achieve technological dominance is the 2015 government initiative to comprehensively upgrade Chinese industry, **Made in China 2025**. The initiative aims to make the country a global leader in high-tech industries. A greater emphasis will be placed on quality management in the sectors and the nurturing of world-class brands, with environmental considerations and energy efficiency at the forefront. The initiative focuses on ten sectors of technology where China seeks to become world leader:

1. *New information technology*
2. *High-end numerically (AI) controlled machine tools and robots*
3. *Aerospace equipment*
4. *Ocean engineering equipment and high-end vessels*
5. *High-end rail transportation equipment*
6. *Energy-saving cars and new energy cars*
7. *Electrical equipment*
8. *Farming machines*
9. *New materials, such as polymers*
10. *Bio-medicine and high-end medical equipment.*

In 2018, the US Council on Foreign Relations stated that Made in China 2025 is “the real existential threat to U.S. technological leadership”, and it may indeed spell the end of Western technological dominance unless Western nations come up with a response.

Source: “‘Made in China 2025’ plan issued”, State Council of the People's Republic of China (2015), bit.ly/2WQBnbn.

soon reach the tipping point where the rest of the world has to struggle to catch up to China.

INFORMATION TECHNOLOGY

The microchip, the internet, and the mobile phone were all invented in the United States, and the West has dominated modern information and communication technology. This looks to be changing. South Korea and China produce most of

the world's smartphones, with Samsung, Huawei, Xiaomi, Vivo, and Oppo having a combined market share of 59 percent in the third quarter of 2018. Apple, the largest Western smartphone producer, holds a measly 12 percent of the market.⁵ A lot of the chips in Asian smartphones are still produced in the West, but Samsung, Huawei, and Taiwanese company MediaTek are now developing high-end smartphone chips with AI and 5G modems.⁶

5G networks are the next major step in wireless communication, promising data transfer speeds up to 100 times higher than the current 4G networks, as well as faster response times with negligible latency (down to a millisecond). 5G also allows the use of a much more thorough encryption than today, since the rapid transfer of data allows a far higher proportion of transmitted data to be dedicated to encryption while still achieving faster data transmission.⁷ 5G networks are expected to carry a lot of data produced or used by artificial intelligence and connected machines such as self-driving cars.

FIGURE 2.2: SUPERCOMPUTER INSTALLATIONS BY COUNTRY (NOVEMBER 2018)

		Count	System Share (%)	Rmax (TFlops)	Rpeak (TFlops)	Cores
1	China	227	45,4	438,228	806,368	26,632,672
2	United States	109	21,8	533,209	757,357	16,101,360
3	Japan	31	6,2	109,436	170,880	5,710,372
4	United Kingdom	20	4	41,729	52,510	1,625,892
5	France	18	3,6	43,580	66,599	1,792,656

Source: Top500.org, 2018.

China is expected to be first in offering 5G networks and commercial services and looks to become cost leader due to the size of the Chinese market.⁸ The Chinese company Huawei is world leader in 5G equipment, and the United States, Australia, New Zealand, and Canada have decided to prohibit or restrict Huawei in their domestic markets, in part to protect their markets, and in part because of worries that China may monitor and abuse the wealth of data moved by 5G networks operated by Huawei. Germany is considering a ban due to security after

being warned by Washington.⁹ While these bans are grounded in security worries, they demonstrate that China is expected to be a major player, even global leader, in 5G networks.

In an age characterised by big data analysis, the internet of things, and artificial intelligence, a new arms race has begun where nations compete to be on the forefront with the world's fastest supercomputers. Supercomputers, or High-Performance Computing, are computers capable of handling computations orders of magnitude faster than typical office computers. They are useful for tasks such as weather forecasts, geological studies, and machine learning. Supercomputers are particularly important in developing advanced artificial intelligence, which is seen as perhaps the most important technological field over the next decades, with applications in warfare and intelligence, robotics, education, and smart-city solutions. PwC estimates that by 2030, artificial intelligence products and systems will contribute up to USD 15.7 trillion to the global economy, with China and the US as the leading developers.¹⁰

As of November 2018, the United States operates the world's two fastest supercomputers, the Summit and the Sierra, but China holds the next two places with Sunway TaihuLight and Tianhe-2A. However, if we measure by the number of supercomputer installations in the global top 500, China is in the lead with 227 supercomputers, more than twice the 109 US supercomputers.¹¹

PwC estimates that China will reap the most benefit from AI over the next decade, with roughly USD 7 trillion in GDP gains by 2030. In 2017, China declared AI a strategic national priority for the country and aims to create a national "deep learning laboratory". China has no less than three supercomputer projects that may achieve performance in excess of 1 exaflop.¹² It looks as if China is investing strongly in taking the lead in supercomputers, and it remains to be seen if the US will respond by investing more in supercomputers.

In September 2018, the European Commission announced the European High-Performance Computing Joint Undertaking (EuroHPC JU), which will pool European resources to develop and deploy two supercomputers that will be among the global top 5.¹³ The budget for this undertaking is about EUR 1 billion, roughly four times the cost of the Summit supercomputer and similar to the expected cost of developing China's three exaflop supercomputers. This looks to make the supercomputer arms race a three-way race, with China as the favourite and the EU as the dark horse.

TRANSPORT TECHNOLOGY

The West may have dominated the development and production of internal combustion vehicles, but when it comes to electric vehicles (EVs), China looks to be in the lead. Of the top 10 global producers of EVs, 5 are Chinese, with 2 more being fully or partly Asian. In addition, China produces 56% of the lithium-ion batteries that drive EVs, with plans to expand the production to a capacity to three times that of the rest of the world combined. Since 2013, almost 500 electric-vehicle companies have launched in China. Heavy subsidies and restrictions of combustion vehicles drive up domestic demand for electric cars.¹⁴

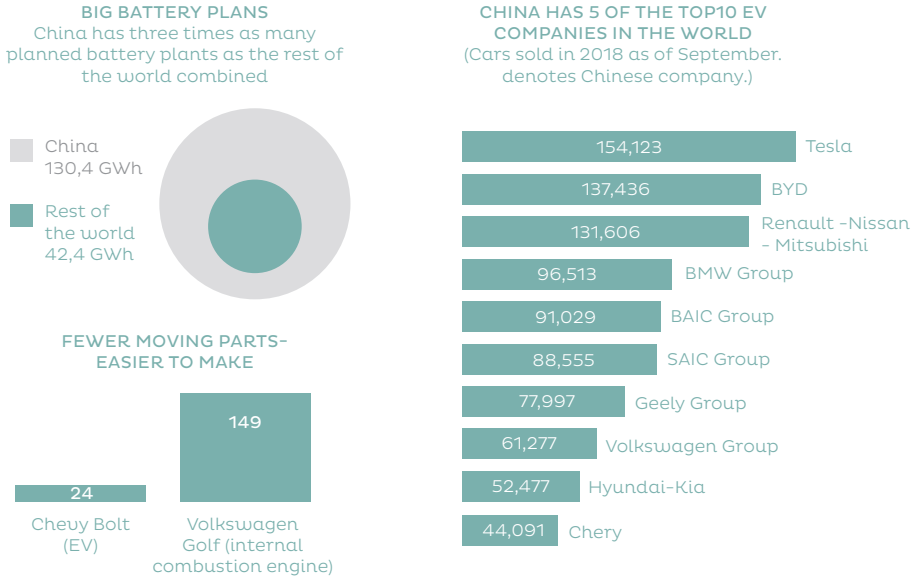
The uptake of electric vehicles has been slow, especially in the West (see CIFS members' report 4/2016: *Evaluating the Hype*).¹⁵ Even so, few deny that EVs are the personal vehicles of the future, given the environmental importance of phasing out fossil fuels and the rapidly declining costs of electricity from sustainable production.

China is the world leader in high-speed rail even today. At the end of 2018, China had over 29,000 km of high-speed railway lines capable of between 250 km/h and a world record 350 km/h. This is two-thirds of the world's total, with 4,100 km added in 2018 alone. In 2019, China plans to put another 6,800 km of new track into service. In 2019, depending on the results of a feasibility study, China may also begin 1,700 km of high-speed rail from Sichuan to Tibet, across some of the deepest valleys in the world. This stretch alone has a budget of at least USD 35 billion. Near-future plans also include a pan-Asian railway network, stretching south through Laos, Thailand and Malaysia to Singapore. China has earlier aired ambitions about building high-speed rails across Russia to Europe, capable of transporting goods and people between the two regions in a few days. The Chinese Belt and Road-initiative is discussed more in-depth in part 3 of the report.

China is also investing heavily in airship technology. Airships have lower construction and operating costs than traditional airplanes, are less harmful to the climate, and don't require runways. On the other hand, they are far slower, with operating speeds on the order of 80 km/h,¹⁶ but that is not a problem for freight, having twice the speed of a typical container ship and the ability to fly directly across land and sea.

Some will even say that Chinese transport technology is out of this world. In fact, in January 2019, China landed a spacecraft and rover on the far side of the Moon, something that has never been achieved before. While this may not sound im-

FIGURE 2.3: CHINA'S DOMINANCE OF THE EV MARKET



Source: MIT (2018).

pressive compared to the US landing rovers on Mars, flying probes close to Pluto, or sending craft into the atmosphere of Jupiter and Titan, the feat was complicated by the fact that direct communication between the Earth and the far side of the Moon is impossible. Communication had to be relayed by a relay satellite carefully placed in one of the Lagrange 2 points behind the Moon, something that also is unprecedented.¹⁷ Over the next decades, China plans to build a new space station by 2022 (at a time when the US-led International Space Station is winding down), followed by a manned Moon research base and missions to Mars. The Chinese space program is advancing at a moderate pace, with a focus on steady advances over prestigious ‘moonshot’ projects – but that may turn out to be the better long-term strategy.

China’s move to become world leader in EVs, along with the focus on high-speed railways, aerospace technology and ocean-going vessels, may hence spell the end of the West’s dominance in transport technology.

BIOTECHNOLOGY

As a part of the Made in China 2025 strategy (see fact box on page 19), China is betting big on biotechnology and aims to have the biotech sector make up 4% of the nation's GDP by 2020 – roughly double what it is in the United States. China has more than a hundred biotechnological science parks working to that end, with 93 in Guangzhou alone. Chinese investments in life sciences have grown from less than USD 1 billion in 2013 to more than 20 billion in 2018, a trend that does not appear to slow down (investments nearly doubled from 2017 to 2018).¹⁸

China's State Drug Administration (CFDA) recently overhauled its regulatory process to expedite the approval of new drugs, among other things accepting clinical trial data from other countries. This has increased the approval of new drugs six-fold. CFDA is in the process of being modernised to live up to international standards, making foreign approval of Chinese drugs more likely. While China has 20 percent of the world's population, it has 30 percent of global cancer cases, including 36 percent of global lung disease cases, as a result of pollution and a high rate of smokers. This makes cancer research a high priority, and biotechnology like T-cell therapy is an important part of this strategy.

Perhaps the most touted biotechnology currently is the CRISPR-Cas9 gene editing tool. Between 2014 and 2017, China published more CRISPR-related articles than the US and Europe combined, and while China generally lags far behind the US in terms of patents, as of 2016 China had almost as many CRISPR-related patents (410) as the US (447).

China doesn't just invest in biotechnology at home, the country also invests heavily in biotechnology startups in the United States. According to Reuters, in 2018, China venture capital invested USD 2.9 billion in US biotech companies, with an additional 1.4 billion invested by other Asian nations. This makes Asia responsible for 43 percent of foreign investment in US biotech, up from just 11 percent.¹⁹

One concern is the lower (or perhaps merely different) ethical standards for biotechnology in China compared to the West. In November 2018, global headlines were made when the Chinese scientist, He Jiankui, of Southern University of Science and Technology in Shenzhen announced that he had edited the genes of newborn twin girls with CRISPR technology, with the aim to improve resistance to HIV infections. This sparked strong response from western scientists, with some calling the experiment “unconscionable”, “not morally or ethically defensible” or even “monstrous”.²⁰ In January 2019, Chinese authorities denounced

Jiankui's experiment, declaring it illegal, and he was fired from his university; yet the fact that the scientist wasn't stopped before speaks of poor oversight of biotechnological research.

DISCUSSION

What are the causes of this shift of technological dominance from West to East? Is it simply a matter of China's impressive economic growth? If so, why didn't the other BRICS countries follow suit when they were at their peak? The size of China's population is a factor, but India's population is equally big with few signs of achieving technological dominance, while South Korea and Japan, with their moderate population and economic growth, has had a far greater impact on global technology. Investment in R&D is of course important, but China's R&D investment as a share of GDP is quite moderate, well below that of Western tech superpowers like Germany and the US and even farther behind Japan and South Korea. Nor does the ratio between private and public spending seem to really play a role.²¹ Government spending on education doesn't seem to be a factor either, with the US and Western Europe spending a greater share of GDP on education than China.

CHINESE ECONOMY

China has the world's second-largest economy, with a GDP of USD 13 trillion and growth in 2018 of 6.6 percent, which, while the lowest since 1990, is still far higher than Western countries. Chinese R&D investments were USD 254 billion in 2017, an increase of 12.3 percent over the previous year. In real terms, this is roughly equal to half the R&D investment of the United States; however, in terms of purchasing power parity (ppp), it is more or less equivalent.

Lacking solid numbers, we are left with conjecture, with all the dangers of erroneous assumptions that may contain. However, one possibility for the success of China and other Asian countries like Japan and South Korea when it comes to technology may be a willingness to focus research investments on the long term. China's Made in China 2025 plan, which aims to turn China into a leading manufacturing power, is certainly long-term planning, whereas the investment horizons of most Western companies are rarely more than a handful of years. Not

being a democracy may in fact aid China in this, since changing governments in Western democracies regularly shift the focus of investment and focus on projects that may produce results before the next election. We mentioned in the introduction to this chapter the theory that Western technological dominance may be the result of competing companies, but paradoxically, this may now be the reason for the loss of dominance: Companies have neither the funds nor the patience for the massive, long-term ‘moonshot’ projects that may be the key to technological leadership in the 21st century.

During WW2 and the post-war years, the United States undertook such projects, most notably the Manhattan Project leading up to the atomic bomb (with nuclear power as a spinoff) and the Apollo Program leading up to the Moon landing in 1969. However, NASA funding has declined from being in excess of 4% of the federal budget in the mid-1960s to less than half a percent today. No other major public project has taken the place of the space program, even though the value of such moonshots is generally believed to be great. Even the much-touted Human Genome Project had a total cost of a measly USD 5 billion, roughly a quarter of the much-depleted annual NASA budget. The Large Hadron Collider and the upcoming James Webb space telescope are in the same order of magnitude. Though Google’s “Google X” department claims to do moonshot projects, their budgets remain far below the Apollo Project.²²

The West may retain technological dominance despite the above factors if enough is done (publicly and privately) to support education and research. However, public schools in the US are notoriously underfunded, with poor maintenance, outdated schoolbooks, and teachers having to take a second job to get by,²³ and things are little or no better in many other Western countries. Attending a decent university in the US, UK, and many other places is too expensive to be affordable for a large part of the population, leading to a loss of potential talent. Even in countries with free education, retaining talent is a big challenge.

Will it matter that the East assumes technological dominance over the West, other than a shift in economic power? Perhaps not. Some may argue that in the West, technological research is subject to democratic control, which may not be the case in China. Others may point to how China through dominance of technology like the coming 5G networks may collect a lot of sensitive data on citizens – but is that very different from what Western tech giants and intelligence agencies do today? The greatest danger may lie in monopolies. The US and the EU have regulations to prevent trusts and monopolies, but this is not the case in China.

PART 3

THE END OF WESTERN-LED GLOBALISATION



Ambitious projects such as the Belt and Road initiative and the Made in China 2025 plan signal a new wave of Easternisation and Chinese-led globalisation. Meanwhile, Western nations are turning inward, and there are clear signs that the Western-led global institutions built to govern the 20th century world are no longer fit for purpose in the 21st.

Globalisation rests on the flow of goods, information, people and even culture and language. The rapid increase in interconnectedness has been propelled by technologies facilitating trade and information exchange at a pace and reach without precedent - just as the domestication of the camel some 1000 years B.C., proved to be a 'technological' breakthrough that ultimately gave us the Silk Road and connected continents with caravans of goods. But in the context of this report, we will stay within the realm of the last century, which is characterised by the decline of traditional imperialism coupled with an accelerating global flow of goods, money, culture and ideology, with the West, especially the US, as the driving force.

Globalisation has not only been evident in the sheer numbers of containers stacked to cross the oceans. What was in these containers has mattered tremendously too. So have the currencies of transactions and the courts in which any global disputes were settled. Hybrid cultural tendencies, with Western traits as a common denominator, have been developing as an undercurrent to the conventional measures of global conversion. Terms such as 'Coca-Colonization', 'Disneyfication', the use of the 'Bic Mac Index' to measure purchasing power parity and Egyptian MacDonald's serving McFalafel, however anecdotal, are tangible indicators of globalisation not being limited to economic and technological phenomena, but also includes societal and cultural aspects.

This is also evident in the increasing lingual dominance of English, which has effectively become the first truly global language in history, despite the fact the its

native speakers originally came from a relatively small country currently counting some 66 million people. Sceptics can argue that while liberalisation of trade, investment and human mobility fuelled economic growth across the globe (even if not uniformly), the shadow development that came with exporting values and ways of life has challenged sovereign nations and their cultures. For better or worse.

This has meant that Western standards and technology have been spread and embedded across the globe. When adventurously backpacking to the outskirts of a Nepalese valley or an Amazon jungle, we appreciate if at the end of a long day of hiking, the menu in the village eatery has some English in it. We also expect to be able to pay by credit card or at least in US dollars or Euros, that our devices connect to the local Wi-Fi, that the power outlets fit our devices or that we brought a transformer so that the number of variables is limited to a minimum.

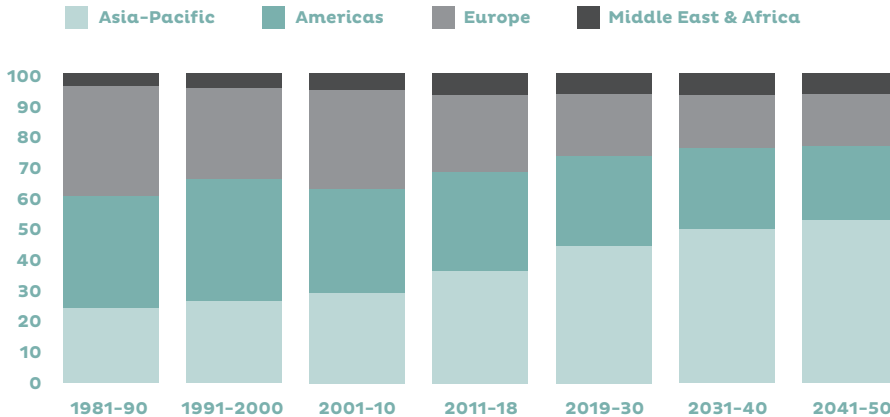
The economic and technological dominance as well as cultural influence of Western-led globalisation over the last century echoes even in the most remote corners of our globe. For decades, it gave the West an advantage by default, made Western businesses serve as global best practice and enabled Western institutions to govern worldwide. Not to mention the millions of containers shipped across the oceans and the funds repatriated in connection with trading all these goods.

And now imagine the next century being shaped multilaterally or perhaps even dominated by a significantly different culture and set of standards. What if next time you fill your backpack and set out to explore, at the end of that long day the internet connection for your social media update runs on a different platform not compatible with your device? Or if speaking Mandarin is a prerequisite for employment in any role within the hospitality, customer service or any other multinational industry in Europe? What if the *modus operandi* of international trade and commerce no longer rests on one, but several different and even conflicting, international institutions you can turn to for legal comfort and judicial enforcement support? In theory, this is just as unlikely as an English menu in a village in Nepal.

WHILE KEEPING OUR EYES ON CHINA, WE STUMBLERD INTO A CRISIS

It is evident that the economic and political gravitational pull is shifting East. Some argue that this rebalancing has come unexpectedly, but has it really? Encouraged and reinforced by the fall of the USSR, the better part of the last decades was spent in hubris-like conviction of liberal democracy and capitalism as the

FIGURE 3.1: REGIONAL SHARE OF GLOBAL GDP



Source: The Economist Intelligence Unit.

only true sustainable future vision for any society. Surely, China was next in line to succumb to the realisation that any rivalling political ideology or economic policy was doomed, and eventually had to surrender to Adam Smith’s ‘invisible hand’ and market dynamics. But for a variety of reasons, this hasn’t happened yet. China holds its ground in maintaining a different vision of governance and has only grown stronger, so far avoiding the ‘expected’ economic crisis to stop it in its tracks and the popular uprising that would overthrow the regime. The cruel irony has been quite the opposite. While waiting for China to hit the development wall, the West has suffered a historic economic crisis and downturn, political division and turmoil, as well as social and political instability. The shock and the muddy aftermath of the Brexit vote and the presidency of Donald Trump are just symptoms of a wider phenomenon – a prevalent distrust in the political and elite classes¹ also reflected in increased division and polarisation.

Recent events are an outlet of alienation and frustration steadily fuelled by the uneven distribution of wealth stemming from globalisation, as well as other factors discussed in Part 1 of this report. But more than that, they are clear signs that the alliances and global institutions built to stabilise and govern the 20th century

world are no longer fit for purpose in the 21st. Take the G7, which to this day, some forty years after its inception, is made up of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. Hardly the most reflective list of the most influential economies by 2019 standards. Bear in mind, China and India are home to one in every three people in the world, and none of them are among these powerful seven.

INTERNATIONAL INSTITUTIONS IN NEED OF AN UPDATE

All the while the East continues to rise and grow stronger, the champions of the last century, Europe and North America, are showing signs of fatigue, internalisation and consequently retreat from the forefront of global leadership. Just in the last three years we have seen a substantial amount of international agreements between allies be disrupted or abandoned. We have witnessed the first vote by a key member to leave the EU, and the US has walked away from the negotiations of the Trans-Pacific- and the Transatlantic Trade and Investment Partnerships (TPP and TTIP), the Paris agreement on climate change, the Iran Nuclear Deal, the Intermediate-Range Nuclear Forces (INF) disarmament agreement with Russia and threatened to end NAFTA.

The lack of consensus among these previously close allies on the approach and efforts needed to address global challenges such as climate change and cyber security is adding to the divide while weakening their individual and collective positions. Even the institutions ultimately tasked with preserving world peace, such as the UN Security Council, are suffering from the disconnect between original intent and the realities of 21st century power distribution and conflicts of interest. In 2003, the Council was served a severe blow by one of its permanent members, not able to prevent the United States from invading Iraq even though the US as the leader of the free world should have great interest in preserving the council's institutional integrity. One can also ponder whether the permanent memberships and vetoes held by Russia, US, UK, France and China in such a council are a thing of the past, in a world of accelerated change and intricate geopolitics.

Adding to the realm of international but Western led institutions that have been established in the wake of the World Wars, we have the IMF, World Bank and WTO all of which govern globally but do not necessarily reflect the global power balance of the 21st century. Sceptics of global governance already regard international institutions as dependent reflections of the participating states' power and as being in very limited position to actually influence a state's behaviour.

Throughout history, it is evident that those with the most power establish and shape the international institutions within which they subsequently exercise these power balances, legitimately. This also means that no institutions are ever stronger or more stable than the power balances at their core. Which accurately mirrors the rising instability we are witnessing in our international ‘pillars’ these days.

GLOBALISATION WITH AN EASTERN FLAVOUR

No doubt, economic muscle also matters. China and India are indisputably the heavyweights of Asia when it comes to growth, but their neighbours in Vietnam and Indonesia have also made impressive headway in economic and technological developments. Consequently, when including growth in Africa and South America, emerging economies have almost doubled their share of global GDP in the last forty years and will, by 2030, likely account for close to 60% while being home to 85% of the world population.²

Historically, no hegemony has been able to keep power indefinitely. The global metamorphosis we are experiencing is just as natural as it may be unnerving for Westerners. In their 2008 World Trade report, the WTO offer a historic perspective:

“One valuable lesson from history is that globalisation has not been a smooth process. It has often been marked by periods of accelerated integration (as observed in the 19th century and in the second half of the 20th century) and by periods of dramatic reversals (as in the inter-war period) sometimes with costly consequences.”³

But perhaps, the unpleasant notion of change aside, it doesn’t have to be so dystopic after all. Although influence and dominance have many different avenues it is worth noting that from a historic perspective China has not exhibited an aggressively expansionary behaviour via military conflict in the same way or frequency as the US, Europe and the Soviet Union/Russia have. The real test may prove not to be how China manages its power but how the West, and in particular the US, reacts to what appears to be a loss of a dominance enjoyed for many decades. Will we remain on our highroad of liberal rights with humanism as our guiding star? Or were they ideals we could afford to protect and promote, when other concerns took up less of our energy, but which will be sacrificed at the altar of pragmatism and populism when our positions are challenged? We have yet to experience a time in history where we defend these liberties absent a dominant global role.

Perhaps the transition from a Western-dominated to a multi-polar world was best described by WTO in their 2008 trade report, published more than 10 years ago. The report read: “The future will not be singular in the manner that the West has long believed it should be, but plural and hybrid, no doubt with a strong Chinese flavour.”⁴ This sentiment seems even more fitting today than it did back then.

Looking into the future through the conventional globalisation lens of economic influence, one initiative stands out – the Chinese Belt and Road Initiative (BRI), backed up by the Made in China 2025 plan. The latter, which is discussed in detail in part 2, is a strategic plan aimed at lifting China from being the world’s factory floor, up the ladder of global value chains. In essence it is a roadmap to upgrade the manufacturing capabilities in 10 key high-tech sectors, including robotics, aerospace and clean-energy cars. The BRI is in turn a roughly one trillion-dollar vision, initiated by Chinese President Xi Jinping with the aim of connecting Southeast Asia, Central Asia, the Gulf region, Africa and Europe with infrastructure and a network of land and sea fairways. Some have referred to it as the Chinese Marshall Plan, others worry it has the characteristics of potential debt-trap-diplomacy. However, no-one can deny that it is immensely ambitious in size and reach. This development project involves a territory equal to 55% of global GDP, 70% of the global population and 75% of its known energy reserves.⁵

But not all of the projects involve bricks and steel; as part of the BRI China plans to set up international courts to resolve Belt and Road related commercial disputes. As Jonathan Hillman, director of the Reconnecting Asia project at the Center for Strategic and International Studies in Washington, writes: “It’s a reminder BRI is about more than roads, railways, and other hard infrastructure... It’s also a vehicle for China to write new rules, establish institutions that reflect Chinese interests, and reshape ‘soft’ infrastructure.”⁶

Beginning to sound familiar yet? Together with the New Development Bank (NDB), the Asia Infrastructure Investment Bank (AIIB) and the proposed Regional Comprehensive Economic Partnership trade agreement (RCEP), the Belt and Road courts can very well form an opposition to the existing Western led institutions that we take for granted and refer to for global rule of law and order. And while there are many pitfalls between the fast and furious catching up and a role of global leadership, such as demographic decline, high debt levels and relatively poor population, China has made its presence known. If the trajectories continue, with old first world in turmoil and the East remaining strong, it may well be about time to sign up for that Mandarin class.

WILDCARD: THE DEMISE OF GDP

Since the Bretton Woods conference in 1944, Gross Domestic Product (GDP) has been the main tool for measuring a country's economy. GDP has become synonymous with wealth, and improving GDP growth is now the goal of most economic policies. However, GDP is at odds with sustainability, since it only measures the monetary value of final goods and services produced and bought. It doesn't matter if any lasting value is created, and indeed, destruction of value and depletion of natural resources do not count against GDP. Planned obsolescence, where products are designed to not last as long as they could, will result in a higher GDP, since it forces consumers to buy the same or similar products over and over. Yet this doesn't benefit the consumer and it isn't good for the environment, since planned obsolescence leads to more waste and greater use of resources unless the products are fully recycled.

In recent years, a number of economists have criticised the GDP measure and the significance it is given.¹ In addition to the above reasons, GDP doesn't include improvements such as computers and smartphones upgrading while also becoming cheaper. Nor does GDP measure the well-being of citizens. If a citizen chooses to work, earn, and consume less to have more personal time with family or for hobbies – as has become increasingly common – it features negatively in GDP even though the citizen may feel happier. Similarly, the value of unpaid voluntary work doesn't feature in GDP unless it leads to measurable transactions of money. Free products like open-source software or other kinds of open content also do not count towards GDP even though they provide real value for users and measurable savings compared to similar commercial products. All this and more shows that

GDP is an increasingly poor measure of wealth and that it would be a costly mistake in the long run to keep using it as a driver for policies.

Other measures of wealth have been suggested, such as the Genuine Progress Indicator – which takes its basis in personal consumption and modifies this with 25 factors including inequality, volunteer work, education, crime, unemployment, and pollution – and Gross National Happiness, based on detailed surveys of the population.²

New measures of wealth and growth are needed but may not address the fact that our economy is fundamentally based on growing consumption. Increased productivity through automation, for example, means that workers produce more goods and services, and all these goods and services must be bought or the workers can't be paid for their work. Growing consumption hence ceases to be a measure of wealth; it becomes a core requirement for the survival of our society. If we reach 'peak consumption', our society will collapse. If we keep consuming more and more instead, the economy becomes unsustainable. Either option will end badly.³ Ultimately, we may have to re-evaluate our current focus on continual growth, at least the way growth is measured today.

1 See e.g. "The trouble with GDP", *The Economist* (2016), econ.st/2tqYZGm.

2 "Beyond GDP: are there better ways to measure well-being?", *The Conversation* (2014), bit.ly/2SKHSOU.

3 Klaus Jø. Mogensen: "What is the purpose of growth?", *SCENARIO Magazine* 2/2017.



PART 4

ACCELERATING ENVIRONMENTAL CHANGE

For centuries, we have been able to take a relatively stable environment for granted. This status quo is threatened by the rapid altering of the world's climate and ecosystems. The consequences will come in the shape of destruction of future value, challenges for future farming and food production, new refugee and migration patterns, and increasing pollution. This clash between ethical and economic considerations – and between short-term and long-term thinking – will force us to rethink how we price nature.

The times when we could take a stable climate for granted are over. Extreme weather in the form of droughts, hurricanes, storm surges, and periods of extreme heat or cold will go from being one-in-twenty-year events to becoming annually recurring phenomena. The world's coral reefs are dying out, and this threatens countless species. Pollution destroys groundwater and causes smog that makes some of the world's biggest cities nearly uninhabitable. Bees, butterflies, and other insects are vanishing at an alarming rate, and this threatens the world's ecosystems and food supply. Sea levels look to rise about a metre, possibly up to several metres towards 2100, and this challenges cities and farmland close to the sea. Growing consumption and population growth may cause a lack of essential resources within decades.

These kinds of environmental changes are a consequence of economic growth, population growth and unsustainable consumption patterns, and they lead to new risks for political systems, world trade, and the global economy. These risks range from fluctuations on the stock market over economic crises to wildcard scenarios such as full-scale societal collapse.

FOUR EXAMPLES OF FUTURE CHALLENGES

Accelerating environmental change challenges the status quo in a number of ways. Below, we look at four such examples that will be especially important in

the decades to come: destruction of future value, challenges for future farming and food production, new migration patterns, and increased pollution.

1: Destruction of future value

The South American rain forests host enormous biodiversity. Brazil is home to one of the most important habitats on Earth, and its rain forest houses a large percentage of the world's plant and animal species – according to some researchers, as much as 13 %.¹ A large number of everyday consumer products and medicines originate in the rainforest or have resources found there as a central component.²

We constantly learn new things about nature and the abilities it possesses. Biologically-inspired design (biomimetics) is a relatively new field, which among other things has enabled new housing construction through examining ant and termite colonies, design of better bathing suits by studying sharkskin, better windmill wings by imitating whale fins, and new ship design from studying penguins. From a utility perspective, the argument against destroying the rainforest is that it will rob future generations of innovations based on the biodiversity the rainforest still contains. This is true for loss of biodiversity all over the world such as the destruction of coral reefs and the extinction of insect species. The following story of the horseshoe crab may serve as an example of how nature often holds 'hidden' innovation potential:

200 million years before dinosaurs walked the Earth, horseshoe crabs were roaming about. This unique animal is one of the planet's oldest species and has survived several mass extinction events. From a classical, environmental-economic perspective, the horseshoe crab has been of little value to humans, as it has mainly been used for fish bait in Asia. Then scientists examined the horseshoe crab's blood and found that it was incredibly useful for detecting gram-negative bacteria such as *E. coli*. This trait is now used to make sure that implants, injections such as insulin, scalpels, and other things that are put into the body are free of bacteria. Now, one litre of the coagulant from horseshoe crabs is valued at USD 14,000.³ Not bad for an animal that used to be worthless. The example illustrates, as so often before, that nature has developed solutions which can be studied and contribute to creating a more innovative society with considerable associated economic effects.

2: Challenges for future farming and food production

Climate change is a central issue for global food security. To feed the world's growing population, food production needs to grow 60 % towards 2050, but without

adaptation to climate change, the global production in 2050 will be 7 % under what it would be without climate change.⁴ The consequences of climate change are already affecting food production with lower yields and reduced food quality. It is estimated that higher temperatures and changed rainfall patterns since 1980 have reduced the yield of wheat by 5,5 % and of corn by 3,8 % below what it would have been if the climate was stable.⁵

This problem will grow, since 25 % of existing farmland areas already have broken down. There is only 5 % more farmland to utilise, and meat production already occupies 77 % of farmland, a share that looks to grow. If everybody in the world consumed as much meat as Americans, the area that today consists of forest or farmland would have to be tripled. This is not possible, since available areas on the planet are primarily deserts or glaciers.⁶

This makes huge demands on productivity growth and streamlining throughout the supply chain. Mankind has faced this challenge before and solved the problem by introducing new high-yield crops combined with new production methods (the so-called 'green revolution'). Luckily, a lot of farming today is still subsistence farming that doesn't make use of modern technology and irrigation. There is hence a lot of potential for increasing production. The problem is that even if we succeed in increasing productivity in pace with economic growth and population growth, analyses show that increasingly extreme weather will lead to growing instability on the food market. According to GFS, a British task force dealing with extreme weather and food security, climate change has more than tripled the risk of extreme price increases, something that used to be considered a once-per-century event.⁷ In one of the scenarios developed by the insurance company Lloyds, a coincidence of unfortunate circumstances such as poor harvests and an outbreak of fungal infestations could lead to a 10 % drop of European stock values.⁸

The challenges aren't limited to farming. The world's coral reefs are expected to be destroyed by climate change, something that doesn't just influence tourism, but also global food supply. Coral reefs are spawning grounds for many of the ca. 170 million tons of fish that we eat globally every year. 260 million people are employed in the global fishing industry.⁹ Fish supply 2.5 billion people with between 20 % and 50 % of their animal protein intake.¹⁰ In some of the world's most food-insecure areas in Asia and Africa, fish protein is an important part of an already low intake of animal protein. Overfishing combined with periodic lower harvest yields will hence be a major challenge. There are plenty of historical ex-

amples of the relationship between food shocks and political instability. The French Revolution and the Arab Spring were both in part caused by increasing food prices. Food insecurity can disrupt the global food trade and thus constitutes a threat to peace, which increases companies' value at risk.

3: New migration patterns

Accelerating environmental change will greatly influence future global migration and refugee patterns. The number of climate refugees may exceed political refugees before 2040.¹¹ The early effects have already been seen. According to NASA climatologists, the period between 1998-2012 in Syria was 10-20 % drier than in the worst period the previous 900 years. The Syrian drought contributed to worsening the situation during the Syrian civil war, which eventually displaced two million people. Some sought towards Europe and, in combination with African refugees, created pressure on European borders that challenged European cooperation and caused the breakdown of the Schengen agreement.

These challenges must be met, since we can expect far more climate refugees in the future – as many as 1 million a year, according to a study from Columbia University.¹² Towards 2040, MENA countries will most likely experience declining soil humidity, since evaporation will grow in pace with increasing temperatures. West Asia, Equatorial Africa, and India are also at risk for desertification. A growing risk of floods is expected on almost every continent. Low-lying coastal areas and small islands are also at risk, and lower food production and quality are expected in South America and Asia. All in all, environmental changes like these will increase migration pressure globally.

4: Increased pollution

In 2015, Beijing experienced a serious case of smog that led the city to close schools and stop work and transport. As a consequence, schools began preparing for more virtual home schooling, just as workplaces allowed their employees to work more from home. In 2015, outdoor pollution cost China USD 850 billion. According to OECD, by 2030 China will experience a pollution-related reduction in GDP of USD 2.3 billion, which happens at a time where China will also be hard hit by massive ageing. Globally, the market impacts of outdoor air pollution, including impacts on labour productivity, health expenditures and agricultural crop yields, are projected to gradually increase to 1 % of global GDP by 2060.¹³ This primarily reflects reduced productivity and higher healthcare expenses.

In January 2019, the Thai capital of Bangkok, which ten years ago was considered

one of the cleanest major cities in Asia, experienced several weeks of smog that caused more than 400 schools to be closed, and authorities tried to remove the smog by shooting water cannons into the air. The smog is the result of a chronic problem in Asia's growth nations: a cocktail of runaway industrialisation, little regulation, a car-happy population, and rapid urbanisation.¹⁴

Groundwater is also affected in many countries. A study from 2016 showed that 60 % of groundwater in the enormous Indo-Gangetic basin, which accounts for a quarter of the world's freshwater from groundwater, is too polluted by salt or arsenic to drink.¹⁵ This water is also used to irrigate fields with the risk of accumulating poisons in crops, as well as salting the soil, making it unfit for growing.

RISK OF SYSTEMIC COLLAPSE?

A look back at world history suggests that a stable environment is crucial for growth. Civilisations have expanded in periods with a stable climate, and many have stagnated or even collapsed in periods of rapid environmental change. Some of these civilisations have met their fate slowly, like the frog that doesn't notice that the water it is in is heating until it reaches boiling level and the frog dies. As inhabitants of the planet Earth we have nowhere to go if we destroy our home. We are, as astronomer Carl Sagan said about Voyager's snapshot of our planet, an isolated little blue dot in a vast universe. There is no planet B.

It is difficult to make a direct comparison between historic examples separated in time, but there is a place in the world that can serve as a large-scale experiment: the island of Hispaniola in the Caribbean Sea. Haiti is located on the western third of the island and borders the Dominican Republic, which makes up the rest of the island. Haiti is one of the world's poorest countries, characterised by soil erosion caused by 99 % deforestation. The Dominican Republic is six times richer. A third of the island consists of forest, and the population density is smaller. Flying over the island reveals the contrast: on one side you see a green tropical island and at the other side a brown, scorched earth.

Haiti isn't unique. Western governance systems are also poor at handling long-term risks. This becomes obvious when we consider the fate of coral reefs. According to the Copenhagen Consensus, protecting coral reefs will lead to the highest returns of all the suggested new UN development goals, no less than USD 24 for every dollar spent. Reducing the loss of coral reefs by half will cost around USD 3 billion every year – and provide a benefit of at least USD 72 billion.¹⁶ Nonetheless, coral reefs are in rapid decline and are expected to have disappeared

END OF THE FOSSIL -FUEL ECONOMY

In 2017, fossil fuels still supplied more than 85% of global energy consumption. However, fossil fuels are the main source of the carbon emissions that are the primary cause of global warming. With rising environmental awareness, the call for a transition to non-fossil fuels will grow stronger. There is little doubt that we are nearing the end of the era of the fossil-fuel economy, but how soon? The transition could take most of the 21st century, but it could also happen much faster, and fossil fuels may be a niche just two decades from now.

70% of new global electricity production in 2017 was from renewables, and if this trend continues, half of all electricity will be from renewables as early as 2030. According to the organisation Carbon Tracker, by 2030, building new renewables will be cheaper than continuing to operate 96% of today's existing and planned coal plants. China alone could save USD 389 billion by closing coal plants in line with the Paris Climate Agreement instead of pursuing business as usual.¹

Cost savings are a powerful driver for change, and with rapidly declining costs of electricity from renewables, potential savings look to grow substantially over the coming decades. The unsubsidised levelized cost of energy (LCOE) for utility-scale onshore wind and photovoltaic (PV) solar power has dropped to or below most other generation technologies. Between 2009 and 2017, the LCOE of onshore wind fell by 67% and of utility-scale solar PV by 86%,² and costs continue to fall dramatically. Onshore wind and solar PV generation costs fell 18% in the first half of 2018 alone.³ Even with the continued decline of fossil fuel costs as we have seen in the last decade, we can expect the cost of renewables to fall far faster. Declining battery costs are also a major factor in making electricity more competitive. With the double driver of environmentalism and substantial cost savings, the shift to a sustainable energy economy may be much more pronounced than the 14% of global energy production by 2040 that current trends indicate.

1 Press release: "42% of global coal power plants run at a loss, finds world-first study", Carbon Tracker 2018.

2 Marlene Motyka, Andrew Slaughter & Carolyn Amon: "Global renewable energy trends: Solar and wind move from mainstream to preferred", Deloitte 2018, bit.ly/2SIDbFr.

3 Jeremy Hodges: "Fossil Fuels Squeezed by Plunge in Cost of Renewables, BNEF Says", Bloomberg 2018, bloom.bg/2GU31z2.

completely by 2050. Could we be in a situation where Haiti's ecological collapse becomes characteristic of most of the planet?

Such a global worst-case scenario could occur with a reduction of the thermohaline circulation, which can be considered the Earth's ventilation system and the engine that drives the Gulf Stream. A significant reduction of the thermohaline circulation would be catastrophic for the Earth's climate, especially for Europe. A weakened Gulf Stream will stop the circulation of oxygen in the oceans and have unforeseeable consequences - also for the economy. Two newly published studies in the scientific journal *Nature* have detected a 15 % reduction in the thermohaline circulation.¹⁷

HOW DO WE PRICE NATURE?

In today's paradigm, nature is priced relative to its direct value to us. A tree in a forest or a lion in a safari park has a value because the tree is raw material and people are willing to pay to see the lion. Nature on uninhabited islands or deep in the rainforest has no value. To this we can add that typical cost-benefit analyses of costs and advantages of climate measures tend to use discount rates that eliminate measures with long-term effects. If, for example, we use an annual market rate of three percent, an investment of one dollar today would have to lead to savings of USD 400 two hundred years from now to be worthwhile.

A relatively high discount rate means that some climate analysts can maintain that it makes more sense to leave the challenges to future generations, since they can better afford to handle the problems. This argument, however, assumes that GDP growth will continue as it has in the past – but climate change itself makes it questionable that such growth can be maintained. In addition, it is doubtful that the nations that will mainly feel the consequences of today's choices will be the same that bear the fruits of continued GDP growth.

The argument against using the market rate is that it doesn't reflect what future people feel we owe them. In addition, externalities are so poorly included in the market that the rate doesn't reflect issues like air pollution, loss of animal species and negative health effects. A social discount rate, it is argued, should reflect ethical considerations, not how the market reflects other considerations.

Climate change is a classic example of the market's inefficiency in handling global challenges. The producers of climate emissions don't pay for the associated costs, and this means that we essentially borrow from future generations. The world's

rainforests are chopped down because future risks aren't priced highly enough compared to short-term profits. Higher pricing of wild forests would imply not chopping them down, with the consequence that food prices will rise and result in increased investments to increase productivity. As it is now, market mechanisms will only really set in once the wild forests are gone. Economy is important, but a more basic question that we have no answer to is if nature possesses inherent value besides the utility value it has for us or whether nature's existence is a prerequisite for the good life and hence is a sort of civil right.

SIGNS OF CHANGE

In many places around the world, the inherent value of nature is now legally recognised. One example is the Ganges river, which the Indian high court has granted legal status as a person. This means that polluting the river is equivalent to harming a person. Forests and rivers have been afforded similar rights in New Zealand, the United States, Ecuador, and Columbia.

We also see signs that companies have begun taking ethical responsibility. The Science Based Targets Initiative counts 515 companies with ambitions to reduce greenhouse gas emissions consistently with the UN's 2°C goal. The Initiative includes among others Carlsberg, China Steel, Coca Cola, IKEA, Procter & Gamble, Tesco, and Walmart.

Many companies think in terms of sustainability because it makes long-term economic sense, but increasingly, they are also forced by their owners, the investors, to take greater ethical responsibility. In 2018, the Anglican Church announced that it would unload all its stock in companies that don't operate according to the Paris agreement. Similarly, the World Bank, AXA, ING, and one hundred other institutions have withdrawn from investments in oil, gas, and coal companies. However, ethics related to environmental issues still face the argument about the economic costs this will have for the existing system. In order to achieve the EU goal of a 40 % reduction in greenhouse gases by 2030, another EUR 180 billion a year needs to be invested. Society must change radically.¹⁸ The last time ethical considerations clashed this radically with short-term economic interests was when slavery was abolished. Then, as now, it is basically a matter of how we price the costs to other people's rights – in this case, future people.



PART 5

PERSPECTIVES

In parts 1-4 of this report we have examined the plausibility of several important pillars crumbling under what we have come to see as the natural state of affairs. In this final part of the report we summarise the main points, tie together some loose ends and offer a perspective on the world to come.

We chose to subtitle this report ‘Threats to the global status quo’ knowing full well that whether something is viewed as a threat or an opportunity depends on who does the viewing. Nevertheless, we see a number of clear signs that the world is changing for good. Liberal democracy appears in global decline, with four out of five indicators of its well-being moving in a negative direction on a global scale. Civil liberties and the rule of law are eroding as full democracies give way to flawed ones that in turn fuel corruption and despotism. Social cohesion is suffering in nations that experience rising economic polarisation and a growing sense of cultural displacement, where large parts of the population feel disenfranchised and without political influence. In the West, the rollback of liberal democracy can be seen as part of a growing civilisational identity crisis, where cosmopolitan and internationalist spirit and dedication to international cooperation, which defined the decades following the collapse of the Soviet Union, are dissipating as nations increasingly turn inwards.

Should we continue down this path, it will be a more difficult world to navigate for companies that seek a global market, due to trade barriers, protectionism and a lack of uniform global standards. The success of a nation may depend on belonging to a strong regional, political and trade bloc. On the other hand, political, ethnic and economic elites may well flourish at the expense of an increasingly disenfranchised majority that is given few real opportunities for advancement, despite promises of such. For some companies and organisations, it will also mean having to re-evaluate the importance placed on seemingly abstract liberal ideals that have traditionally only been relevant outside the realm of the corporate world

— similar to how sustainability has become an integral part of some companies' agendas in just a few years.

If there is one nation that embodies many of the challenges to the global status quo outlined in this report, it is China. The impressive transformation of China from an agricultural economy to an industrial superpower over the last decades has shown how an alternative system of government can rival the Western democracies in providing wealth and prosperity to its people, while becoming increasingly competitive on the global stage economically, scientifically and technologically.

China is in the process of pushing its own brand of centralised globalisation that shows little regard for the civil liberties promoted by the West. These same liberties are meanwhile challenged and eroded in the West as well. China's success has shot down the idea that full democracy is a prerequisite for growth and prosperity, and China may use its future position as world leader in digital communication technology and consumer electronics to further the aims of the state — or even as an instrument of repression. In any case, it is likely that moonshot projects like the Belt and Road initiative and the Made in China 2025 growth plan will be remembered in the future as having undoubtedly cemented what some already refer to as the 'Chinese century'. How exactly China will leverage its increasing presence and newfound power on the world stage remains to be seen. It also remains to be seen how China secures long-lasting governmental mechanisms that safeguard against despotism, something which innovative companies are notoriously allergic to and which creates a business climate they have a hard time thriving in. Failure to do so might eventually present a slowdown or an outright roadblock for China in the long term. At this point in time, however, it remains speculation, and the impetus of globalisation as well as technological and scientific innovation seems to be shifting East, with China taking a leading role in these areas.

Underlying all the economic, political and technological shifts, pollution and global warming threaten the hitherto relatively stable natural environment. Major cities increasingly experience flooding as sea levels rise and hurricanes grow stronger and more prevalent, farmland is turned into desert or salt swamp, and devastating forest fires due to drought become more common.

Global warming looks unavoidable to some degree, and it will mainly impact the world's poorest and weakest nations. However, the effects of accelerating environmental change will soon enough be felt globally in both poor and rich nations

– both directly, in terms of more extreme weather, and indirectly, with fluctuating food prices, a growing number of climate refugees and radically altered migration patterns. It may be too late to do much about it, but the pendulum will surely swing to a wider adoption of a serious sustainability agenda. When it does, it will happen with such force that the survival of companies that have strongly supported unsustainable agendas will be at risk.

The signs are obvious. In the absence of national commitment to climate change, cities, corporations and states are moving beyond national or federal policy and multinational bodies are pledging to commit to the climate agenda and the Paris Agreement. On the international stage, and due to the lack of American leadership on sustainability, China has once again moved to fill the gap. They have done so by introducing carbon markets, mandating the electrification of public and private transport, as well as becoming major drivers behind green energy technologies, with investments surpassing EU and the USA.

All of the above taken together paints a picture of a future that is in many ways more volatile — and in some respects bleaker — than the one we were promised a generation ago. However, this picture does not go unchallenged. Environmental movements are on the rise, and while most indicators of global democratic quality are in decline, voter turnout is generally increasing, showing increased interest in democracy in a time of democratic crisis. More and more commercial companies are adopting social and environmental agendas, often as an open protest to foot-dragging politicians. Public education is supplemented by free or inexpensive online courses offered by top universities, and personal, internet-connected devices empower the masses with access to knowledge, training, communication, culture and entertainment (though also to fake news and disinformation). Renewable energy technologies are greening the transport and energy sectors and slowly moving the world away from the fossil fuel economy. Leapfrogging allows for non-linear implementation in regions that need the most progress. These currents of countertrends are an important part of the story that can nevertheless be easily overlooked with a too narrow focus on the threats that lie ahead.

We hope you enjoyed reading.

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