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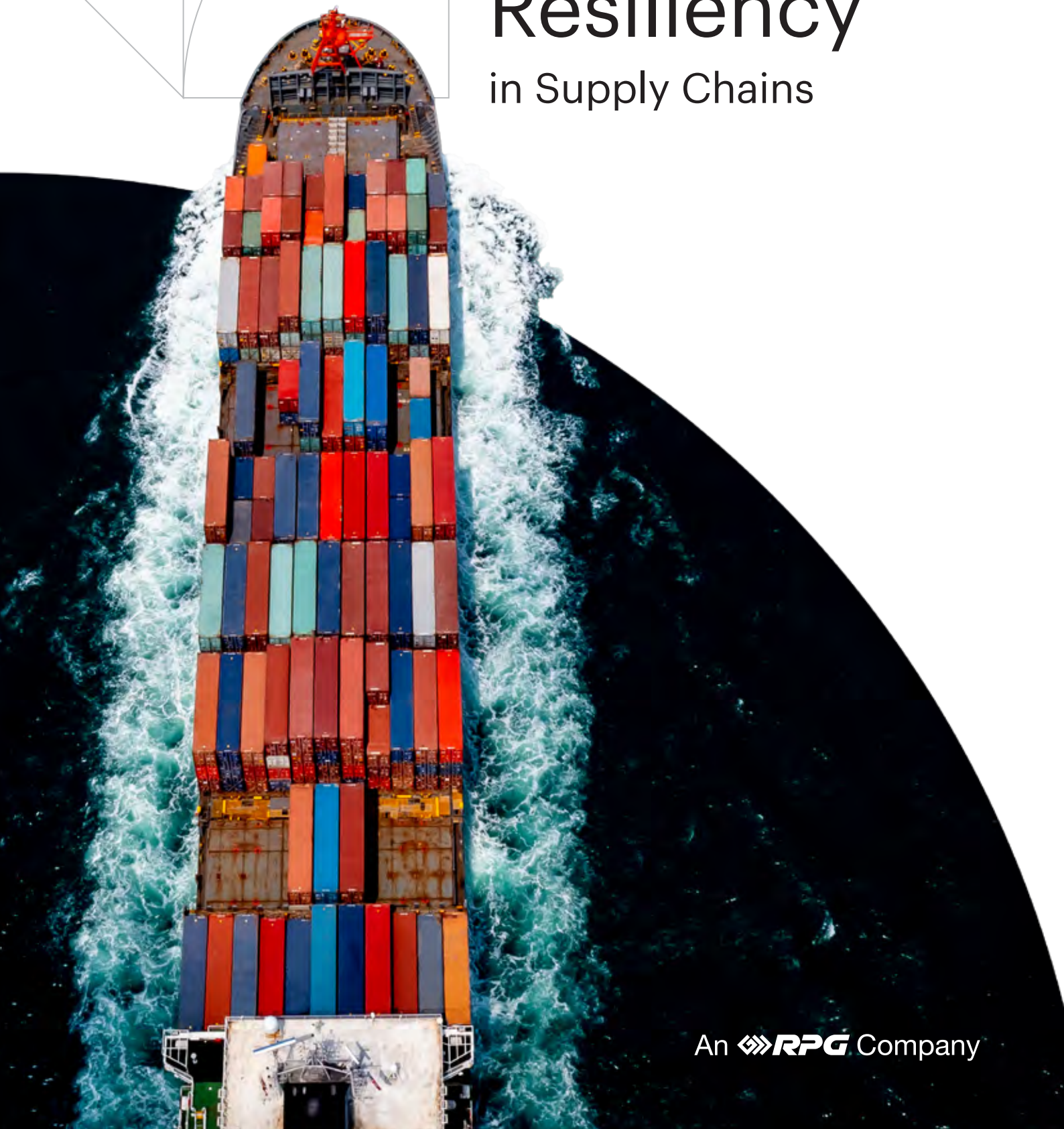
Enhancing Resiliency

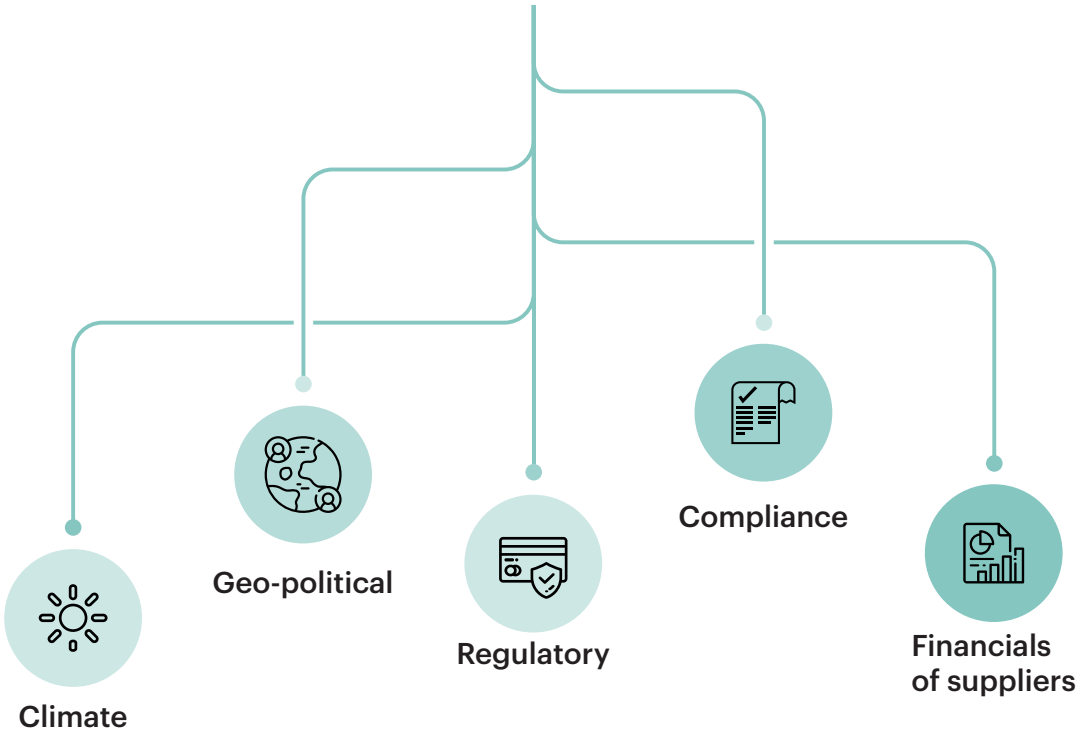
in Supply Chains



An RPG Company

Resiliency: The Need of the Hour for Supply Chains

Every year, global supply chains are disrupted due to several factors. Unexpected events are becoming more common, forcing businesses to reconsider how they can make their supply chains more resilient and avoid disruptions. Enterprises expect to stay ahead of supply chain risks and understand the risk landscape that falls under five significant categories:



According to a February 2021 report by Ernst & Young[1] on the business impact of COVID-19, only two percent of companies surveyed stated that they were prepared for the event. About 57 percent of companies reported severe business disruptions, and 61 percent expressed that achieving supply chain visibility will be their key priority over the next three years. This data reflects the need for greater end-to-end supply chain risk resilience and visibility.

In this white paper, we highlight the two significant themes that are relevant to gaining overall supply chain risk resilience:

I. Multi-tier supplier visibility

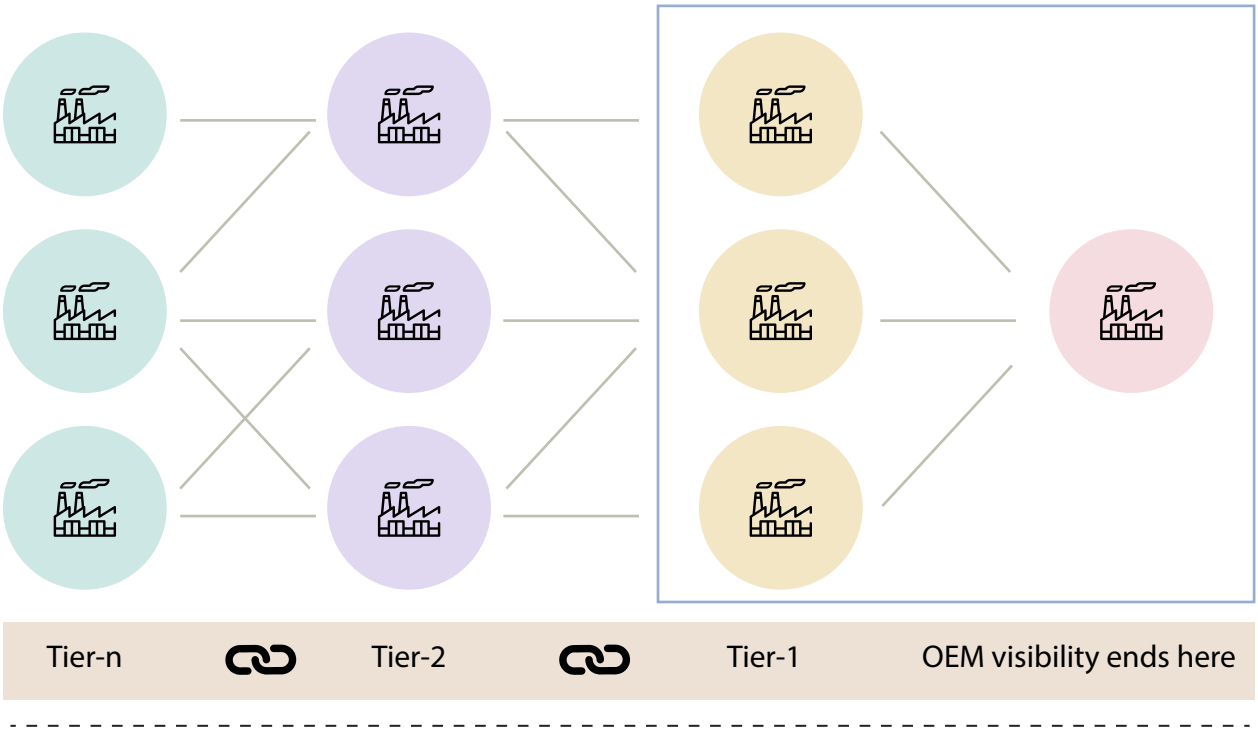
II. Inventory visibility and pre-emptive prediction of stockouts

The diagram below depicts a timeline of events which led to significant global supply chain disruptions. As we know, such events can recur without prior warnings again.

I. The case for multi-tier supplier visibility

Multi-tier supply chains are multiple single-level collaborations within one supply chain, i.e., multiple suppliers to buyer relationships. Multi-tier supply chains are becoming a critical strategic driver as they lower costs, reduce capital assets, and get products to market more efficiently than the competition. Multi-tier strategies have increased complexity and reduced visibility and control over the manufacturing process, as the critical planning and execution data resides outside the enterprise's four walls.

Supply chains are only as strong as their weakest link, and in today's complex networks, companies have little insight beyond their tier-1 suppliers. According to McKinsey[2], roughly 51 percent of supply chain disruptions occur in tier-2 suppliers and lower, but only two percent of companies have visibility into their supply base beyond the second tier. With many corporate relationships and transactions across disparate business networks, proactively identifying risk across multi-tier supply chains is nearly impossible.



Relooking at approaches to this challenge

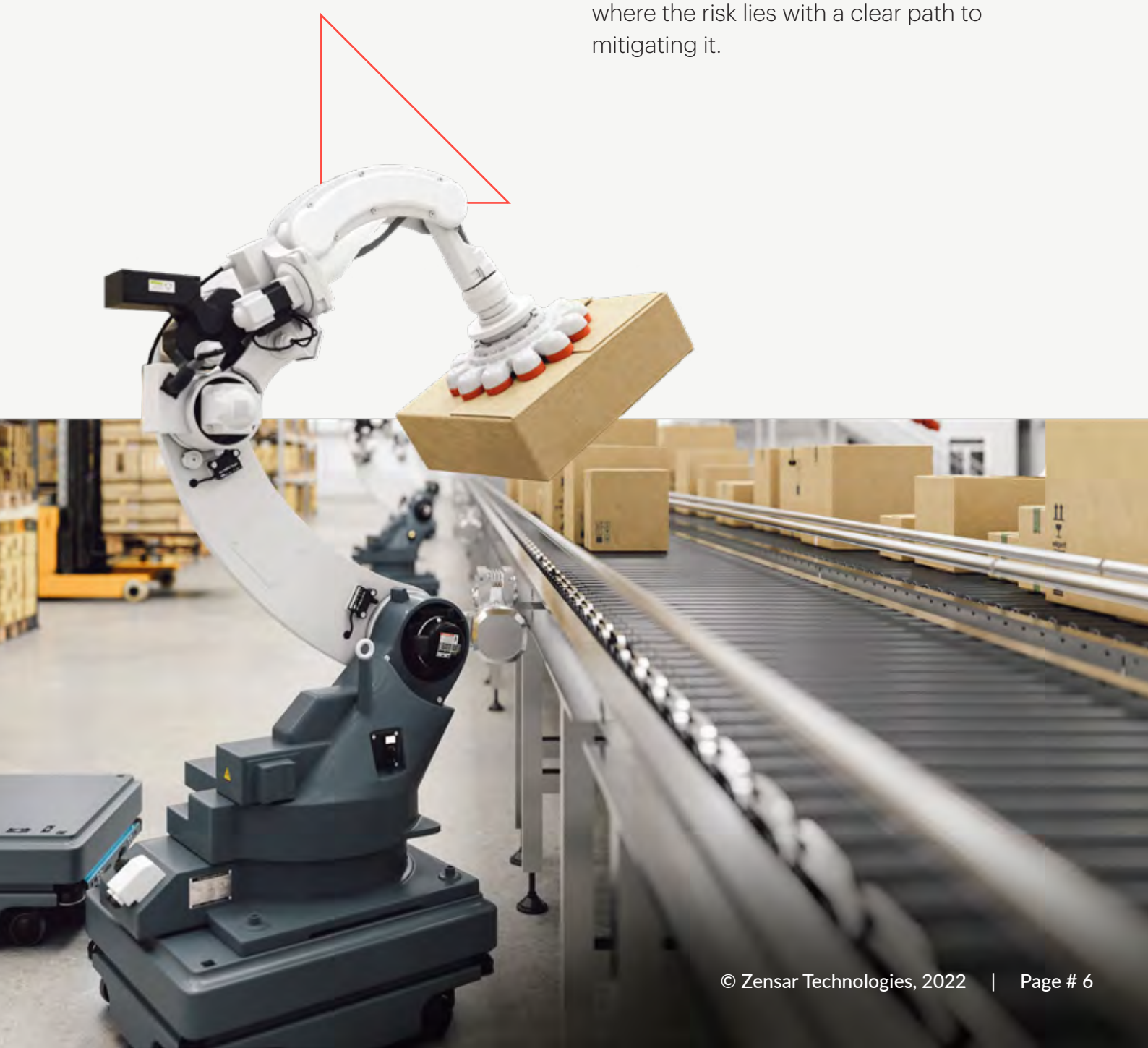
Supply chain risk was considered a third-party risk, where supplier risk was the primary focus of risk management efforts. But enterprises are differentiating themselves by changing their view about analyzing risk with a more data-centric approach. Data-centric risk analytics involves understanding where the product is coming from, not just which supplier and the facility it comes from, to consider external facility and location-based risk. Recourse to secondary sites to get this data is often advisable, especially when visibility to the nth supplier is sparse.

One such approach could be as follows:

Assess	▸ Identify business-critical activities, products, services, processes, and systems ▸ Dependency mapping with critical suppliers ▸ Internal system data sources • Where do you have sole supply? • Where do you have low inventory levels, etc.? ▸ External data sources • Tier-1 supplier locations • Dependency on tier-2/tier-3 suppliers • Tier-2/tier-3 supplier locations • Supplier's financial health	**Supplier market database**
Measure	▸ Understand the true exposure of critical suppliers ▸ Establish contingency plans ▸ Need for a platform-based approach vis-à-vis traditional manual methods	**Multimodal AI-based forecast model**
Act	▸ Root cause analysis based on the risk • Financial risk • Geo-political risk • Environmental risk ▸ Identify mitigation strategies and put them action	**AI-based RCA**
Analyze	▸ Establish ML-based multi-tier risk sensing model within the organization ▸ Plan and hone your organization's response to crisis ▸ Optimize mid-crisis financial outcomes ▸ Prepare to capture future crisis	**ML-based multi-tier risk sensing model**

This helps understand the supplier who produces the immediate bill of materials and tier-2/tier-3 and raw material suppliers.

Traditional multi-tier supply chain visibility approaches involve tedious and expensive manual processes based on subjective or inaccurate data. Enterprises expect a data-centric, ML-based, integrated multi-tier risk sensing approach that combines data based on billions of supply chain interactions with powerful artificial intelligence, advanced analytics, and graph technology to produce long-range strategic risk assessed at the material, supplier, and facility location level. We analyze data using open-source information, machine learning models, industry insights, local news, and human networks to identify early indicators of supply disruption. As networks and risks change, the assessment changes to keep customers on top of where the risk lies with a clear path to mitigating it.

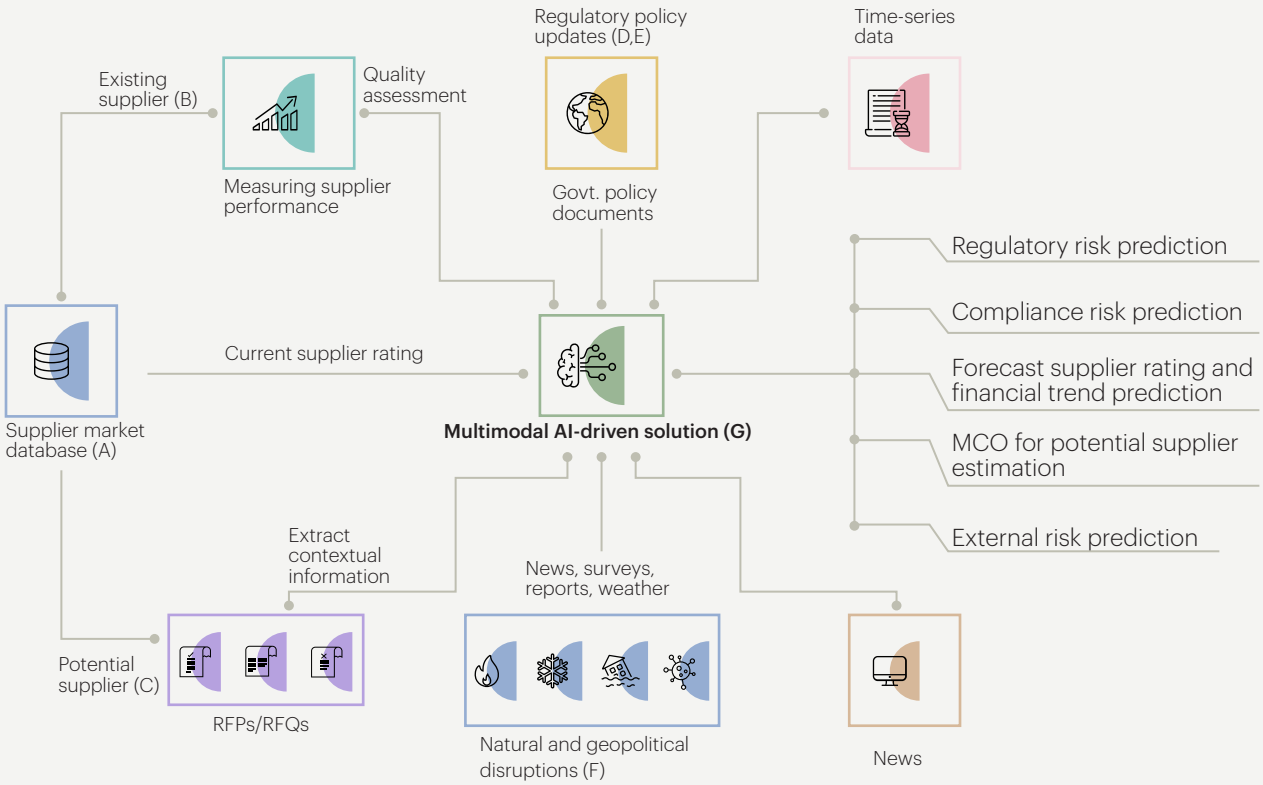


Multimodal AI-based supplier sourcing and risk management model

Sourcing risk mitigation begins with analyzing suppliers' total spending and value, followed by risk assessment of quality, financial, supply, and customer support risk assessment. Identifying these potential risks usually takes weeks or months, preventing effective strategies from being devised to mitigate and reduce risks.

The fundamental requirement for any supplier risk management is the need for an exhaustive supplier market database (A) that consists of an extensive record of supplier profiles across multiple tiers.

Information such as the companies' financial and revenue data, historical performance in the industry, supplier rating, etc., are captured in this database. Companies can periodically collect such information by requesting RFPs/RFQs from suppliers to reinforce their supplier market database and keep it up-to-date for potential supplier disruptions. A multi-criterion optimization (MCO) strategy to detect prospective suppliers based on various risk factors should be in place to keep up with the changing trend in the supplier ecosystem.



Two sets of suppliers are in focus:

Existing suppliers (B)

Suppliers must be rated based on the quality of the raw materials, timeliness of delivery, customer support response, etc., based on the feedback from those dealing directly with the suppliers. These ratings can derive a metric that can be continuously evaluated and forecasted to track the possibility of continuing with existing suppliers.

Potential suppliers (C)

Supplier capabilities and their market standing captured in the database through RFPs and RFQs provide one set of value in supplier rating. External sources of information can record the disruptions caused by suppliers to other competitors, and such information is regularly available through surveys and online sources. The same can assess and rate potential suppliers already in the supplier market database.

Some of the risks include:

Regulatory risks (D)

Require an advanced level of tracking from external sources to avoid non-compliance with regulatory requirements in the jurisdiction of operation. Regulatory policy documents published by various ministries and financial news articles will form the primary source of tracking these regulatory risks. Natural language processing techniques to extract meaningful information from documents and online sources can be captured in the supplier market database or stored in a knowledge graph for regular tracking and update.

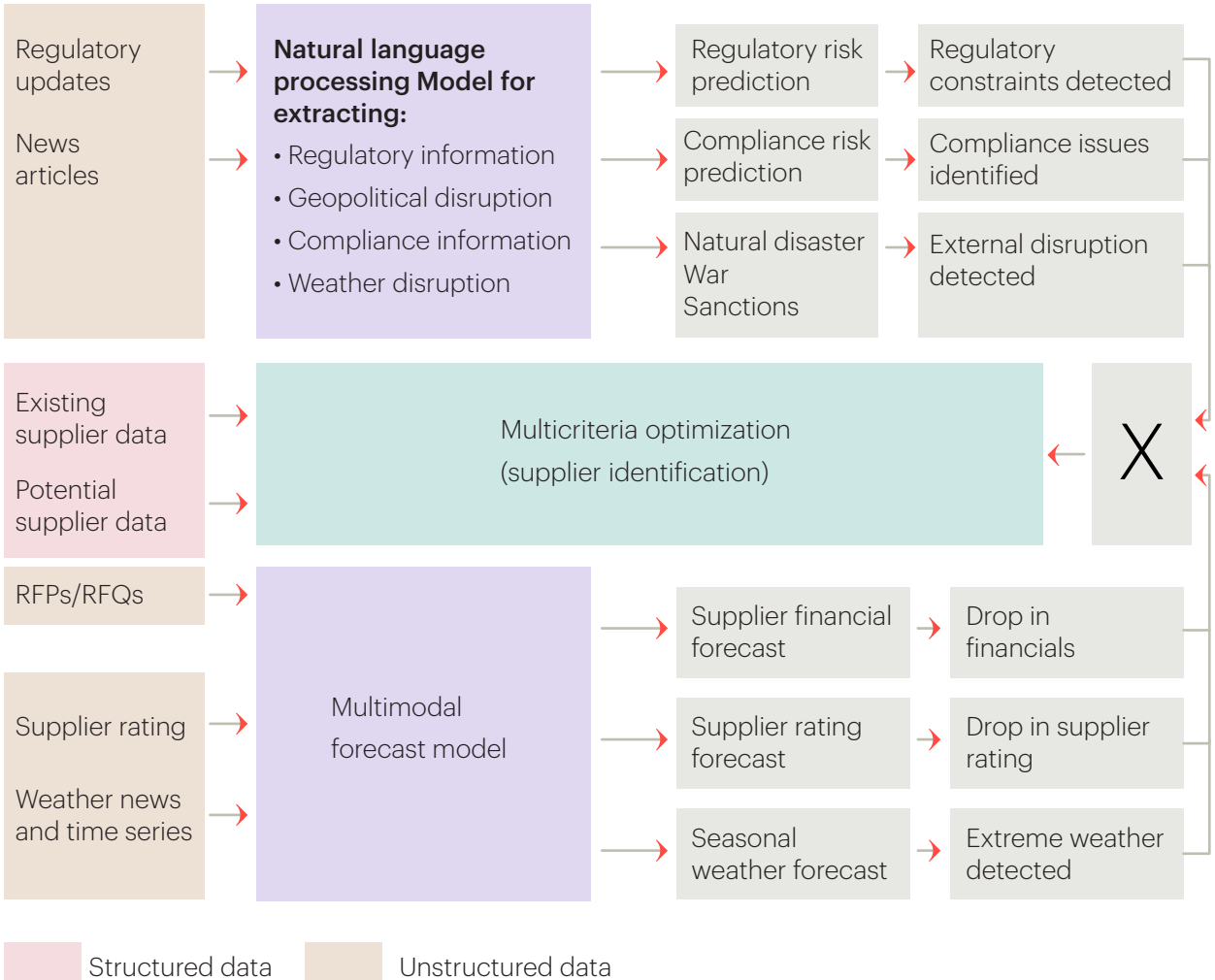
Compliance risks (E)

This is closely related to regulatory risk and deals with the compliance of already existing regulations. Compliance risks usually result in penalties that place severe stress on the suppliers' finances, and they need to be recorded. The data infrastructure regulatory risk continues to source information dealing with economy and commerce in news articles to warn compliance risk and provides a mean for human intervention and risk mitigation. As mentioned in (B), any compliance risk will affect supplier rating.

External risks (F)

The possibility of external risks is high, and the variability is plentiful. Risk can occur due to global factors such as variation in the exchange rates, geopolitical risk, protests, or acts of nature, including earthquakes and floods. In all these cases, the sustainable multimodal AI model (G) can fuse multiple sources and modes of information in time series and text to predict and forecast the impact of these external risks. Risks such as variability in exchange rates and weather deal with time-series data that can forecast and take preventive measures to mitigate risks. However, factors dealing with geopolitical risk can affect varying time durations. Associating geopolitical risks to suppliers can be deduced through analysis of news articles and expert interviews that require multimodal analysis. The modern multimodal AI is highly effective for such specific tasks. Based on the systematic analysis of multimodal data, suppliers' vulnerability can be measured, warnings like supplier rating downgrade, regulatory, and compliance risks can be generated, and MCO can be triggered to alert decision-makers and suggest alternate strategies.

The model incorporates both structured and unstructured data, as shown below:



II. Inventory visibility and pre-emptive prediction of stockouts

An estimated four percent of total annual revenue worldwide in the retail sector is lost due to OOS events. In a more recent study, this loss is close to USD 984 BN[3]. OOS events result in a direct sale loss for retailers and manufacturers and operational and strategic costs. From an operational perspective, OOS events reduce the potential impact of promotions and distort true demand. From a strategic perspective, these events impact brand loyalty, promote competitors' brands, and diminish the effectiveness of sales team resources.

34% of supply chain executives cite inventory visibility across all locations, including in-transit inventory, as a top fulfillment challenge. [4]

Inventory risks leading to stockouts

Inadequate forecasting and reporting

A survey of corporate retail professionals by Wakefield Research and Bossa Nova Robotics[5] found that 73 percent of respondents consider inaccurate forecasting a constant issue for their store. It also found that 87 percent of respondents consider inaccurate inventory a more significant factor in revenue loss than theft.

Inadequate forecasting and reporting

Nearly three in four retailers struggle with inaccurate inventory forecasting.

Unreliable suppliers

38.8% of small businesses in the US experienced supply chain delays due to the COVID-19 pandemic.

Inefficient stock replenishment

~70-90 percent of stockouts are caused by poor shelf replenishment practices.

Unreliable suppliers leading to supply chain problems

Unreliable suppliers fail to meet their established delivery schedules and quality standards. This causes businesses to have delays in production and fluctuations in inventory levels.

Inefficient stock replenishment

Careful attention to stock replenishment has become increasingly important in the omnichannel retail environment, where you must provide the best product selection, whether online or in-store.

Why pre-emptive stockout prediction is the need of the hour?

Cost of stockout is paramount

How often does a product's non-availability on the shelf force you to say "no" to your customer's requirement? What is the impact of those "no's" on your organization? It's not just lost revenue — if you don't see all your inventory, you risk delivering a poor customer experience. With the time and money an organization invests into enhancing the customer experience, you cannot let inventory challenges derail those efforts.

Omnichannel view of end-to-end inventory

Many B2C businesses now offer services such as buying online, picking up in-store (BOPIS), and shipping from a store in response to customer demands, resulting in inventory being housed in and shipped from many more locations. Dark stores have become the norm for many retailers. B2B firms are expanding their inventory locations beyond traditional distribution centers to meet rising customer expectations and deliver a better fulfillment experience. As we move from centralized DC to regional ones, micro-fulfillment centers, and eventually stores as storage of inventory, the end-to-end inventory view becomes crucial.

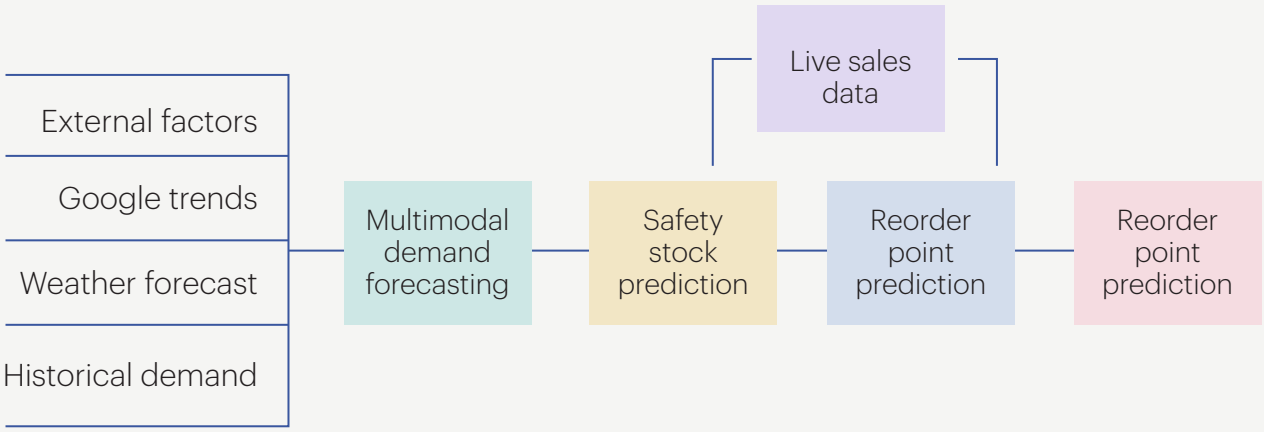
Maximize ROI on your inventory

Unsold inventory is part of your firm's assets you must manage well. You may carry too much safety stock because you don't want to decline your customers. In retail, this means having too many markdowns at the end of each season or, worse, liquidated stock. In the B2B world, that is a margin carved from your bottom line. But if you err on the side of too little safety stock, you risk losing sales and reputation by not being able to deliver.

Pre-emptive stockout prediction using AI and ML

Prediction of safety stocks

Safety stock prediction depends on the forecasting model used. In the age of deep learning, modern multimodal networks are state-of-art in generating an accurate demand forecast. Considering various aspects of external information can indicate product interest. For example, many articles discuss the importance of sanitizers to prevent the spread of the coronavirus, which was widely covered and published in external sources. We can use state-of-the-art NLP models to extract the impact of such information on the demand through a multimodal network. Given the exact need, the rise in demand can also be predicted, which will function as a datapoint for predicting the safety stocks. Analysis such as ABC/VED/HML can be used to prioritize products for safety stocks procurement to ensure minimum loss of revenue.



Reorder point prediction

It is critical to know when to reorder if a looming stockout scenario occurs. Both stockout and reorder point prediction go hand-in-hand as replenishment orders must be placed considering the lead time for the product. Many retailers use digital interventions to fine tune the traditional ROP calculation. Machine learning models can detect these reorder points to understand at what stage of the value of the existing stock should the order be placed for replenishment.

Location constraints

Another factor that needs to be mentioned is the placement of safety stocks and evaluating supplier location. Placing the order with the proper manufacturer plays a significant role in optimizing replenishment, but the same ideally needs to be managed at supplier risk analysis.

Another way to approach this is to handle the next order date estimation better. This includes two steps:

Determine purchase propensity

Predict purchase propensity for the coming week by developing a probabilistic model using logistic regression/random forest/CHAID. The higher the probability, the greater the purchase propensity.

Purchase propensity = f(Product freshness, sales visit frequency, order gaps, seasonality, order fulfillment level)

Revisiting store purchase propensity

Product of order size and purchase propensity for each SKU.

Store purchase propensity = $(\text{Order size} * \text{purchase propensity})_{sku1} + (\text{Order size} * \text{purchase propensity})_{sku2} + (\text{Order size} * \text{purchase propensity})_{skuN}$

Conclusion

As global supply chains recover from the aftermath of the pandemic, current geopolitical conflicts have added to the ever-growing risk. With each event — black swan or regular — industries worldwide are increasingly reminded of the need to handle supply chain risks better. The right digital levers and data analytics offer enterprises greater control and management of supply chain risks. It is safe to say that firms who can tide over these risks effectively will be the north stars for supply chain excellence for decades to come.

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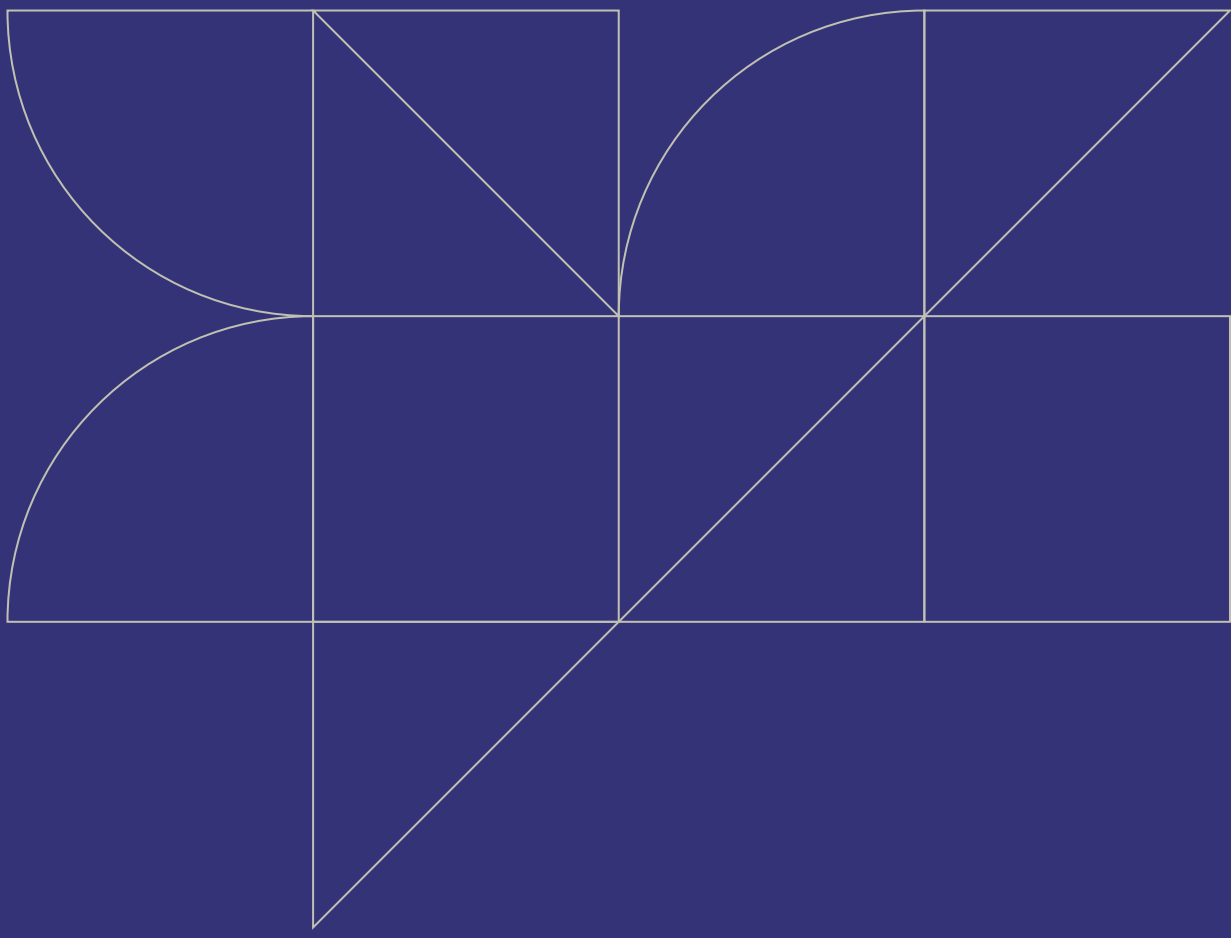

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