

# Managing Manufacturing & Supply Chain Risks in Global Automotive Operations

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Roundtable

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# Quick Facts About General Motors Corp.

Mfg Operations in 32 countries  
 Vehicle sales in 200 countries  
 Sold almost 9 million vehicles in 2004

GMAC (financing operations, mortgage, insurance, etc.) reported 10th consecutive year of annual earnings growth, posting a record profit of \$2.9 billion.

\$193 Billion in Revenue for 2004  
 Earnings of \$3.6 Billion for 2004



# Vehicles Then...



# Vehicles Now!!!



# Outline of Presentation

- New Perspectives on Manufacturing & Supply Chain Risks
- Why Should CEOs & CFOs Care About Operational Risks?
- Getting Started With Identifying & Assessing Operational Risks
- Value Proposition for Better Operational Risk Management
- Key Takeaways

# More Corporate Sensitivity to Operational Risks

(supply chain problems, loss of key facilities, business interruptions)

Sept 2001  
Terrorist Attacks

A photograph of the World Trade Center towers in New York City, with a small airplane flying in the sky to the left.

West Coast Ports  
Lockout

An aerial view of a busy port area with numerous shipping containers stacked in rows and several large cargo ships docked at the piers.

Oklahoma City  
Tornados

A photograph showing the aftermath of a tornado in Oklahoma City, with debris scattered on a street and a large building in the background.

Conflict in Iraq

A photograph of a military helicopter in flight over a desert landscape, with another helicopter visible in the background.

SARS outbreak in Asia

A photograph of a crowd of people in Asia, many wearing face masks, gathered in front of a portrait of a man.

## Two Observations:

1. Global Risk Events Overlap and Impacts Compound
2. Dealing with Risks is the Normal Operating State

# Why CEOs and CFOs Should Also Pay Attention To Operational Risks

## *Shareholder Value Impact Is About the Same Magnitude & Duration for Mfg. & Supply Chain Risk Events and Traditional Crises*

- Cost of supply chain “glitches” – average of 10.28% decrease in shareholder value at time of announcement, with share price recovery (if firm does recover...) in roughly 60 trading days.<sup>1</sup>
- Cost of crises – sharp initial decrease of almost 8%, with full share price recovery (if firm does recover...) in roughly 50 trading days.<sup>2</sup>
- 69% of CFOs, Treasurers & Risk Managers at Global 1000 companies in North America & Europe view fires/explosions and supply chain disruptions as leading threats to top revenue sources.<sup>3</sup>

<sup>1</sup> Hendricks & Singhal, “The effect of supply chain glitches on shareholder wealth,” Journal of Ops Mgmt., Vol 21, 2003, pp. 501-22.

<sup>2</sup> Knight & Pretty, “The impact of catastrophes on shareholder value,” The Oxford Executive Research Briefings, 22 pages.

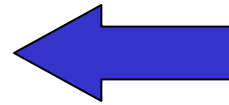
<sup>3</sup> Green, “Loss/Risk Management Notes: Survey: Executives Rank Fire, Disruptions Top Threats,” Best's Review, Sept. 1, 2004

# Why There Are More Supply Chain Risks & Larger Impacts From Operations Disruptions

## Changing nature of supply chain operations

- Lean / Just-In-Time operations
  - less inventory
  - less unutilized capacity
- Single sourcing
- Global sourcing
- More responsive to real-time customer demands

Traditional “buffers”  
against supply chain  
disruptions are no longer  
available!

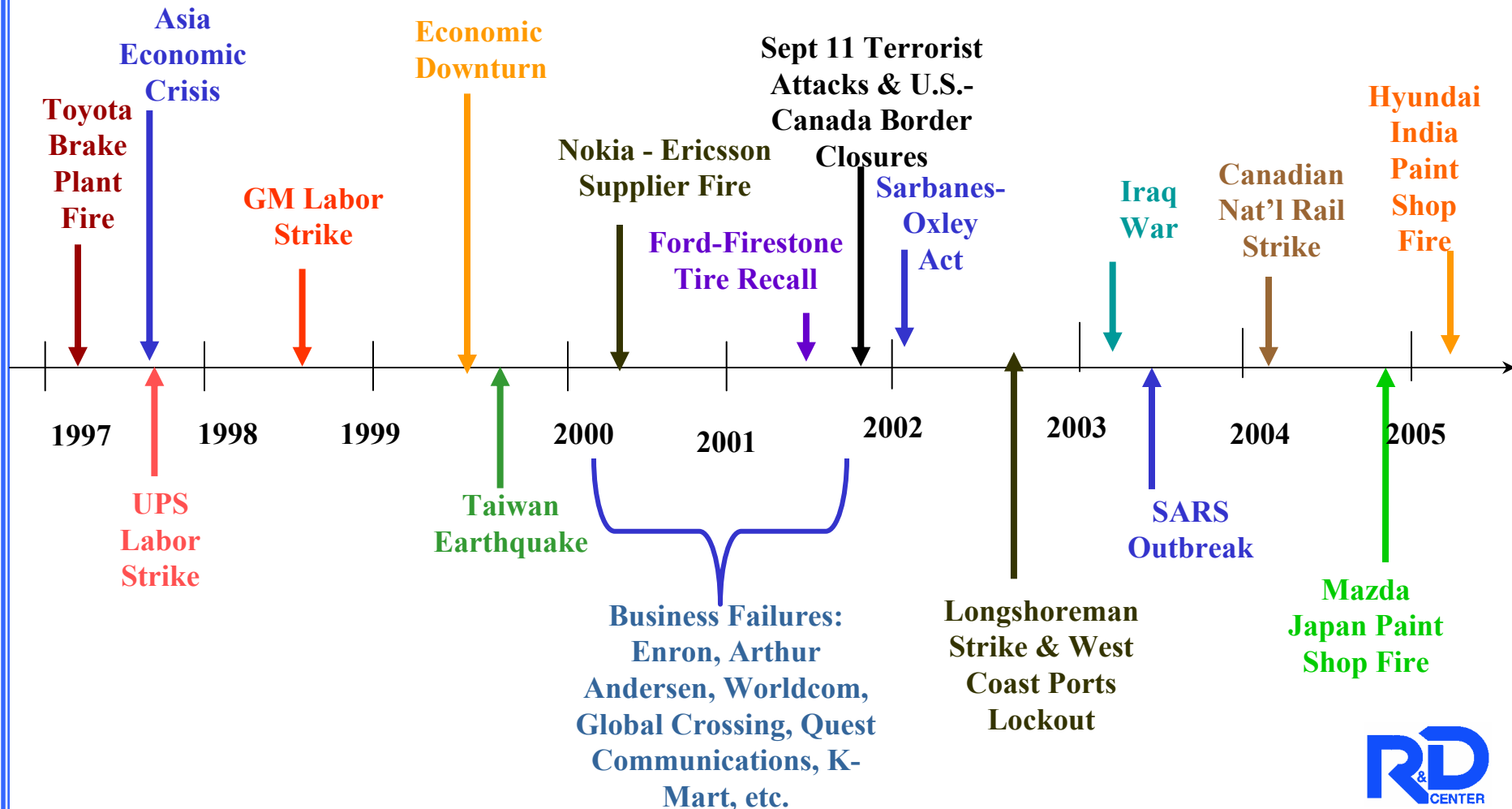


**Observation:** Significant cost savings and production efficiencies achieved, but supply chains are more vulnerable to disruptions.

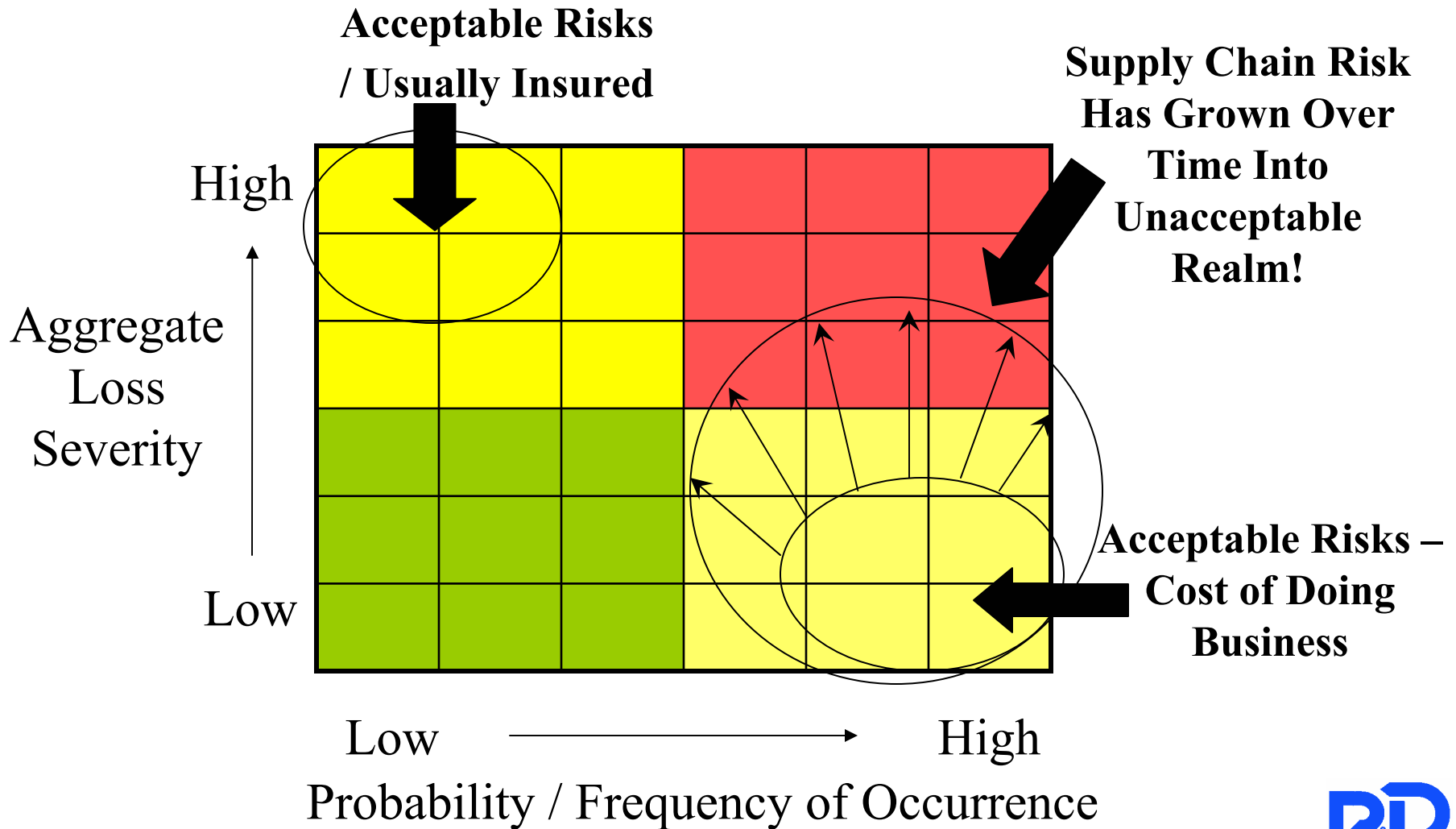


# Selection of External Risk Events Impacting Global Operations

*Regular Pattern of Severe Business Interruption Events*



# Risk Map: Acceptable & Unacceptable Risk Levels

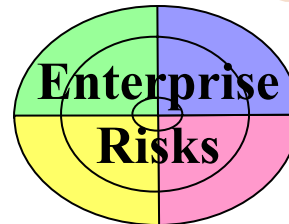


# Getting Started With Identifying and Assessing Mfg & Supply Chain Risks...

Step 1 – Form a Cross-Functional Team



Step 2 – Identify Portfolio of Risks



Step 3 – Filter, Assess and Prioritize Risks



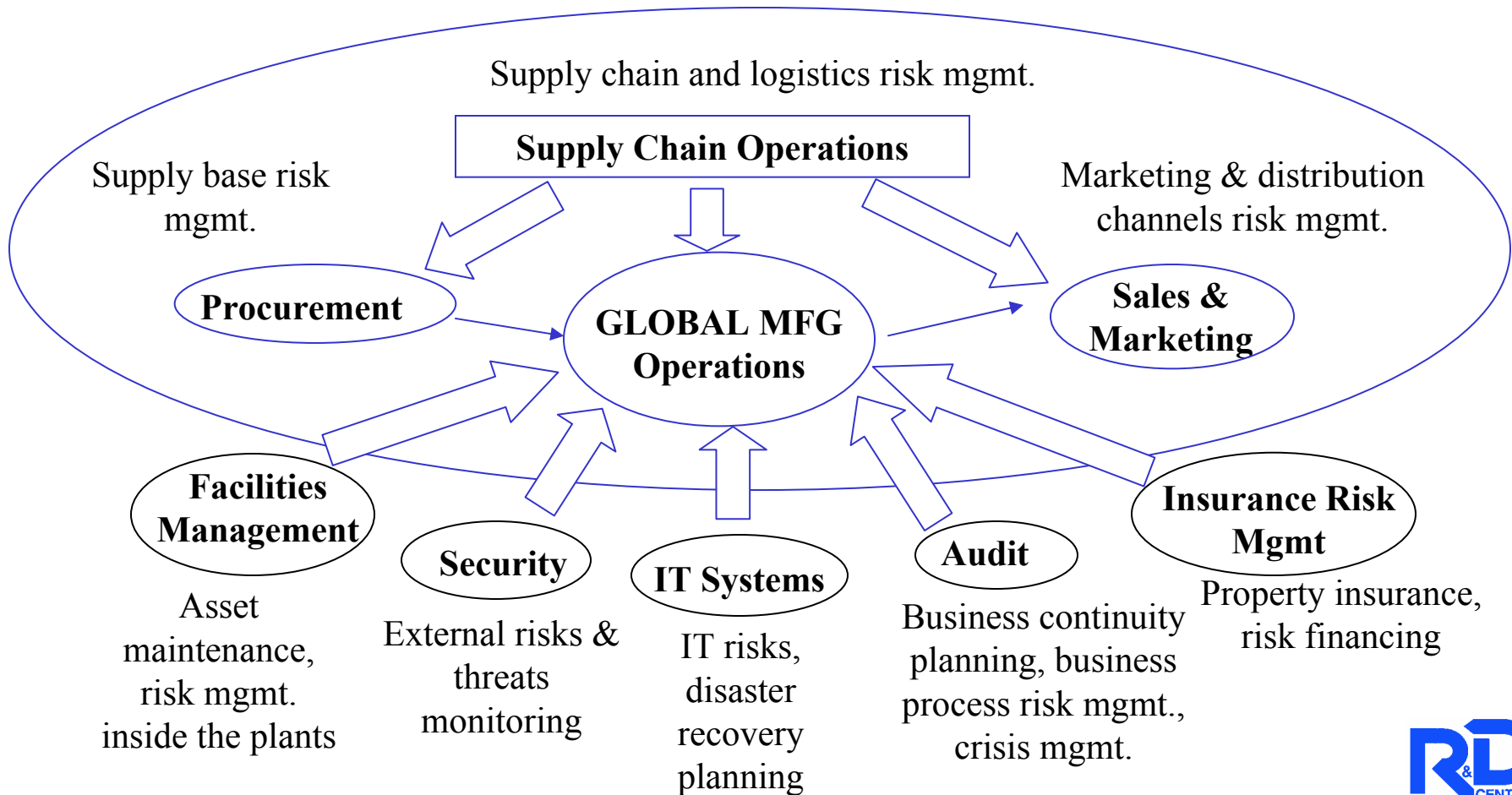
Step 4 – Develop Op Risk Analysis Models



Step 5 – Work on “Actionable” Risks and “Integrate Learnings” into Business Processes

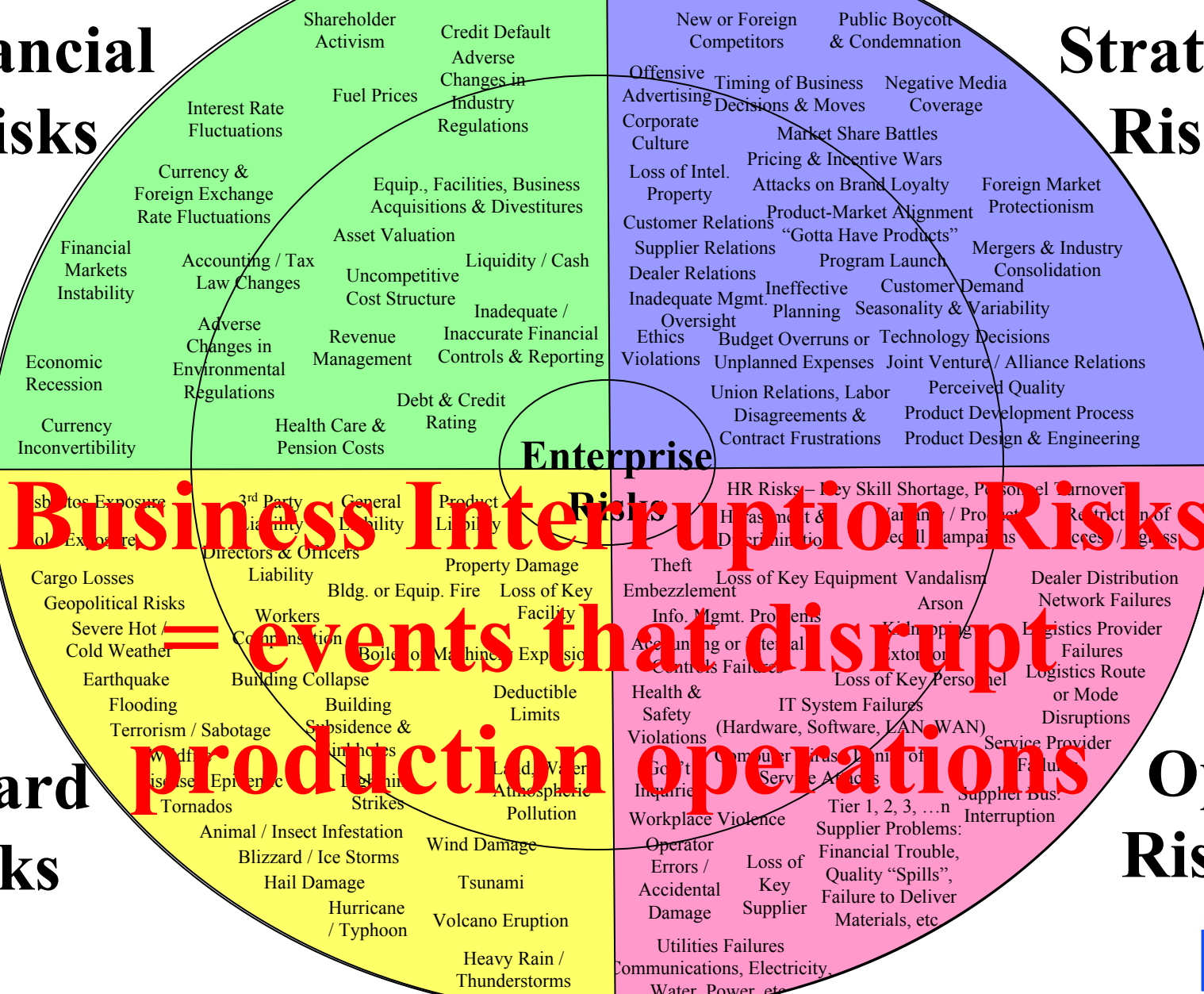
# Step 1: Form a Team To Identify Operational Risks in Key Business Processes

*Enable cross-functional collaboration to manage risks!*



## Financial Risks

## Strategic Risks



## Hazard Risks

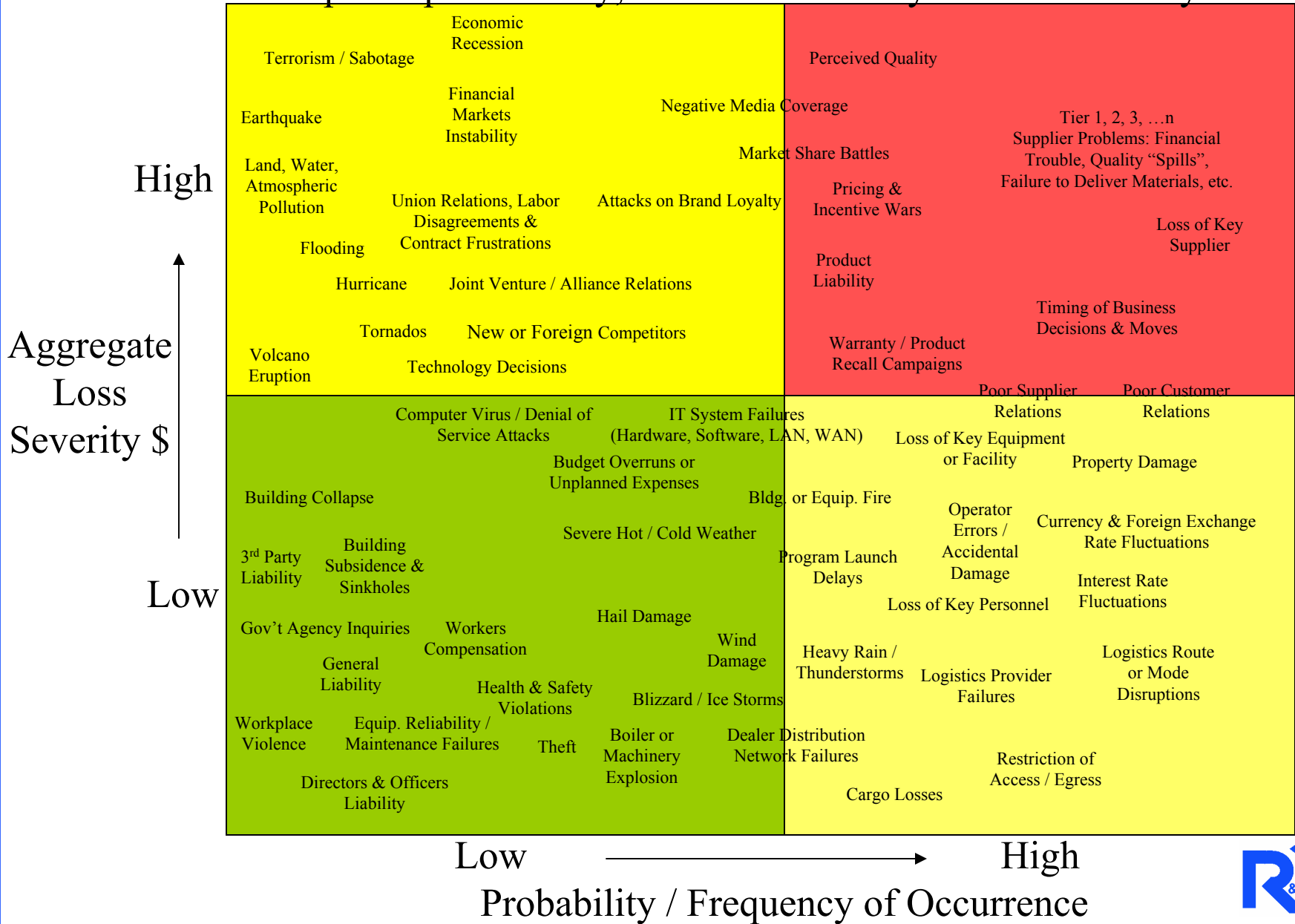
## Op. Risks

# Notes on Risk Portfolios

1. Portfolio documents and demonstrates that we've been as thorough as possible in identifying manufacturing and supply chain risks.
2. Categorizing risks helps with identifying risk owners and getting owners to take responsibility for risk management.
3. Portfolio is also a key "tool" for getting groups to talk openly about risks they can control, manage, or mitigate, and those risks that are outside their spheres of influence.

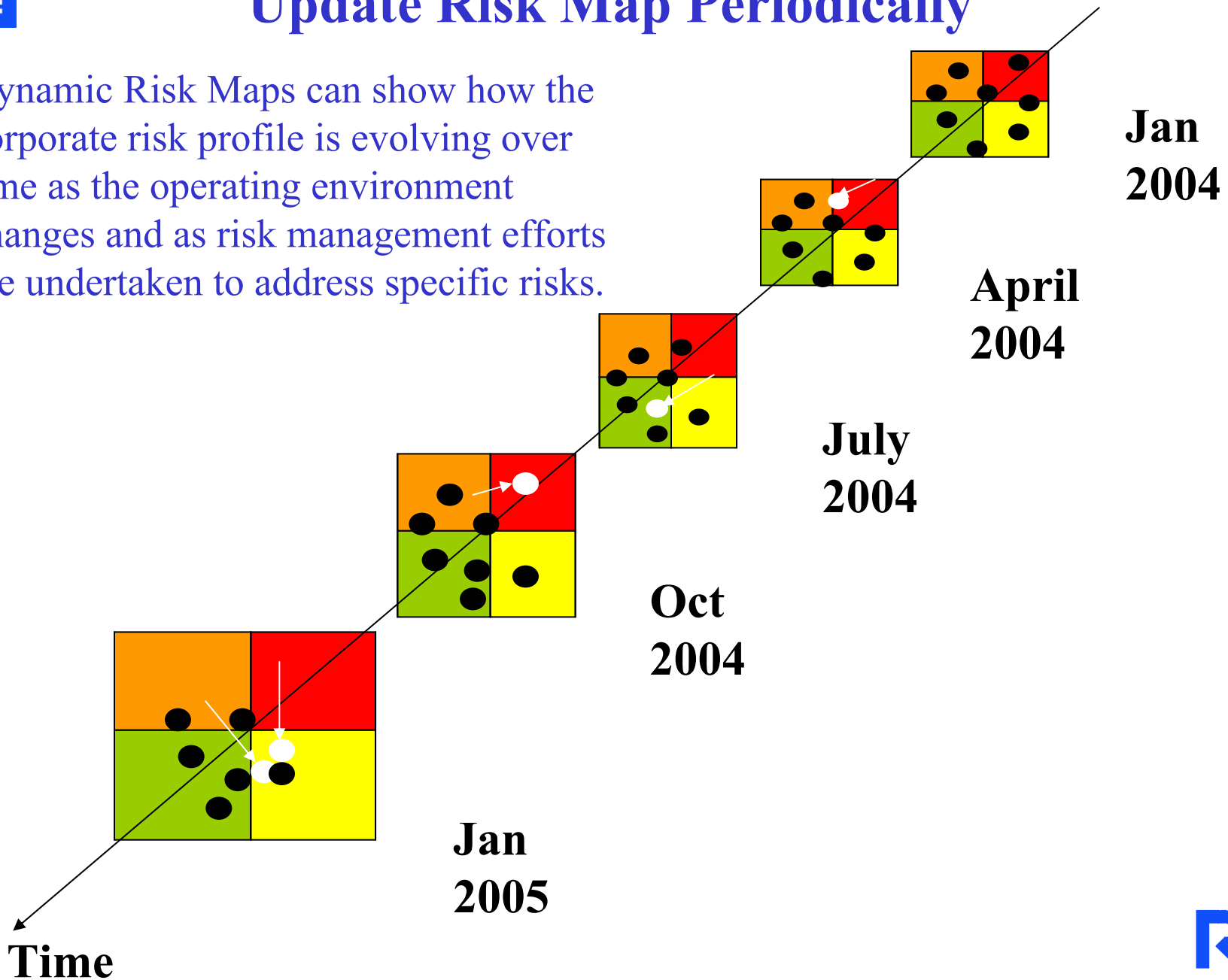
# Step 3: Draft a Subjective Risk Map

Expert Opinion Only, Not Based on Any Statistical Analysis



# Update Risk Map Periodically

Dynamic Risk Maps can show how the corporate risk profile is evolving over time as the operating environment changes and as risk management efforts are undertaken to address specific risks.





## Notes on Risk Maps

1. Developing such a map is a quick way to focus a team to critical risks in the “red zone.”
2. Using a risk map to generate a Top 10 List of Risks forces subject matter experts to make some risk comparisons and adjust/refine their assessments.
3. Any method of “Quick & Dirty Subjective Risk Assessment” (e.g., risk mapping or risk scoring) yields a priority ranking of risks, so resources (people, time, and money) can be allocated to manage risks most effectively.
4. Recognize that a risk map is a 1-time snapshot of risk event likelihood and severity, and require periodic updating.

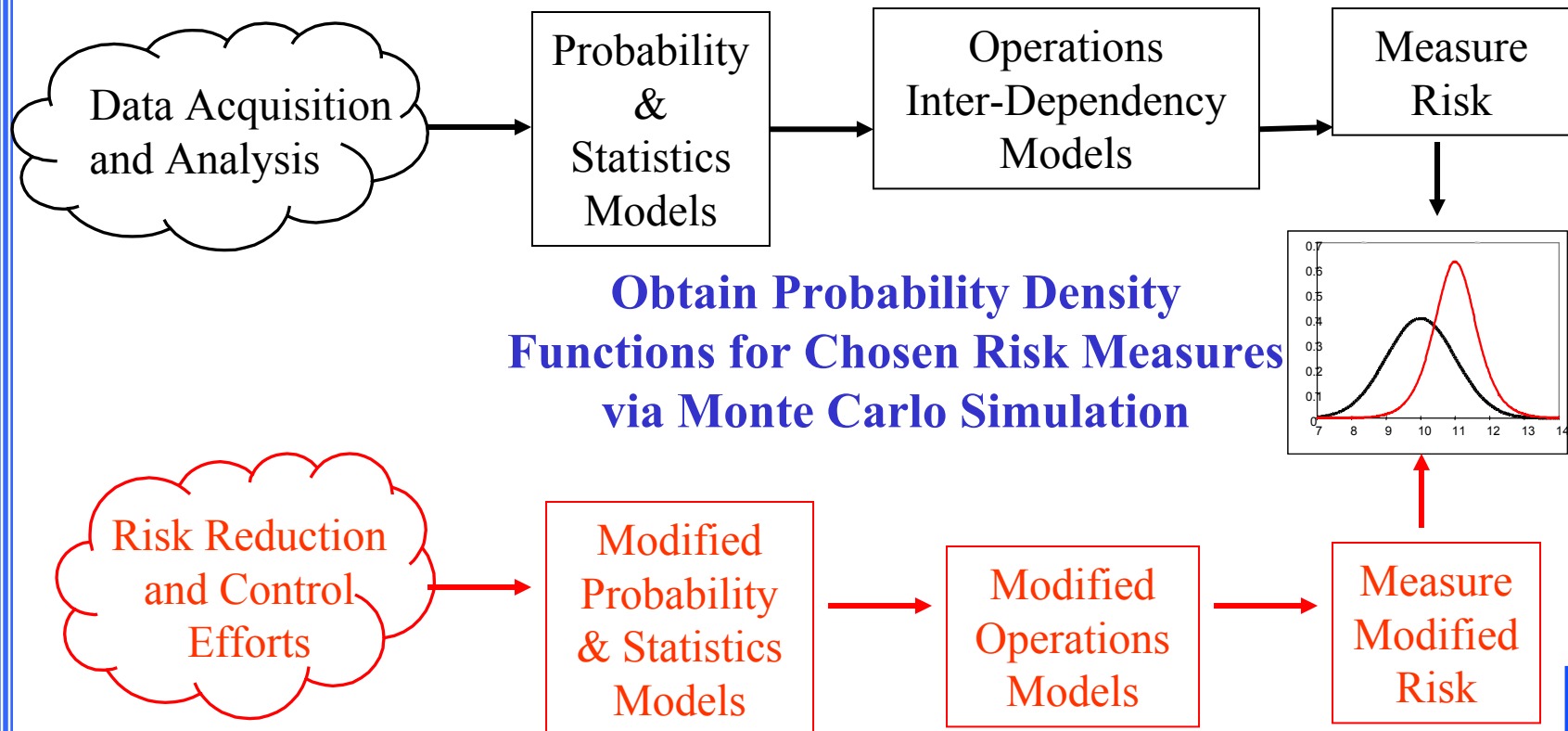
# Step 3: Develop Op Risk Analysis Models

Why? Op Risk ideal for Monte Carlo Simulation Analysis.

Treat risks as “shocks” that impact inter-dependent operations.

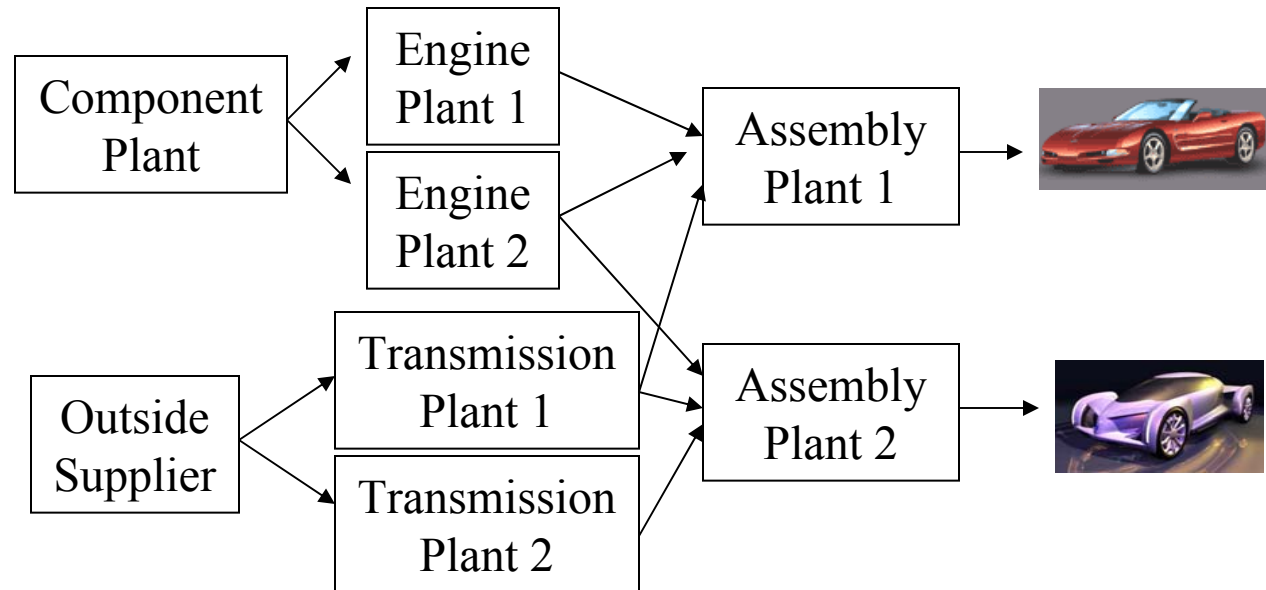
Perform Risk Cost-Benefit Analysis Using Models.

- Evaluate options that change frequency / severity of risk events.
- Evaluate options that change structure of operations.



# Model Business Operations Process Flows to Capture Key Inter-Dependencies

- Cash
- Information
- Knowledge
- Material
- Logistics
- Other



Map Key Processes & Interactions

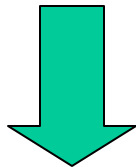
- Manufacturing Processes / Locations
- Supply Chain Material Flows

# Op Risk Model Application: Fire Risk

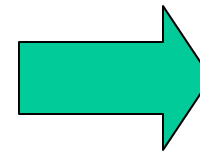
Probability  
Inputs

Include plant dependent statistics data

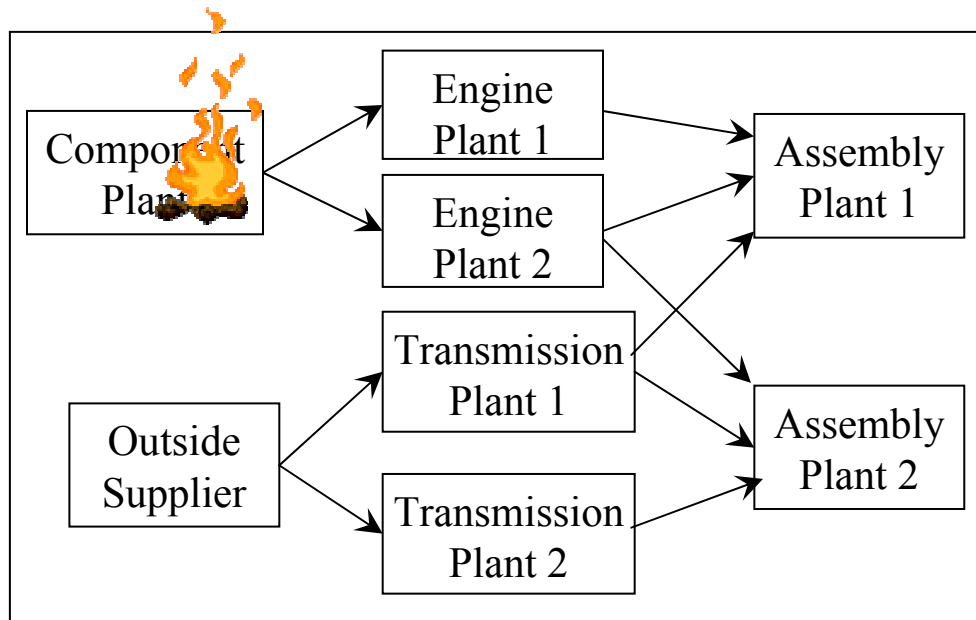
- (1) likelihood of fire event occurrence
- (2) property damage severity
- (3) production disruption duration



For each fire, evaluate direct and indirect impacts



Probability  
Model Outputs



Use Monte Carlo Analysis to simulate lots of fires “shocking” the mfg. network per 90-day quarter

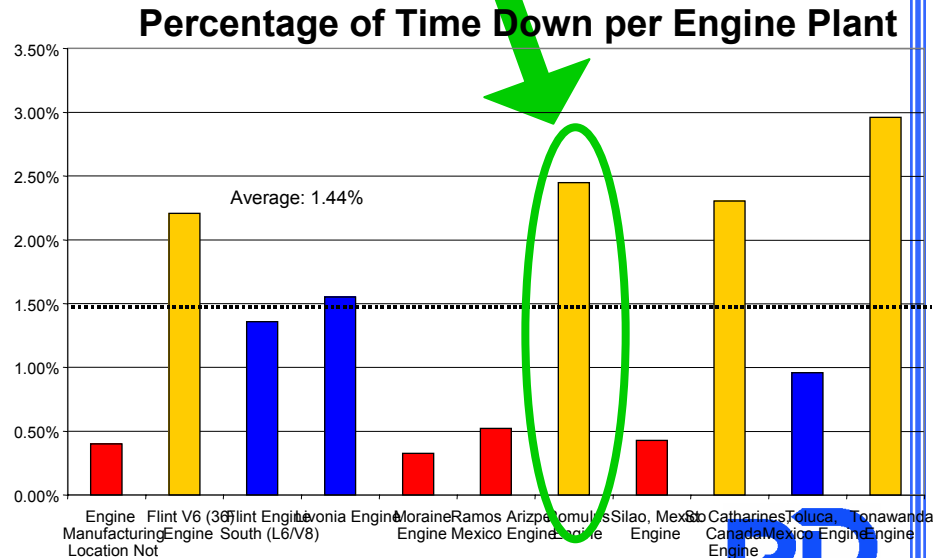
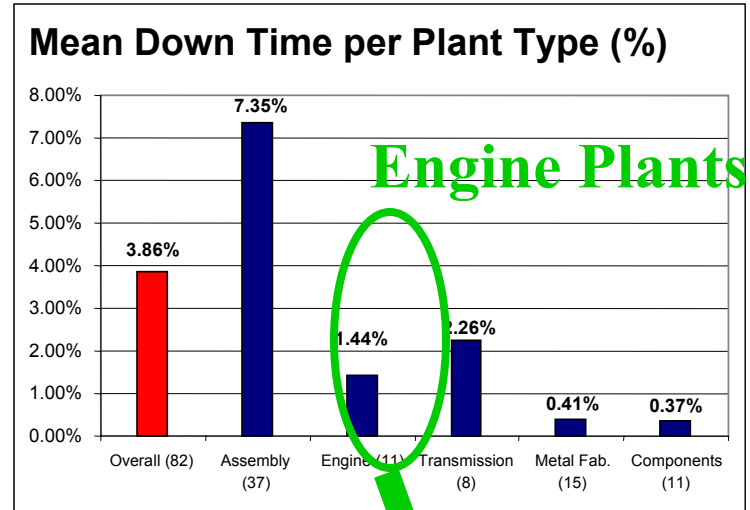
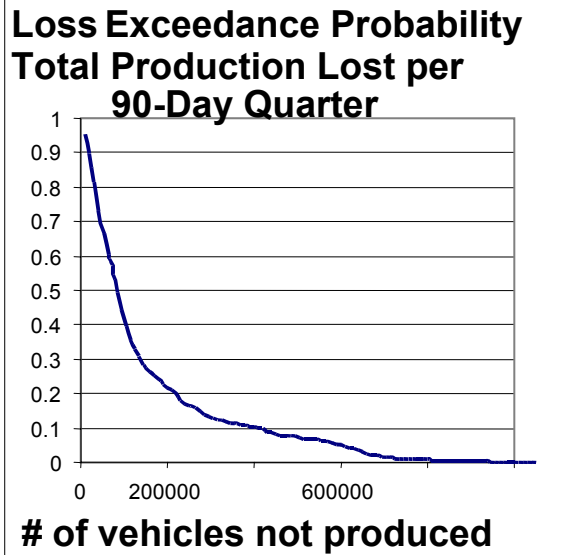
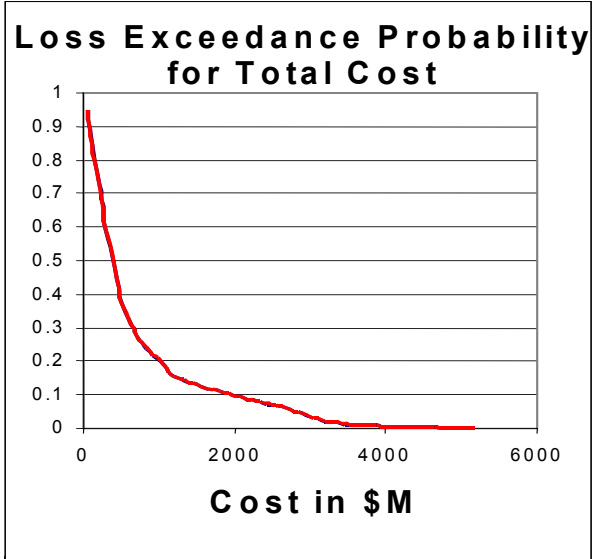
(1) \$ Total Cost Loss Exceedance Probability

(2) # Vehicles Loss Exceedance Probability

(3) Other statistical reports that help focus fire protection efforts

## Enterprise Level Aggregate Loss Probabilities

## Statistical Reports to Focus Fire Protection Efforts



**Romulus Engine – more fires than expected  
– update fire protection & loss control?**

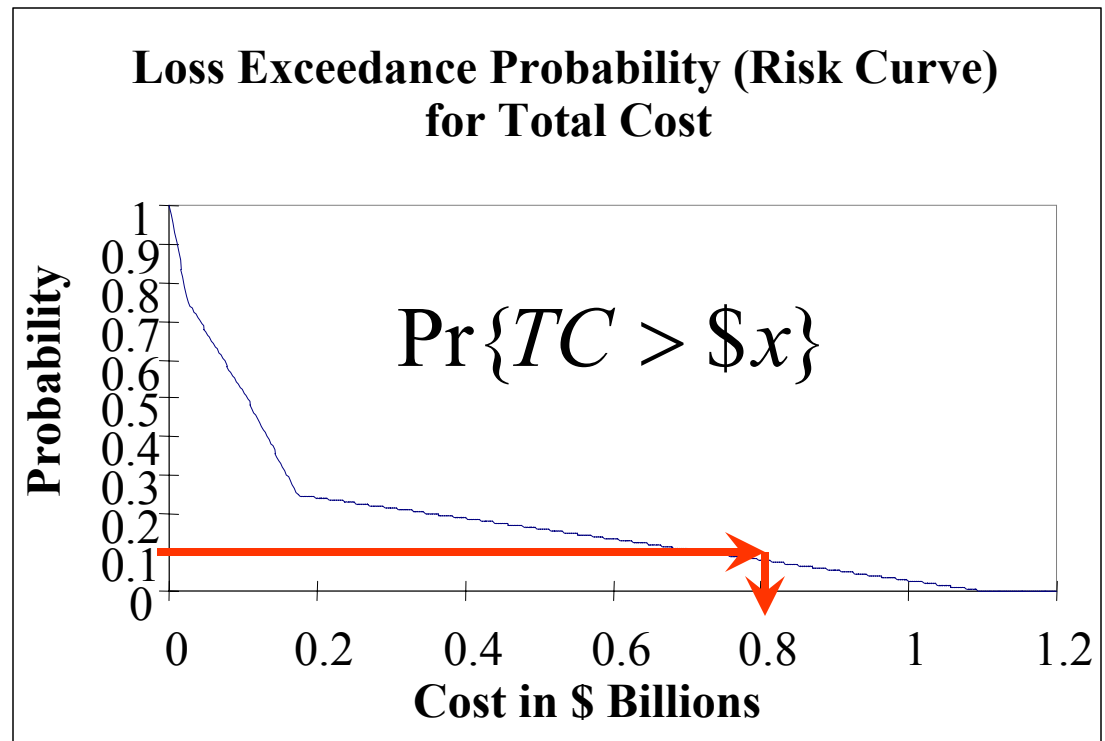


# Example Results: Total Cost of Risk

Risk Profile Can Guide / Support Risk Management Decisions.

Example: Can I tolerate a 10% chance that our total losses exceed \$800M per Qtr?

Statistics	Total Cost in \$M per Qtr
Mean	213.97
Std Dev	283.24
Min	0
25%	25.66
50%	105.65
75%	173.03
Max	1,103.06



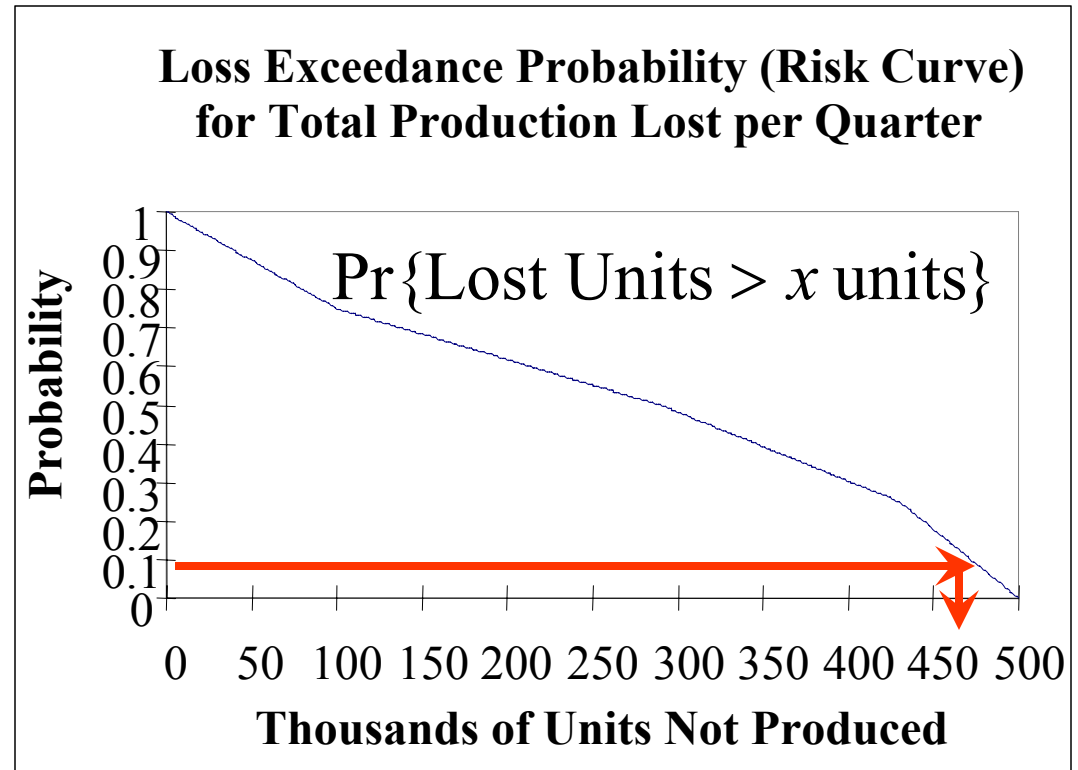
Numerical values are for illustration purposes only.

# Example Results: Lost Production Risk

## Alternate Risk Profile Characterization

Example: Can I tolerate a 10% chance that losses exceed 450,000 units per Qtr?

<i>Statistics</i>	<i>Lost Production Units per Qtr</i>
Mean	267,500
Std Dev	162,790
Min	0
25%	100,000
50%	290,000
75%	430,000
Max	500,000



Numerical values are for illustration purposes only.

# Op Risk Modeling Comments

1. Start with simple business process inter-dependency models and add details as necessary.
2. Start with basic probability models to gain confidence in output results.
3. Can implement models in MS Excel with Monte Carlo Simulation Add-Ins
  - Palisade Decision Tools @Risk
  - Decisioneering's CrystalBall
4. Simple modeling approach permits comparison of a wide variety of risks and risk management options in a common framework.



## Step 5: Integrate Learnings

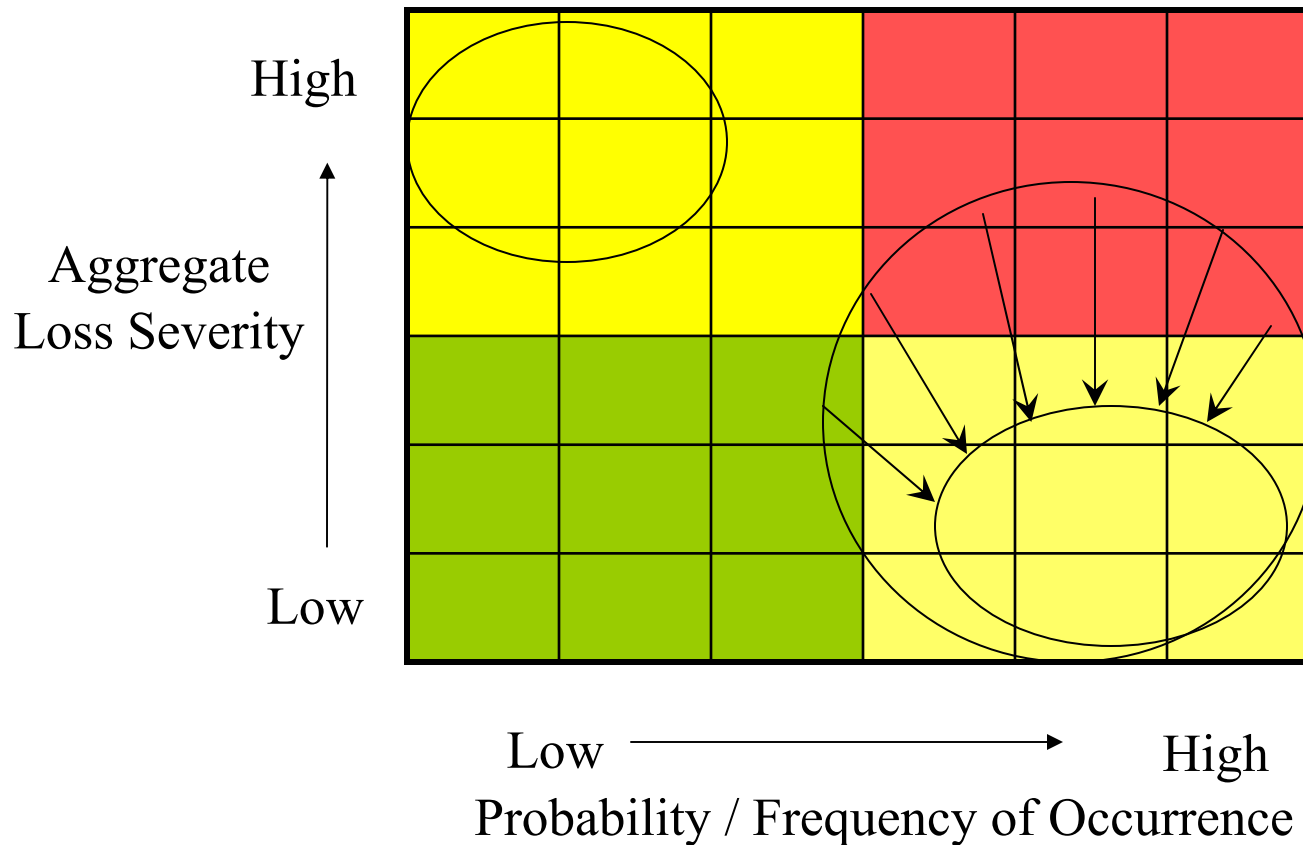
# Deploying Risk Mgmt. Across The Supply Chain

- Work on “actionable risks” – risks we can change.
- Build upon successes - business unit by business unit
- Get senior management attention and support
- Report back regularly to top executives
- Recognize organizational change management battle - moving from risk-averse reactive culture to risk-aware proactive culture

# Where Are The Savings To Be Gained?

1. Enhanced coordination of different business units managing risks.
2. Faster risk detection, assessment, mitigation, & business resumption.
3. Improved supply chain resiliency / robustness.

*Some reduction in insurance costs & improved coverage limits.*



*Reduce time and cost of responding to unplanned events.*

## Prediction on Future Industry Trends:

*“Industry moves past lean and Just-In-Time manufacturing to risk-informed operations management.”*

- Supply Chain Redesign to Achieve Resiliency & Robustness
- Product Design Issues – Modularity
- Dynamic Pricing and Revenue Management to Respond to Risks

Implementation Cost is Low – Use internal cross-functional team.

Value to Enterprise is High – Efforts can significantly reduce risk detection and mitigation response times. *And time is money...*

- Be thorough in identifying enterprise risks.
- Don't get lost in too much data collection to assess probability & severity of risks.
- Use simple op risk models to tell the story and provide quantitative metrics of risks
- Prioritize focus to the top risks identified.
- Empower business units to take ownership of managing risks.
- Integrate learnings into operational business units.

# Questions ?

