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Research Report

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SWP Comment

NO. 60 DECEMBER 2021

Supply Chain Instability Threatens Security of Supplies

Options for Industry and Policymakers

Günther Maihold and Fabian Mühlhöfer

The Covid pandemic has severely upset global supply chains. This disruption has now spread to many branches of industry, and consumers are starting to feel the impact. No short-term improvement is in sight, which has serious implications for manufacturing processes all over the world. To begin with, the pandemic primarily affected personal protective equipment; however, the collapse in international trade has also created delivery bottlenecks in other sectors.

The instability of supply chains has become painfully obvious during the pandemic. This endangers the security of supplies just as much as cyber attacks or geopolitical imponderables along supply chains do. To respond appropriately to these challenges, the pandemic-related disruptions must be seen as both a challenge and a chance. Lasting changes have to be initiated in the design of supply chains by both businesses and policymakers, so as to counteract the increasing vulnerability of the chains and to meet the growing demand for critical goods.

As a trade nation, Germany depends to a particularly high degree on stable supply chains and secure international trading conditions. Security of supplies is therefore a key condition for Germany's viability as an industrial location, as well as being essential for a panoply of consumer goods. The accumulation of debilitating framework conditions in many sectors of the world economy drives the current debate about security of supplies in Germany. The key item in analyses of production problems and supply bottlenecks is scarcity of resources, which affects semiconductors as

much as raw materials and basic manufacturing materials. According to an analysis by the Institute for the World Economy (IfW) of the state of the international economy, this scarcity is caused not just by economic catch-up effects created by the Covid pandemic but also by interruptions of global supply chains and problems in the logistics and container industries, which will take a long time to resolve. Currently this means a reduction in production of around 5 percent for German industry.



Susceptibility to Disruption Has Increased

Open and integrated markets are the precondition for supply chains to function effectively. However, their mechanisms are increasingly put under pressure by external events, market interventions and manipulations, and planned interruptions of the movement of goods and services. These events include suppliers abroad no longer being able to meet their delivery obligations due to various obstacles to production, and the shortage of products and bought-in parts as a result of growing demand in a rallying economy.

Based on business surveys on potential losses and disruption scenarios, the Allianz Risk Barometer 2021 lists three key risks resulting from the pandemic that companies in Germany have to cope with: business interruptions (50 percent), closely followed by cyber attacks (48 percent) and the outbreak of the pandemic (35 percent). Companies are expected to engage more strongly in risk management to prevent loss of revenue and productivity as well as rising business costs; in turn, they expect policymakers to provide both guidelines on framework conditions and support with growing trade conflicts.

Supply chain disruptions are not a new phenomenon. Unforeseen or unplanned events can interrupt the usual flow of goods and materials in a supply chain. In the simplest case, a supplier can be replaced to meet the purchaser's needs; storage capacities can also be expanded at reasonable cost. However, business closures or extensive legal proceedings to recover damages can seriously threaten the economic existence of many companies.

The complexity of today's global supply chains, just-in-time production and tightly coordinated transport routes are an ever-greater challenge for worldwide delivery networks. It raises their susceptibility to disruption by both internal and external parameters. The pandemic reinforced already existing supply chain problems. After the outbreak, it quickly became obvious

how fragile the web of globalised goods flow was in the face of a worldwide health emergency. National and international measures to combat the coronavirus led to serious interruptions in global supply chains and value chains. As of March 2020, events had a direct impact on supplies of basic medical goods and intensive care goods. Disinfectant, face masks and protective clothing became appreciably scarcer. In the current (fourth) wave, this is true for testing materials. As Covid spread, dependence on China and the many (medical) goods imported from there, as well as on medications from India, became particularly palpable.

Regardless of pandemics, global country risks and location risks (e.g. natural disasters, strikes, and fires or explosions at production sites or logistics hubs) and cyber security risks also have a direct impact. However, dependencies within today's complex value chains are often still underestimated, especially as regards the extent of the potential damage, which can multiply across the various stages of the supply chain known in what are known as cascade effects.

Conflicting Objectives: Economic Efficiency vs. Security of Supplies

The pandemic-induced withdrawal from global value chains shifted the economic focus onto conflicting objectives, namely cost efficiency (from the business perspective) vs. security of supplies (from the perspective of the nation-state). The fundamental logic applied until then — to order supplies from countries with advantageous cost situations — led to an acute shortage of relevant goods, such as medical materials, triggering a debate about expanding national production sites for this category of goods. This immediately raises the issue of what strategy needs to be adopted to ensure an adequate response to future events of a similar scope.

When the container ship *Ever Given* ran aground and blocked the Suez Canal for a week, this not only caused losses that have

been estimated at 6 to ten billion US dollars. It also exacerbated the already tense situation in worldwide trade flows and supply networks. Many manufacturing companies still use the principle of just-in-time production, whereby – to reduce storage costs – components they require are delivered just before use. Tight delivery times and tight transport routes are a problem whenever a single link in the supply chain fails; this can quickly have far-reaching consequences for the world economy as a whole.

In particular, the semiconductor shortage potentially endangers the functioning of global value chains precisely because semiconductors are traded intensively and are thus risk factors for global demand. The world's car industry was particularly hard hit by the stoppages on production lines and the associated introduction, at short notice, of short time work. This was caused by the high demand for semiconductors, resulting from the great need for microelectronics as part of ongoing digitalisation.

The Transport Sector Bottleneck

Transport tends to play a subordinated role in traditional perspectives on supply chains, both in terms of added value and as a cost factor. This has markedly changed: factory closures in China in early 2020; lockdowns in several countries around the world; labour shortages; robust demand for tradable goods; disruptions of logistic networks; and capacity bottlenecks have greatly increased freight costs and noticeably lengthened delivery times. The days-long closure of the Suez Canal by the container ship *Ever Given*, Covid-related stoppages in the combined Ningbo-Zhoushan port complex near Wuhan Province and in Yantian port in the metropolis Shenzhen, which is home to millions, resulted in substantial delivery delays from China.

This has triggered a debate, particularly in the logistics sector, on how risks might be reduced without repatriating business or production processes (known as reshoring), which would instigate a total reversal of

the outsourcing that has been practised for many years. Consequently, great efforts are being made here too to diversify transport means and routes, and thus ensure the largely undisturbed circulation of goods via the supply arteries of global trade, beyond the heavily burdened international container traffic. Rail transport and air freight could be an alternative for some goods.

Despite this, transport costs have risen dramatically, which has driven up goods prices worldwide. Transporting a container from Shanghai to Hamburg before the Covid pandemic (January 2019) cost 2,000 euros; in September 2021 this reached 20,000 euros for the first time. The extreme increase of freight rates due to container shortages and to ships' long waiting times outside congested international ports makes clear that there are hardly any buffers left in transport deals that could absorb some of the bottlenecks in supply chains.

Targeted Attacks on Supply Chains

Explicit attacks on supply chains are increasingly a problem for global value chains, especially in the context of cyber security. Such supply chain cyber attacks are often directed against service providers that equip their clients with software and with network solutions. According to estimates by the EU agency responsible, ENISA (European Union Agency for Cybersecurity), the number of these attacks has quadrupled in 2021. A cyber attack is when goods, services or other technologies that a provider is supposed to supply to a client are damaged or compromised.

The central weakness is the suppliers' distribution system; attackers therefore target logistics companies to spread malware. Hackers modify codes so that, when software updates are installed, they block all systems. This is a risk for the clients as well as the supply companies concerned. The extent and depth of the damage caused always depend on the type of attack and the intentions behind it.

In the event of a supply chain attack, the affected company will be blackmailed and great financial damage caused. The failure of a single supply chain link can result, domino-like, in far-reaching production outages. For example, the attackers might use a compromised or hacked email account to spread malware infections (known as ransomware attacks). More elaborate attacks can also compromise the supplier's entire network and use administrative access to infiltrate the actual target network. Particularly serious attacks also modify trustworthy software tools.

Furthermore, this type of cyber attack has been used by states as part of intelligence activities; however, ransomware attacks in particular are increasingly carried out by criminal actors. In July 2021 software provider Kaseya was attacked by the Russian hacker group REvil, which infected the computers of the affected companies with malware that made them, and the companies' entire digital infrastructure, unusable until a ransom was paid. REvil was believed to have primarily criminal and monetary reasons for the ransomware attack but a distinct classification of such incidents is often difficult.

In December 2020 the Orion network management system of the SolarWinds software was compromised, affecting 18,000 networks that used it. Suspicions quickly attached to the hacker group APT29/Cozy Bear, which is considered part of the Russian external intelligence service SVR. It is now believed that of the 18,000 potentially affected networks fewer than 100 were damaged. However, these include parts of the US federal government, for instance the Pentagon and the Treasury. Such incidents imply that hacker groups have more than purely financial motives (i.e. blackmailing for money): they may be interested in causing far greater damage. The implicit (or explicit) involvement of state agencies, such as by the Russian external intelligence service SVR in the ransomware attack on SolarWinds, suggest it.

Options for German Industry and Policymakers

Global supply chains are increasingly viewed from the perspective of the instability of their structures and the risks that might arise from disruptions of the security of supplies. This is especially true for the steadily increasing demand for, and significance of, growth-relevant goods. Businesses and policymakers need to draw up appropriate (and ideally joint) measures for reducing the susceptibility of supply chains and preventing conceivable crises. They are trying to expand the robustness of supply chains by employing expanded instruments, such as a strategic policy of security of supplies and increased warehousing. Upheavals within value chains thus offer an opportunity for tackling specific and previously-neglected areas of Germany's strategic positioning on the security of supplies. Germany – and Europe – will need to make it a collective organisational task to find a good balance between de-globalisation, re-regionalisation and deceleration of economic processes

A Direct Duty of Companies: “Responsible Supply Chains”

It is vital that businesses exercise due diligence vis-à-vis their suppliers. Due diligence obligations cover the rules enshrined in law on the implementation of human rights and sustainability, but they are fundamentally also intended to establish transparency and traceability of purchasing policies so as to ensure stability and reliability. This safeguards against reputational and liability risks; certifying one's own supply chain is an important tool here. What is needed alongside the established principle of “know your customer” is an equally sophisticated process striving to “know your provider”. More pressure must therefore be exerted, for example, on dealers in raw materials to increase transparency about the origins and mining of these minerals. This will take substantial international competence from businesses in the context of growing com-

petition for raw materials: according to estimates by the International Energy Agency, in 2040 we will need six times as many mineral raw materials to reach net zero greenhouse gas emissions by 2050. For some substances, such as lithium, demand might even rise thirtyfold by 2030.

Comprehensible transparency rules and extensive risk assessments make it possible to reduce the susceptibility and vulnerability of supply chains; this orientation in resilience is clearly in the interest of any business wishing to remain successful in the markets. However, it goes hand in hand with modifying previously accepted fundamental principles for managing supply chains, which are largely characterised by power asymmetries in the division of labour; cost and time pressures; extensive fragmentation and geographical decoupling of production processes; and anonymity. The management of supply chains cannot be expected to be “clean” and less susceptible to crises for as long as the links within those chains that create the most value are concentrated in industrialised nations while extraction and production are outsourced to countries with lower standards.

Selective Re-Regionalisation of Production Ties

The Covid pandemic has shown that the strategy of reshoring must be rethought, especially where it concerns securing access to critical (medical) goods. Given the profound integration of the German economy in global value chains and its extensive role within the European Union (EU), general reshoring is not appropriate. Policy design of supply chain governance should instead focus on securing the supply of those critical goods and products that require raw material deposits from outside of the EU. The current shortage of raw materials that are indispensable for manufacturing goods is only one example to show that it is just as crucial for industry and policymakers to devise a joint strategy as it is to rethink current raw materials strategies. In consultation with its EU partners, Germany should

strive for a united approach and establish a joint European geopolitical strategy. This is the only way to adequately safeguard the security of supplies through stable supply chains.

Updating the Raw Materials Strategy and Resilience Regime

To meet the world’s demand for rare earths, for example, and reduce the vulnerability of supply chains, it is also advisable for German companies to enter into and intensify bilateral private sector cooperation with extraction countries (in accordance with EU partners). The German government can contribute by creating a stable foreign policy framework that comprises legal certainty and predictability. This should be part of an adjustment of the raw materials strategy.

However, state intervention should be limited to complementary and accompanying measures so as to avoid potential dependencies linked to guaranteed purchases or the preferential treatment of specific sectors. The operative patterns to be created should address how to cope with external problems as well as how to minimise international risks for supply chains. This will require substantial governmental support as companies by themselves are unlikely to take the necessary steps, due to the high cost of such measures. Special attention has to be paid to public procurement as many public institutions have so far not included resilience and sustainability requirements in their purchasing policies.

An effective resilience regime, which improves the ability of companies to react adequately to unforeseen changes, can make supply chain networks secure and is thus also in the interest of policymakers. The same is true for the transformation of industry towards supply chain 4.0, which aims to integrate new and digitally networked technologies so as to produce more efficiently and intelligently. Only by establishing the appropriate framework for this — such as a higher degree of digitalisation and automation — can the German government offer businesses a reliable trading environment.

Cyber attacks, particularly on government agencies, critical infrastructure and supply chains, are financially and geopolitically highly topical. It is therefore important to apply existing tools for improving cyber security to their full extent, and to identify new opportunities for action, including with European partners.

Building a Strategic Supply Chain Policy

Beyond acute supply chain disruptions, their long term impact on the global economy is hard to estimate. A return to the pre-pandemic supply chain model is no longer possible since supply chains now have to meet other, extended challenges. Whereas in the past the focus in supply chain design was guided by minimising costs, the most recent disruptions (changed trading patterns, supply bottlenecks, attacks and lockdowns) have foregrounded other criteria. Businesses have to demonstrate more agility; comprehensive measures to increase resilience and thus the stability of the entire value chain have become indispensable. This means a re-orientation towards the target values of sustainability and security of supplies. Supply chains will remain a decisive instrument of globalisation; however, risk factors must be tackled effectively to avoid a lasting stagnation of worldwide economic performance. It is therefore appropriate to rethink and modify the global supply chain model.

Reducing one-sided dependencies. The weak point of many businesses is their dependence on China, especially the supply of Chinese raw materials, components and finished products. Companies therefore need to make an effort to diversify their suppliers. One approach is the so-called China+1 strategy, whereby companies that used to be strongly dependent on China for procuring and manufacturing now try to extend their capacities to additional markets. As a consequence, Vietnam, Thailand, Malaysia, Cambodia, Indonesia and India have become regional production hubs in

Asia. The Chinese model of “the world’s factory” has substantial negative repercussions on global supply chains, which must therefore be redesigned to be much more flexible so as to lessen production risks.

Modifying “single sourcing” towards a more diversified supplier structure also paves the way to a modular layout of supply chains, which places greater demands on their organisation and internal coordination. It therefore seems logical to tie the restructuring of supply chains to complementary elements.

Producing closer to the demand. Depending on the production branch, the option of nearshoring looks very different, especially regarding the availability of raw materials. It could even include increasingly locating production sites in the Mediterranean basin – but this will not be possible for all production branches. What is required is therefore a political decision on which goods and services have strategic importance for Germany’s and Europe’s security of supplies, so as to set clear and calculable framework conditions for industry. This should not be understood in the sense of a state-ordered policy of autarky and excessive protectionism but as an incentive to increasingly integrate various instruments – such as the raw materials strategy and supply chain policy. Guidelines on warehousing strategic products or on redundant formats in essential service provision should also be derived from this.

The sustainability of transport infrastructure (such as the energy and CO₂ footprint for transport and packaging) also needs to be a criterion here. Here too it is a good idea to minimise the risk of disruption to transport infrastructure and logistics by diversifying transport routes and means. This will necessitate the construction of fairly large numbers of regionally distributed logistics hubs. Such multimodal solutions can also be more cost efficient since they shorten transit times from closer production sites or entrepôts, increase reliability and improve customer care.

Modular supply chains lead to power shifts.

Renouncing single sourcing changes power relations in supply chains. A purchasing company tied to only one supplier is in a position of strength, and will expect discounts and other perks. Diversification improves the negotiating position of the supplier and affords them more opportunities for a more favourable arrangement within the supply chain. This should be of interest from a foreign policy perspective as well – the countries that host supply companies also come into play in enforcing sustainability criteria and social standards.

As part of such diversification, businesses will be called upon to give their supply chains end-to-end visibility so as to help secure quality standards and supply volumes; to know who their most important suppliers are; and to be aware of any changes occurring at the various stages in the supply chain. For instance, it is expected that shortening supply chains and developing micro supply chains will increase the security of supplies. One option under discussion anticipates a power shift towards growers and producers, especially in the agricultural sector. This would generate value creation effects at source of production and would indirectly also improve the negotiating power of those producers and producer countries. However, this option can only be implemented in a very limited way for complex supply chains with great depth staggering. To guarantee oversight and transparency, relationships within complex supply chains will have to be reorganised. It is therefore logical (and not just from the perspective of international development) to promote added value designs that are product-related and favour upstream economic actors – in other words, the actors involved in making raw materials available to the producers.

Potentially disruptive factors can also be reduced with other instruments: blockchain technology is considered a technical option

which enables a secure unchangeable record of origin data, does not require an administrative centre or substantial coordination efforts and yet guarantees the integrity of transactions. A network of several sites could achieve a presence close to consumers as well as the reliability required to avert the risk of capacity interruptions.

Verticalisation within supply chains. Input failures are a serious production risk, in particular for Germany as a trade nation. Since the German economy has high input needs, a strategic supply chain policy is an integral part of any forward-looking configuration of Germany as an industrial location. This kind of approach, based on security of supplies, can diminish economies of scale and thus make inputs and supplies more expensive, which in turn is likely to drive up production costs for the purchaser and ultimately also for the end consumer. All these potential consequences should be discussed openly.

The organisational logic within some supply chains may also shift. To optimise their supplier portfolio, businesses would more strongly integrate their production processes vertically by taking over suppliers or using platforms of supplier aggregates run by investment funds. Due diligence obligations, as contained in Germany's supply chain legislation, gain in relevance precisely during such processes of reorganising production and supply. They contribute to giving greater visibility to sustainability criteria as well as security of supplies and reliability.

Prof. Dr Günther Maihold is Deputy Director of the SWP and leads the SWP contribution to the research network Sustainable Global Supply Chains; Fabian Mühlhoyer is an intern on this project, which is funded by the German Ministry for Economic Cooperation and Development (BMZ).

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