Building Supply Chain Risk Resilience - In a Complex World.

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Introductions

- Audience – who do we have here?

Introductions – Who is this guy

Andrew Tait, PE
Managing Director, Sigma7

- 36 years Risk Management
- 8 years RM at Aventis/Sanofi
- Prior experience: FM Engineering, J&H, Marsh, JLT
- 20 years strategic Risk Consulting
- Mechanical Engineer/MBA
- Supports Temple University and SUNY Oswego ERM programs
- Member of NFPA 1600 Technical Committee

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An independent and integrated partner for Risk and Resilience

One Partner for Strategic Risk and Resilience:
Combining threat intelligence, security, engineering, claims, training, and due diligence support into one integrated offering: manage proactively and recover decisively

End-to-End Risk Management:
Consultants supporting clients across the full risk lifecycle

Global, Cross-Disciplinary Expertise:
Industry specialists working to delivery localized insight

Unified Technology Platform:
Enabling clients to make faster, and better -informed decisions

Trusted in Critical Sectors:
Relied on by leading organizations across all major industries

From Intelligence to Action:
Analysis, operations, and recovery services for seamless support

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Agenda

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Understanding the Supply Chain Topic

- Thinking about Supply Chain Risk Management more broadly
- Context is everything
- What concerns your management the most? What's a bad day for them.
- Resilience by design – can you be the shepherd?

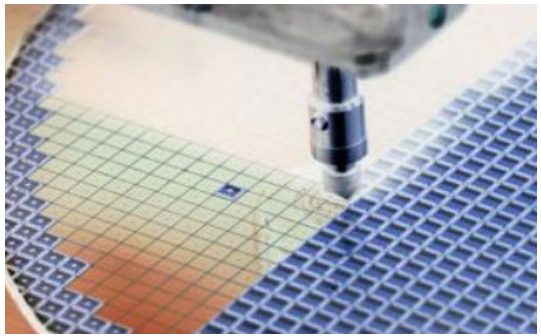
"'Be careful'! All you can tell me is 'be careful'?"

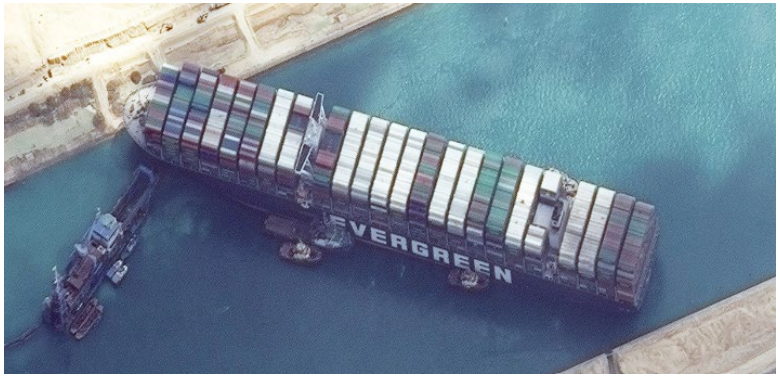
A Resilient Supply Chain – How wide is the topic?

- Perils:
  - Manmade Perils
  - Natural Catastrophe
  - Climate
- Suppliers (extended)
- Customers
- Trade routes & Transportation
- Geopolitical
- Financial
- Quality/Compliance
- Technology
- Key Staff

Ever changing global issues to consider – be flexible

- Global supply chain shortages (Semiconductor shortage, Covid - longer lead time on all equipment/supplies, other)
- Global transportation issues (port strikes, shipping route closures/delays)
- CAT/Climate risk (weather, wildfire, sea level)
- Geopolitical/War (China, Ukraine, Middle East, US etc.)
- Global energy challenges (Fuel for western Europe, and the world)
- Etc.





Critical notions to understand as foundation

- Supply Chain Mapping (*get the details*)
- Commodity (usually ok – but check)
- Single Source Supplier *(better make sense)*
- Sole Source Supplier *(do I have a choice?)*
- Single-Sole Source *(Shudder)*
- Interdependent exposure *(1st party)*
- Contingent Exposure (CBI) *(3rd party)*
- Resilience (*can mean a lot*)
- Business Continuity (*what it should be*)
- BoM (Bill of Materials) *(your friend)*

Understand which risks you most need to Understand

- Based on your Industry
- Physical exposures – NAT CAT, FIRE, weather, Wildfire etc.
- Critical equipment (replacement/spares)
- Other consumables (keep machines running, production)
- Single & sole source supplies
- Competition (acquisition of supplier)
- Regulatory
- Key employees
- CYBER
- Insolvency
- Transportation
- Strike
- Loss of raw ingredients
- Government action – important ban, embargo, trade sanctions
- Geopolitical
- Reputational – Human rights, environmental, etc.

What else? - Need to understand the industry to appreciate what matters most

Supply Chain - Take an Enterprise Approach

Important things to understand

- Which suppliers are higher risk?
- Which production lines are harder to replace?
- Which supplies or equipment have longer lead times?
- Which small order/low volume items can shut down the supply chain?

- What does the BoM tell you?
  (remember - it's your friend ☺)

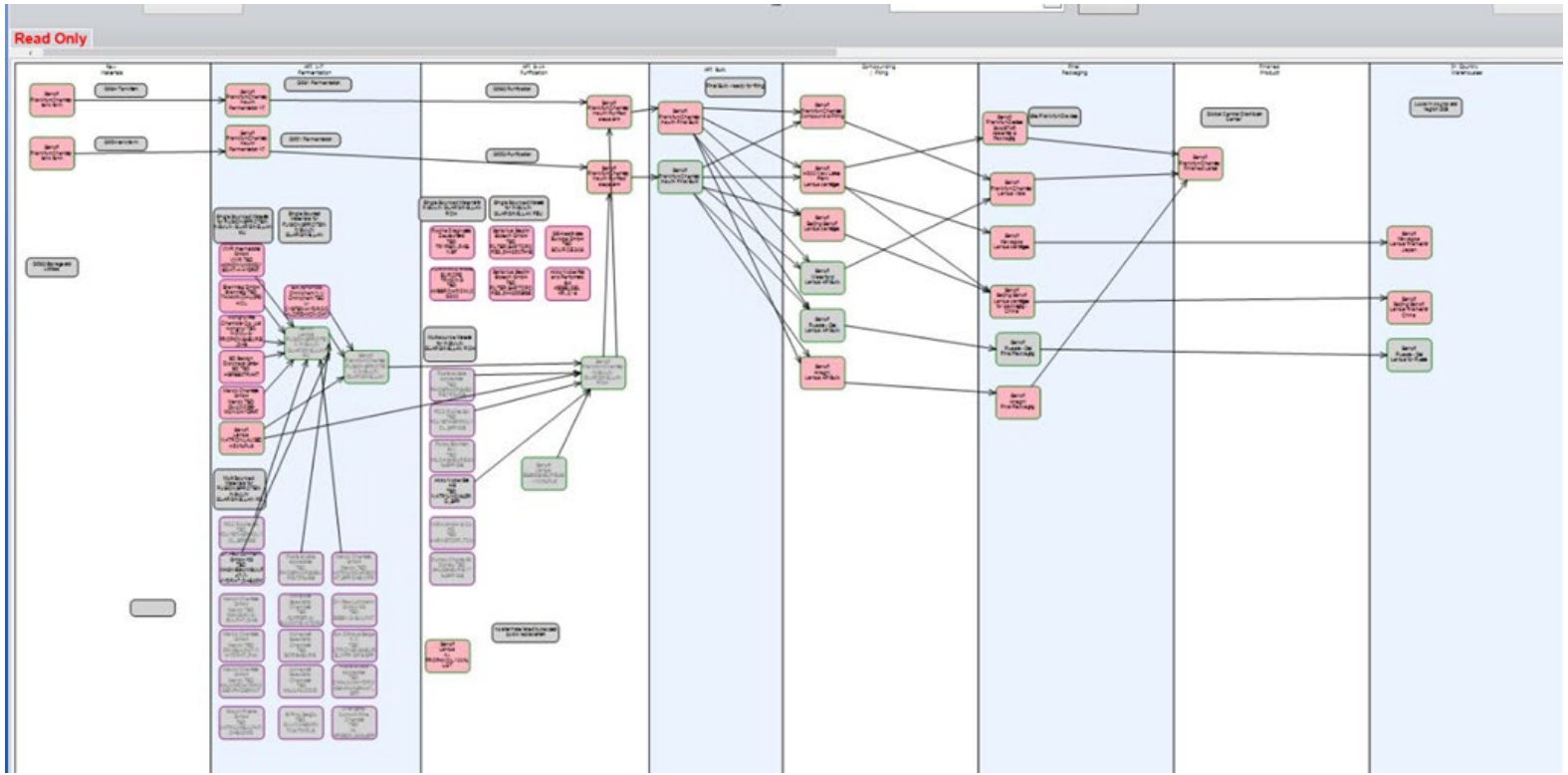
Resources to consider

- ERM interviews
- Risk Engineering reports
- Special assessments
- BCM team
- Procurement assessments
- Supply chain workshops
- Supply Chain maps

Understand the supply chain

Supply Chains can be complex

– and many steps can take out 100% of the product



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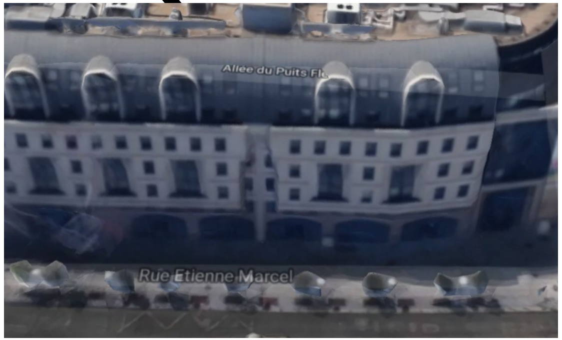
Contingent BI – understand and ask

Supplier Name	Street	City	Country	Exposure (Euros million)	Contribution
Aliapharm	Niedenau 49	Frankfurt	Germany	191.1	Aethyl Benzolsulfonamid
CECA/ DTAI	la défense	PARIS	France	50.0	magnésium stéarate
Specialité chimique de distribution		Versailles	France	150.0	macrogol 6000
Daiichi Pharma Co	14-10 Nionbashi, 3-chrome 103-8234 Chou-Ku	Tokyo	Japan	95.3	Ofloxacin
Allait		Paris	France	125.0	lactose monohydraté



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Business Interruption Reported Values vs. Value at Risk

For Insurance Placement and Risk Management outcomes

Insurance BI Calculations (For Premium Calculation)	Key considerations	Value At Risk (For Supply Chain Management)	Key considerations
Accountancy allocation of BI value to sites	Needs to be accurate and not overstate total exposures (variable costs, payrolls, etc.)	Models global impact of loss of a site or asset	Critical to prioritize areas for improvement and increases risk engineering fidelity
Focused on allocating insurable global margin using accepted insurance practices	Forensic account prepared BI gives insurers more confidence in numbers for better outcomes	Supports Supply Chain Team (SCT) resiliency decision making	RM team can be a valuable resource to SCT by facilitating a global view of critical assets
Insurance company requirement	Needed to quantify global exposure being underwritten	Provides timely input on impact of loss for faster claims settlement	Accurate supply chain modelling increases engagement with insurers and improves claims outcomes.
Used for Premium allocation	Forensic account can work with transfer pricing team to optimize allocations	CEO/CFO view of risk	Provides C-suite comfort that risk is understood and appropriately managed

Accurate and insightful business interruption values = better risk decision making outcomes.

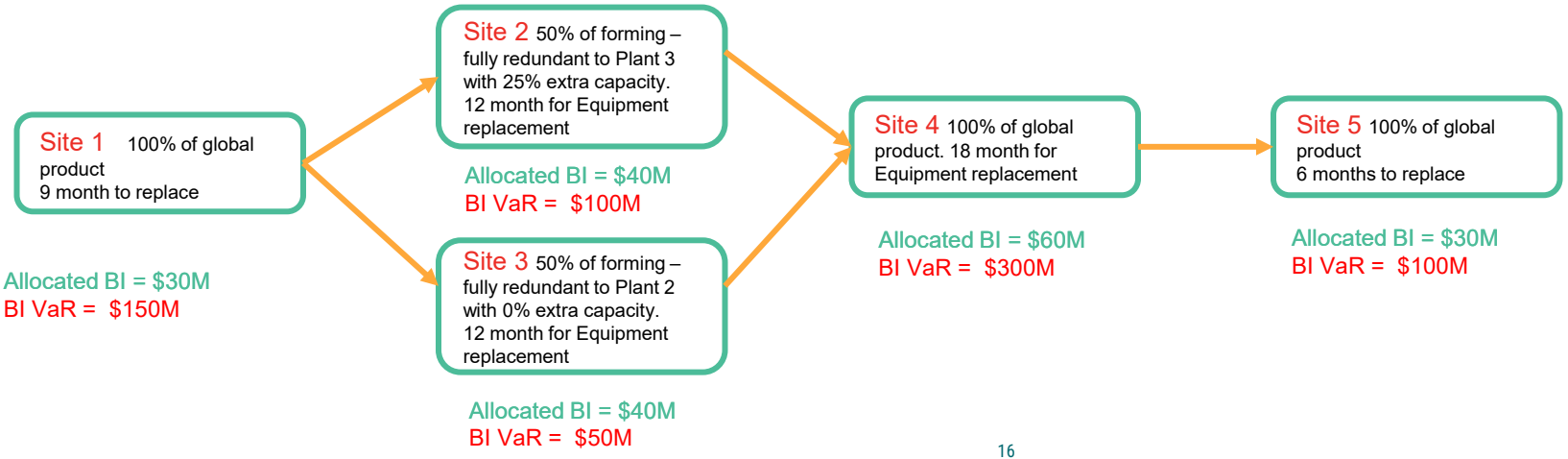
2 views of Business Interruption – *Allocated* vs *Value at Risk*

Importance of understanding the real global "Value at Risk" for key production lines and buildings – to make better risk resiliency decision making? ….

Example: 1 product's global supply chain: 4 step process at 5 different facilities.
The product has ~$200M in Global Profit Margin for 12 months

Allocated BI = for insurance reporting of 12 months figures
BI VaR = actual loss which would be sustained if major loss at site

	Raw material warehouse and initial blending	Component forming	Component assembly	Final packing and warehouse
BI Allocation% for Ins reporting	15%	40%	30%	15%



Loss Control Program design – add more value

- ❑ **Site Level**
- Identify strengths and weaknesses
- Benchmark across sites
- Understand the *global Value at Risk* for production lines and buildings at the site
- ❑ **Provide insight to Regional or BU Level management to help them manage**
- ❑ **Globally**
- *Adopt company wide Protection standards (don't rely on local country codes)*
- *Customize risk engineering program to support the business* ***– not just the insurer***
- *Communicate* interdependencies between sites – **What is the global impact of loss**
- Understand ***Return on Risk Improvement*** –$$$ (support CAPEX decision making)
- *Support other departments* (EHS, Facilities, Supply Chain)
- Assess changing problem sets: Climate, Wildfire, Geopolitical, transportation…

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Climate Change Risk – take advantage of the long runway

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Climate Change Risk – the long-term view

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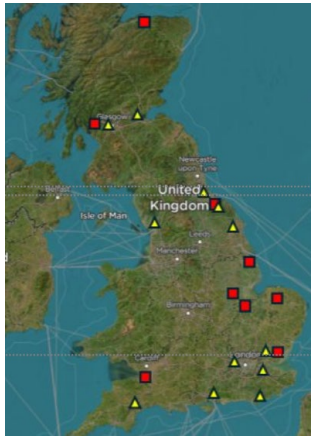
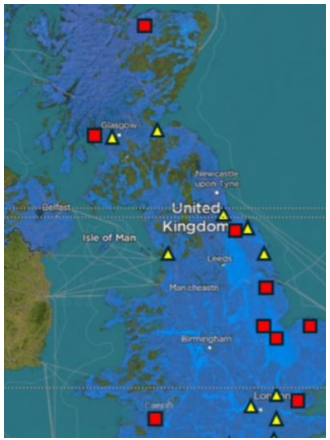
Portfolio Level assessment:– owned sites, supplier, customers



Critical Owned and Supplier Sites



Fluvial Flood future risk

Site (Owned and Key Supplier) (Highest $ exposure)	Country	Future Climate Risk: As Is	Future Climate Risk: W/ Mitigation	# of Recs	River Flood: Future	River Flood: Present	Rain Flood: Future	Rain Flood: Present	High Temp (Days Heat wave): Future	High Temp (Days Heat wave): Present
Site A	DE			5	3 months	1 week	1 day	< 1 day	3 days	Very low
Site B	DE			5	1 day	< 1 day	2 weeks	< 1 day	3 days	Very low
Site C	HU			4	2 weeks	5 days	3 days	1 day	3 days	< 1 day
Site D	IT			4	20 days	3 days	1 days	< 1 day	< 1 day	Very low
Site E	IT			5	2 months	2 days	2 days	< 1 day	3 days	Very low
Site F	US			1	Very low	Very low	1 day	< 1 day	< 1 day	Very low
Supplier 1	MX			6	1 month	3 days	3 days	< 1 day	15 days	1 day
Supplier 2	VN			2	1 week	2 days	1 week	3 days	15 days	1 day
Supplier 3	VN			2	n/a	n/a	2 weeks	1 week	15 days	1 day
Supplier 4	VN			4	2 Months	3 days	5 days	3 days	15 days	1 day
Supplier 5	TW			8	1 day	< 1 day	1 day	< 1 day	< 1 day	Very low
Supplier 6	TW			7	2 days	< 1 day	2 weeks	1 week	< 1 day	Very low
Supplier 6	CN			3	1 week	< 1 day	2 days	< 1 day	Very Low	Very Low
Supplier 7	CN			3	1 week	3 days	5 days	< 1 day	Very Low	Very Low
Supplier 8	JP			3	Very low	Very low	2 days	Very low	7 days	Very Low
Supplier 9	TR			2	n/a	n/a	3 days	1 day	1 day	< 1 day
Supplier 10	SK			4	1 month	2 weeks	2 weeks	1 day	3 days	< 1 day
Supplier 11	IN			4	1 month	1 week	1 day	< 1 day	3 days	Very low
Supplier 12	IN			4	1 month	1 Week	1 day	< 1 day	3 days	Very low
Supplier 13	JP			2	1 day	< 1 day	< 1 day	1 day	< 1 day	Very low

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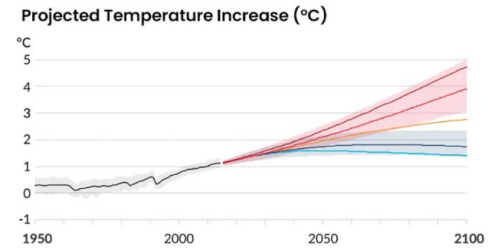
Climate Risk: Micro Level Risk Assessments – at the site level

Example: Heat Wave Preparedness - Cooling System Resilience

- Identify specific changes that should be engineered during coming 20-30 years as sites upgrade
- Flood, Wildfire, Thermal load, Water availability, etc.

Ensure the HVAC and cooling systems can withstand future extreme heat waves.

- 🔍 **Review system design limits** (max temperature & humidity) against **projected future climate conditions** based on the **latest IPCC scenarios**.
- 🧪 **Test actual performance** under simulated high-temperature and humidity conditions.
- 🔧 **Plan adaptation measures** if gaps are found (e.g., upgraded components, redundancy, enhanced maintenance, backup cooling).
- 📡 **Install real-time monitoring and alert tools** for temperature, humidity, and signs of system stress.

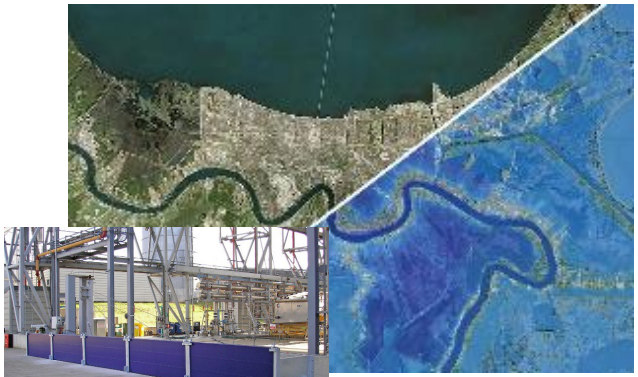


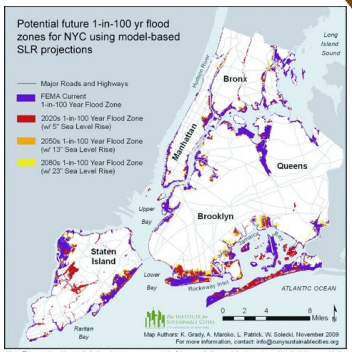
Climate - Micro Level Risk Assessments – at the site level

Flood Risk Today and in 2050

Leverage Multiple Data Sources – Understand how the exposure will evolve and identify targeted measures to **protect critical infrastructure**.

- 📍 Combine **current flood maps** with **future climate projections**.
- 🛡️ **Elevate/ Protect critical utilities**
- 📈 Define **flood physical response plans** and **Raise Ground floor Elevations**





Wildfire

Strengthen site resilience

Key Elements Reviewed:

- 🏗️ **Building construction** – combustible materials, fire-resistant openings, air intakes.
- 🌿 **Vegetation interface** – clearance zones, firebreaks, and surrounding fuel load.
- 🚒 **Access & water supply** – road clearance, hydrants, water sources, active protection.

Logistics, Access, Power and Utilities Under Climate Stress

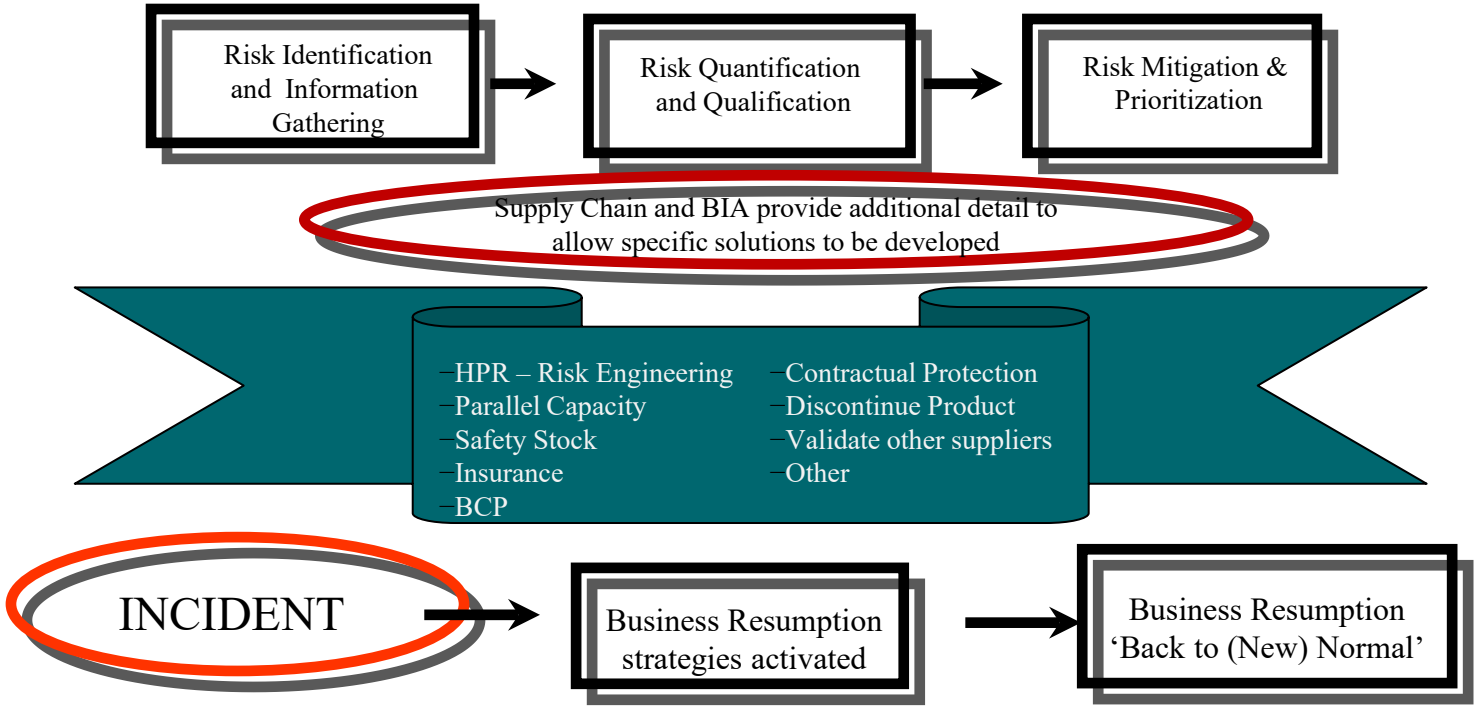
Ensure supply chain and site access during climate-related disruptions.

Key Actions:

- 🛰️ **Assess access routes and logistics infrastructure**
- 🏭 **Review supplier and utility locations** to identify broader vulnerabilities
- 📦 **Expand Business Continuity Plans (BCP)** with alternative routes, backup suppliers, and emergency logistics options.
- 🛠️ **reduce dependency on single access points** during extreme events.

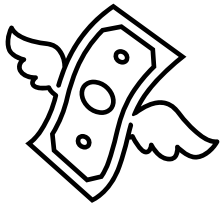
Sample SCRM Process – Step by Step

Supply Chain Protections – Bringing it together



Sample SCRM Process – Step by Step

1. Identify priority products/product families



Sample SCRM Process – Step by Step

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Sample SCRM Process – Step by Step

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3. Quantify the annualized impact of the loss of critical sites, down to individual production lines

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4. Identify and catalog inventory positions, lead times, alternative sourcing strategies, parallel or redundant product standardization, key staff, technology

Sample SCRM Process – Step by Step

5. Assess the potential duration of outages and restoration periods (current and best future case and add additional time for unanticipated delays)

Sample SCRM Process – Step by Step

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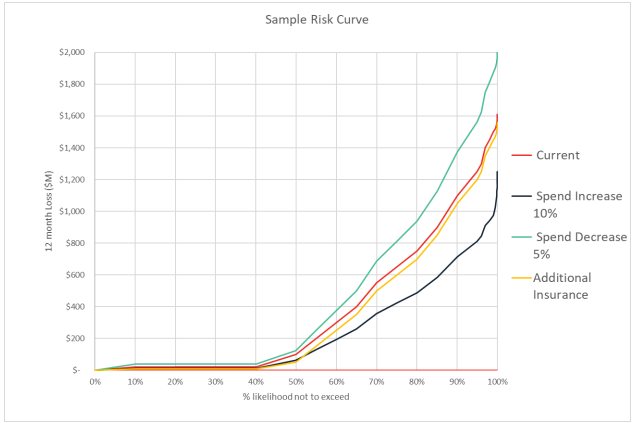

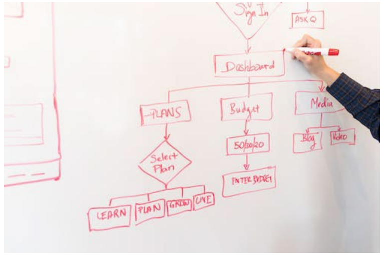

7. Document plans to prioritize action to protect – and communicate with management

Sample SCRM Process – Step by Step

8. Perform additional risk assessments to identify vulnerable sites/nodes

Sample SCRM Process – Step by Step

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Sample SCRM Process – Step by Step

1. Identify priority products/product families
2. Map supply chains, including critical suppliers/customers
3. Quantify the annualized impact of the loss of critical sites, down to individual production lines
4. Identify and catalog inventory positions, lead times, alternative sourcing strategies, parallel or redundant product standardization, key staff, technology
5. Assess the potential duration of outages and restoration periods (current and best future case and add additional time for unanticipated delays)
6. Develop risk curves across a range of possible return periods
7. Document plans to prioritize action to protect – and communicate with management
8. Perform additional risk assessments to identify vulnerable sites/nodes
9. Develop appropriate plans, policies, and procedures for business continuity/resumption

Rinse and repeat

Supply Chain Risk Management - What others do…

Learn from bad experience?	
Analyse your purchasing spend with high $$ volume suppliers?	
Do a general risk assessment of the threats facing your key products?	
Quantify the value at risk for the critical dependencies of key high margin products and put in place controls to reduce or eliminate bottom line risk?	

which will you try?

Case Study #1

$1.5B biological product with global supply chain (margin = 75%+)

- Key ingredients sourced in Asia
- Active production and syringe filling in Europe

Supply chain modeling initially focused on owned sites and high-cost active ingredients only.

The single sourced syringe supplier was considered high quality due to brand recognition, and therefore limited analysis had been performed.

After a more detailed assessment, the process identified:

- The syringe supplier **manufactured product at only 1 site**, and Finished syringes were stored in **1 section of a single large unprotected warehouse**
- Potential to run out of stock and materially impact sales was identified

Subsequently; Supplier was contacted and added back-up capacity at alternate site and split finished product storage into 3 warehouses

Case Study #2

$3 billion tableted product with global production/supply chain across several countries (margin: 90%)

- Supply chain modeling initially focused on owned sites and high-cost active ingredients only
- A more detailed assessment including all key ingredients (defined as items that would stop the product if not available) identified:
  - A 3rd party sourced talc was used during the tableting process to keep pills from sticking
  - The talc was sole sourced and listed in FDA product registration
  - $1,000 of talc was used per year, a 6-month safety stock was maintained
  - 18+ months to qualify new supplier
  - $4.1B of revenue was at risk after safety stock of finished product depleted

Subsequently: Company increased their talc safety stock to 2 years ($2,000 total)

Conclusions

Work to better understand and protect key income streams through:

- Supply chain mapping for key products
- Quantify exposure for “breaks” in the chain - **WHAT IF, SO WHAT**
- Analyze single/sole source suppliers, both Internal (BI) and External (CBI)
- Optimize Number of sites that can produce critical products
- Focus on Risk Quality of key sites
- Inventories – Shift mindset from Just-in-Time to Just-in Case
- Design Make-up capabilities
- Take steps to reduce exposure

- start somewhere…

Reference Article - “What did we learn about business interruption in 2022?”

Questions?

Thank you.

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