

MIND your business



Institute for Catastrophic
Loss Reduction

Building resilient communities

ICLR Commercial Bulletin

ISSUE 23 • OCTOBER 2024

SPECIAL BUSINESS RESILIENCE SERIES



Severe weather events and climate change: Supply chain exposures and risks

Written by Chris Snider, AMBCI
Principal, The Snider Group Consulting
www.tsgconsulting.ca

Understanding how disruptions in local, regional and global supply chains can impact your organization's business revenue and how to manage those risks.

An organization's supply chain spans from sourcing raw materials upstream to distributing finished products downstream. It includes the specific location BI, the organization's Interdependencies, and the first-tier suppliers and customers for CBI insurance. Supply chain transparency to multi-tier levels may be difficult for an organization to determine. However, as their position within the marketplace increases, an organization may demand more transparency from its suppliers as part of ongoing business.

While having BI, CBI, and supply chain insurance policy coverage, an organization's value chain may still have uninsurable risk gaps. Therefore, it is important to have a strong knowledge base of organizational supply line risks and a robust continuity plan with procedures to help reduce those risks and protect the organization's value chain.



(Image credit to Microsoft Copilot AI Image Generator)

Important points about supply chain insurance: Typical Supply Chain Insurance (TSCI) versus Specialized Supply Chain Insurance (SSCI); Supply chain definitions; Supply chain flow

- Typical Supply Chain Insurance (TSCI), more broadly found today, is essentially an extension (or augmentation) of a standard CBI insurance product. It would likely still require an insurable physical damage loss at the named key supplier (the exact supplier must be disclosed to the insurance provider), like CBI coverage. Still, it may offer slight changes such as deductibles, insurable limits and capacity. Essentially, it is an insurance policy allowing for a more robust CBI policy with coverage under the name of "Supply Chain."
- Specialized Supply Chain Insurance (SSCI) is a more current and innovative insurance product. It is coverage that tends to extend beyond the typical CBI coverage, particularly with the way a loss may be triggered. A difference between the typical and SSCI policy coverage may require a specifically named supplier or a specifically named supply to be identified and assessed before coverage is offered. The difference is coverage for another organization as your supplier versus a specific product as a critical supply, which may come from more than one supplier. An SSCI policy, due to its increased flexibility in coverage, will generally require a risk assessment of the supplier/supply throughout the supply line (multi-tier). This risk assessment data may be necessary before a policy is issued, requiring pre-planning a policy well before requiring coverage. In addition, with the added exposure, policy pricing may be more expensive and potentially cost-restrictive in the balance of risk versus cost.



Image licensed by Adobe Stock

- It is essential to have a standard definition of supply chain terms to understand, assess, and control risk exposures properly. Some important definitions are as follows:

1. **Supply chain:** Includes the complete supply line from raw materials upstream to the final customer downstream. It includes harvesting raw materials, shipping, storage, fabrication, completed product warehousing, packaging, delivery, and more. The definition is not limited to purchasing, shipping, and inland logistics.
2. **Supply nodes:** Refer to each point in a supply chain where there is a transition. Nodes can be inland shipping, rail stations, seaports (departure port and destination port), third-party warehouses, courier shipping, an organization's internal locations, etc. They are important to identify as they can be a key link in any supply chain.
3. **Bottleneck/pinch point:** Already common terms known in the supply chain world; however, organizations need to identify and define the criticality of these terms. An organization may define a pinch point as a single point of flowthrough of a supply that is not critical, and a bottleneck may be a single point of flowthrough of a supply that is critical and/or has multiple supply exposures.
4. **Concertina effect (Accordion effect):** An uncommon term and more frequently used in the UK, the concertina effect describes the clustering and then extension of a flow through a node. Looking at traffic on a busy highway can best explain this effect. If you are towards the end of the traffic congestion, you may see cars at the front starting to drive away quickly while you remain still, and it takes time before you can start moving. This effect allows the front of the congestion to increasingly move further and further away from the rear of the congestion, increasing the delay time for those at the end of the congestion. In a supply chain, this can be amplified at ports due to congestion or travelling through the Suez or Panama Canals and other inland shipping nodes.

5. Supply chain deconstruction: Supply chain deconstruction: A relatively uncommon term and generally used by select risk professionals when completing an end-to-end risk assessment of a specific supply chain. This term refers to assessing the supply chain from downstream to upstream or reverse from the finished product to raw materials. A standard assessment typically starts with raw materials and identifies critical nodes as the supply line travels downstream. Deconstructing the supply chain and reversing the flow direction of an assessment can help identify additional hidden exposures that could cause an interruption.

- Understanding the full directional flow of an organization's supply chain is critical in understanding where exposures exist and how to manage, reduce or eliminate them.

Understanding and mapping the supply flow can show specific nodes that may be a critical bottleneck for multiple supplies or nodes that may be impacted by seasonal fluctuations or climate-related events (e.g. flooding of a critical inland shipping route). A key aspect of understanding and visualizing the supply chain is to use digital solutions to plot the directional flow. This can allow organizations to see how and where their supplies/products are traversing the local, regional and global supply routes and which of those routes/nodes may then be susceptible to interruptions or loss events. The digital plotting of the supply line can also be a great visual of the entire supply chain/value chain flow and be used by an organization to prioritize which routes/supplies to ensure are not interrupted or minimally interrupted. This helps protect the value chain flow and thus protect the organizations most critical revenue streams.

Climate change and geopolitical risks that can impact a supply chain

Two emerging risks that have started to take hold and impact supply chains are climate change (including severe weather events) and geopolitical events (changes in governments and policy). These two risks are intertwined and can grow or retract as risks in conjunction with each other. They can easily exacerbate an organization's loss exposure potential faster than typical.

Geopolitical risk to an organization's supply chain can shift dramatically based on local, regional and national political leadership actions. Fractured or divided political leadership can impact policy and trade, as well as increase bipolar or multipolar viewpoints from country to country or even province-to-province/state-to-state, all of which can force an organization to choose one geopolitical position or another to lay down the foundations of a three-to-five-year business plan.

Climate change and severe weather risks

- The most common exposure to supply chains, whether local, regional, or global, are severe weather events such as flooding, windstorms, drought and storm surge events. These events can interrupt supply routes, shut down shipping ports, cause major damage to supply node infrastructure as well as causing damage to important crops for the food industry. These events have increasingly become more common and more severe (e.g. wildfires being more severe).

- Climate change also impacts human, animal and insect migration. Migration impacts used to be a slow-moving risk but have become more common and can significantly impact supply chains.
- Invasive species of insects and animals can have a dramatic impact on crops as well as local ecosystems. Climate warming allows invasive species to move into areas of a region that were typically too cold and, therefore, unprepared for the interaction. Generally, the impact of migration is only felt once it is too late to stop and therefore relies on adaptation, which also means that the impact or interruption to the supply chain has already happened or is imminent.
- Human migration also occurs due to a warming climate. When farming and living in warming climates become harder, migration occurs and typically moves northward globally. This can impact the region by potentially losing a source of raw material and workforce (due to the creation of an unfavourable climate for either crops to grow and/or human habitation) and having a population shift due to the migration, changing the global shift in demand for products.



Lean, agile and robust supply chains and associated risks

A **'lean supply chain'** can be defined as one that delivers its products or services to customers, end-to-end, in an efficient way with minimal waste (time and cost). Lean supply chains generally have low costs but can experience higher than manageable risk potential and severity, such as having a single node supply line that could impact the entire supply chain if disrupted. High risk/low cost.

A **'robust supply chain'** is generally a supply line that has gone through a strong risk management process and utilizes capital investment to reduce the risk of loss to a minimal point as well as the severity of a loss. High cost/low risk.

An **'agile supply chain'** focuses on the ability to pivot quickly in the event of an interruption to a specific node. Agile supply chains can also be lean, but investment has been made to secure quick alternatives to minimize any severity of a loss. This style of supply chain is normally a well-balanced entity between being lean and robust. Balanced cost and risk.


- Severe weather events and a changing climate can also adversely impact aging infrastructure. Overwhelming bottlenecks such as bridges, tunnels and congested cities can lead to short interruptions but still have significant impacts due to just-in-time (JIT) or just-in-sequence (JIS) supply lines utilized by several industries. Combining severe weather events and migration to urban centres and stressing the infrastructure is also a supply risk that generally occurs before an organization identifies the risk and subsequent impact on their supply line or supply needs.

Geopolitical risk

An important point about geopolitical/political risk is that some events that impact an organization's supply chain are not always a coverage trigger for BI, CBI, or SSCI coverage.

- Relative to the timing in developing this bulletin, the most noticeable and common political risk is the widening of political views in Western democracies. The impact can be directly related to how cities, provinces/states and countries approach geopolitical/political policies, including changes in laws with impacts on supply chains (Canada – [Bill S-211, An Act to Enact the Fighting Against Forced Labour and Child Labour in Supply Chains Act and to amend the Customs Tariff](#)). This risk can also increase tensions between provinces/states and countries, leading to changes in trade, safety and security of global supply, and the ability to transit goods in various regions.
- COVID-19 – Differences in various countries' actions had an impact on importing and exporting supply goods, and regional restrictions placed a serious strain on small to mid-size businesses.

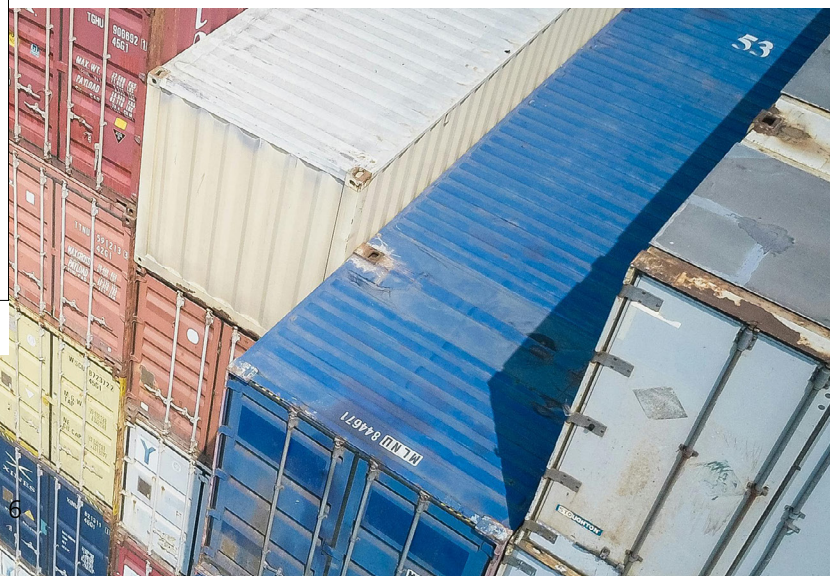
- Russia/Ukraine conflict – Once the conflict started, over 5,000 direct suppliers were impacted by sanctions and the inability to conduct business in conflict regions.
- Israel/Hamas conflict – This conflict had a direct impact on one of the most critical global trading routes, the Suez Canal (up to 12% of global trade runs through the Suez Canal system).
- Change in political leadership in a country or region can directly impact its climate policies, which in turn can impact an organization's business plan related to those policy changes. This can occur for a few different reasons:
 - Organizations may have their own climate and social governance policies, and a change to a region's political policy may conflict with their own. As such, it may put the organization in a position to seek an alternative supplier.
 - Climate policies can either benefit or harm the climate. While these policies may take time to show a visible impact on the climate or contribute to more or fewer severe weather events, an organization may need to make supply chain decisions in support of or in opposition to the policy changes. This process also becomes more complex and complicated to manage based on the recycling of political leadership, which generally represents a short time in the long life of a strong and established business organization.



Like your organization's BI and CBI exposure, know your supply chain's critical infrastructure and how it is protected. Understand the difference between "supply chain" and "value chain."

As noted in the two previous *Mind your business* bulletins, insurance carriers will want to ensure you understand your business's various supply risks. This still includes the standard BI and CBI risks to your organization's infrastructure and the deeper tier and shipping nodes exposed to interruptions, even those that may not always be insurable (but can still cause a disruption that may impact an insurable interest). Furthermore, with identified supply risks, the insurance carrier will also expect to see the organization's resilience plan and implemented mitigation actions.

- When assessing your supply chain and its associated exposures, both upstream and downstream, it is important to understand the subtle difference between your supply chain and your value chain. Your supply chain is the people, materials, activities and logistics that create the product or service you bring to market. The value chain speaks more to the broader end-to-end process that includes every aspect of the product/service idea through development, manufacturing, and logistics and ends with a sellable product/service that provides tangible value to customers. While not always the case, generally, your "supply chain" resides within your "value chain," which is important to differentiate as insurance coverage tends to focus on supply chain exposures as opposed to value chain exposures. In addition, interruptions to your value chain can cause greater revenue loss during the development phase due to the concertina effect (also known as the accordion effect) mentioned earlier.
- It is critical to identify your key suppliers on as many tiers separated as possible. Looking at spend or volume per supplier will not always identify which suppliers are key to organizational resilience. There may be key suppliers with low volume or low spending, but if interrupted or lost, they have a supply in all your organization's products. Difficulty in supply tier transparency increases the further away from your organization you assess. Some organizations cannot track supplier lines past the second or third tier due to suppliers not always cooperating with transparency.
- When assessing your suppliers (on as many tiers as possible), it is critical to understand the natural hazards, severe weather and political risks that may affect their region. Fire protection and prevention are relatively well understood regionally, but exposure to flooding, windstorms, earthquakes, severe weather, and political changes are always dynamic. Two critical areas to properly assess and manage supplier risk are the impact of natural hazards on their physical infrastructure and their region's policy on labour.
- Forced labour and child labour legislation is advancing quickly in Western nations (Canada, USA and EU) and becoming stricter for companies doing business in these areas. This places an onus on organizations to manage and ensure they work with suppliers that ethically source and manage their supply chain labour. Lack of management of an ethical supply chain can result in fines to the organization and the CEO/President/Board of Directors being held responsible.
- Climate risks that can exacerbate typical natural hazard exposures need to be identified, and how they may impact your organization's supply line needs to be understood. All nodes, including shipping ports, that could be at risk should be identified and assessed in terms of the likelihood and severity of possible loss, as well as sourcing alternatives. These supply nodes could also service several other organizations, and when interrupted, alternative nodes will be overwhelmed with new supply traffic, causing congestion and delay.



Digitally mapping and monitoring your supply routes

The Business Continuity Institute (BCI) is a global membership association for professionals involved with business resilience in their organization. The BCI has over 9,000 members in more than 100 countries dedicated to developing and sharing business resilience insights for all industries with a variety of resilience exposures. The Institute publishes annual reports detailing survey data from global organizations, and in January 2024, it published its 2023 annual Supply Chain Resilience Report which included data from 228 respondents from 58 countries within 17 business sectors. Of all the data gathered for the report, one main finding was that nearly 60% of respondents used an Excel spreadsheet, a passive supply chain management form. While this allows for data gathering and calculations, it is not dynamic, requires consistent human interaction to update, and is prone to human data error. Less than 12% used supply chain and BCM digital software, and less than 5% used geospatial models. Advanced technology and AI tech are available to help map and manage your organization's supply chain. However, most organizations need to make the necessary investments in the proper tools, leaving organizations unable to properly manage the fast pace of risk to their supply line.

Digitally mapping your organization's supply chain is not difficult but is time-consuming for full development. The process does become less onerous once the initial mapping work is done. The complete mapping of supply lines allows for visualizing critical supplies and common nodes that can become bottleneck exposures. Mapping also enables an organization to see its regional cluster of supplies or shipping nodes and understand how a severe weather event, for example, may impact the various supplies, the region's ability to recover quickly, and the use of alternative routes.

When live monitoring your organization's critical suppliers or critical supply nodes, you take digital mapping to the next level of resilience. Monitoring, either via mapping software or AI engines, can identify key suppliers or shipping nodes if an event threatens interruption. This may be a notice of an impending labour disruption, company insolvency or a catastrophic event that immediately impacts a supply node. Combined with mapping, your organization can identify the critical nodes/bottlenecks and have advanced knowledge of a loss event and its impact on the supply line. This enables your organization to pre-plan alternatives as part of a robust continuity plan, ensuring such plans can be implemented immediately and effectively.

Excel spreadsheets remain the most popular indicator to record, measure and report on supply chain disruptions, followed by financial models and geopolitical models.



59.8%
Excel
spreadsheets



25.0%
Financial
models



13.4%
Geopolitical
models

In the past 12 months, the main causes of supply chain disruptions were:



46.8%
Loss of talent/skills



55.6%
Cyber-attack and
data breach



46.0%
Human illness



46.0%
Adverse weather



44.4%
Transport network
disruption



44.4%
Natural disasters



42.9%
Adverse weather



41.3%
Energy scarcity



35.7%
Cyber-attack and
data breach



40.5%
New laws or regulations

(Image credits to Microsoft Copilot AI Image Generator)



2011 Tōhoku earthquake, tsunami and Fukushima nuclear accident

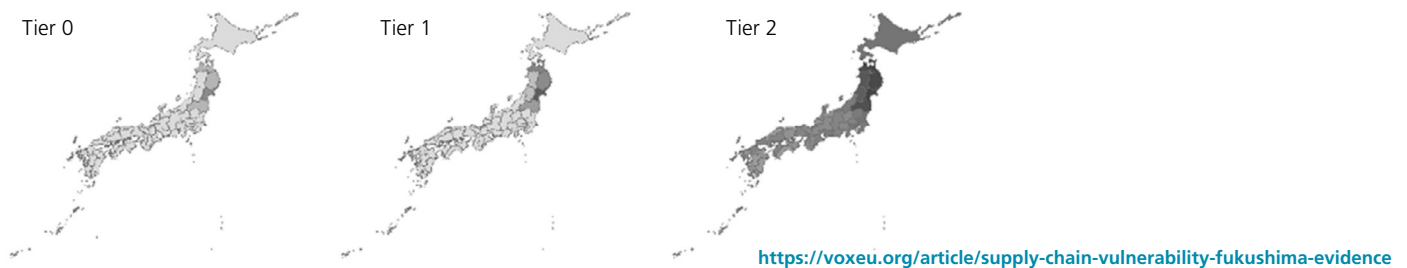
On March 11, 2011, the Great East Japan Earthquake occurred along the east-northeast coastline of the islands of Honshu, the largest and most populous of the four islands that make up Japan. There were three distinct impacts of the earthquake:

- Initial damage impacts of the 9.1 magnitude earthquake;
- The resulting tsunami, which had an estimated wave height of 40 metres and travelled inland nearly 10 kilometres in some places;
- The major nuclear accident at the Fukushima Daiichi power plant.

The combination of these cascading events resulted in several Tier 0, Tier 1, and Tier 2 global supply chain interruptions. While several studies have estimated the impact of this event on supply chains, one investigation showed that only 3% of companies had transactional partners in affected areas. When moving to sub-tiers, the number increased to 60%, highlighting how single events can have an exponential impact as supply chain transparency grows beyond the initial tier supplier.

This event illustrates why organizations need to fully understand their supply chains through multi-tier transparency and know the vulnerabilities in other organizations' supply chains. Ultimately, collaborating with suppliers and customers will help identify exposures and allow organizations to become more resilient.

Companies affected by the Great East Japan Earthquake



Exploring severe weather events and natural hazard exposures that can impact organizations' supply chains.

To understand your supply chain exposures well, you must understand your CBI, interdependency and location-based BI exposures. In addition, not only do you need to understand your risks and exposure to losses across your business (CBI/BI and Interdependencies), but your organization also needs to understand insurance policy wordings and what parts of a supply chain loss would or would not be covered in the event of a loss. The best way to accomplish this is to conduct a supply chain exposure analysis (mapping the organization's multi-tier supply lines, bottlenecks, various exchange nodes, etc.) and then create "what if" scenarios of potential losses that could impact the organization's supply chain. Bring these scenarios to your insurance broker or carrier, and they can indicate which parts of the scenario, if any, would or could be covered by insurance.

- Floods are one of the fastest-growing severe weather exposures that in many areas are increasing as flood zone boundaries change. Flooding often impacts infrastructure of an affected area by overwhelming both natural and built drainage systems. In addition, in some places flooding is occurring more frequently, making existing flood zone mapping obsolete. It is becoming increasingly more difficult for organizations to manage and plan around flood events since many places still reference older flood maps and often don't address how existing flood zones will change in the future due to climate change and changes in land development. The best defense against severe flood events is to diversify the organization's revenue-generating operation to multiple locations, making it less likely a single event would cause a significant interruption loss.



2021 Pacific Northwest floods


In mid-November 2021, torrential rainstorms resulting in mass flooding impacted the Pacific Northwest (British Columbia, Canada and Washington, USA). In BC, extreme weather contributed to the flooding and closing of highways to the BC interior, rail transport to the same areas, and oil pipelines from the interior to the coast.

The impact on road and rail transportation directly and seriously affected regional, national and global supply chains in Canada and the USA. For several days, it was not possible for incoming ships to unload cargo, including shipping containers. While the Port of Prince Rupert remained operational, it was impossible to redirect shipping traffic from the Port of Vancouver to the Port of Prince Rupert as interior roads and rail would still impact transportation into the interior and east of BC. In addition, the storm's impact in the State of Washington also affected shipping port access in Seattle and other ports in Puget Sound.

Due to the closing of various ports, ships could not “recycle” goods and containers going into and out of Vancouver. Cyclical supply chains require that shipping containers be offloaded of imported goods and then reloaded with outbound goods for the return trip. When these cycles are interrupted, as they were with the 2021 flooding, further transportation delays within supply chains are caused, and the delay grows exponentially the longer the interruption exists.

Overall, it is estimated that the event caused over \$675 million in insured losses and over \$3 billion in total losses (including non-insured losses). These losses do not reflect the fact that this event occurred while COVID-19 was still a present danger within North America and that a large portion of actual supply chain losses were not covered by insurance or any government recovery fund.

- Wildfires: Like flooding, wildfires can also interrupt and impact an area's infrastructure and transportation routes. Wildfires can grow quite large, impacting broad geographical regions. As such, an organization needs to identify any part of its supply chain that is located in a possible wildfire zone and any supply chain nodes where a wildfire may occur. Similar to mitigating flood risks, the best way to protect the organization's revenue is by diversifying revenue-generating locations across areas that would not be affected by the same wildfire events.
- Windstorms: While windstorms can also affect wide areas, their impacts on supply chains tends to be more regional in the USA, Caribbean and Asia (typhoons). Within the upper East Coast of the USA and Canada, windstorms typically manifest as flood and storm surge events with high winds. Supply chain disruptions typically affect north-south trade routes more than east-west routes. This difference means organizations must assess the risks and impacts of north-south supply chains differently than those of east-west flows. Not identifying the horizontal versus vertical flow differences can result in missing critical nodes that could impact revenue.
- Winter and ice storms: With a changing climate, the frequency of traditional winter storms occurring in various parts of North America may be decreasing depending on location. Storms may, instead, manifest in a hybrid form of winter storm and ice storm. Winter storms (colder temperatures and snow accumulation) and ice storms (warmer temperatures and supercooled rain freezing on surfaces) can seriously impact a region's infrastructure, particularly roads, bridges and electrical distribution, and have a moderate impact on rail and marine shipping. These storms can also affect a large area during a single event, and recovery may take days to weeks. Knowing the organizations' location exposures and planning for alternative locations to support (or contracting third party companies) is an effective way to help manage the impact of a winter or ice storm and revenue recovery from impacted locations.



How to build transparency in your supply chain. Identifying Critical Control Nodes (CCNs) and how to manage CCNs within your supply chain to minimal acceptable risk exposure.

To safeguard your organization's revenue across the supply chain, it's essential to establish maximum transparency from upstream to downstream, including as many Critical Control Nodes (CCNs) as possible. Understanding the supply chain flow and visualizing it on a map helps to conceptually understand which CCNs are more exposed to loss events and the ability to integrate an alternative supply route that can be reasonable, reliable and activated at a moment's notice.

Unlike assessing your BI exposures (location-based), Interdependency exposures (multi-location within your organization) and CBI exposures (1 tier upstream and downstream), identifying your organization's supply chain exposures and CCNs requires a more in-depth analysis and the ability to assess multi-tier risks (upstream to downstream). The CCNs identified throughout the supply line may be local, regional, continental or global. They could all be subject to different natural hazards and severe weather events at different times of the calendar year. This makes managing the risk identification and mitigation steps more important. Utilizing advanced AI supply line monitoring systems and digital supply chain management tools can be a very effective way for an organization to quickly identify risks to CCNs and pivot quickly to previously planned alternatives.

It is key for any organization with a moderate to complex supply chain to:

- Gain the transparency needed to visualize the supply lines and CCNs.
- Run potential loss scenarios that could impact the organization's supply chain as well as the organization's revenue.
- Develop reasonable, reliable and actionable supply line alternatives.
- Monitor the alternatives to ensure they remain viable.
- Test the alternatives and the speed at which they can be activated.


To better protect your supply chain and revenue stream, you need to continue your organization's step-by-step BI, CBI, and interdependency risk assessment process.

The base process outlined in the first two *Mind your business* bulletins in this series (Business Interruption, Contingent Business Interruption and Interdependencies) can still be used to expand the identification of multi-tier suppliers, customers and CCNs. These steps include:

1. Understand your current BI/CBI insurance coverage to identify where supply chain coverage begins and ends.
2. Compare your knowledge of the critical infrastructure serving your organization to potential gaps in your current insurance coverage, including supply chain-related insurance.
3. Using the knowledge gained through a gap analysis, bring in the potential and known exposures associated with severe weather/natural hazard events to all areas of the supply line.
4. Review the full analysis and begin to collate similar events/scenarios that can be solved by a single solution.
5. Build a risk registry from the BI/CBI process and incorporate the risk mitigation and reduction solutions into your next steps and business continuity plan.

These base steps generally help build the foundation of understanding the BI exposure and insurance gaps for single locations. With adaptation, organizations can also use them to lay the foundation to identify CBI and interdependency exposures. Further adaptation allows these base steps to extend the analysis to your organization's supply chain.





However, additional considerations are required to better understand the multiple-tier exposures found in a typical supply chain.

1. **Multi-tier transparency**

One of the most challenging aspects of understanding your organization's supply chain risk exposures is acquiring the transparency of all supply lines and CCNs. Without full knowledge of the supply lines and CCNs, it is very hard to determine what natural hazards and severe weather events may impact your organization. Here are some ways to help bring transparency to your organization and understand the supply line flow:

- If you are a large, global, and influential organization, you can use your market position to require supply chain reporting from your multi-level suppliers. These suppliers may be more transparent about their position within your supply line to ensure the financial relationship remains intact.
- Most western democracies now have laws and legislation that require organizations to report transparency throughout their supply chain. The legislation is to identify supply lines that may have unethical components, such as forced labour and child labour. The legislation typically imposes severe financial penalties on organizations that fail to report on supply chain transparency or do not implement changes if unethical practices are identified within supply chain nodes. By adhering to the legislation, companies are required to ensure their suppliers show transparency throughout the supply chain. Non-compliant suppliers risk losing their contracts.
- Engaging multi-tier suppliers as “partners in the value chain group” can help manage upstream and downstream risks. Suppliers and customers are more apt to engage and share transparency when included in the entire value chain conversation. This tactic must have strong controls, and it is suggested that non-disclosure agreements be implemented.

2. **Natural hazard and severe weather events**

Depending on the geographical spread of your organization's supply chain, several data points may be required to properly assess exposures to typical natural hazards and severe weather events. Exposures can be different at a municipal, regional, national, and international level, as can the local response and recovery of damaged infrastructure.

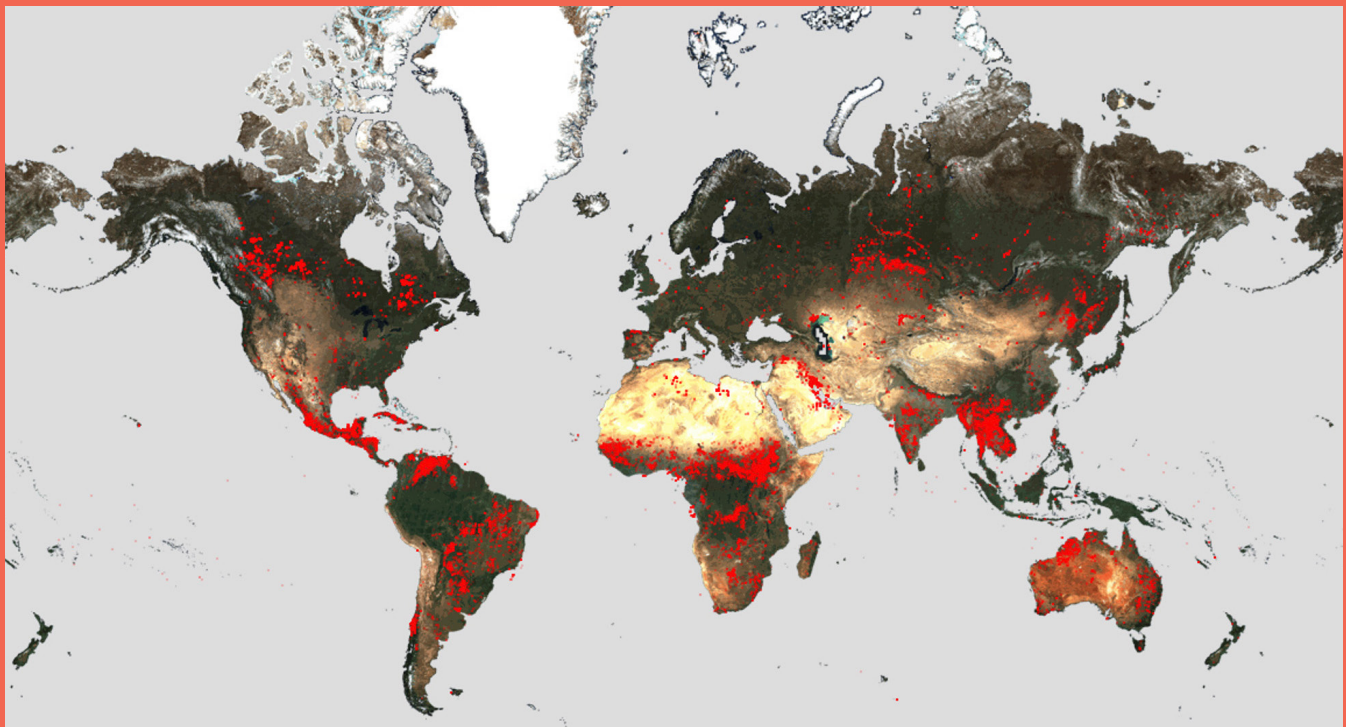
Flood (pluvial and riverine): Several tools are available to determine flood exposure in most North America and Europe locales. Using local data maps to indicate flood zones and return frequency is best. At worst, tools available on the internet can overlay a specific water level change on the current location topography. It is important to understand a location's flood history, damage, and recovery and to project potential future losses, particularly if the area is vulnerable to severe climate events. For example, pluvial flooding from heavy rainfall in Toronto, Ontario, can disrupt downtown traffic corridors. At the same time, Calgary, Alberta, faces both urban and riverine flooding that impacts the east and west sides of the downtown core, including the Stampede grounds and Saddledome Arena.

Wind (hurricane, cyclone and tornado): Wind exposures can also include flooding exposures such as coastal storm surges and inland pluvial flooding. Understanding the geographical position of suppliers and supply chain nodes exposed to these types of windstorms is critical, especially since we are seeing changes in the severity of these storms. One of the critical aspects of destruction from windstorms is compromise of a building's envelope. These storms can cause significant air uplift, which can cause severe damage to roof-mounted services (HVAC, silos, collection units and PV/solar panels. In addition, if the roof assembly is not adequately secured to the structure's frame, the wind uplift can cause the roof to be ripped from the structure, exposing the entire interior of the building. From an insurance risk perspective, once the envelope of the building is compromised, it is generally considered a total loss (meaning any salvage due to either wind or water damage would typically necessitate the demolition and rebuild of the entire structure). In addition, windstorms can also wreak havoc on the localized infrastructure, not only causing damage at the supplier location but also causing damage and delay in an appropriate recovery response.

Wildfire and bushfire: Wildfires and bushfires, while found on all six habitable continents, tend to affect specific areas of these continents. But the impacts can extend well beyond areas experiencing immediate physical damage to include smoke impacts, driving significant interruptions across a continent or even other continents. From a supply chain perspective, it is key to understand the supply nodes and if they are in an area that can be directly impacted by physical damage caused by a wildfire/bushfire. As fires can grow significantly in size, understanding the supply chain location and surrounding infrastructure is key. From there, depending on alternatives for the at-risk nodes, a more in-depth understanding of the risk of those alternatives is important to understand as they may be either impacted by the same event or in the path of destruction of the same event.

Another key aspect of wildfires/bushfires is that they tend to be in geographical areas where several resources are used in various industries, such as agriculture, mining, oil and gas, textiles, and electronics. And unlike other natural hazards or severe weather events, the recovery from wildfires/bushfires can take several years. Wildfires may cause lost woodlands and raw materials for frame and mass timber construction, loss to seasonal crops devastating global food supplies, damage and contamination to tech-based occupancies that are highly sensitive to damage by-products of combustion and so on.

In the seven-year data collection by the ESA (May 2016 to June 2023), there has been significant wildfire/bushfire concentration noted in Canada, Central America, North and Central South America, Sahel region in Africa (critical sub-Saharan agricultural, textile and mining region) as well as India, China and Mainland Southeast Asia. All these regions are key to several global supply chains; however, other types of global supply interruption events have accelerated the actions of companies operational in these regions to relocate their supply chain nodes to nearshore or onshore locations for better control. While this occurs, it is integral that these companies also consider the relocation concentration of new supply nodes and their exposure to wildfire/bushfire risk as well as other natural hazard/severe weather risk events.



Locations of wildfires/bushfires May 2016-June 2023 – European Space Agency (ESA); World Fire Atlas.



How will climate change and global tipping points, now and into the future, impact the resilience of your organization's supply chain, both upstream and downstream?

Tipping points are climate-related events that reach a point at which they begin to move forward at a pace and destination that cannot be reversed or controlled explicitly by human intervention. These tipping points can be in the cryosphere (cold climate zones like Greenland and Antarctic), biosphere (warmer and dryer ecosystems like forests, lakes and coral reefs) and ocean-atmosphere circulation (Atlantic Meridional Overturning Circulation or AMOC). Theoretically, tipping points can disrupt global weather patterns, increase the frequency and severity of extreme weather events, alter migratory patterns of various species, and push currently habitable regions closer to uninhabitable conditions (e.g., intense temperature increases, droughts, and loss of viable agricultural land).

1. The concept of global tipping points is that once triggered, they are seen as perpetual in nature and would, in fact, continue to feed the growth of the impact of the tipping point or feed into triggering other global tipping points. As such, theoretically, any supply chain impacted by a triggered tipping point would require a significant and adaptable change to the affected supply line/node or a complete removal of that supply line/node from the supply chain, with alternatives required.
2. Global, regional and local supply chains are already battling the impacts of climate change and increasing severe weather events. As these events worsen, potentially triggered by global tipping points, they can disrupt entire industries' access to unique raw materials (e.g., cobalt and lithium for electronics and EV batteries) or cause significant interruptions at critical bottlenecks along global supply routes. For example, drought conditions in Panama can hinder the normal flow of ships through the Panama Canal, impacting multiple industries.
3. With climate change and triggered tipping points, global weather patterns can be significantly affected, particularly the Intertropical Convergence Zone (ITCZ), also known as the tropical rain belt. This phenomenon is mainly felt in South America and Sub-Saharan Africa. Two main impacts include shifts in expected rainfall patterns (leading to floods and droughts) and changes in migratory patterns (affecting humans, animals and insects).

Disruptions in migratory patterns can impact the following:

- The movement of humans from south to north causes an imbalance of both supply source labour and supply requirements volume. If you rely on a supplier in an impacted region, it may be harder to find labour due to migration. In addition, the migration could be towards where your target consumer resides, thus increasing demand at the same time that you are dealing with reduced supplies of labour.
- Insect migration can impact the ecosystem of destination. The ecosystem may not be used to the different variants of insects, which can impact the agricultural industry and threaten forestry and impact other necessary insects that provide for a balanced system.
- The migration of other animals can change the predator-prey balance. This imbalance can have a significant impact on the ecosystem. A lack of predators can allow for more plant-consuming animals to impact the agriculture industry and cause physical changes to areas such as riverbanks (thus allowing the river to grow in width and have fewer natural controls for flooding). Lack of natural prey can drive predators to source food from domesticated sources such as farms.

Regardless of the extent of your organization's supply chain, it is likely that there are aspects of the multi-tier supply lines/nodes that are hidden from standard view and thus cannot be properly assessed. This makes it hard to understand which climate change, severe weather events, or global tipping points may impact supply lines/nodes and, therefore, make them harder to protect.

In addition, climate change and severe weather events are occurring more frequently and with more severe outcomes, making it difficult – and sometimes cost-prohibitive – to manage and protect. If your organization is experiencing an industry-type supply chain disruption, your competitors are likely to experience the same challenges. This means multiple organizations will seek alternative supplies simultaneously within a market that may be unable to service every organization's needs.



Managing your supply chain risks

As mentioned in the two previous *Mind Your Business* bulletins (Contingent Business Interruption, Interdependencies and Business Interruption), the best way to address supply and value chain disruptions is to develop and maintain a well-structured impact analysis while being proactive about how climate change and severe weather events could affect your suppliers and internal operations. Utilizing digital solutions to help identify and manage your exposures can be vital to having a resilient BI-ready organization. Solutions will be discussed in this series' fourth and final *Mind Your Business* bulletin.

Your organization's supply chain and value chain exist beyond your CBI, Interdependencies and BI exposures, and therefore, if you are properly assessing, managing and maintaining good controls over these areas, the jump to doing the same for your entire critical supply chain is less daunting. Basic steps to help get started in your assessment include:

1. Identify, as much as possible, all critical suppliers (multi-tier), supply lines (shipping routes, inland shipping) and supply nodes (ports, rail transfer, borders, bridges) that your supplies cross or traverse.
2. Identify the current natural hazard exposures at these supply lines/nodes, then identify which show a growing severity with recent climate-related events.
3. Utilize risk control/risk engineering professionals to help determine the probability versus severity of the event's impact and possible controls or changes to minimize risk. Remember that while these risk professionals may not be experts in your industry, they are experts in resilience and have multi-industry perspectives on the supply nodes versus just your organization's industry perspective.

4. Prioritize the threats to your supply lines/nodes (typically based on severity, probability and impact) and identify corrective actions to reduce or eliminate these risks. Implement the actions in the order that provides the greatest benefit to the organization.

Managing and understanding your supply chain risk exposures to severe weather events and climate change can be daunting. The more complex the supply lines, the more critical it becomes to ensure transparency and implement effective risk control measures. Utilizing resources such as risk control professionals, digital monitoring of supply nodes, solutions for identifying climate risks, and an effective supply chain team (not limited to logistics and warehousing) will be key to successfully managing the balance between risk and cost in supply chain protection.

The Carbon Disclosure Project (CDP) Supply Chain Report (2022) indicates that, on average, an organization's supply chain generates 14 times more emissions than its in-house operations. As we strive to manage the risks associated with climate change and severe weather within our supply chains, we must also acknowledge our contribution to global climate change through these emissions. Therefore, gaining a comprehensive understanding of your organization's supply chain – including all tiers and vulnerabilities to severe weather events and natural hazards – is a crucial step in analyzing supply lines and reducing the associated carbon footprint.

Institute for Catastrophic Loss Reduction

Mission

To reduce the loss of life and property caused by severe weather and earthquakes through the identification and support of sustained actions that improve society's capacity to adapt to, anticipate, mitigate, withstand and recover from natural disasters.

30-34 Duncan Street
Toronto, Ontario
M5V 2C3
T 416-364-8677
www.iclr.org
www.PIEVC.ca

Western University
Amit Chakma Building, Suite 4405
1151 Richmond Street
London, Ontario, Canada
N6A 5B9
T 519-661-3234
F 519-661-4273
www.iclr.org