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# Management of Supplier Risks in Global Supply Chains

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## *Improve predictability and business continuity in global supply chains using the SRM framework*

The US manufacturing sector contributes over 12% of total US GDP and two-thirds of total US exports [1]. In recent times, companies in this sector are faced with significant operational pressures. With hourly labor costs in China estimated to be 3-4% that of the US [2], US manufacturers are finding themselves getting priced out of the market by lower cost manufacturers. In addition to the pricing pressure from overseas, the industry has witnessed an inflationary trend in raw material and energy prices. In the last 5 years, for instance, the base steel prices have almost doubled [3]. Energy prices, which cause a direct increase to overhead costs, have also increased.

With all the core inputs to manufacturing (labor, material, overhead) seeing tremendous price hikes, manufacturers have expectedly responded with a relentless focus on operational cost reduction. The trend towards low cost country sourcing has been rapidly growing. A recent study by Boston Consulting Group mentions that LCC imports are growing at over 20% in certain categories [4]. Spend aggregation, leveraged sourcing and modular sourcing - where vendors source not just parts but entire modules including accompanying services (design, inventory management, after-sales service), is also a growing trend.

While these strategies have yielded significant operational benefits, recent events have proved that there are also inherent risks that could significantly impact benefits. As manufacturers source globally, they increase their lead-time and vulnerability for supply chain failures.

Risks impact total cost of ownership through their effect on quality, delivery and end customer satisfaction. There is a need to effectively assess these risks and develop a comprehensive mitigation approach to ensure supply chain continuity.

This paper is focused on providing a framework to: (i) assess the negative impact

of risks in global supply, (ii) applying a comprehensive framework to identify and mitigate the supply risks, and (iii) highlighting critical success factors and benefits of the framework.

## THE RATIONALE FOR SUPPLY RISK MANAGEMENT

In the context of global supply, there are a variety of factors that can contribute to supply disruptions ranging from geo-political instability in the supply region to more localized factors such as strikes at the source of supply. The following high profile events provide an insight into severe supply disruption losses due to supply chain risk:

- In 2004, a strike by 500 workers at an auto parts supplier forced General Motors to idle two of its Canadian factories which employed about 6000 workers, costing millions of dollars in losses [5].
- About 37 percent of Dow's North American production capacity, which totals 1.35 billion pounds of polypropylene annually, was affected by Hurricane Katrina in 2005 [6].
- In March 2000, a Philips manufacturing facility in Albuquerque, New Mexico, was destroyed by fire; the facility supplied radio frequency chips (RFCs) to Ericsson. The company was not aware of the supply problems for weeks, by which time its ability to meet customer demand had been seriously compromised. And because Ericsson relied exclusively on the Albuquerque plant for the RFCs, they had nowhere else to turn for these vital components. Ericsson posted a nearly $1.7 billion loss for the year, and ultimately had to outsource its cellular handset manufacturing business to another firm [7].

*Globally, billions of dollars have sunk in supply chain disruptions due to lack of or weak supply risk mitigation strategies*

As can be gauged from the above examples, a series of events produce a domino effect and cause disruptions to supply. There are several risk categories which have to be analyzed for potential impact - in isolation, as well as in combination, with other contributing factors. Supplier risk is one category that is localized within the source of supply and can include supply delays due to strikes, non-performance of products/components against specifications and non-compliance to contracts. A second risk category is related to logistics from the supply source to destination including factors such as distribution infrastructure breakdowns, communication breakdowns with logistics and supply partners due to hardware or


***Exhibit 1**: Supply Risk Management Framework* ***Source:** Infosys Experience*

software issues and cross-border shipment delays due to changes in customs and other statutory regulations. The third, and most unpredictable risk category is related to macro-factors such as sudden geo-political instability or natural disasters such as hurricanes or earthquakes.

Supply risk factors are further amplified when considered in the context of cost efficiency strategies that have been adopted by several manufacturing companies. Strategies such as consolidation of supplier base, lean manufacturing and JIT pose serious threats in case of disruption to normal routine. To add to this, legislation compliance has added a complexity factor due to international labor laws, environmental regulations and volatility in global trading.

Clearly, global sourcing decisions cannot be made purely on a total cost basis alone. Risk analysis needs to be an inherent part of any global supply scenario analysis.

## FRAMEWORK FOR ENTERPRISE SUPPLY RISK MANAGEMENT

Supply risk management is a systematic process of managing unwanted events or unwanted change in the supply chain and developing more predictability in supply.

The challenge in supply risk management is that the strategies taken for various business objectives are working at cross purposes. In order to be more responsive to market, companies have invested in product diversification and to minimize time to market they match product delivery rate to demand. However, with a view to cut cost, companies have outsourced business operations, minimized inventories, and made operations very lean. The challenge is in maintaining cost efficiency without compromising on schedules, quality and market response rates.

One way to align both objectives is to have a consistent and reliable source of supply. This essentially means identifying and resolving supply issues as early as possible. While this is conceivably easier if supply sources are very close to the destination, the complexity increases in a global supply chain. Global corporates need to develop and follow an all-encompassing and holistic risk management model - one that looks at all the uncertainties and their degrees of influence on the various segments of the global supply chain.

The following exhibit provides a proposed framework for supply risk management:

### Profile Supply Risk

In order to understand and mitigate risks, corporates need to generate supplier risk profiles. An intuitive and effective way

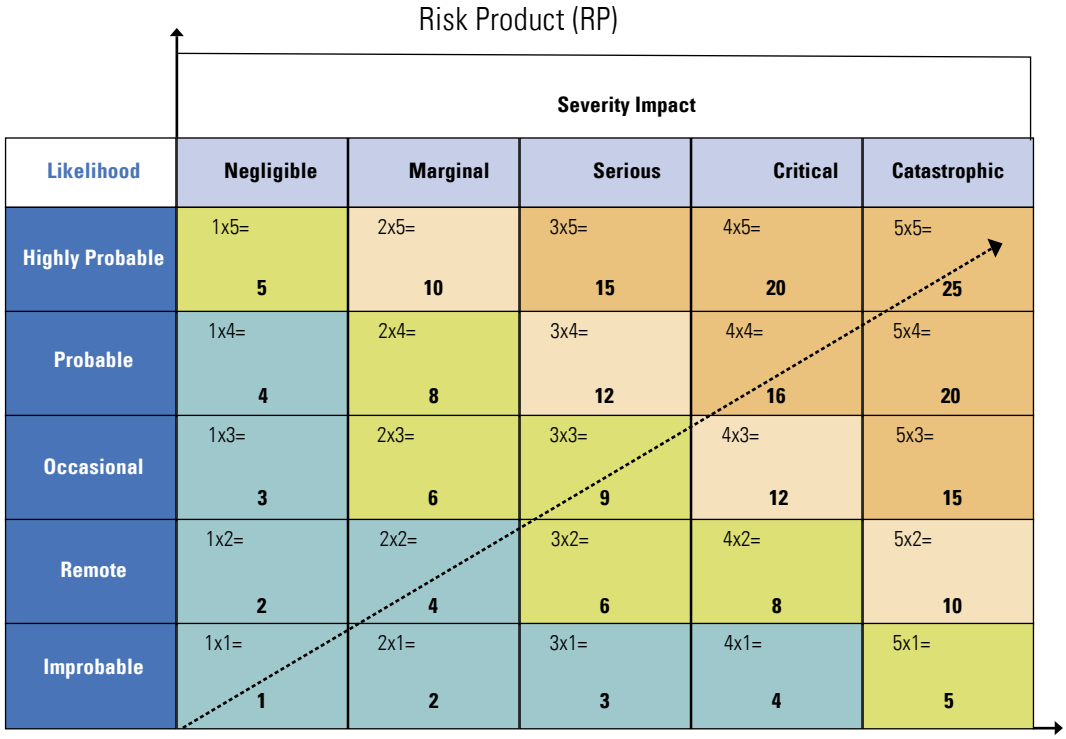


***Figure 1**: Sample Profiling of Risk* ***Source:** Infosys Research*

is to review the processes within a given supply chain and segregate the risk based on likelihood of occurrence and severity of impact. The steps to profile supply risk are outlined below [8]:

i) Prepare a process map of the overall supply chain and sub processes with the help of key stakeholders, critical supply chain system, process and production activities;
ii) Determine likelihood of unwanted variation (risk events);
iii) Identify which sources of variation represents higher severity;
iv) Determine risk product profile.

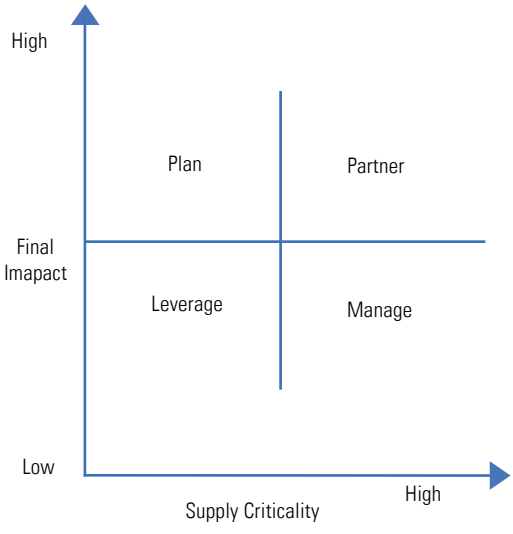


***Figure 2:** Risk-Response Matrix*

***Source:** Infosys Experience*

| RP | Risk | Action | Control |
|---|---|---|---|
| 20 | R1 – Sole source vendor in tornado alley | A1 – Determine vendor recoverability<br>A2 – Find second source | C1 – Independent validation of recovery capability. Reevaluate |
| 16 | R2 – Non-ISO certified vendors | A1 – Re-negotiate contracts requiring ISO certification | C1 – Require proof of certification by 3rd party bi-annually |
| 15 | R3 – Pending legislation adds 2 days on-dock time for key components | A1 – Require vendor/ shipper to meet earlier shipping schedule | C1 – Monitor delivery times and on-dock wait |
| 12 | R4 – Critical component lost shipments | A1 – Increase insurance to offset lost revenue<br>A2 – Work with vendor/shipper processes to improve tracking | C1 – Monitor insurance payout vs lost revenue<br>C2 – Implement vendor controls to monitor processes and data |

***Figure 3**: Prioritize Risks - Identify Controls* ***Source:** www.QualityPlusEngineering.com*

Manufacturers need to repeat the entire profiling process regularly in order to have a realistic picture of risks in the supplier base. Figure 1 shows a sample profiling of risks based on likelihood of occurrence and severity of impact.

**Prioritize and Plan**

Based on the risk profiles that have been generated, risk managers can assess, prioritize and plan the risk response and update them to the corporate risk database.

Developing a risk response plan can be challenging and the approach would vary from supplier to supplier based on criticality of the supply and the financial impact as shown in Figure 2. A part with high supply criticality in this case is defined as one which has high switching costs and/or does not have many alternative sources of supply.

Risks for suppliers falling under low material criticality and low financial impact can be countered by leveraging the organization pull for better contracts and by demanding a higher level of risk insurance from the supplier. For example, if the supply is an MRO component such as a standard fastener, the onus of managing the supply and inventory can be passed on to the supplier.

Risks on low criticality parts with higher financial impact can be countered through traditional planning and forecasting cycles. An example of this would be AC motors used in various consumer goods where there are numerous sources of supply but costs are not necessarily low.

For more critical parts with low financial impact, risks can be countered by managing inventory effectively. Creating extra buffer inventory for these parts can typically insure against any disruptions. Custom molded rubber parts used in specialized packaging systems, for instance, may not be expensive on a unit cost basis but it may be difficult to retool an alternative supplier under short notice. This would make it critical from a supply perspective.

Critical parts with high financial impact require the closest amount of planning and monitoring. Establishing strategic supplier partnerships to collaboratively manage risks is the most effective approach in such situations. This scenario would apply, for example, in the case of industrial electronic manufacturers who buy specialized processors which are both expensive and have a very limited source of alternative supply.

Figure 3 shows sample risks along with a number representing the risk product (RP), potential actions and controls. Action denotes the steps recommended by the risk experts to respond to the risk and control denotes the checks and balances placed in the supply chain to ensure the effectiveness of the risk response plan.

**Implement and Monitor**

The success of the risk management program lies in the effectiveness of execution. Tools and techniques that can be utilized to aid in implementation and monitoring are key to effective execution.

Given a specific approach, a number of tools and techniques can be utilized depending on the specific situation. Many of the available tools are fairly intuitive and are used in some form or the other by most organizations. Tools by themselves are just enablers, and need to be applied appropriately in the context of the specific risk control plan, in order to maximize their effectiveness. Following are some best-in-class implementation tools and practices:

**Risk management data base -**This is a collation of statistics and data from each project to be stored in an organizational risk database. Value-added information such as choices or options that were available and decisions taken that were taken to mitigate the risk and their success could be documented. This historic information is made available for future projects to help make right decisions at the right time.

**Global supplier directory:** This is a large compendium or reference document of latest information spanning suppliers of components, features, costs, performance and contact information across different geographies. This is useful in supplier selection and audit phases.

**Designing redundant systems:** While creating the supply chain master plan, designing redundant systems will allow flexibility of operations by allowing for alternate supply sources [9]. Making systems lean is a risk due to the fact that a local disruption or event can cause the entire supply chain to be at risk. In case of labor strike, acts of God or political unrest this redundancy helps in re-configuring the supply chain in response by taking an alternate supplier. This approach would be recommended in case of highly critical components where the impact of any supply failure would be catastrophic.

**Susceptibility of network calculator** is a tool to determine the impact of a natural or man-made disaster on the individual locations of a supply chain and also the combination of them. This helps in gauging extent of damage to take risk

**Supplier Score Card**

| | |
|---|---|
| 5 | Excellent |
| 4 | Above Average |
| 3 | Average |
| 2 | Below Average |
| 1 | Poor |

| Categories | Rating | Comment |
|---|---|---|
| Business competency | | |
| Technical competency | | |
| Competitive Price | | |
| Competitive Service | | |
| Schedule | | |
| Quality | | |
| Scope | | |
| Cost | | |
| Communications | | |
| Issue/Risk | | |
| Collaboration | | |
| Disaster recovery & BCP | | |
| Overall | | |

***Exhibit 2**: Supplier Scorecard* ***Source:** Infosys Research*

avoidance or transfer options or steps to limit the risk exposure. For e.g., to open a plant in an earth-quake prone area, one may need to know the amount of insurance cover to be taken or the size of the plant to be built given the likelihood of the inherent risk. It will also aid in planning the contingency fund that the management can budget for, in case of an emergency occurrence.

**Supplier quality audits** are performed by the procurement managers to see if quality and performance requirements will be met. During the planning phase, the schedule for audit, purpose of audit, persons to be audited, samples to be inspected could be decided. The timing of the audit should be such that there is a possibility of corrective and preventive action being taken if audits bring out high risks.

**Pareto analysis to weed out ineffective global players.** 80 % of problems may be caused by 20 % of suppliers. The analysis would help in isolating these trouble points, providing opportunities to improve by giving time. If these suppliers do not perform to the expected level then they can be removed from the list of suppliers. In cases where 80% of high quality products come from 20% suppliers, rewards to such suppliers could help keeping their motivation levels high.

**Supplier scorecard** is a tool to rate performance of suppliers. Additionally supply chain would be at risk if a supplier goes bankrupt or has cash flow problems. So, it would help to monitor the financial health of the supplier since this could result in potential supply risk. The parameters that indicate the quality of service and products could be measured as in the sample indicated in Exhibit B and corrective action can be taken as needed.

Once the audit results are published, certain corrective action needs to be taken. Based on the risks that occurred and the supplier's performance, manufacturers could re-negotiate contracts to include clauses to ensure business continuity planning and penalties for non-conformance or poor performance.

Software tools – Use of Information Technology in GSC risk management is three tiered:

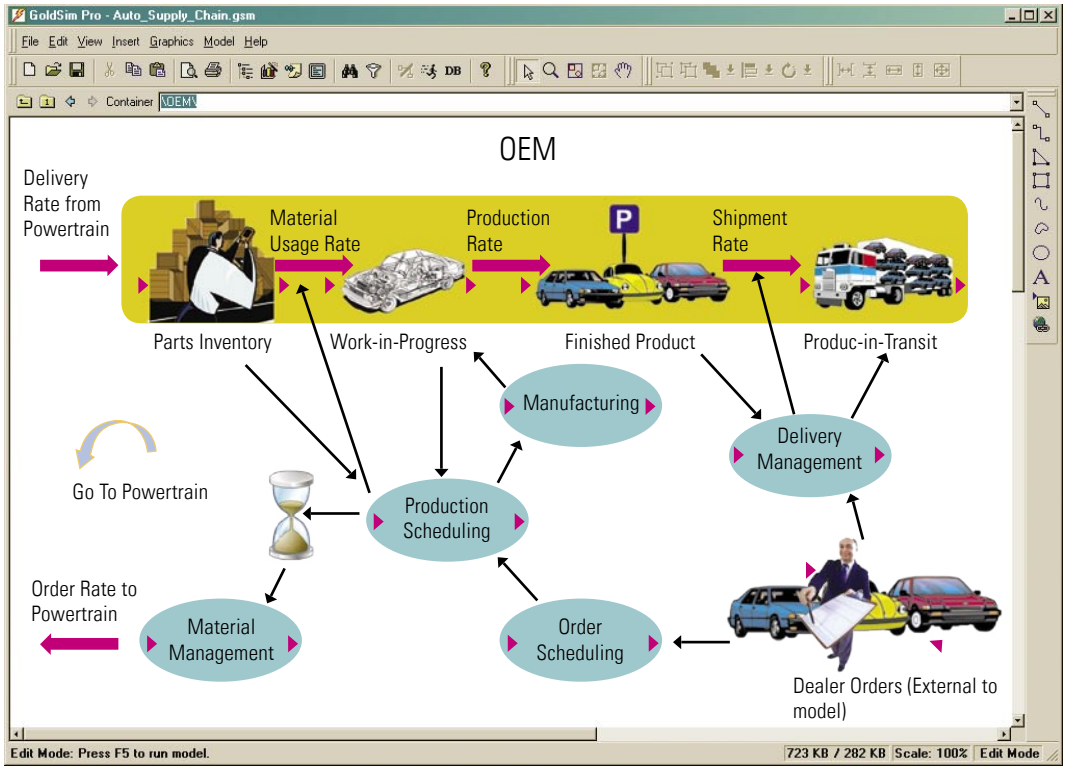


***Figure 4**: Screen Shot from GoldSim Supply Chain Model.* ***Source:** www.goldsim.com*

**Tier 1 - Tools for operational efficiency:** These are tools that deal with flow of data and information at the operational level. Examples are tools to handle inventory management, network design, product life cycle management, demand visibility, supply visibility, demand planning, sales and operations planning.

**Tier 2 - Analytic tools:** These are decision support tools used for proactive analysis conducted by analyzing and mining information obtained from operational level.

**Tier 3 - Strategic tools:** Modeling and simulation packages would be the prime tools in this category. Dynamic simulation softwares help diagnose problems, evaluate options, optimize operations, and mitigate risk factors. The objective is to interpret the influencers and interrelationships of the system with respect to time and use it to predict the future behavior of the system or determine what factors to vary to achieve a desired result state. One such example is the GoldSim simulation software package that uses time-dependent simulation to predict the full range of possible futures, analyze results and communicate the findings to stakeholders and decision-makers [10]. The screen [Fig. 4] depicts the conceptual model for an OEM. Quantities that are tracked within the model include: parts inventories, backlog,

work-in-progress, finished product, and product-in-transit.

The other emerging trend in this category is predictive analytics – Open Ratings (a Dun & Bradstreet Subsidiary) mines supplier data from a variety of sources and runs statistical analysis which can predict the risk of supplier failure. It looks beyond financials into factors such as on time delivery and product quality to predict the suppliers most likely to have problems [11].

**Innovate and Improve**

The above tools and techniques if implemented effectively and in a structured manner should be fairly effective in insuring against supply risks. The next stage in the evolution of supply risk management goes beyond the first tier to subsequent tiers in the supply chain and involves an increased level of collaboration with suppliers. The key to innovation and improvement lies in knowledge and experience sharing with specific suppliers and about those suppliers' suppliers.

**Information tracking and collaboration portals** move beyond immediate suppliers to the next tiers down the chain. Information workflow and shared knowledge portals help in reducing uncertainty. Manufacturers could get visibility into status of parts and material shipments and also view legal documentation related to the supply from the portal. Notification of service interruptions can be posted to help indirect suppliers and customers be aware of the event and also understand the business impact on them. Supply chain managers from leading electronics companies confirm that globalization is affecting everyone in the electronics industry and that collaboration across organizational silos and supply chain partners is critical to a successful product introduction and management.

**Forecasting of aggregates -** Another risk reduction example in the supply chain planning cycle is the use of aggregates or sub-assemblies instead of raw materials to reduce forecasting risk. The principle behind this is forecasting of aggregates is more reliable than forecasting single products.

**Supplier self-assessment -** A third example of collaborative risk reduction is the process of self assessment by suppliers on their internal constraints. Suppliers can complete this and share the information with their immediate next set of suppliers and customers. This ensures a minimal level of awareness of performance risks within segments of the supply chain. If there are no plans for contingencies, then manufacturers need to work with the suppliers to come with a business continuity plan.

**Use of SCOR -** Supply Chain Operations Reference Model as a process reference model is a standard and effective way of sharing supply chain information among partners [12]. SCOR is an industry standard for management focus across inter-company supply chains. SCOR is used to describe measure and evaluate GSC configurations.

**Describe –** Standard SCOR process definitions allow virtually any supply-chain to be configured.

**Measure –** Standard SCOR metrics enable measurement and benchmarking of supply-chain performance.

**Evaluate –** Supply-chain configurations may be evaluated to support continuous improvement and strategic planning.

**Risk appetite baseline –** Senior management of manufacturers need to document their appetite for risk and risk tolerance limits. This would outline guidance for downstream operational managers to take decisions and also bear in mind the revenue that the management is willing to risk. This is particularly useful in deciding on introduction of new suppliers, products and services and also in sourcing from new geographic locations.

**Disruption drill** is the mock disruption of supply in the supply chain to test the redundancy of network, process capability and supplier capability. A supply interruption of a critical component is mimicked to appraise the supply chain and also gauge the time taken to recover from a disaster as well as the cost taken to ensure business continuity. The disaster recovery and business continuity plans may be revised based on the outcome of the simulation. The learning from the exercise could be shared through the collaboration portals.

Innovation lies in the understanding that the success of the manufacturer lies in the success of the suppliers. Supplier base could be reviewed to decide on sole-sourcing versus multi-vendor sourcing strategy. For example, if a local supplier's performance is better, but costs more than a global supplier's, the supply chain strategy could be to avoid global outsourcing of critical components and source them locally to mitigate risk. The framework provides an innovative paradigm shift from cost reduction to supply chain continuity.

## COMPONENTS OF THE GLOBAL SUPPLY RISK MANAGEMENT MODEL

Just like in any enterprise initiative, people, process and technology components of risk management need to be clearly identified and considered prior to embarking on a supply risk management program [13]. Figure 5 below depicts the components of the Global Supply Risk Management model.

**People -** At each node or entity of the supply chain there are set of key stakeholders including operational managers, third party logistics providers, purchasing analysts and risk experts. The roles and responsibilities of each of these stakeholders within the risk management program need to be clearly defined. For example, does purchasing own the supplier risk profiling or is it the operational managers? What is the role of business continuity managers in ongoing risk management? All these need to be clearly mapped out upfront to prevent confusion.

**Process –** The success of a program lies in the effectiveness of execution – process standardization is critical especially in large, global enterprises. Ideally, supply risk management processes are streamlined across the entire global supply chain but are agile enough to adapt to specific supply situations

**Tools and technology –** Tools and technology act as enablers of any people and process based initiative. Many of these have been discussed under the 'Implement & Monitor' section earlier.

**Governance** is achieved through a central body that stresses compliance to a set of performance and quality standards. Metrics for monitoring supply risk are often very similar to regular operational metrics (price, quality, delivery). However, the metrics for measuring the effectiveness of a risk management program would be unique. Some metrics include:

- Ratio of actual financial impact to potential impact of disruption

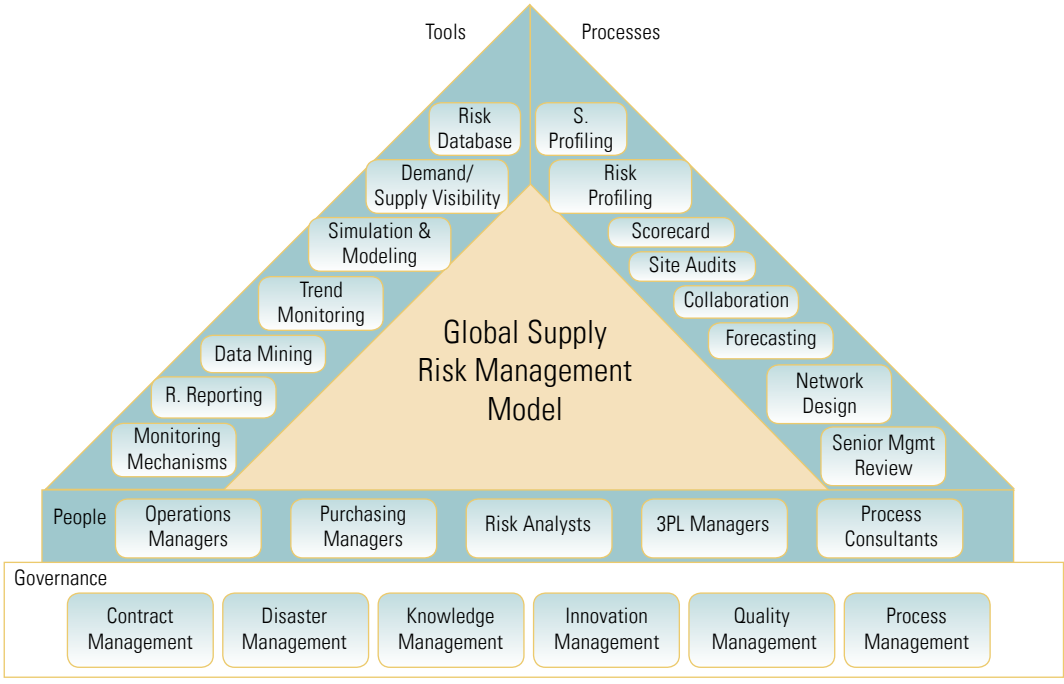


***Figure 5**: Components of the Global Supply Risk Management Model* ***Source:** Infosys Research*

- Ratio of risk redundancy cost to potential impact of disruption
- Lead time to contain disruption.

## PRE-REQUISITES FOR AN EFFECTIVE IMPLEMENTATION

Changes to organization or operations are difficult to implement as they require a change in the mind-set of the persons affected. The framework provided here attempts to change several aspects not only in a single organization but spanning across organizations. For a change of this magnitude to be accepted and embraced by all, it is essential to identify certain key factors. The critical success factors for the model are:

- Continuous and concerted effort in identifying and managing risks and ensuring business continuity
- Constantly measure and strive to attempt the right balance between operational efficiency and risk
- Senior management commitment to risk management
- Customize and SCRM strategy specific to your organization - change it based on the business environment
- Analyzing and learning from supply disruptions to increase supply chain continuity
- High level of trust and confidence in sharing information and co-operation between business entities. This can be very difficult to achieve if the customer supplier relationship is competitive and based on price alone. But once they see their relationship as a long term win-win partnership possibilities for collaboration automatically open up.

## CONCLUSION

Business disruptions in global and complex supply chains have tested the manufacturer's resilience due to global sourcing and lean manufacturing. Manufacturers can benefit from increased transparency and communication, business continuity, performance-based contracts and reduced risk exposure by adopting this model. Manufacturers need to encompass first-tier, second-tier suppliers and understand source-to-destination issues in global supply chains. There is a need to closely work with suppliers and vendors and develop business continuity plans. The risk management model is a reference for transforming the supply risk management process from a reactive exercise to a proactive practice. A robust, systematic and multi enterprise-wide approach to risk management is essential to meet business objectives in a flat world. Early and continuous focus on risk management will be critical for operational success and predictable continuity of a supply chain. Collaboration and increasing information transparency reflect the collective resolution of the supply chain industry to resolve its problems. The GSC Risk Management model offers a pro-active and pragmatic approach to mitigate risks in Global Supply Chains.

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