

North Korea: The Supply Chain Perspective

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Introduction:

With the world's eye on the escalating geopolitical developments in North Korea, many business leaders and supply chain experts are wondering what impact this evolving situation might have on their operations. To provide supply chain practitioners with a foundation, this whitepaper brings together experts to provide insight into the geopolitical considerations as well as the associated supply chain dependencies.

North Korea's exports in 2016 amounted to $2.9 billion, of which its top ten exports accounted for 87.9% of the value of its global shipments. These exports include minerals and oil, clothing and textiles, iron, steel and their ores, electrical machinery and equipment, and computer parts and peripherals. North Korea's major trading partners are China, Russia, India, Pakistan, Singapore, Germany, Portugal, and France. Although Resilinc has determined that none of its customers have sites in North Korea directly, the indirect impact of a North Korea initiated conflict will have a lasting impact with the nations both taking sides and remaining neutral, all caused by a nation with an area slightly smaller than the US state of Mississippi. This can be attributed to the interconnected and layered nature of global supply chains and operations. Countries that trade with North Korea also trade with the United States, Japan and South Korea. In the event of a military scenario with even one of these nations, businesses worldwide will be impacted.

Providing a background for supply chain practitioners to leverage in the development of event response, this whitepaper will examine at a high level:

- An analysis of the developments in North Korea and what could potentially happen in the coming months.
- A few concrete scenarios and their expected supply chain impact that can aid in the planning and development of a playbook
- Recommend actions you can take now to prepare yourselves and your suppliers for these scenarios

North Korea: Development of the Political Standoff

North Korea's desire to advance its nuclear capabilities was the starting point of the current volatile geopolitical instability. North Korea launched its first intercontinental missile on July 30 and heightened fears that an attack on mainland US could be imminent. The UN Security Council adopted sanctions banning exports worth $1 billion, with the support of the US, South Korea, Japan and China. In retaliation, North Korea threatened the United States pacific territory of Guam, also promising pre-emptive action if the US showed signs of provocation. China, North Korea's biggest trading partner, and Russia agreed to work together, warning the US and North Korea to de-escalate the situation and come to a peaceful resolution. On August 29, a North Korean ballistic missile flew over Japan into the northern Pacific Ocean.

North Korea has claimed to have developed an advanced nuclear weapon with great destructive power. Despite facing economic and diplomatic pressures exerted by the US, South Korea, and the UN, North Korea has not shown signs of abandoning nuclear armament. The UN has imposed export sanctions on goods worth over $1B from North Korea, including coal, iron ore, lead ore and seafood. To exert further pressure, China, which accounts for 90% of North Korea's foreign trade, has also imposed limits on its exports of refined petroleum, condensate and liquefied natural gas to the nation. The UN has also sanctioned a ban on North Korea's textile exports, while a freeze on Kim Jong Un's assets and ending payments to North Korean guest workers has been proposed by the United States.

Following the UN sanctions backed by Japan, China, and Russia, North Korea threatened the United States sparking a war of words between the North Korean leader and the President of the United States.

Global Political Alliances:

The US conducted joint military drills with South Korea, which are largely computer simulated war games. Japan voted on all the UN sanctions against North Korea, protested the launch of North Korea's missile and promised to work closely with South Korea and the US. The Russian President had warned the US and North Korea that military hysteria would not result in resolution, and the nation had agreed to partner with China to contain tensions. It was reported that China would stay neutral if North Korea struck first against the US, but would also intervene if US and South Korea carried out strikes to overthrow the North Korean regime. China later complied with the UN sanctions limiting oil exports to North Korea. Australia had called on China to exert more pressure on the nation; France and Britain have requested the Security Council to impose additional sanctions and discuss next steps.

Resilinc, with the help of our geopolitical expert Bob Kyle, identified six different scenarios that supply chain practitioners should be aware of. These are:

Scenario	Type	Description
1	Best Case	It's a war of words...
2	Trade Sanctions	US issues trade restrictions against China
3	Military Option	North Korea attacks South Korea
4	Accidental	North Korea attacks Japan
5	Military Option	US attacks North Korea pre-emptively
6	Military Option	North Korea attacks US Asia Pacific bases

This whitepaper will examine each of these scenarios in depth, detailing the geopolitical context and providing a supply chain insight.

Scenario 1: War of Words



"There's no military solution, forget it."

"Until somebody solves the part of the equation that shows me that ten million people in Seoul don't die in the first 30 minutes from conventional weapons, I don't know what you're talking about, there's no military solution here. They got us."

Steve Bannon, August 2017

The current situation is the result of a rapidly escalated war of words. With both North Korea and the United States threatening potentially nation destroying actions, the situation will spill into military conflict if it worsens further. Over time, a negotiated settlement between the US, China, Japan, South Korea and North Korea is a possibility. Steve Bannon mentioned a scenario in the same August interview as the quote above, where the US withdraws from the Korean peninsula in return for China freezing the North Korea nuclear program

Geopolitical Analysis:

Experts believe that North Korea cannot afford to back down from the path they are on, because history has proven that every dictator who did ended up worse off, so the world might have to get used to the idea that they will continue to advance their capabilities. Over time, multi-country talks are a possibility where each country makes painful concessions to pressure China to dry out North Korea's nuclear program. Steve Bannon, in his August interview, mentioned a deal to remove American forces from the Korean peninsula in exchange for China freezing North Korea's nuclear program. This is not a popular option, and many in the administration are opposed to it. However, given the lack of any better options, it continues to remain a possibility. Another possibility could be the deterioration of US- China relations, which would have major impact on global economy and the cooperation between the east and west that has developed over the past decades.

Supply Chain Impact:

Uncertainty in the political situation over a war of words is likely to persist with Japan and South Korea boosting their defensive capabilities. In this scenario, however, the uncertainty will allow businesses to spend time conducting research, evaluating impact, assessing response and thereby keeping their playbooks and event response protocol updated. Status quo or a negotiated settlement that resolves the current escalating geopolitical crisis is the best outcome for supply chain managers. The current tension might be good for business owners in that they would see an increasing demand for defense and aerospace equipment as countries like Japan and South Korea look to shore up defenses, which drives demand down the supply chain to their suppliers. Many business leaders might pull in orders to create an inventory buildup as a risk management strategy, driving additional demand in the near term.

Status quo, or a negotiated settlement is expected to keep the supply chain viability of the region unchanged. Thus, the overall outlook might be “slightly better” or “neutral”.

Scenario 2: Trade Restrictions



Geopolitical Analysis:

Sanctions have already been placed on North Korea by the UN. To put greater pressure on North Korea's nuclear disarmament, US may impose trade restrictions on China, which could cause a trade war, raising prices on certain classes of goods. "We're talking about a global recession and devastation for the global economy," according to Marianne Schneider-Petsinger, the U.S. Geo-economics Fellow at Chatham House, a think tank based in London.

The US could also cut off financial bank access to Chinese companies doing business in North Korea. In the past, most companies would choose to cut off ties with the sanctioned nation, and opt for maintaining or expanding access to the larger US market. However, China has insured itself well against the world's ability to act against it in a sustained way. Almost every manufactured product, gets at least one part from China, whether directly or through a supplier, giving China significant bargaining position in any trade restriction strategy.

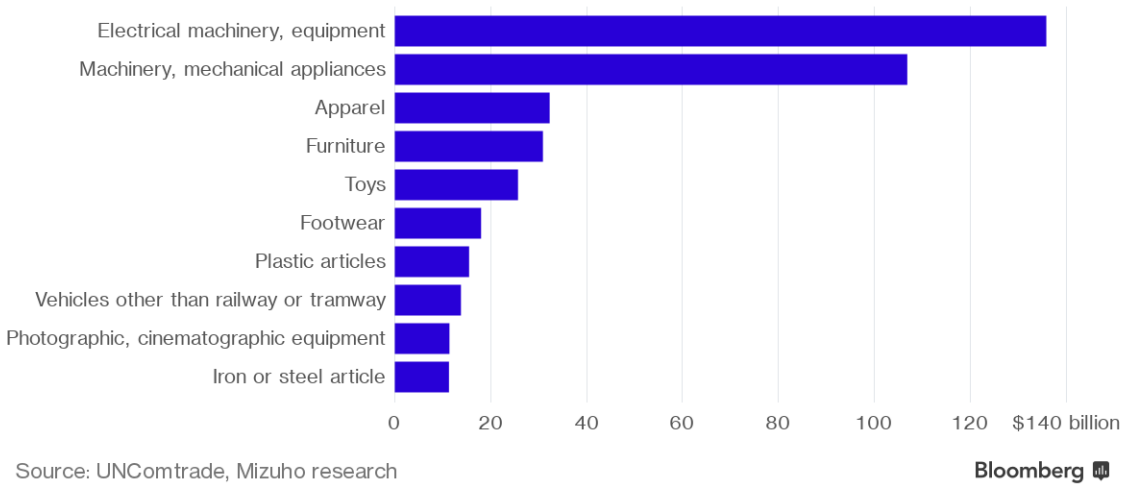
Experts believe this scenario is unlikely to come to fruition as outlined by the President. The last eight months of the Trump administration has revealed the modus operandi of the team. First, the President makes a controversial policy statement using Twitter, and sends the media into a frenzy. Then, his team provides more color and boundaries on how the administration is expecting to implement the measures. So, while this is a possible scenario, implementation would likely be limited to key sectors or products.

Supply Chain Impact:

Those products or sectors that could face trade restrictions would be protectionist in nature, to limit foreign competition. For example, restrictions in the steel industry could constrain capacity for certain specialty metals and/or result in a price increase on steel products and derivatives. Downstream, automotive, heavy machinery, and transportation equipment manufacturers could experience higher raw material pricing and capacity constraints.

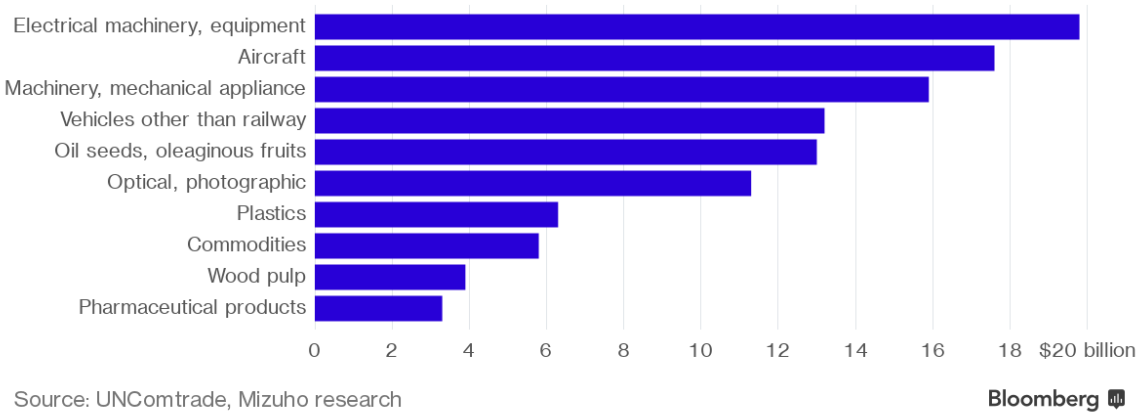
The charts below show the top products that China exports to the US, and those that the US exports to China. A high-level assessment of the trade shows that Apparel, Furniture, Toys etc. are unlikely to be sectors that would fall under protection measures. Electrical machinery, equipment, machinery, mechanical appliances, photographic equipment etc. are products or sectors which have players in both countries. These are industries who might want to evaluate their China based supply chains and understand what the impact of trade restrictions might be to their businesses. Retaliatory restrictions from China might be a possibility, which would impact pharmaceutical, aerospace and heavy equipment industries.

Top Chinese exports to U.S. in 2015



Below are the key products that China imports from the United States.

China's top imports from U.S. in 2015



President Trump has also threatened dissolution of the Korea-US Free Trade Agreement (KORUS), which could also lead to trade restrictions on imports from South Korea. This would help certain US sectors, as the US has a massive trade imbalance with South Korea. Automotive companies have been hurting because of lower cost South Korean automakers providing competition to US automakers. However, high tech and automotive industries, also have a heavy dependence on suppliers in the Korean peninsula, and trade restrictions could impact the pricing of many components and raw materials from South Korea.

Scenario 3: South Korea under attack

Geopolitical Analysis:

A few important issues to keep in mind with discussion of the military options in the situation. First, all the military conflict scenarios are layered and potentially interactive. Second, geopolitical experts caution that the media tends to exaggerate the current situation and make it seem all or nothing, which may not be the case. Third, predicting the sequence of events after a military conflict may not be straightforward, with all sorts of unintended effects. For example, the invasion of Iraq was a successful military exercise but led to a chaotic aftermath of political events.

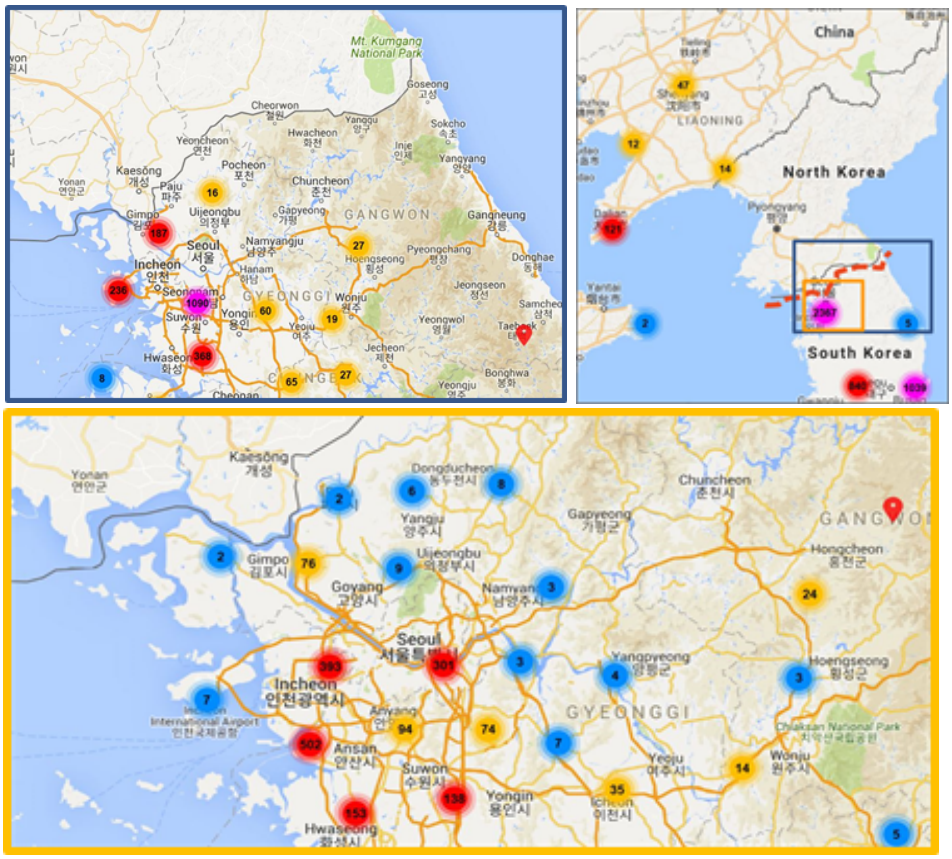
North Korea may not intend to attack, but during ICBM testing, a test could send missiles towards South Korea, or towards a US Navy base in the region. This could be interpreted as an attack, and may escalate an already tense situation. Possibilities here are retaliatory attacks resulting from pressure on the US or South Korea to respond militarily. The September missile test by North Korea triggered live-fire ballistic missile drill in South Korea.

In the event of a North Korea strike, particularly in deliberate aggression, it is possible that the US could evaluate a military response. China has recently indicated that in case of a "North Korea attacks first scenario", China would not defend North Korea. It is possible that China might cut off all trade with North Korea as a final push to get them to back down.

However, China may need to step in and though China might support North Korea, all scenarios don't lead to World War III. Geopolitical experts remind us that one must always remember that China cannot afford for the two Koreas to unite. A war that creates a single Korea aligned with the US, would be unacceptable to China, which shares an 880-mile border with North Korea. Russia has taken more of a neutral role, indicating they will follow China's lead. A major attack by the US would also create a refugee crisis for China, destabilize the neighboring countries, and will undoubtedly increase tensions between two of the world's largest economies. The fact that it could be so disastrous to China and its neighbors virtually guarantee that they will not stand by silently and will choose a side.

Supply Chain Impact:

In an escalating situation where, North Korea attacks any part of South Korea, whether deliberately or during a test, supply chains would come to a standstill within days. Resilinc's supply chain mapping efforts have resulted in over 4000 sites being mapped to South Korea.

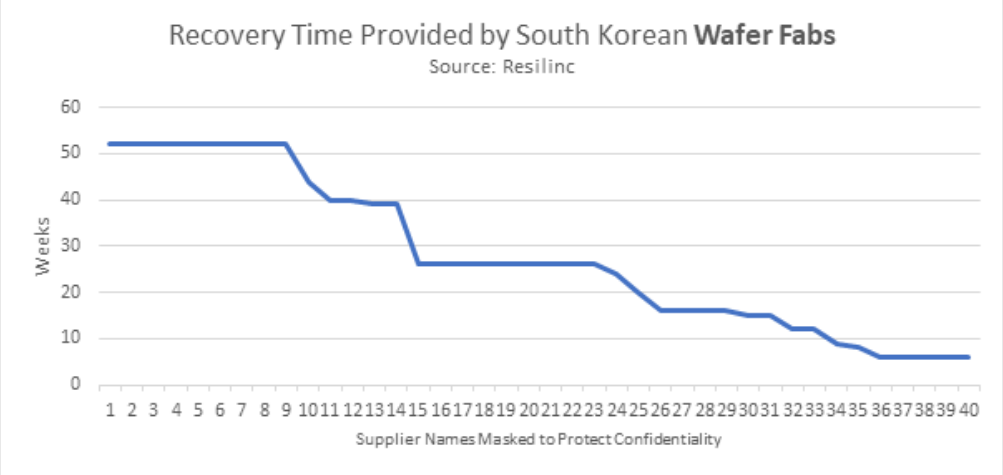


These sites span complex manufacturing primarily focused on high tech, medical devices and automotive industries, where every product has at least one part that touches South Korea's high tech, semiconductor and other manufacturing sites (originating in the direct or sub-tier supply chain). The sites that should cause the greatest concern to all supply chain experts are semiconductor chip wafer fabrication and assembly and test sites located in South Korea. These sites are highly complex manufacturing facilities that take $4 billion at the low end to build, and run at 95% or higher capacity utilization once online. They are all highly sensitive clean-room environments that manufacture some of the smallest components we all rely on in our everyday life.

Resilinc has mapped almost 40 wafer fabrication sites. Average recovery times are 28 weeks, with 28 out of the 40 fabs reporting maximum recovery times between 6 months to 1 year. Any damage to a facility would disrupt supply chains for many months.

Of 1500 products mapped in Resilinc's repository for the high-tech industry, between 90-100% have tier-1 or tier-2 supplier site based in Seoul and Incheon area, placing a very high value target on products coming from South Korea. There are over 200 sites within easy reach of Kaesong base and an additional 1300 sites in the high-risk zone of a coordinated attack.

Supply of products using semiconductor devices--consumer electronics, phones, networking equipment, cars, industrial products and medical devices--would be impacted within days.



Companies would be directly, indirectly and tangentially impacted:

- Direct impact for companies like LG, Samsung, Amkor, ASE, SK Hynix, Hyundai, Kia, and many others.
- Indirectly impacted would be the thousands of companies who use these and other Korean suppliers in their supply chain.
- Tangential impact is loss of revenue from falling demand. For example, after the Thailand floods in 2011, Intel lost several billion in revenue because disk drives were affected, therefore no one was buying processors.

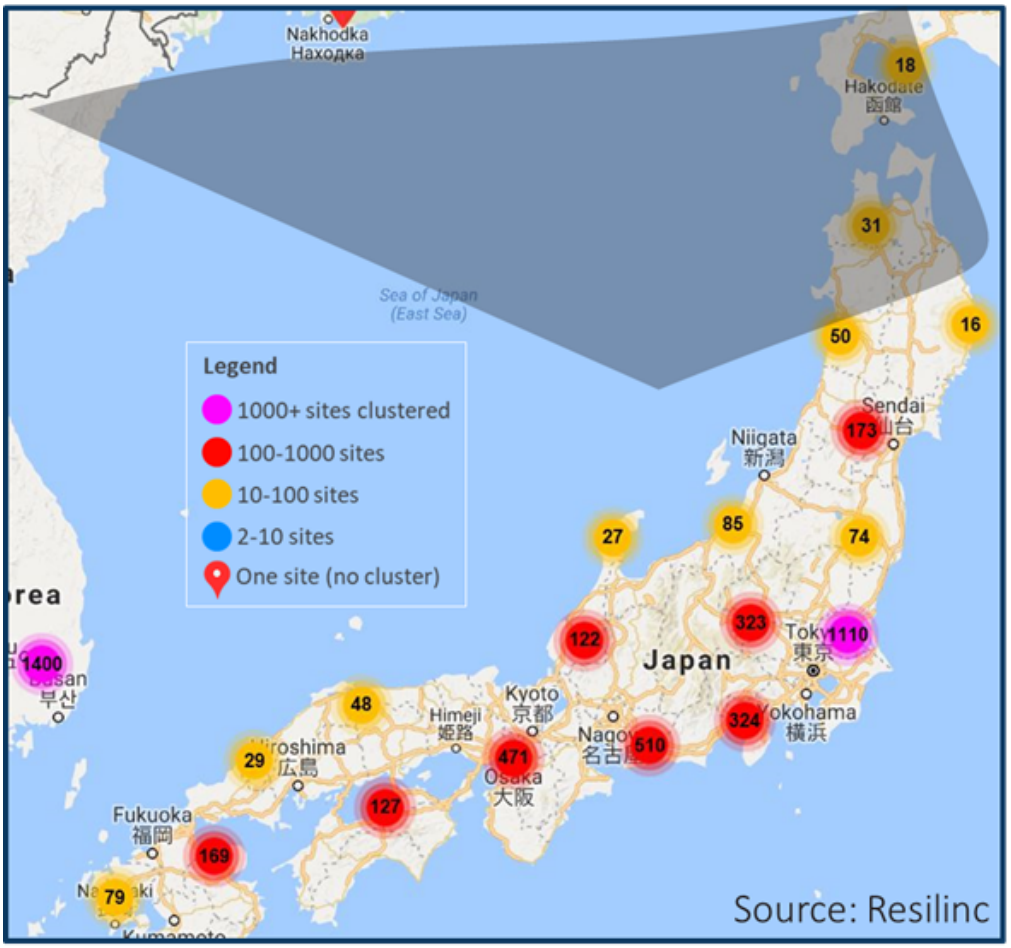
Scenario 4: Japan under attack

Geopolitical Analysis:

All 14 missiles launched by North Korea in 2017 have been aimed towards Japan's coastal regions, including the ICBMs that were recently tested. An inadvertent attack on Japan could simply be a test gone wrong, meaning every test has potential to escalate to a military conflict in the form of retaliation against North Korea. This response could bring South Korea into the impact zone, triggering Scenario 2. If the Security Council can distinguish a deliberate attack from an unintentional one, it becomes paramount to be able to plan a response to both.

Supply Chain Impact:

A broader attack on mainland Japan would have massive supply chain consequences, no matter which part of the country is attacked. Almost 4900 critical manufacturing, warehouse and distribution centers are mapped by Resilinc to Japan, and like South Korea, most high tech, automotive, and medical D\devices products use at least one part that touches a Japanese site in its direct or sub-tier supply chain. Resilinc's core industries--high tech, semiconductor, and automotive--can expect to be impacted very quickly and severely.



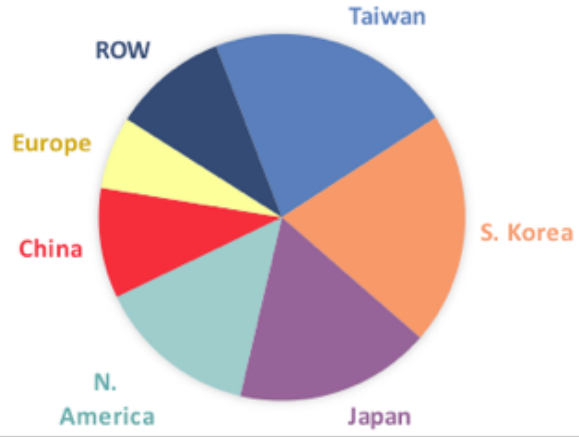
In the above map, the shaded area represents the zone of impact from a missile fired from North Korea. Although the number of sites in the area is not high, any change in the direction of a test missile could impact any number of sites that are

further south. From the mapped sites in Resilinc's database, 95 – 100% of any high-tech industry product had one part come from Japan directly or a sub tier supplier part that comes from Japan.

Importance of Semiconductor Components from Japan and South Korea

The importance of the semiconductor supply chain cannot be understated. In this age, where everyone carries a device that has a chip in it, that is dependent on manufacturing sites either in Japan or South Korea. In accordance with Moore's law, the number of transistors per square inch on an integrated circuit would double about every year. The law has held true till about the last five years and has had tremendous implications on global electronics manufacturing capacity and capabilities. The first step in producing these devices, the wafer fabrication process, is complex and precise. Each line costs up to a billion dollars and has to be mostly rebuilt every two years as processing power increases. As all the wafer fab lines run at >90% capacity there is little to no excess capacity to absorb a major disruption of the size discussed in this paper.

The chart below shows where most of the capacity originates.

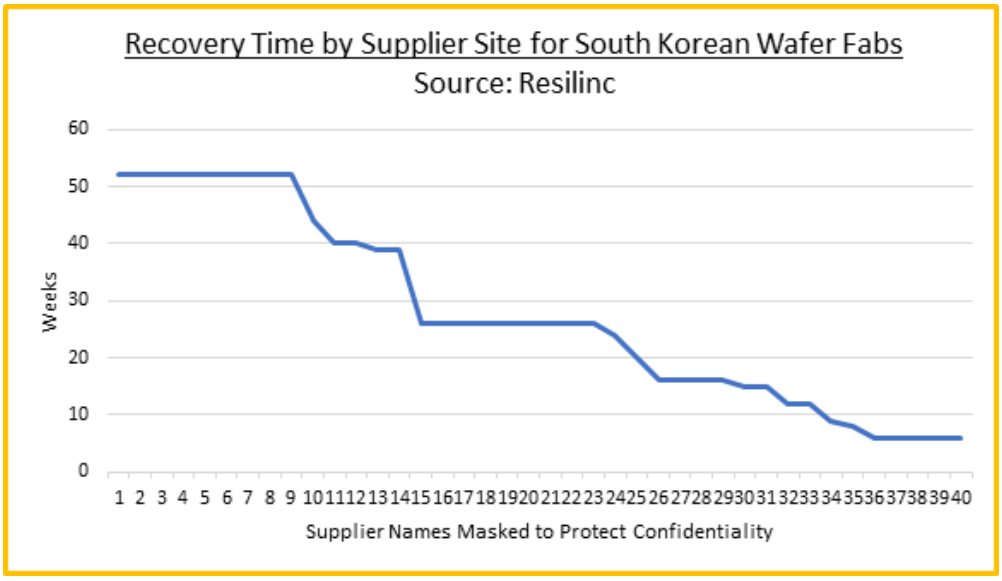


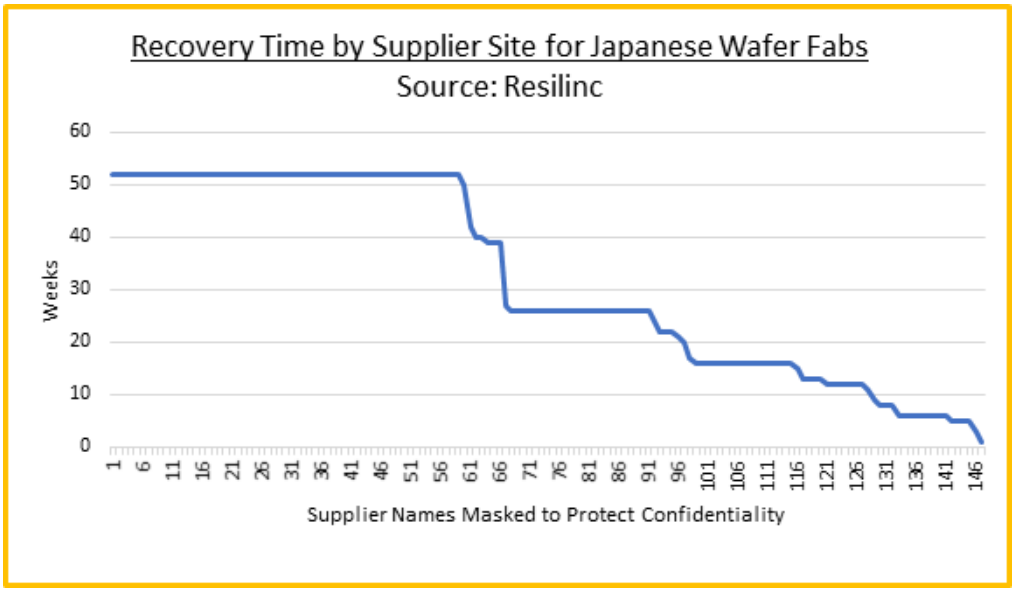
Region	Installed Capacity (K w/m)	% of Worldwide Total
Taiwan	3,547	21.7%
S. Korea	3,357	20.5%
Japan	2,824	17.3%
N. America	2,320	14.2%
China	1,591	9.7%
Europe	1,046	6.4%
ROW	1,665	10.2%
TOTAL	16,350	100%

Source: IC Insights

Looking at the chart, it may seem like only the wafer fab capacity coming from Japan and South Korea – about 37%, will be affected. However, Resilinc's part site mapping reveals that 80% parts manufactured in Taiwan are shipped to South Korean assembly and test sites for packaging, which implies more than 50% worldwide capacity

is now impacted. So, any military conflict that impacts South Korea or Japan will not only have a humanitarian impact but will also impact the quality of human life worldwide.



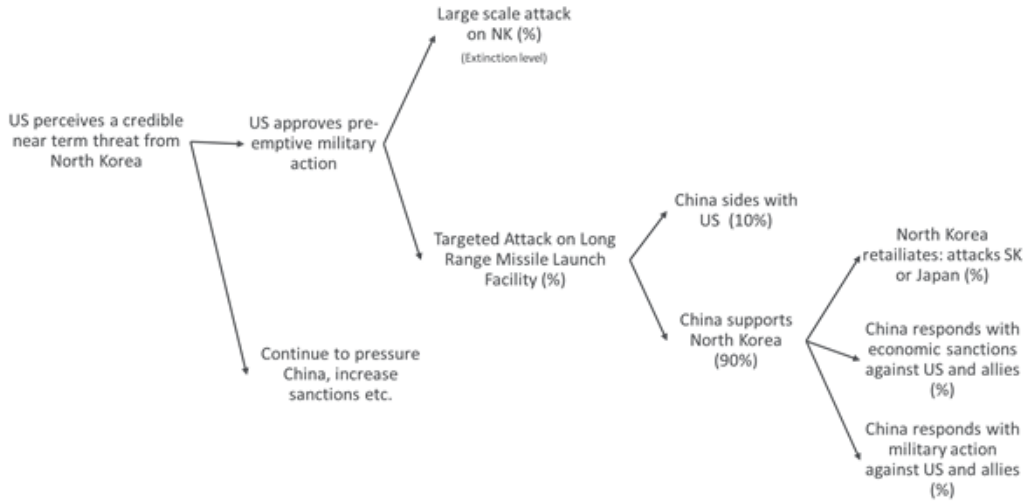


The recovery times by supplier site for South Korea and Japan are almost a year long and this is to only resume pre-disruption run rate. The duration to catch on unfulfilled demand and get the supply chain back on track would take at least another year during which the only the most critical products will be allocated capacity.

Scenario 5: US preemptively attacks North Korea

Geopolitical Analysis:

The absolute worst-case scenario is a preemptive attack on North Korea by the US. This could be a targeted attack on a launch facility that the US perceives as a major threat. Any attack would put a lot of pressure on North Korea to respond in the form of either posturing via border skirmishes with South Korea or a more comprehensive attack by North Korea. Given the reach of North Korea's ICBMs, the US and its allies could all be at risk. In the event of a war, North Korea, which is bound to lose, could launch a major attack to cause maximum damage. There is a risk that a pre-emptive attack by the US could also trigger an economic, political or military response by China.



Scenario 6: North Korea attacks U.S. bases or Territories

Geopolitical Analysis:

If North Korea attacks US allies, its bases or its territories, the US response will be an escalation of military conflict. This again will have deep repercussions as North Korea either responds to the US or backs down from the confrontation. The resultant scenario will then follow the chart from Scenario 5 with Chinese intervention.

Supply Chain Impact:

The supply chain impact of North Korea attacking the US bases or territories or US pre-emptively attacking North Korea would result in the breakdown of global political alliances. If China sides with North Korea, the chances of attack on South Korea and Japan are high, as are the chances of Chinese sanction against the US and its allies. China could also respond with military action against US or its allies. The supply chain impact of South Korean or Japanese attack has been previously discussed as having a deep impact on the global electronics manufacturing industry. With China emerging as a self-sustaining nation, sanctions imposed by the government could still impact the global supply chain in sectors not confined to the electronics sector. Chinese participation in a military conflict will lend North Korea more defensive capabilities and will extend the duration of the conflict.

Next Steps and Recommendations:

In summary, the scenarios, their likelihood, the extent and type of supply chain impact are as below:

Scenario	Type	Description	Likelihood	Supply Chain Impact	Type of Impact
1	Best Case	It's a war of words...	High	Low	Somewhat positive
2	Trade Sanctions	US issues trade restrictions against China	Medium	Medium (Varies)	Neutral, Negative
3	Conflict	North Korea attacks South Korea	Low	VERY HIGH	Global, negative, crushing impact
4	Conflict	North Korea attacks Japan	Low	VERY HIGH	Global, negative, crushing impact
5	Conflict	US attacks North Korea pre-emptively	Low	VERY HIGH	Variable
6	Conflict	North Korea attacks US or Asia Pacific bases	Low	VERY HIGH	Variable

Planning is the key to a streamlined recovery. While it is impossible to fathom protecting the supply chain from some of the worst-case scenarios, it is valuable to be aware and to discuss with the team and ensure playbooks are created wherever response or mitigation is possible.

"It is not a matter of if, but when."

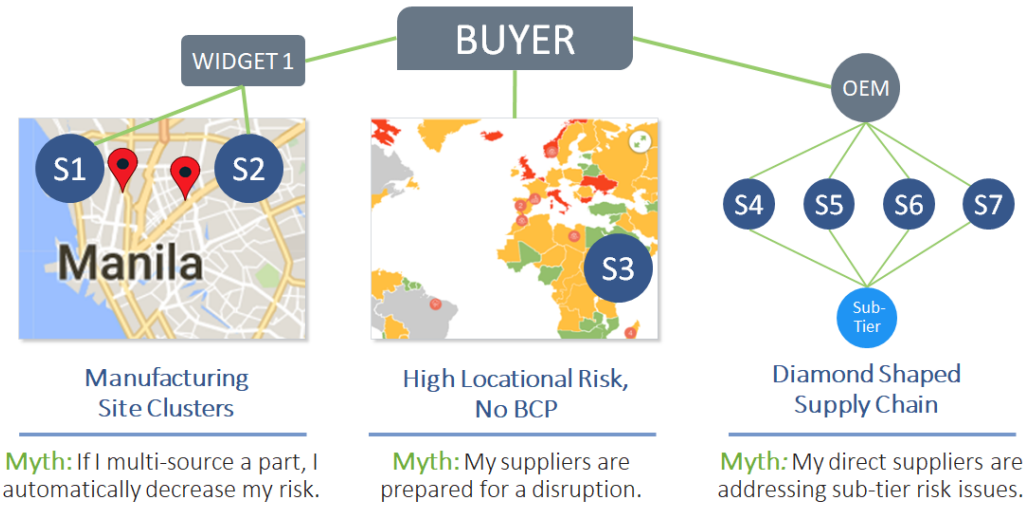
To properly plan for the scenarios above, consider the steps below:

Mapping the supply chain:

Gaining visibility into your tier-1, tier-2 and deeper sub tiers, collecting site statistics and recovery times, assessing revenue impact, collecting alternate site bring up time through supply chain mapping will enable the team to conduct a quick analysis of various scenarios. Information about what products, suppliers and industries at risk in each scenario is key to the development of a playbook for each scenario so if suppliers in South Korea or Japan are affected, identification of alternate sites elsewhere in the world become possible. It is not necessarily true that the supply chain is safe if your suppliers are not in the zone of impact - raw materials

and feedstock to your sites could be sourced in sub tier sites in the target zones such as South Korea, Japan or Taiwan. Many times, the sub-tier supplier that becomes a constraint the quickest is not the largest or most obvious in a company's spend profile. Smaller companies, without multiple factories or the ability to flex their capacity, could cause the most vulnerability to your deliveries. Although a smaller spend, they may be present in most or all your companies, and without whom, your company can not ship product. Examples include items such as labels, boxes, shipping material, custom metals or brackets, new technologies from upstart suppliers, etc.

Don't fall victim to these common myths that could be present in your supply chain without you knowing them!



Examine your supply chain readiness

Establishing an event response team only after an event is triggered will leave your resources scrambling, concede market to your competitor and most importantly, compromise your supply chain and potentially your customers. Creating a cross-functional team with clearly defined roles and responsibilities clearly allow it to take the lead in the event response. Playbooks should be developed well in advance that will enable your organization to recover in a streamlined fashion, keeping in mind the characteristics of suppliers mapped to various regions, triggers for contingency measures and to protect supply chain continuity. Engaging in dialogue with the team to identify high risk or single sourced suppliers and identifying sources of mitigation in the event of site impact will advance the supply chain resiliency program.

Monitor the situation for any change

Keeping an eye on new developments is critical – early reaction to a deteriorating situation would enable faster recovery. With new developments every day about the standoff, paying close attention to the situation as it escalates or improves will help in developing a resilient response. The faster you are able to trigger orders or capacity options, the better your ability to influence the outcome. Speed and agile communication is the key to response. Therefore, setting up internal protocols for communications is key. Companies should establish a clear Event Management governance structure, in advance. This governance should cover, among other questions, who is involved in updates, how decisions are made and how does the team communicate to the rest of their corporate community and interested parties (executives, customers, corporate risk team members, etc.).

Are your suppliers preparing?

It is key to remember that one company cannot be resilient in isolation. Each one is part of a network and the nodes up and down the supply chain must work together to improve the resiliency of the overall supply chain. It is imperative that companies have the uncomfortable conversation with suppliers about what they are doing to protect their own supply chain now, versus after an event has already occurred. During a crisis, it is too late then to collect emergency contact information and ensure your suppliers are prepared, themselves. Even proactive audits and assessments of your supplier business continuity plans, in detail, are reasonable steps companies are taking to ensure that their suppliers' plans are more than form, consultant-written pages in a 3-ring binder.

The best strategy in supply chain risk management, is to prepare for the worst and hope for the best.

About Resilinc

Resilinc is the leading provider of supply chain resiliency solutions and delivers scalable enterprise solutions that enable supply chain professionals to gain visibility across multiple tiers of their complex, global supply chains. With a comprehensive offering that encompasses multi-tier supply chain mapping, single points of failure analytics, global disruption event monitoring and management, mitigation workflow and part-level supply chain compliance programs for conflict minerals monitoring and business continuity planning, Resilinc has become the leader in comprehensive supply chain resiliency solutions. Resilinc helps customers achieve supply chain resiliency through innovative and patent-pending technology, an extensive resiliency-driven supply network, and a proven comprehensive enterprise scale solution that delivers strong value to both clients and supplier partners.

For more information, visit **http://www.resilinc.com**.

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