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A New Era for Supply Chains
Why Supply Mesh Is the New Supply Chain and What that Means for Investors

Over the last year, supply chains have become an unexpectedly urgent focus in corporate boardrooms and halls of government. Shortages of basic goods and medical supplies in the midst of a global pandemic have brought home to leaders and citizens alike that access to food, medical supplies, life-saving pharmaceuticals and industrial products are only as good as their supply chains. This recognition has triggered intense debate and national security focus. During the same period, increased geopolitical competition, particularly between the U.S. and China, have grown. Together, these challenges are causing increased speculation about the need for global economic decoupling of supply chains and even mass reshoring. Given the enormous potential economic, industrial, and investment implications of these questions, we decided to dig deeper on supply chains to help KKR’s network of investors, portfolio companies, and partners separate the signal from the noise.

As is so often the case, the signal involving supply chains is more complex, nuanced, and interesting than the definitive noise from some policymakers and commentators. We have found a situation of fundamental shifts in the global economy, of globalization splintering, of systemic risk punctuated by acute pain points, and of consumers demanding companies concentrate on impact. Most importantly, we have found the need for business leaders to extend supply chain thinking beyond margin maximization to address issues of resiliency, sustainability, and geopolitical risk. Amidst this complexity, we have also found significant opportunities to invest in supply chains that address these issues.
Summary

The events of 2020 have shown that senior executives and investors will need to reassess the way that businesses think about adapting and evaluating their supply chains. In the early decades of global supply chain development, efficiency was the dominant consideration. This led companies to shift production based on labor costs, tariff regimes, and similar margin maximization considerations. More recently, enhancing resiliency, often through redundancy and digitization and sometimes through reshoring, grew in importance in supply chain design—a trend that has been vastly accelerated by the pandemic. We believe that the next step in the evolution of supply chains will require a wider lens to account for more strategic considerations, including more volatile geopolitics and heightened stakeholder demands.

Traditional global supply chain thinking has rested on four fundamental dynamics that, in our view, are no longer the whole story. The first pillar was that trade in goods was the driver of the global economy. Today, however, services and data, encompassing local experiences that are domestic by nature, and gaming, advertising, and cloud computing, which defy nation-state boundaries, are the growth engines of global commerce. Even the nature of goods is changing as more products integrate usage of data and computing technology. The second pillar was that Asia’s role in supply chains was to build and export. Yet today, businesses are increasingly recognizing the attractiveness of serving Asian consumers and exporting to them.

The third pillar was that globalization would continue to deepen, enabling ever-greater trade across all elements of supply chains. Today, however, globalization is splintering. Some areas, including goods, capital, and people, are seeing significantly higher barriers to international flows. In data and technology, rapid globalization continues, but is generating public and political resistance in some areas. Yet, meanwhile, information and culture, accelerated by social media and digital mobility, creates near-instantaneous globalization in most markets.

The fourth and final pillar of traditional supply chain thinking was that consumers care most about cost. Of course, cost still matters, but consumers (and governments) increasingly demand that businesses pay attention to all of their stakeholders, not just their shareholders, on issues such as climate change and labor rights. At the same time, consumers have greater expectations for speed, experience, and personalization.

It has been non-commercial factors during 2020 that have caused the greatest disruptions to existing business models. COVID-19 lockdowns, product scarcity at the start of the pandemic and limits on medical equipment and therapeutics throughout, increasingly nationalist economic policies, and heightened geopolitical confrontation, have each had significant and largely negative effects on conventional supply chains. These disruptions have accelerated an emerging trend toward corporate embrace of building resiliency into their supply management.

We believe that the post-pandemic winners will be those who act to build in resiliency and take steps to think of supply management less as a ‘chain’ and more as a mesh—that is, a group of interlocking inputs. And, in so doing, these winners will bring focus to managing a broader set of non-commercial risks, avoid wasting time on severing chains that cannot be decoupled, invest in resilience even at the cost of some redundancy, maintain access to attractive Asian markets, and advocate for better policy safeguards.

The business implications of making changes to supply chains are significant. Understanding those implications is important for investors to help mitigate risk, build for the future, and access attractive market themes. In this paper, we hope to lay out five key messages that we think will be useful to all senior executives and allocators of capital as they consider supply chain design:

1. Building resiliency is key to securing supply chains post-COVID. Resiliency strategies for businesses vary and include diversification, mirroring production of critical components, stockpiling, and distributed logistics nodes. For governments, resiliency can be developed via new rules and agreements with like-minded countries to improve coordination in critical supply chains and more targeted domestic policies. Some degree of reshoring and decoupling in critical components may be involved.

2. Supply chains will need to evolve as they continue to remain under pressure and face uncertainty from a more volatile geopolitical environment, more inward-looking national politics, and increasing supranational risks such as climate change and public health. For companies, the risks associated with the old model, which focused largely on lower labor costs, may carry heightened levels of risk and increased vulnerabilities.

3. Rather than relying on the traditional trope of a ‘chain’, our view is that supply chain thinking needs to evolve to incorporate a more holistic view, one that sees the traditional supply of goods as being embedded in a ‘mesh’ of interlocking inputs, each with its own risks and value levers. For governments, this implies more emphasis on establishing rules of the road on an international basis for issues such as data privacy, climate impact, and modernizing trade mechanisms. For companies, this likely means adopting a more robust risk mitigation strategy including maintaining production in China in order to better serve its domestic and regional markets while duplicating production elsewhere for added diversity in production and assembly.

4. Companies and governments should focus on critical nodes of vulnerability. Trying to mitigate risk along every link in the broad mesh of inputs that comprise supply chains would likely lead to spiraling costs for greatly diminished returns. Instead, investors should apply a critical lens to their existing portfolios and future investments to identify positions likely to draw political or reputational scrutiny. While it is not possible to draw up a comprehensive list in such a dynamic political and technological environment, certain technologies, use cases, and sectors are emerging as having an elevated risk profile.

5. This period of supply chain rethinking presents an opportunity to build for a future in which supply chains will be shaped by the need for environmental sustainability and adoption of automation. Long-term pressures on supply chains include both the ‘what’ and the ‘how’ of production. The ‘what’ envisions a more digital economy in which every industry will increasingly rely upon emerging technologies of advanced manufacturing and automation. The ‘how’ embeds heightened social and political consciousness of environmental, social, and governance (ESG) considerations that value social responsibility alongside cost.
We view the supply chain shifts outlined above as more evolutionary than revolutionary. Yet, we think they merit a thoughtful consideration in light of the social, political, and geopolitical environment and a need for alignment with long-term structural trends. While periods of change involving the rethinking of norms can prove challenging, the pressures on, and adjustments to, global supply chains also can present opportunities for businesses and investors, including:

### Domestic and regional demand over global demand
We see increasing opportunities in positioning supply chains to achieve efficiencies in addressing domestic and regional demand. This includes domestic demand and localization opportunities, particularly as the centers of global consumer demand shifts.

### New infrastructure & logistics
Supply chains rely upon entire built ecosystems, creating tailwinds for emerging manufacturing centers, build-out of modern telecommunications infrastructure, and greener, more energy- and resource-efficient solutions.

### Increasing automation
As companies shift and build redundancies into supply chains, there will be opportunities to upgrade capex plans to incorporate enhanced automation and complementary supply chain transparency and management capabilities.

### Continuation of China’s manufacturing upgrade
We expect more opportunities within China for advanced manufacturing including industrial robotics, medical technology, and new energy vehicles, while also seeing more regional opportunities for less complex manufacturing, creating opportunities in countries like Vietnam, Bangladesh, Cambodia, and potentially, India.

### New emphasis on diversification
Critical and sensitive components and goods will see the most rapid build-out of new supply chains and, in some cases, reshoring to ensure greater resilience through diversification of manufacturing and assembly.

### Greater demand for ESG solutions
We see significant opportunities to upgrade business operations for a sustainable future and to invest in businesses that are providing solutions for climate and broader ESG considerations.

### Increased prospect for opportunistic investments
We have seen that times of dislocation and economic shifts often reward nimble investors.
SECTION I

Prevailing concepts of supply chain thinking are outdated

Trade in goods has peaked; virtual trade is on the rise. Over the past century, many people, companies and countries have benefited from globalization and increased trade across nations. During the period of Industrialization, global trade grew from four percent of GDP in 1842 to 14% in 1913, facilitated by free movement of goods, people, and capital (Exhibit 1). However, this period ended with increased protectionism. Following the world wars, we saw two significant periods of globalization. The first wave, during 1945-1980, was facilitated by international barriers coming down and rising global cooperation through agreements and collaborative organizations like the General Agreement on Tariffs and Trade, the World Trade Organization, Bretton Woods, the World Bank, the International Monetary Fund, and the World Health Organization. The second wave occurred from 1980-2008 during a period of rapid urbanization, the emergence of the BRICs (Brazil, Russia, India, and China), the global investment boom, and the commodity super cycle. Notably, the post-war period was one of exceptionally strong growth that created a largely benign trade environment, enabling companies to make commercial – and specifically, supply chain – decisions based almost solely on economic terms that maximized margins and efficiency.

Thinking of supply chains simply in terms of distribution of manufactured goods, however, no longer fits with global economic trends and the shift in importance to services. Indeed, we believe that global trade in goods has peaked for the near-term, at the least.

Trade cycles tend to be correlated to investment cycles, as increasing amounts of equipment and commodities are required to build homes, factories, and cities (Exhibit 2). In the past 150 years, there have been three such super cycles driven by urbanization in the U.S., Japan, Korea, and now China. We do not expect another investment super cycle, or global trade cycle, for some period of time, since we do not believe any of the large emerging countries has the ability to urbanize as rapidly as the aforementioned countries.

Within mature economies, domestic consumption is a more important driver of growth than trade. That trend is now starting to play out in China and is reflected explicitly in Chinese economic policy. Moreover, consumption itself is shifting. Within goods, incorporation of data and computing technology is blurring the line between goods and services. Think, for example, of a smart TV that builds a user profile or a smart car that optimizes user experience based on driving habits.

Even more importantly, however, is the rise of services as a growth driver. Many such services are inherently local, such as entertainment, salons, and restaurants, and reflect a core theme of KKR’s macro team: the rise of the experience economy. Global trade in

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EXHIBIT 1
For Decades, Companies Have Built Supply Chains by Taking Advantage of Globalization to Increase Efficiencies

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
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<tbody>
<tr>
<td>1827</td>
<td>Opium War</td>
</tr>
<tr>
<td>1837</td>
<td></td>
</tr>
<tr>
<td>1842</td>
<td>7.8</td>
</tr>
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<td>1847</td>
<td></td>
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<td>1857</td>
<td></td>
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<td>1997</td>
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<tr>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td></td>
</tr>
</tbody>
</table>

Opium War 1839 7.8 1842 3.9
900bp decline during the Great Depression 1913 14.0
Industrialization which facilitated free movement of people & capital, but ended with increasing protectionism
Dislocation 1914 World War I 1917 Russian Revolution 1918 Spanish Flu Immigration restrictions 1930’s Protectionism

services is also evolving from back office tasks such as call centers and accounting to consumer interfaces in areas such as online gaming, streaming video, and online shopping. All of these factors mean that services—not goods—will be the main driver of globalization going forward.

Trade barriers are also going up. While there have been some significant expansions of regional trade agreements in recent years (e.g., RCEP and CPTTP), on balance, trade policies have been more restrictive than liberalizing. Notably, as shown in Exhibit 3, that divergence started well before the trade wars of the Trump era, although recent years have seen a sharp escalation, led by China, Germany, the U.S, Italy, France, and Korea.

**EXHIBIT 2**

Trade Super Cycles Are Tied to Urbanization and Investment Super Cycles

<table>
<thead>
<tr>
<th>Urban % Total Population (L)</th>
<th>Global Exports % Global GDP (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>China</td>
</tr>
<tr>
<td>Japan &amp; Korea</td>
<td>Japan &amp; Korea Urbanization &amp; Post War Reconstruction</td>
</tr>
<tr>
<td>Urbanization</td>
<td>China Urbanization</td>
</tr>
</tbody>
</table>

Within mature economies, domestic consumption is a more important driver of growth than trade. Moreover, consumption itself is shifting. Within goods, incorporation of data and computing technology is blurring the line between goods and services.

Geopolitical factors are on the rise. As globalization enters a new era, we are likely going to see increased geopolitical, economic, and natural disaster drivers that push toward more integration in some areas and less in others. There are several geopolitical trends intersecting to pressure commercial decision-making on supply chains that have elevated counter-globalization forces and undermined assumptions of ever-greater integration. In our view, focusing simply on the U.S. and China misses equally consequential policies for businesses operating in, and governments working with, major markets like India, France, and Japan, to name just a few.

While Sino-American geopolitical tension is the key source of strain on supply chains, it is the compounding effect of three major trends that necessitates a wider view on this topic:

1. Greater strategic competition in geopolitics. A new period in geopolitics has emerged in which major world powers are increasingly competitive for political, military, and economic influence. While allies and adversaries have always competed, the...
current period is characterized by a shift from an emphasis on cooperation to one on competition and more confrontational tactics.

Today, the most prominent point of competition is between China and the United States, but a more openly competitive dynamic has also arisen in relations between China and the European Union, Japan, India, and Australia, among others. However, there is also a friendlier yet still spirited competitive dynamic occurring between countries that are allies but who are vying for advantage in the industries of the future, especially in advanced technology and energy sectors. Although we expect strategic competition to continue, we do not ascribe to views that see confrontation between great powers as inevitable. Rather, we note encouraging signs that leaders can agree to compete in some areas and cooperate in others.

The risk for investors, however, is that the current phase of competition is blurring the boundaries between politics and security on the one hand, and the economy and technology on the other. While investors need to be vigilant to risks, there also can be opportunities to invest in areas of emerging agreement such as environmental and health solutions.

The above geopolitical trends amplify one another, creating a more adverse and uncertain policy terrain for supply chains. Indeed, the rise of digitization across the global economy changes the nature of competition to focus more on control of data and advanced technologies. Meanwhile, the pandemic refocused political attention on control of critical supply chains in areas such as pharma, medical supplies, and food. The result is that more industries are impacted by the crosscurrents of geopolitical competition, economic nationalism, and transnational threats.

A more challenging global macroeconomic environment is a further compounding factor for geopolitical volatility (and, notably, geopolitical volatility in itself is an economic headwind). That growth outlook will continue to face substantial headwinds with higher global debt levels, interest rates at or below zero with little room for further cuts, and negative demographics in many nations. These factors, in aggregate, will likely prove to be sources of volatility.

EXHIBIT 4
National Security Is Now Bundled With Rule of Law and Trade Negotiations, and Wrapped in the Complexity of Digitization

The global environment has changed. The number of noneconomic shocks — hurricanes, tsunamis, epidemics, pandemics, and political and geopolitical developments — has risen, putting long complex supply chains at risk.

Technology is moving faster than legislation. In our view, the rise of the digital economy and pervasive use of data is an overlay that exacerbates uncertainty and policy volatility. Collection, trade, and usage of data are now integrated across sectors and growing. Personal data is essential to creating a superior user experience but raises privacy and security questions. Companies and consumers thrive on data-driven apps, media, and gadgets. Today, telecommunications connect the world faster than ever before, but these new platform technologies are susceptible to manipulation. For example, a digital economy can be disrupted by cyber threats. The shift from global trade to global services dependent on data has happened quite quickly, but governance frameworks for international data transfers and storage have failed to keep pace. With global norms to govern those and other areas thus far out of reach, our view is that the digital economy will continue to stoke, rather than soothe, geopolitical volatility in important ways.

We believe that the prevailing concepts of global supply chains are outdated. Over the past century, companies have structured their supply chains to maximize efficiencies created by globalization, to source and develop new markets, and to reduce input costs, labor in particular, to maximize margins. In the early decades of global supply chain development, businesses were hyper-focused on extracting efficiencies, and even as supply chains grew increasingly complex, the focus on profit maximization largely prevailed (Exhibit 6). In some circumstances, these long, complex supply chains led to six-month lead times for components, as companies used software to optimize for a small set of variables, relied on just-in-time logistics and manufacturing, single-sourced suppliers, and traded and re-traded across large distances, creating opacity in the actual sourcing of critical inputs.

However, the global environment has changed. The number of noneconomic shocks — hurricanes, tsunamis, epidemics/pandemics, and political/geopolitical developments — has risen, putting long complex supply chains at risk (Exhibit 7). As the events of 2020 have illustrated, the prevailing complex model that focused primarily on maximizing profits and margins, is inadequate.

EXHIBIT 6
Companies Rely On Complex, Multi-Tiered, and Interconnected Networks...

While long complex supply chains have yielded efficiency, in the changing global environment they present clear challenges. Specifically, they are:

- **Too fragile.** As we have seen, modern supply chains are subject to delays and critical points of failure – as most any American looking to buy hand sanitizer or toilet paper witnessed throughout much of 2020. From natural disasters delaying delivery of single source inputs to customs delays, practical vulnerabilities of the outdated supply chain model were under increasing scrutiny well before the pandemic. Global economic lockdowns, shuttered industries, and closed borders resulting from the pandemic have magnified already existing vulnerabilities in the dominant supply chain model.

- **Too unresponsive to customer demand.** Rapid shifts in consumer demand require greater degrees of speed and flexibility. Products themselves, particularly rapidly moving goods, should keep pace with trends driven by greater Internet connectivity, mobility, and social media. That is not possible when the complexity of supply chains dictates a six-month wait time. Logistical elements also likely need more flexibility. While e-commerce was already rapidly gaining global market share prior to the pandemic, public health measures to reduce foot traffic in stores have only increased consumer appetite for online purchasing. What we are watching closely, however, is the ‘stickiness’ of certain categories of pandemic driven e-commerce spending, including on groceries and durable goods. The ability of companies to adjust to the new realities of consumer behavior has significant implications for supply chains as middlemen become disintermediated and companies face choices between additional distribution nodes and stockpiles or shifting production closer to consumption.

- **Unable to accommodate stakeholder and ESG considerations.** There has been a series of high-profile issues in supply chains involving forced labor, workplace safety, and conflict minerals that have challenged businesses to try to improve supply chain management. Mechanisms such as the United Nations Global Compact have helped focus attention on improved practices down through supply chains suppliers. Yet, some stakeholder and environmental, social and governance (ESG) concerns likely require entirely new thinking. For example, consumer and political demands for responsible climate policies argue against current energy-intensive transport, the spreading of components and assembly among dozens of countries, or locating facilities in countries lagging in clean energy transition. The emerging demands are manifesting themselves in changes in consumer preferences, heightened public scrutiny, and legal regimes that will force supply chains to account for emissions, such as the potential emissions border adjustment tariffs under development in the EU.

- **Insufficiently aware of diverse new risks.** Traditional supply chain thinking has tended to silo production and delivery of goods or services as an independent process from other essential business inputs. Yet, optimization of supply chains themselves, as well as the global reach of the businesses they serve, has also relied on broader globalization trends. Key here were business inputs including the multi-decade trend toward freer global movement of capital and investment, increased labor integration across the value chain from basic manufacturing to high-tech research, and cross-border development and utilization of technology. More recently, global data transfer has risen in prominence as improved computing power and internet speed has transformed data into a critical business input. Thinking of supply chains as an independent process may blind businesses to vulnerabilities in key inputs.

- **Overly dependent on a trend that may not persist.** The concept of maximizing efficiencies at each link of a global supply chain relies on what we now view as an unreliable assumption of ever-greater globalization. Although globalization has never been strictly linear, recent decades of a clear trend line toward deeper and lower-cost global integration allowed companies the freedom to optimize operations and margins across goods and services, as well as capital, labor, technology, and data, on a global basis. Global supply chain integration based on that model brought enhanced margins, but it also relied on assumptions of stability in the global trade architecture, fewer restrictions on cross-border movements, and resiliency to global risks. These assumptions, and the supply chains that resulted, are vulnerable to counter-
Looking forward, we see a more complex globalization story in which certain areas accelerate toward integration whereas others, such as trade in goods and capital flows, have a far murkier outlook.

So far, our research points to more companies understanding the need to adapt from an efficiency-focused supply model to one that incorporates resilience as a strategic objective. In fact, prior to the pandemic, 70% of companies surveyed in McKinsey’s supply chain management survey expected to change their globalization and sourcing strategies (Exhibit 10). We attribute this risk mitigation approach in no small part to the various shocks companies have faced, particularly since the Global Financial Crisis, which have illustrated the true value of resilience. As shown in Exhibit 9, the difference in the change in EBITDA margins between resilient and non-resilient companies during times of shock is a massive 20 percentage points. Thus, we believe resilient firms could benefit not only from greater stability, but can dominate coming out of disruption, with optionality to reinvest to achieve yet higher potential.

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Many Companies Are Considering Shifting Supply Chains

Global Executive Survey: December 2019, n=610

- 70% Expect to change globalization & sourcing strategy
- 32% Move operations closer to end consumers
- 24% Diversify their supply chains across countries


In our view, however, moving to resiliency in isolation is not sufficient to address the deficiencies of the existing supply chain model. While senior executives have focused on adapting supply chains, so far the key driver behind supply chain evolution has been the opportunity to be closer to new markets, rather than to navigate material political or geopolitical issues (Exhibit 12).

EXHIBIT 11
Political Risks Are Rising...

Global Economic Policy Uncertainty Index With Current Price GDP Weights


EXHIBIT 12
However, the Key Driver Behind Supply Chain Shifts Are Still Mainly Economic in Nature

- Revenue Growth - Organic Offshore: 68%
- Revenue Growth - New Markets and/or Segments: 57%
- Cost-efficiencies and/or Bottom-line Growth: 11%
- Post Covid-19 Change in Company Strategy: 11%
- Trade Tensions (Tariffs & Non-Tariff Barriers): 11%
- Economic or National Security Concerns or Policy Changes: 6%
- Other Government Policy Changes: 6%

Data as at June 23, 2020. Source: Alphawise, Morgan Stanley “Investing in a Multipolar World”.

We believe that companies (and investors) need to do more to incorporate strategic thinking to better navigate the dynamic geopolitical landscape and policy evolution in critical areas such as climate change mitigation. Taking that wider view will be essential both to build access to global markets and to maintain license to operate in a more precarious period of time. Unfortunately, that is only beginning.

Importantly, the interlocking of trade, national security, and rule of law does not mean that supply chains must be severed. Instead, it requires those in corporate leadership positions to utilize a more balanced strategy than one solely focused on cost efficiency.

The highly uncertain geopolitical environment is a risk that senior executives and allocators of capital should not minimize. Our view is that decisions can no longer be solely focused on profit maximization, but should also consider the broader political and policy landscape. And, importantly, the interlocking of trade, national security, and rule of law does not mean that supply chains must be severed. Instead, it requires those in corporate leadership positions to utilize a more balanced strategy than one solely focused on cost efficiency (Exhibit 13).
SECTION II

Supply chain decision-making reflects a mesh of interlocking geopolitical pressures

A better way to understand the current evolution of supply chains, in our view, is to think of them less as a chain and more a mesh of interlocking inputs. In this mesh, conventional chains of value-added goods interlock with other essential inputs of technology, capital, labor, and data. While corporate executives consider these inputs from a micro level, these are the same crucial factors that policy makers focus on from a political and geopolitical perspective.

Most of the world is too linked and interconnected for true decoupling to occur. The mesh is just that — a connection of chains too difficult to separate in most practical senses. However, there are specific issues to which corporate executives and investors would be wise to pay extra attention that are affecting the globalization of goods and services, technology, data, labor, and capital upon which global supply chains rely.

a. Goods and services

Policies that disrupt global trade in goods and services have dramatically risen over the past four years (Exhibit 15). That shift includes general restrictions on trade, targeted restrictions on national security grounds, new legislation encompassing data-driven services, and incentives to encourage domestic production.

Trade policy disruptions will likely pressure supply chains by increasing costs through tariffs, non-tariff barriers, and taxes on foreign operations. Moreover, such policies could undermine the predictability of market access and dispute settlement through, for example, withdrawal from free trade agreements or blocking WTO actions. Higher tariffs mean higher costs and lower profit margins, resulting in re-thinking of business models and relocating certain supply chains. A positive outcome can be automation offsetting some of the costs. A negative outcome can be stagflation i.e., higher inflation, high unemployment, and weak growth due to higher costs, lower margins, resulting in slower growth, and layoffs.

Trade disputes are not new, but in recent decades the norm was for them to be contained — both in process via dispute mechanisms and in substance through trade being kept apart from more confrontational foreign policy issues. The exception was sanctions, which typically were targeted and tied to specific foreign policy outcomes. The Trump Administration further opened the aperture to use trade policy for broader national security purposes. More pointedly, whereas U.S. tariffs on China started with an effort to remedy what was viewed by the Trump Administration as unfair treatment and to reduce trade imbalances, they are now firmly intertwined with broader foreign policy and security issues that will make them more difficult to unwind (including by a Biden Administration).
More aggressive use of trade policy has uncorked the proverbial genie’s bottle. Going forward, we believe supply chain design should assess the risk of becoming collateral damage in geopolitical disputes, especially between China and the U.S., but not exclusively so.

Environmental policy is, increasingly, trade policy. An emerging area of trade policy that calls for advanced planning is integration of climate change policy into trade policy. Climate and related environmental issues have risen to the top tier of policy actions across most major economies. The European Union is at the forefront of efforts to utilize previously unlinked policy areas to achieve climate goals. From a macro perspective, what is interesting to us is that clean energy policy tends to favor domestic energy sources, such as renewables and nuclear. While trade in power components will rise and eventually more electricity will trade, that is likely to pale compared to reductions in trade in coal, oil, and, eventually, natural gas. Most importantly, policy formulation to create an emissions border adjustment tariff could force supply chains to assign cost to emissions from their production in all countries globally and for the emissions required to operate global transport of those goods. Incorporating climate concerns into financial services could also reduce related financing alternatives. These are early days, but it is clear that new investments in supply chains should consider the rapidly evolving policy landscape and plan accordingly.

Governments are also ramping industrial policies to encourage reshoring of supply chains and incentivize domestic investment in certain industries. Recently, as an example, Republican congressional leaders in the U.S. issued recommendations to reshore medical supply chains. At its core, industrial policy encompasses efforts by governments to encourage investment in certain sectors of the economy. Doing so is not new (e.g., economic development plans in emerging markets; state investment in companies in Europe; and tax incentives in the United States), but the rising number of supply chain shocks and the job losses associated with companies shifting supply chains overseas have created new imperatives for such policies.

In recent years, industrial policy as a tool has gained momentum. The rise in domestic nationalism and populism fuels more inward-looking economic policies at the expense of global markets. Even considering relatively more laissez faire economies such as the U.S. and the U.K., these and more state-driven economies seek to capture value chains for the economies of the future – especially technology-driven and greener economies – that will likely be dependent on emerging technologies, such as: artificial intelligence and quantum computing, semiconductor manufacturing, and clean energy. However, increased incorporation of automation and advanced manufacturing may reduce the domestic job creation hoped for by industrial policy. Dislocations in supply chains may also open opportunities for advanced technologies to gain ground. The combination of declining cost curves for robotics and additive manufacturing have prompted rethinking of physical locations, and desire to bring production closer to consumers can create new opportunities to justify new capital expenditure in production.

COVID-19 accelerated industrial policy and spurred incentives for reshoring (Exhibit 17). These include programs targeted at supply chains determined to be essential as a result of the pandemic (e.g., pharmaceuticals and personal protective equipment), and may yet affect supply chains in areas such as food where acute shortage fears have for now subsided. Other more broad-based incentives are emerging. For example, Japan offered financial incentives to companies relocating from China, and President-elect Biden during his presidential campaign revived the idea of “Buy American” provisions.
The Pandemic Gave Executives the Mandate to Invoke Change

McKinsey Survey of Supply Chain Executives
Conducted in May 2020

Planning To Increase Resilience
Increase Resilience At The Expense Of Short Term Efficiency


With the U.S. and China seemingly locked in increasing competition, other countries are also pushing ahead with their own domestic agendas and their own international agreements. The EU’s strategic autonomy agenda is illustrative. Faced with what is perceived as a more assertive China on the one side and a less reliable United States on the other, the EU and individual Member States are now pushing to develop more domestic capabilities across a range of areas, including critical supply chains. Meanwhile, as headline trade conflicts have recently emanated from the United States, bilateral and multilateral trade agreements such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and Regional Comprehensive Economic Partnership (RCEP) have continued to move ahead. Although geopolitics may gradually resemble a more bipolar world, markets will actually need to adapt to a multi-polar world where numerous countries increase their restrictions on foreign flows and encourage domestic industry. In other words, countries pushed to choose between the U.S. and China for supply chains may opt for neither.

As ‘carrots,’ proliferation of industrial policies can create opportunities for companies looking to relocate or diversify their supply chains and for companies to diversify their businesses by creating new domestic supply chains. There are preliminary efforts by some countries to coordinate international efforts, but the more likely outcome is competition between geopolitical rivals and allies as seen, for example, in corporate tax rates. Companies should also be vigilant to where ‘carrots’ may turn to ‘sticks’ for those industries deemed too sensitive to rely just on incentives.

b. Technology

Governments are opening their national security lens apertures to implement targeted restrictions on commercial trade dealing with specific companies and in specific advanced technology categories, such as artificial intelligence, biotechnology, and autonomous systems. The vast majority of these policy actions center on China. The United States government, as well as many other large liberal democratic governments, now openly state their view that deep integration with China for certain supply chains poses a national security concern. Concerns regarding the use of certain technologies, economic and financing leverage, market strength in critical supplies, and lack of transparency into the control of both public and private companies within China, all fuel these policies. Regardless of the accuracy or fairness of such perceptions, the reality is that they are spurring a wave of new restrictions and scrutiny on supply chains that extends well beyond long-standing U.S. disputes over China market access, intellectual property infringement, and forced technology transfer.

2 See, for example: https://www.whitehouse.gov/wp-content/uploads/2020/10/National-Strategy-for-CET.pdf
3 Examples cited include market dominance of rare earth minerals used in military and new energy products.
For example, China is deploying its own so-called “wolf warrior” assertive diplomacy, potentially blocking transfer of intellectual property from China as a response to the reported purchase of TikTok, and releasing rules of a new “unreliable entity” mechanism that could penalize foreign companies for acting in ways perceived to be against China’s interests.

The current wave of “securitization,” or applying a national security lens to trade in certain technologies and with specified companies highlights the heightened risk of business transactions in sensitive areas, especially in relation to China. From a U.S. perspective, the key differences from previous export control regimes are, on the one hand, the broadening of national security considerations to cover a much wider swathe of technologies, such as advanced software and analytics categories (artificial intelligence, facial recognition, and digital surveillance), advanced biomedical and bioengineering, and critical hardware (semiconductors and transformers) and, on the other hand, targeting of specific companies deemed by officials to be national security risks. The Chinese government is to some extent reciprocating through diplomatic and domestic economic regulations. China’s responses are likely to continue to balance reciprocity with China’s desire to attract foreign technology and investment. In our view, all investments should be reviewed for their intersection with national security sensitivity.

Applying a dominant national security viewpoint to supply chains raises three significant issues. First, certain areas of advanced technology with direct national security implications or applications are likely to see decoupling between China and the U.S., Japan, and other allied nations. Advanced semiconductors, for example, are essential to the operation of advanced software, robotics, and military applications. Second, advanced technology is by its nature rapidly evolving and as such a moving target. For example, artificial intelligence is not one piece of software, it is a stack of technologies (algorithms, data sets, and enabling hardware) with interchangeable components. Consequently, companies and governments will struggle to adequately define what components of technology are sensitive. And finally, the precedent for a national security lens being applied to civilian and dual-use technologies indicates that restrictions emerging today may be applied more broadly than the current focus on just the U.S. and China. Other rival states, countries with differing governance and rights models or norms, and even allies competing for the industries of the future may also be subject to varying degrees of restrictions. As such, supply chain design in advanced technologies themselves – and reliant on using advanced technologies that would need licensing – should prepare for the possibility of additional restrictions. This points to the need for improved private-public cooperation on technology and presents an opportunity for investors able to navigate a dynamic policy environment.

c. Data

We believe that restrictions on cross-border data flows will continue to broaden. With the rise of computing power, mobility, and high-speed data transmission, data has emerged as a critical currency to broaden. With the rise of computing power, mobility, and high-speed data transmission, data has emerged as a critical currency to broaden. With the rise of computing power, mobility, and high-speed data transmission, data has emerged as a critical currency to broaden. With the rise of computing power, mobility, and high-speed data transmission, data has emerged as a critical currency to broaden. With the rise of computing power, mobility, and high-speed data transmission, data has emerged as a critical currency to broaden.
protection, and responsible use of data have not moved as swiftly, and countries are competing to set the global rules of the road (for example, China’s proposed Global Data Security Initiative). Countries differ widely on norms for security, privacy, and appropriate use of data. As a result, we see policy trending toward greater restrictions.

Privacy concerns, centered on but not exclusive to the tech giants, are at the leading edge of the push toward more regulation in many countries. The European Union’s General Data Protection Regulation (GDPR) is the most forward leaning on privacy rules, with a wide swath of countries from India to Brazil moving ahead with their own sets of standards. A notable exception so far is the absence of a national regulatory framework in the U.S., although individual states like California and Washington are attempting to fill the void. The resulting patchwork of rules on data management will make it increasingly difficult for companies to comply, but it may also reward countries that have established rules that give businesses more certainty on data usage.

All said, we think there is an opportunity for corporations to take a leadership role in this area, and to partner with governments to establish rules of the cyber road that enable greater productivity and efficiency, while not compromising on data security and privacy rights.

COVID-19 may also encourage greater regulation if, for example, greater confidence in personal data protection can encourage more citizens to sign-up for testing and contact tracing. All said, we think there is an opportunity for corporations to take a leadership role in this area, and to partner with governments to establish rules of the cyber road that enable greater productivity and efficiency, while not compromising on data security and privacy rights.

Data, like advanced technology, also is increasingly being filtered through a national security lens (Exhibit 21). The most visible instances include the Trump Administration actions to limit the perceived risk of data transfer from TikTok and WeChat. India is pursuing even broader measures, including banning use of dozens of apps that require data localization as a response to perceived aggressive behavior from China in the border region. These actions indicate a potential shift from government focus on theft or cyber espionage of sensitive personal data to a position that large-scale transfer of personal data, even if it is public and voluntarily disclosed, could be a national security risk. It is too early to determine whether such a position will be permanent or widespread since specific cases are tied to challenging U.S.-China ties and there are other cases globally where the same data was not deemed a security risk. Nonetheless, companies whose supply chains rely on large amounts of data (especially personal data) should expect more scrutiny and potential restrictions on transnational transfer. This risk will likely grow as more and more data is stored in the cloud as a result of widespread cloud-based computing adoption and COVID-19 accelerating utilization of cloud-dependent telework.

**Exhibit 21**

The Globalization of Services Is Challenging the Status Quo


**Exhibit 22**

U.S.-China Tensions and Cross-Border Data Flow Are Key Cybersecurity Concerns

Immigration is particularly sensitive in many major economies since it directly intersects with identity politics. Labor is an essential driver of supply chain design and has historically been the most pressing commercial consideration. For decades, manufacturing has chased low-cost labor throughout emerging markets, shifting from northeast Asia, to China, to Southeast Asia and other emerging regions. The flow of people, from traditional manual labor to highly specialized tech development, is essential when considering physical location of global business operations. Immigration has long been challenging across major economies due to concerns of displacing domestic workers and more abstract worries of cultural change. These concerns have been particularly pointed in recent years as national elections in Europe, the U.S., and Japan featured immigration as a major issue. More recently, the U.S.-China confrontation has spilled over into immigration with the Trump Administration putting greater restrictions on Chinese students and on high-skilled workers more generally (Exhibit 23).

Even while access to needed labor is becoming more difficult in certain industries and countries, the role of workers themselves is shifting in supply chains. Automation, additive manufacturing, and robotics – what is sometimes referred to as the next industrial revolution – will likely displace manual labor in certain industries such as manufacturing and call centers (Exhibit 24). Although fewer workers will be needed for some roles, there will be a greater need for those with enhanced digital and engineering skills. In the normal course of business, replacing existing facilities with new automation technologies can seem cost prohibitive. Yet now, the combination of declining cost curves for a suite of automation technologies, forced rethinking of physical locations, and a desire to bring production closer to designers and consumers can create new opportunities to not only rethink supply chain location but also the underlying methods.

The irony of reshoring manufacturing jobs is that more services jobs are now at risk of heading offshore. While lower-skilled services jobs become replaced by technology – within warehouses, at checkout counters, in call centers, within factories, and beyond – virtual technology and connectivity has reached a level where the globalization of services could also put higher-skilled services jobs at risk. The pandemic has accelerated this trend by proving to the world that it is possible to operate highly effective and efficient services functions remotely. As a result, companies should have the ability to source talent from any country, which could tip the balance of job creation to lower cost countries, with equivalently skilled talent. Geographic location matters less in this environment. The gating factor to globalization of services is virtual connectivity, which brings us back to this mesh of technology, capital, labor, data and national security. Notably, while manufacturing makes up about 10% of U.S. jobs today, it made up close to 40% at its peak. Many of those jobs went to the service sector which is now about 80% of nonfarm jobs. We think the risk of another wave of offshoring, this time of broader services, is substantial and could have significant political consequences.

d. Labor

Immigration Has Declined Under President Trump

EXHIBIT 23

50% of U.S. Companies Expect Advanced Robotics to Impact Jobs Negatively

EXHIBIT 24

Cross-border capital and investment restrictions are also increasing as a result of national security concerns related to foreign influence in strategic industries, as well as in support of national industrial policies. National security concerns have propelled greater scrutiny of foreign investments in the U.S., the EU, Australia, and elsewhere. Government scrutiny through CFIUS in the U.S. and similar procedures abroad give significant discretion for governments to reject certain investments (and even retroactively force divestitures),
restrict governance, and increase scrutiny on passive investment structures.

Governmental concern regarding foreign ownership has focused on infrastructure, dual-use equipment, and essential services. More recently, it has broadened to include sensitive personal data and advanced technologies such as artificial intelligence, robotics, and certain advanced biology technologies. Although the greatest scrutiny is on Chinese investments, the scope of this scrutiny is global.

On the other hand, China has continued to liberalize capital markets to allow more foreign direct investment and to move toward a more level playing field between domestic and international companies.

Emphasis on industrial policies also reinforces barriers to investment. More nationalist and populist governments in Poland and Mexico, for example, have increased barriers to foreign investment in critical industries like energy. Investment review mechanisms have accelerated in 2020 as governments work to protect critical domestic industries weakened by the economic downturn, for instance in France and India. More broadly, new fronts to restrict capital are emerging, such as recent U.S. rules on publicly listed companies. For financial investors, these tightening rules raise additional risks around capital raising, deployment, and exit assumptions.

With over 4.6 billion people in Asia, including a billion millennials, access to Asian markets is a critical growth path for global companies.

The shifting of supply chains is not new; comparative economics of production has continued to move between countries. The most striking change over the past decade is labor-intensive manufacturing pivoting away from China as that country moves up the technological value chain and wages rise. Hence, even before the recent geopolitical and pandemic tumult, lower-skilled and certain industrial manufacturing was shifting toward countries such as Vietnam, the Philippines, and Mexico. That trend is likely to continue, and to some extent includes Chinese companies that have found their domestic market too costly for production. Yet, what is new is that the primary driver of previous shifts – labor costs – is not so obviously dominant in an economy where labor is relatively less important due to rise of services automation and robotics.

Each sector will have varying levels of exposure across supply chain inputs, and certain categories of goods will be viewed as more important to secure than others due to considerations of national security, economic prosperity, and public health. When it comes to risk assessment for portfolio companies and allocators of capital, it is important to account for a broader category of risks that can disrupt a wider variety of inputs than are typically associated with traditional supply chains.

SECTION III
Trends toward delinking supply chains have political and commercial limits

Despite political hyperbole around broad economic decoupling, current supply chains anchored in Asia are stickier than commonly thought. While a more volatile world puts pressures on existing supply chains, there is also an inherent impediment to a dramatic redesign, specifically, the importance of access to Asian markets, the costs and complexity of shifting existing supply chains, and varying exposure to supply chain risks (Exhibit 25).

Perhaps the most important factor holding existing supply chains in place is access to that region’s markets. With over 4.6 billion people in Asia, including a billion millennials, access to Asian markets is a critical growth path for global companies (Exhibit 27). International companies have spent decades building local presence across Asia, and policies aimed to build local markets and encourage indigenous technology in the case of China and manufacturing in the case of India point to the need for local presence. In spite of headline numbers of reduced investment in China, international companies doing well there are increasing their investment. Indeed, even as the Trump Administration called for broad decoupling from China, Washington continued to push for more market access for U.S. companies. In the end, companies are likely to take a “yes and” approach to duplicating certain supply chains to serve multiple markets from multiple locations via a regionalization of supply chains approach, to take a more ‘neutral’ geopolitical position.

EXHIBIT 25

87% of Companies Have No Plans to Shift Production Out of China

Has your company moved or does it plan to move any operations out of China?

- Yes, to the U.S.
- Yes, to another location
- No

Most U.S. businesses plan to stay in China

88 93 91 90 88 87

Industries Vary In Their Exposure to Supply Chain Risks

**EXHIBIT 26**

SOME VALUE CHAINS ARE MORE EXPOSED TO SHOCKS THAN OTHERS

**BASED ON GEOGRAPHIC FOOTPRINT, FACTORS OF PRODUCTION, AND OTHER CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Most Exposed</th>
<th>Less Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication Equipment</td>
<td>Other Pharma</td>
</tr>
<tr>
<td>Active Pharma Ingredients (APIs)</td>
<td>Food &amp; Beverage</td>
</tr>
<tr>
<td>Apparel</td>
<td>Medical Devices</td>
</tr>
<tr>
<td>Petroleum Product</td>
<td></td>
</tr>
<tr>
<td>Computer &amp; Electronics</td>
<td></td>
</tr>
<tr>
<td>Aerospace</td>
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<tr>
<td>Semiconductors</td>
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<tr>
<td>Chemicals</td>
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<tr>
<td>Automotive</td>
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In addition, there is an incumbency advantage for countries that have supportive systems in place for supply and production. Supply chains rely upon entire business ecosystems, including factors such as tax and customs regimes, trade agreements, power reliability and cost, customs efficiency, labor availability, and supporting infrastructure such as ports and roads. Telecoms infrastructure, requiring significant new investment, is increasingly important as industries digitize, as are technology innovation ecosystems stitching together research centers, start-ups, and scaled industries. All of that takes time to develop, which gives existing manufacturing centers distinct advantages. Notably, China is directing substantial investment to all those areas. More broadly, capital-intensive industries with billions of sunk costs face a higher burden to relocate or diversify, whereas labor or knowledge-based industries face less cost restraint.

Finally, industries vary in their exposure to supply chain risks. Exposure is a function both of the physical and the political (Exhibit 26). On the former, considerations include issues such as concentration of suppliers and buyers (by number of companies and geography) and transparency in the supply chain itself (with many large multinationals having little visibility into their second and third tier suppliers). While industries such as textiles have tended toward more concentration, others such as medical devices and aerospace are relatively diversified and thus have an easier path to improved resiliency.

**A significant challenge for companies will be to anticipate the evolution of what will be considered sensitive, and whether countries acceptable to locate to today will remain so.**

Political exposure is also not uniform across industries. Although virtually any industry can get caught up as collateral damage in trade wars or unwittingly end up in the crosshairs of a political firestorm, acute political risks are slowly concentrating in a number of discrete areas. The most sensitive areas (leaving aside explicitly dual-use goods) are advanced technologies under rapid innovation such as AI, quantum computing, advanced bioengineering, hypersonics, and advanced data analytics; critical hardware such as advanced semiconductors and microprocessors; critical raw goods such as rare earths; and innovative new energy and telecommunications technologies. Many of the affected supply chains today include manufactured goods as well as intellectual property (labor) and data. In the future, it is easy to imagine that certain pharmaceuticals and medical equipment (e.g., PPE, ventilators) will also be included.

A significant challenge for companies will be to anticipate the evolution of what will be considered sensitive, and whether countries acceptable to locate to today will remain so. That is especially challenging in the software arena and advanced technology areas where rapid innovation defies the ability of policy-makers to create any single list. However, beyond these sensitive areas, deepening commerce is very likely to continue.

**EXHIBIT 27**

Half of All Companies Surveyed Are Planning to Expand Their China Presence

Of companies reporting continued resource commitments to China operations, how will resources be accelerated in the next 12 months?

- Expand existing product line or business unit: 50%
- Increase headcount: 50%
- Invest in new product or service: 47%
- Introduce new product or service: 47%
- Expand commercial footprint: 44%
- Acquire an existing production line or business unit (M&A): 21%
- Invest in/exand R&D activity: 18%
- Other: 6%

Key takeaways and investment themes for corporate executives and investors

Investors, corporate executives, and governments working to rethink supply chains should consider these key implications:

1 Building resiliency is the key to secure supply chains post-COVID in our view. Resiliency strategies vary, including diversification, mirroring production of critical components, stockpiling, and distributed logistics nodes for businesses, and for governments, new rules and agreements with like-minded countries to improve coordination in critical supply chains.

- Although achieving this resiliency likely involves some degree of reshoring and decoupling, it must be integrated with a commercial mindset, including traditional cost considerations and maintaining access to China and other major markets. The resiliency frame allows for companies and governments to more effectively achieve both improved supply chains and the cost efficiencies that come with global supply chains.

2 More volatile geopolitics, more inward-looking national politics, and increasing supranational risks such as climate change and public health, will all likely continue to pressure supply chains across essential inputs of goods, capital, people, technology, and data.

- While there is a certain degree of unpredictability to those risks, the trend is toward continued volatility. In that environment, neither companies nor governments should focus on singular solutions to supply chain vulnerability. Crucially, for companies, that means avoiding reverting to old impulses of chasing cheaper labor costs in new locations that may mitigate one risk while potentially increasing exposure to new ones.

- Global competition for advantage in cutting-edge transformational technologies will strengthen barriers to their transnational development and supply chains, including between allies, in the near-term. This will be the most pronounced zone of decoupling between the U.S. and China given these technologies’ intersection with national security and economic competition. However, the scope of competition remains in flux, adding uncertainty for businesses and investors.

This period of supply chain rethinking is an opportunity to build for a future where supply chains adapt to the need for environmental sustainability and adoption of automation technologies.
Supply chain thinking should incorporate a more holistic view of traditional supply chains of goods being embedded in a mesh of interlocking inputs, each with its own risks and value levers.

- For companies, that means adopting a more robust risk mitigation strategy. For governments, that highlights the need to “own the board” in updating global rules around areas such as critical goods distribution and data privacy while also investing in the wider business ecosystem that allows for companies to cost-effectively relocate operations. Also for governments, that implies having rules to encourage broad-based resiliency, rules of the road that address key issues such as data privacy and climate impact, and limiting the detrimental effects of duplication between like-minded nations.
- In the near term, strategic competition and distrust between China and the U.S., and to varying degrees other developed economies, will continue to magnify scrutiny on supply chains with a China nexus, regardless of changes in political power. The more likely outcome for most (non-sensitive) supply chains that determine geopolitical crosscurrents are creating an intolerable business risk is to duplicate production elsewhere (including reshoring) while maintaining production in China in order to continue to access its domestic and regional markets.

Companies and governments should focus on critical nodes of vulnerability. Trying to mitigate risk along every link in the broad mesh of inputs in which supply chains sit will lead to spiraling costs for greatly diminished returns.

- Companies should, on the one hand, focus on their own critical points of potential failure, and, on the other hand, assume acute government scrutiny on certain categories of activities such as advanced technologies and critical goods. Governments need more improved communication

### EXHIBIT 28

While Evolving Supply Chains Are Challenging, They Also Present Opportunities

<table>
<thead>
<tr>
<th>COST</th>
<th>RESILIENCE</th>
<th>AUTOMATION</th>
<th>STRATEGIC/POLICY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Cost Destinations</strong>&lt;br&gt;- Shifting of labor intensive, low end manufacturing to low cost destinations which have abundant low cost labor, and sufficient infrastructure&lt;br&gt;- e.g., Industries&lt;br&gt;- Commodities, textile, electrical equipment&lt;br&gt;- e.g., Beneficiaries:&lt;br&gt;• Vietnam&lt;br&gt;• Bangladesh&lt;br&gt;• Cambodia&lt;br&gt;• Mexico&lt;br&gt;• India</td>
<td><strong>Quest for Resilience</strong>&lt;br&gt;- Access to resources:&lt;br&gt;• Restoring/Nearshoring&lt;br&gt;• Dual supply&lt;br&gt;• Increased inventory&lt;br&gt;• Shorter supply chains&lt;br&gt;• Suitably skilled labor&lt;br&gt;• Visibility through supplier risks&lt;br&gt;• Shorter lead times and faster design improvement&lt;br&gt;• Access to hubs of demand:&lt;br&gt;• Localization of production&lt;br&gt;• Customer collaboration</td>
<td><strong>Rise of Industrial Robots</strong>&lt;br&gt;- Enables reshoring, reduces human error, improves data accuracy, improves compliance, enables faster turnaround response, decreases environmental footprint, enhances customer satisfaction&lt;br&gt;- 3D printing&lt;br&gt;- Last mile delivery platforms&lt;br&gt;- Natural language processing&lt;br&gt;- AGVs (Autonomous guided vehicles)&lt;br&gt;- AMRs (Autonomous mobile robots)&lt;br&gt;- Collaborative robots &amp; exoskeletons&lt;br&gt;- Stand-alone SCARA (Selective Compliance Assembly Robot Arms)&lt;br&gt;- CRMs (Customer Relationship Mgt)&lt;br&gt;- SRMs (Supplier Relationship Mgt)&lt;br&gt;- Supply chain planning AI&lt;br&gt;- Warehouse machine learning&lt;br&gt;- Cognitive inventory management&lt;br&gt;- Chatbots&lt;br&gt;- Re-education &amp; skills upgrade</td>
<td><strong>Aligned with Policy</strong>&lt;br&gt;- Demographics&lt;br&gt;- Climate change&lt;br&gt;- Industrial upgrade&lt;br&gt;- Self-sufficiency&lt;br&gt;- National security&lt;br&gt;- National competitiveness &amp; industrial policy&lt;br&gt;- One Belt, One Road&lt;br&gt;- Stakeholder engagement and ESG&lt;br&gt;• Worker health &amp; safety&lt;br&gt;- Reducing carbon footprint&lt;br&gt;- Regulatory &amp; public pressure&lt;br&gt;- Reputational risk</td>
</tr>
</tbody>
</table>

with companies to identify critical nodes, build strategies to relocate or duplicate critical supply chains, and maintain policy consistency to allow companies to invest in needed adjustments.

- Investors should apply a critical lens to their existing portfolios and future investments to identify positions likely to draw political or reputational scrutiny. While it is not possible to draw up a comprehensive list in a dynamic political and technological environment, certain technologies and sectors are known to have a higher risk profile. The most critical message is to focus on those areas most likely to be flashpoints in the future rather than to press for a broad decoupling that is unlikely to succeed.

This period of supply chain rethinking is an opportunity to build for a future where supply chains adapt to the need for environmental sustainability and adoption of automation technologies. Companies that do so may have more favorable positions with consumers and governments and be more agile in a dynamic market.

- Long-term pressures on supply chains include both the ‘what’ of production and the ‘how’ of production. The ‘what’ envisions a more digital economy in which every industry will increasingly rely upon emerging technologies. The ‘how’ embeds heightened social and political consciousness of environmental, social, and governance (ESG) considerations that reward responsibility alongside cost. For example, distributed additive manufacturing can be a win-win to reduce environmental impact while improving consumer delivery times.

While periods of change can prove challenging, they also present corporate and investment opportunities. As noted above, the supply chain shifts are more evolutionary than revolutionary, and do not call for a hard stop in globalization. To the contrary, we are suggesting a more thoughtful consideration of the implications of the social, political, and geopolitical environment and aligning supply chain design with long-term structural trends.

We see this period of dislocation and redesign of supply chains as presenting several areas of opportunities, including:

- Domestic and regional demand over global demand: We continue to see greater growth opportunities for supply chains that serve domestic and regional demand.

- In its simplest form, this means a greater investment focus on companies serving domestic demand in comparison to export-oriented companies. That is particularly the case across Asia given the region’s trends in higher economic growth, urbanization, and the rapid adoption of technology-based services among millennials.

- Priority for domestic and regional facing supply chains also reflects the importance of resiliency and sustainability by narrowing the distance between production and supply to shorten and reduce complexity. As the epicenter of global consumer demand shifts towards higher growth countries, it is frequently less costly, less emissions-intensive, and more efficient to align production centers with demand centers.

- Build out of infrastructure and logistics: Supply chains rely upon built ecosystems, some of which will need to expand and modernize to accommodate shifts in global commerce.

- We think that telecommunications upgrades and clean energy solutions are particularly attractive near-term opportunities. Given increased digitization and data utilization across industries, more advanced telecommunications could be necessary, from fiber optics to data centers. Data localization rules are a particularly strong tailwind for data centers and associated infrastructure. The shift to eCommerce will also require more advanced last-mile logistics and eco-friendly packaging solutions. The intersection with the climate agenda is especially important. Companies will likely demand lower-emissions (or net zero) power solutions for transport, buildings, and manufacturing, creating a tailwind for renewables, energy storage, and efficiency investments.

- Geographically, lower-cost destinations such as Vietnam, Bangladesh, Cambodia, Mexico, and India, all of which are well-positioned to continue to attract companies investing in new supply chains, will need upgraded infrastructure and logistics to cater to new manufacturing needs. The shift to regional over global also means more demand for road and rail transportation, which has implications for logistics and warehousing along these new arteries.

- Growth in automation: As companies shift and build redundancies in supply chains, there likely will be an opportunity to digitally upgrade capex plans to incorporate enhanced automation hardware and software solutions. Investments in supply chain transparency and management capabilities can improve productivity and responsiveness.

- The pandemic has highlighted the benefit of artificial intelligence supply chain planning, warehousing machine learning, and cognitive inventory management, which enabled manufacturers to pivot production and inventories to match rapidly shifting demand. Notably, that is true for both goods and services supply chains.

- Additive manufacturing (3D printing) in particular seems to be an inflection point for increased penetration both in centralized manufacture and in distributed manufacture, facilitating greater localization of production. Consumer companies are using 3D printers to reduce time to market for new products, while healthcare, energy, auto, and aerospace companies are already beginning to embark on using 3D printing to create prototypes, develop new devices or print parts locally.

- Additional emerging areas of interest include the use of autonomous guided vehicles and mobile robots in warehouses, assembly robot arms and exoskeletons on industrial production floors, and natural language processing, virtual assistants, and chatbots in customer services centers.
Continuation of China’s manufacturing upgrade: Significant domestic supply chain investment will be required as China adjusts its economic program consistent with a shift to developed nation levels and with more focus on environmental impact. A key component is to move up the value added curve to raise incomes while aligning with its “dual circulation” policy.

We expect more opportunities within China for advanced manufacturing including industrial robotics, medical technology, high speed rail, and next generational transport (land, sea and air), as well as upgrades to Chinese energy and logistics infrastructure as the country shifts away from coal and petroleum-derived fuels. Advanced manufacturing will also be fueled by innovations in the consumer sector including robotic restaurants, autonomous couriers, passenger drones, edtech, and the rapidly evolving digital payments industry.

China’s manufacturing upgrade can also create opportunities in the region and beyond. Outsourcing of lower-skilled manufacturing in industries such as furniture, textiles, apparel, and electronic equipment are likely to accelerate investments in countries like Vietnam, Bangladesh, Cambodia, and potentially, India. We also expect Mexico to benefit as higher-skilled industrial manufacturing in sectors such as autos and aircraft expands.

Increasing emphasis on diversification: Critical and sensitive goods, components, raw materials, and data management will see the most rapid build-out of new supply chains and, in some cases, reshoring to ensure greater resilience through diversification of manufacturing, assembly, and stockpiling.

Public-private cooperation can be an important complement to industrial policies and opportunity for companies to align with stakeholder interests, including in meeting public health and national security needs in the wake of the pandemic and spurring the economy of the future in areas such as new energy, biotech, and advanced tech. We think interesting growth areas include personal protective equipment, communication equipment, semiconductors, computers, active pharmaceutical ingredients (APIs), small molecule drugs, and mining and processing of rare earth minerals. We note,
however, the need for rigorous stakeholder engagement and diligence processes to be successful in building out in these areas.

- Diversification within supply chains to move away from risks associated with oligopolistic supply bases will create opportunities for small and medium enterprises to gain market share. Corporate emphasis on diversity and inclusion as part of their social impacts and efforts to reach socially conscious consumers can be an important tailwind. Companies like Google, Nike, Pfizer, and IBM are using B2B (Business-to-Business) programs to support small businesses run by historically underrepresented groups.

- Greater demand for ESG solutions: As businesses shift and reinvest in their supply chains, we see significant opportunities to upgrade their own operations for a sustainable future (and require their suppliers to follow suit) and to invest in businesses that are providing solutions for climate and broader ESG considerations.

  The climate and broader ESG agenda should be taken into account across the entirety of supply chain design and management. Adoption of environmental sustainability measures, a pivot to automation technologies, and deployment of cleaner and more efficient transport solutions are just a few examples of action areas for business and investors that will position companies to access consumer preferences for social responsibility and tightening government regulations.

  We also see opportunity to invest in businesses that themselves are providing ESG solutions servicing supply chains. For example, environmental solutions can be seen in areas such as electric and autonomous vehicles, energy efficiency, and waste management and water quality. We also see opportunities in social protection including food safety, access to education and medical services, data security and privacy, diversity, financial inclusion, and housing affordability. Technology is now enabling greater access to services including tele-education and digital health solutions.

- Increased prospects for opportunistic investments: We believe that times of dislocation and economic shifts can reward nimble investors. We see potential across a wide variety of areas, including technical education, cybersecurity, insurance, and risk management solutions. We are also particularly excited about the compounding potential of education. Many countries’ workforces lack sufficient training and skills for more automated and digital business processes. This will remain an ongoing challenge as technology is frequently moving faster than the education system. McKinsey estimates demand for people with technological skills – both coding and interacting with technology – will increase by 50%, while demand for leadership and entrepreneurial skills will increase by 30%.

Given heightened government and stakeholder scrutiny, it is important that investors and businesses undertake rigorous diligence integrating geopolitical, macroeconomic, and ESG perspectives to identify, assess, and mitigate commercial material and reputational risk.

Conclusion

The past year or so has seen dramatic disruptions to global supply chains. From the pandemic to geopolitical flashpoints, executives and governments alike have been forced to rethink conventional business models and, in particular, the creation and evolution of supply chains. We have seen that heightened political and geopolitical risks can be very disruptive to supply chains, particularly long and complex ones.

The factors that have been most important over the past year (particularly the non-commercial and pandemic-related ones) and the trends that will take us through the years ahead (including constructive consumer trends such as eCommerce, eServices, and environmental consciousness) are far more complex and structural than those in the headlines. We see encouraging signs — and opportunities for investors — as more businesses build upon decades of focus on efficiency to achieve resiliency. Yet, that will not be enough. Winners will think of supply mesh management in strategic terms — less as a ‘chain’ and more as a mesh — and in so doing focus on managing a broader set of non-commercial risks across their business inputs while avoiding wasted time severing chains that cannot be decoupled, and building their businesses for long-term growth. We believe that doing so is not just good business. It will also be necessary in order to build access to diverse global markets and maintain the license to operate in a more fraught global environment.

Corporate emphasis on diversity and inclusion as part of their social impacts and efforts to reach socially conscious consumers can be an important tailwind. Some multinational corporations are using B2B (Business-to-Business) programs to support small businesses run by historically underrepresented groups.
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