Risk Management

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CHAPTER NINE: Supply CHAIN RISK MANAGEMENT

Textbooks:

- *Introduction to Risk Management and Insurance, by M. Dorfman and D. Cather, 10th edition, Prentice Hall.*
- *Quantitative Analysis for Management, by B. Render, 14th edition.*
- *Lecturer Handouts, Book Chapters*

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Supply Chain Risk Management (SCRM)

Supply Chain Risk

Covid 19 Effects

- Considerable ‘chaos’ exists in our supply chains through the effects of Covid 19
  - Supply Chain Disruptions
  - Supply Chain uncertainty
    - Shortage of freight containers
    - Increased shipping cost
    - Longer lead times
  - De-globalization
    - Reshoring
    - Shorten of Value Chains
    - Localize production

Reshoring is the process of bringing back manufacturing and other operations to a company's original country from overseas locations. It typically involves relocating production that was previously outsourced to foreign countries back to the domestic market, often to reduce costs, improve quality control, or strengthen supply chain resilience.

Russia-Ukraine War

- Sanctions

Sanctions are penalties imposed by countries against others to influence behavior, often in the form of trade restrictions, financial barriers, or diplomatic measures. They aim to achieve political or economic objectives.

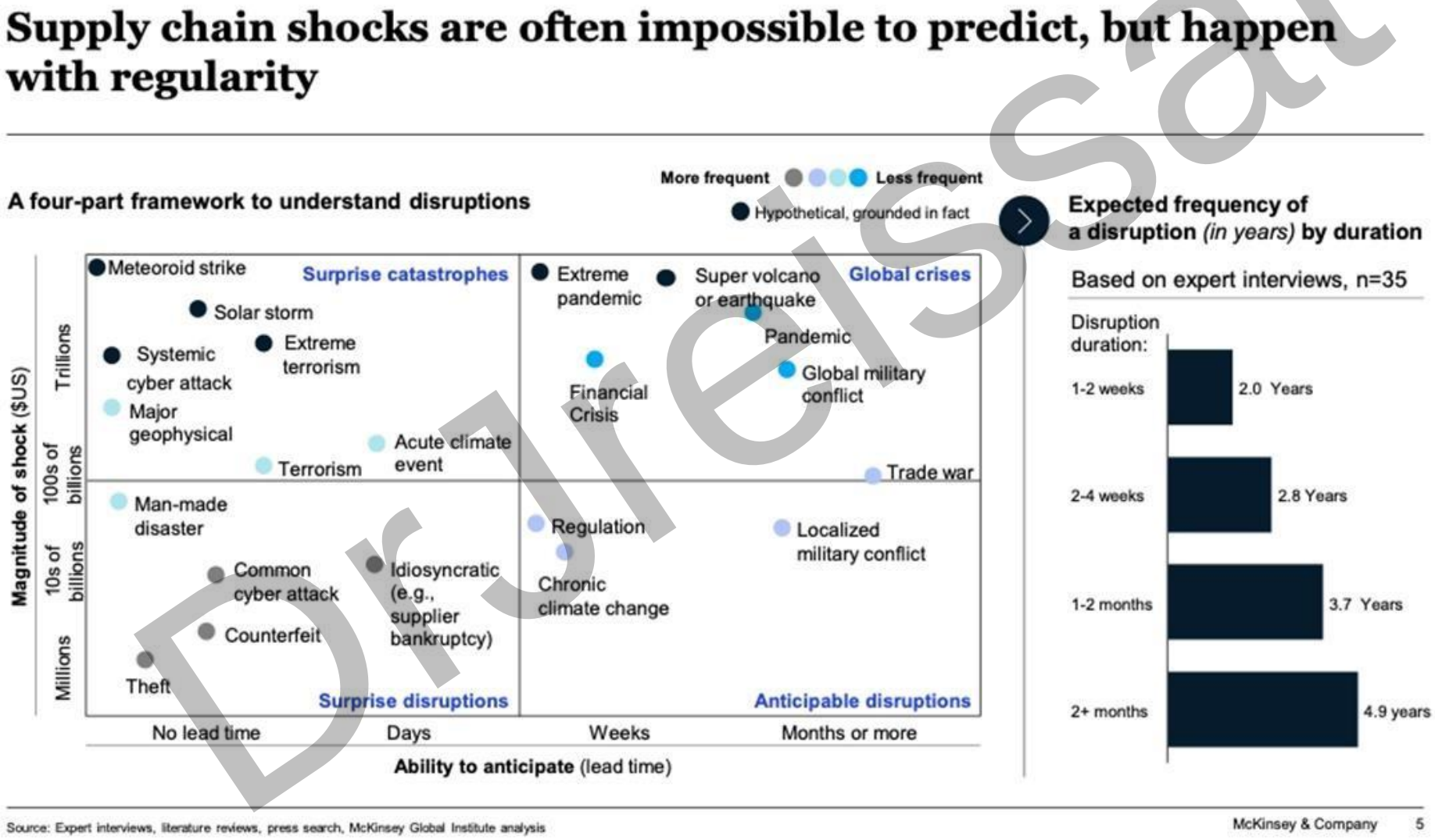
- Increase Oil prices-→ Gas→ Transportation Cost
- Food Shortages→ Inflation
- Rare Earth Material Shortages→ Chip Shortage

Supply chain shocks are unexpected events that disrupt the normal flow of goods and services in a supply chain, leading to delays, increased costs, or shortages.

Examples include:

Natural disasters: Earthquakes, hurricanes, or floods that damage infrastructure or factories.
Pandemics: Like COVID-19, which caused widespread disruptions due to lockdowns and restrictions.
Geopolitical events: Trade wars, sanctions, or political instability that affect international trade.
Cyberattacks: Attacks on critical systems that halt production or distribution.

Predicting Supply Chain Shocks



Supply Chain Vulnerability

- Exposure to serious disturbance

- From risks:
  - within the supply chain
  - as well as risks external to the supply chain (Cranfield School of Management 2002)

Supply chain vulnerability refers to the susceptibility of a supply chain to disruptions or risks that can adversely affect its operations. These vulnerabilities can arise from various factors, such as:

Natural Disasters: Events like earthquakes, floods, or hurricanes that disrupt production, transportation, or distribution.

Political Instability: Geopolitical tensions, trade wars, or sanctions that impact the flow of goods and materials.

Economic Fluctuations: Changes in market conditions, currency fluctuations, or economic downturns that affect supply chain costs and demand.

Operational Risks: Issues like equipment failures, labor strikes, or supplier bankruptcy that can interrupt production or supply.

Cybersecurity Threats: Cyberattacks on supply chain systems that can compromise data, disrupt operations, or lead to financial losses.

Dependence on Single Suppliers: Over-reliance on a single supplier or geographic region, which increases the risk of disruption if that supplier faces difficulties.

Supply chain vulnerability highlights the importance of identifying and mitigating risks to ensure the resilience and continuity of supply chain operations.

Vulnerability of supply chains to disturbance or disruption has increased

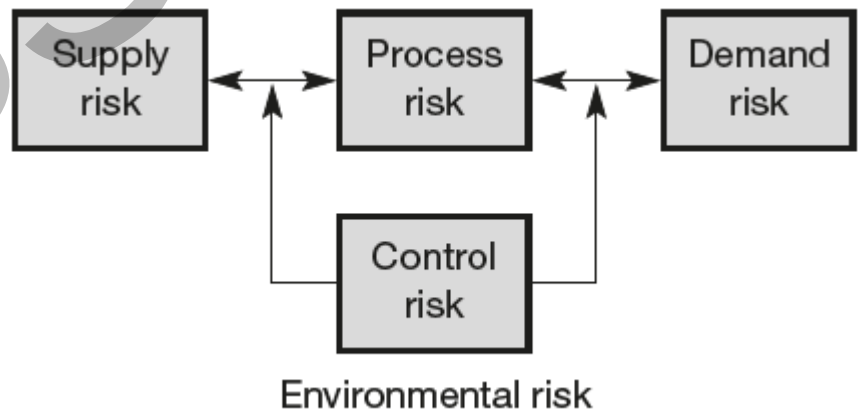
- **Due to:**
  - The globalisation of supply chains
  - The adoption of 'lean' practices,
  - The move to outsourcing
  - Tendency to reduce the size of the supplier base
  - Focused factories and centralised distribution

Risk Identification

Sources of Risk

1. *Supply risk*
   How vulnerable is the business to disruptions in supply? Risk may be higher due to global sourcing, reliance on key suppliers, poor supply management, etc.
2. *Demand risk*
   How volatile is demand? Does the 'bullwhip' effect cause demand amplification? Are there parallel interactions where the demand for another product affects the demand for ours?
3. *Process risk*
   How resilient are our processes? Do we understand the sources of variability in those processes, e.g. manufacturing? Where are the bottlenecks? How much additional capacity is available if required?
4. *Control risk*
   How likely are disturbances and distortions to be caused by our own internal control systems? Do we have 'early warning systems' in place to alert us to problems? How timely is the data we use?
5. *Environmental risk*
   Where across the supply chain as a whole are we vulnerable to external forces? Whilst the type and timings of extreme external events may not be forecastable, their impact needs to be assessed.

(Christopher, 2016)



The bullwhip effect is a phenomenon in supply chain management where small fluctuations in demand at the consumer level lead to increasingly larger fluctuations in orders and inventory levels as you move up the supply chain. This means that minor changes in consumer demand can cause major variations in orders from retailers to suppliers, and even larger variations from suppliers to manufacturers.

Supply Chain Risks to Be Considered During Network Design

Category	Risk Drivers
Disruptions	Natural disaster, war, terrorism Labor disputes Supplier bankruptcy
Delays	High capacity utilization at supply source Inflexibility of supply source Poor quality or yield at supply source
Systems risk	Information infrastructure breakdown System integration or extent of systems being networked
Forecast risk	Inaccurate forecasts due to long lead times, seasonality, product variety, short life cycles, small customer base Information distortion
Intellectual property risk	Vertical integration of supply chain Global outsourcing and markets
Procurement risk	Exchange-rate risk Price of inputs Fraction purchased from a single source Industry-wide capacity utilization
Receivables risk	Number of customers Financial strength of customers
Inventory risk	Rate of product obsolescence Inventory holding cost Product value Demand and supply uncertainty
Capacity risk	Cost of capacity Capacity flexibility

Source: Adapted from "Managing Risk to Avoid Supply Chain Breakdown." Sunil Chopra and Manmohan S. Sodhi, *Sloan Management Review* (Fall 2004): 53–61.

Risk Identification

- Establish risk profiles for all elements of your supply chain
- Active monitoring to keep these profiles up to date
- Determine which segments of your supply chain and how many sub-tiers to actively monitor

Understanding the supply chain risk profile

- The purpose of the risk profile is to establish:
  - **Where the greatest vulnerabilities lie?**

- Seek out the '**critical paths' through the network** where management attention should be especially focused

- Undertake an audit of the **main sources of risk** across the network

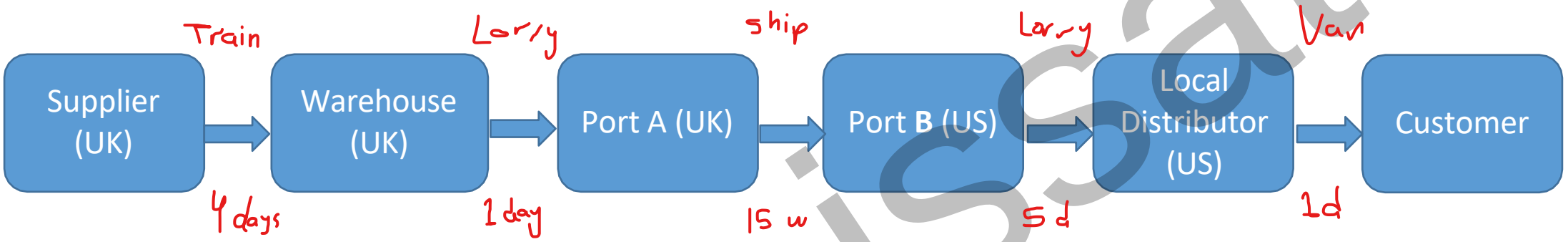
Critical paths are likely to have a number of characteristics

تجديد

- **Long lead-time**, e.g. the time taken to replenish components from order to delivery.
- A **single source of supply** with no short-term alternative.
- **Dependence on specific infrastructure**, e.g. ports, transport modes or information systems.
- A high degree of **concentration amongst suppliers** and customers.
- **Bottlenecks or 'pinch points'** through which material or product must flow.

Supply Chain Risk Profile:

One Path in the Supply Network



Source	Destinations	Logistics	Delivery time	Risk
Supplier	Warehouse	Train	4days	Unreliable train service
Wareho use	Port	Lorry	1day	Lorry breaking down
Port A	Port B	Ship	15 weeks	Bad weather
Port B	Local distribution	Lorry	5 days	Traffic
Local distribut ion	Customer	Van	1day	Customer Not at home

Risk Assessment

Calculate Size of Risk

- What the probability of disruption is?
- What is the impact of the disruption?

$$\text{Supply chain risk} = \text{Probability of disruption} \times \text{Impact}$$

(Christopher, 2016)

- A risk profile can be quantified by assigning score such as:
  - (1) for low, (2) for medium and (3) for high

  OR
  - 1 (low) to 10 (high)

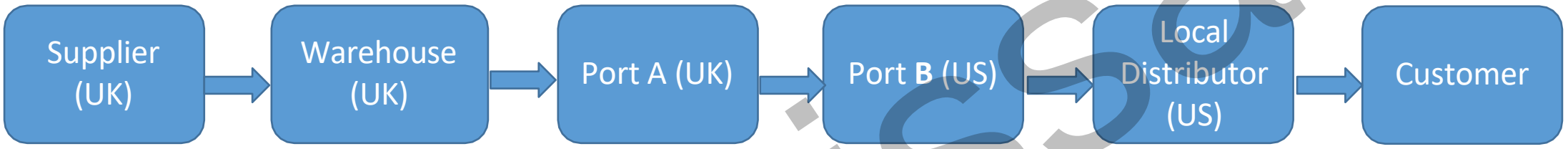
Supply Chain Risk Profile- Simple

Risk name	Owner	Probability points	Consequence points	Total severity points
IT system fails	IT	Low: 1	High: 3	(1x3)=3
Key supplier strike	Buyers	Medium: 2	High: 3	(2x3)=6
Hail damage	Facilities	Low: 1	Low: 1	(1x1)=1
Obsolete inventory	Production	High: 3	High: 3	(3x3)=9
Unrealistic key customer demands	Sales	Low: 1	Medium: 2	(1x2)=2

APICS (2015)

Supply Chain Risk Profile:

One Path in the Supply Network

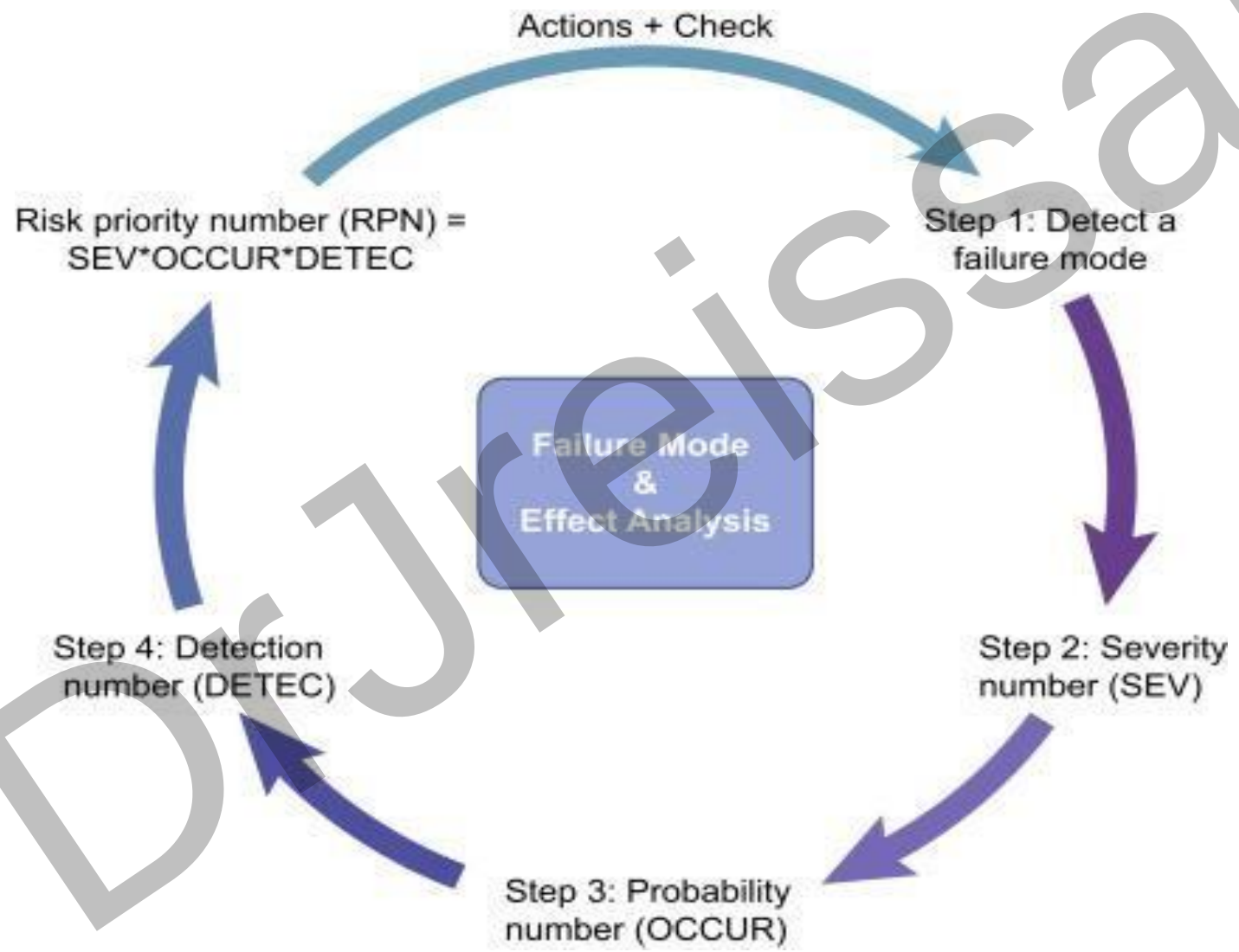


Source	Destinations	Logistics	Delivery time	Risk	Probability (1 low 10 high)	Impact (1 low 10 high)	Size of risk
Supplier	Warehouse	Train	4days	Unreliable train service	3	2	6
Wareho use	Port	Lorry	1day	Lorry breaking down	1	8	8
Port A	Port B	Ship	15 weeks	Bad weather	3	6	18
Port B	Local distribution	Lorry	5 days	Traffic	3	3	9
Local distribut ion	Customer	Van	1day	Customer Not at home	5	5	25

Failure Mode Effect Analysis (FMEA)

- Used to Identifying where the priority should be placed
- So as to reduce the risk of failure
- Ask:
  - What could go wrong?
  - What effect would this failure have?
  - What are the key causes of this failure?

FMEA Process



FMEA- Scoring

- Assess any possible failure opportunity against the following criteria:
  - **SEVERITY-** What is the severity of the effect of failure?
  - **OCCURENCE-** How likely is this failure to occur?
  - **DETECTION-** How likely is the failure to be detected?
- Calculate Risk Priority Number (RPN)

RPN = severity x occurrence x detection

Risk analysis scoring system	
S = Severity	1. No direct effect on operating service level
	2. Minor deterioration in operating service level
	3. Definite reduction in operating service
	4. Serious deterioration in operating service level
	5. Operating service level approaches zero
O = Likelihood of occurrence	1. Probability of once in many years
	2. Probability of once in many operating months
	3. Probability of once in some operating weeks
	4. Probability of weekly occurrence
	5. Probability of daily occurrence
D = Likelihood of detection	1. Detectability is very high
	2. Considerable warning of failure before occurrence
	3. Some warning of failure before occurrence
	4. Little warning of failure before occurrence
	5. Detectability is effectively zero

(Christopher, 2016)

FMEA- Example

SC Stage	Potential Disruption	Potential Effects	Causes	Severity (S)	Likelihood of Occurrence (O)	Likelihood of Detection (D)	Risk Priority Number (SOD)
Supplier/ Production	Production inconsistencies	Low product quality	No set quality standards	4	2	3	24
Warehousing	Errors in packaging of orders	Errors in the order, extend lead time	Errors in the order descriptions, Packaging info not available	3	2	3	18
Distribution	Insufficient volume at Warehouse	Backorders	Errors during production planning and forecasting	4	2	4	32

Risk Mitigation

Risk Mitigation

- Organizations will need to develop appropriate programmes to mitigate and manage SC risk
- The goal is to:
  - develop operational resilience
  - foster the ability to recover quickly
  - plot alternative courses to work around the disruption

Mitigation Strategies

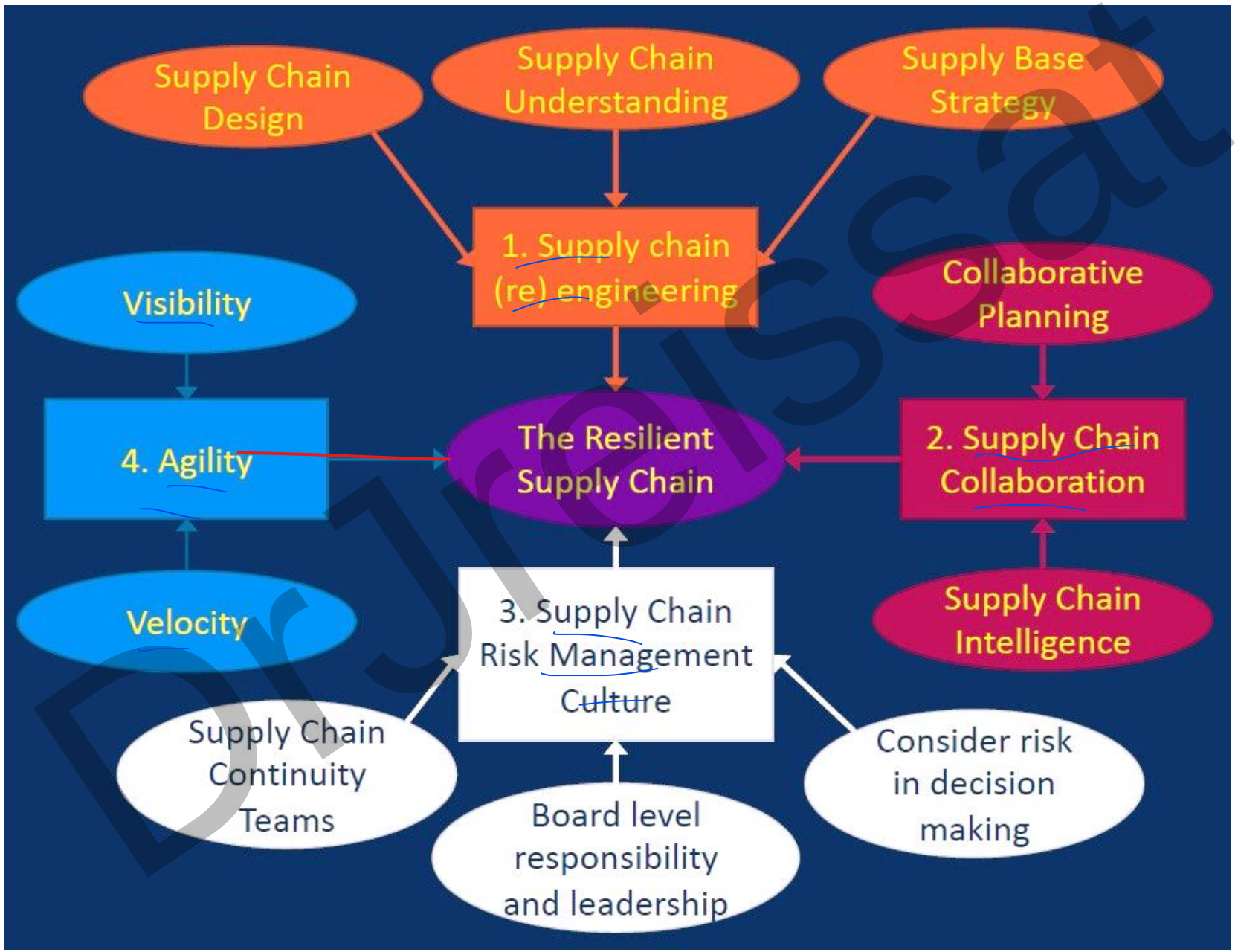
- End to End supply chain **visibility-** establish a supply chain **'control tower'**
- Work with suppliers and customers- **Synchronize**
- **Contingency plans** for actions to be taken in the event of failure
  - Adding capacity
  - Holding inventory
- **Re-engineering** of the supply chain

Achieving Supply Chain Resilience

- The ability of a system to return to its original or desired state after being disturbed
- Two key components:

1. **Resistance** refers to the robustness of the supply chain which enables it to avoid the shocks
2. **Recovery** relates to the ability of the supply chain to get back on its feet quickly

Key Factors for Building Resilience



(Christopher, 2016)

Tailored Risk Mitigation Strategies During Network Design

Risk Mitigation Strategy	Tailored Strategies
Increase capacity	Focus on low-cost, decentralized capacity for predictable demand. Build centralized capacity for unpredictable demand. Increase decentralization as cost of capacity drops.
Get redundant suppliers	More redundant supply for high-volume products, less redundancy for low-volume products. Centralize redundancy for low-volume products in a few flexible suppliers.
Increase responsiveness	Favor cost over responsiveness for commodity products. Favor responsiveness over cost for short–life cycle products.
Increase inventory	Decentralize inventory of predictable, lower value products. Centralize inventory of less predictable, higher value products.
Increase flexibility	Favor cost over flexibility for predictable, high-volume products. Favor flexibility for unpredictable, low-volume products. Centralize flexibility in a few locations if it is expensive.
Pool or aggregate demand	Increase aggregation as unpredictability grows.
Increase source capability	Prefer capability over cost for high-value, high-risk products. Favor cost over capability for low-value commodity products. Centralize high capability in flexible source if possible.

Source: Adapted from "Managing Risk to Avoid Supply Chain Breakdown." Sunil Chopra and Manmohan S. Sodhi, *Sloan Management Review* (Fall 2004): 53–61.

Summary- Managing Supply Chain Risk

(Christopher, 2016)

Supply Chain Risk Management: Concepts & Best Practices

Risk Defined

Risk in general can be defined as a collection of pairs of ***likelihood*** *(L)* and ***outcomes / impact*** *(O) of events.*

The combination of all the (likelihood; outcome) pairs is called a ***risk profile***.

Definitions of risk must also have a ***time dimension*** or a specific time horizon (day, month, year, etc.) and a specific *perspective* or view that defines the **scope** (boundaries, what's not included, etc.).

Risk Events and Disruptions

Supply Chain Disruptions – any event that negatively impacts the intended functioning of the supply chain.

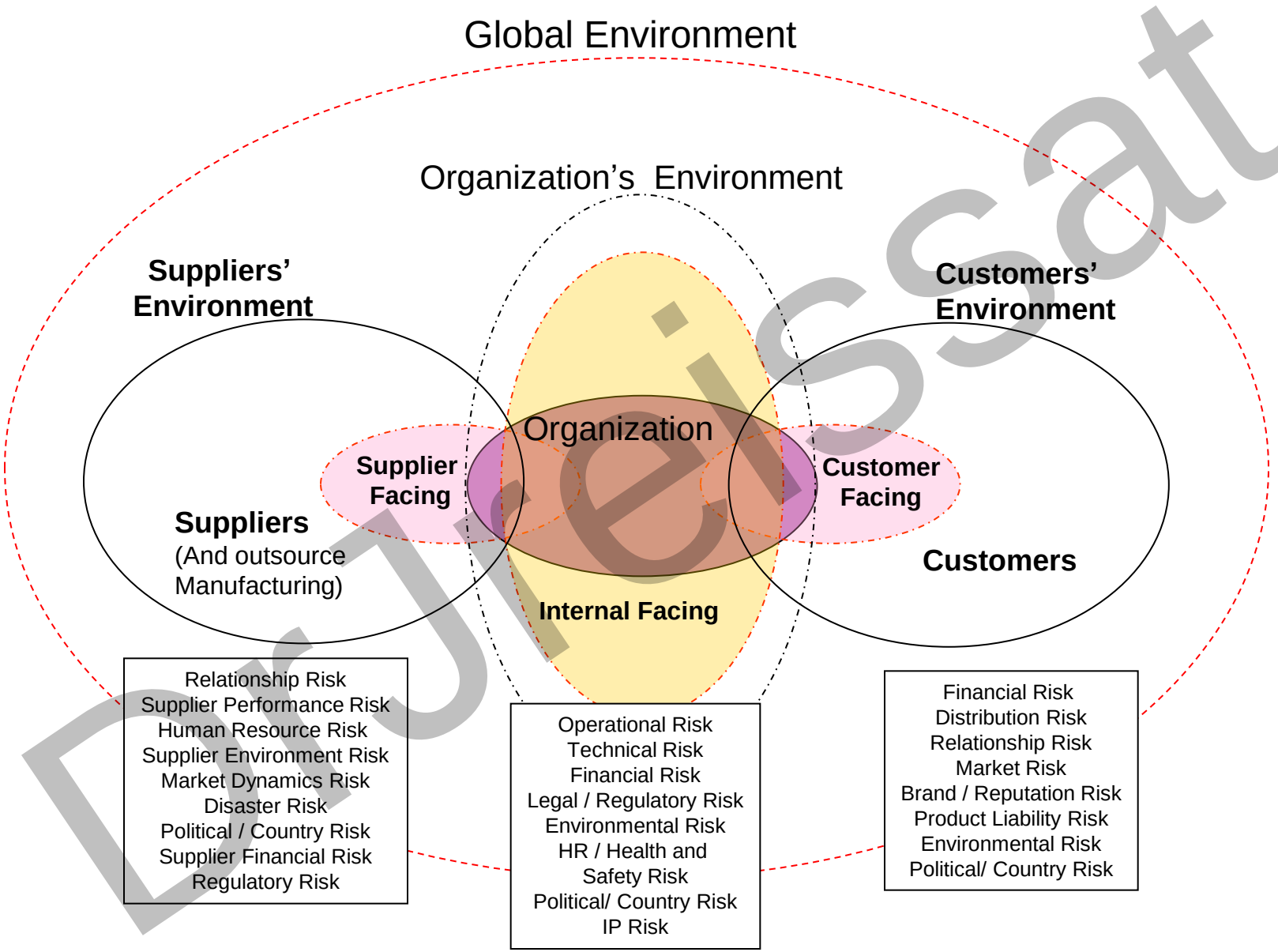
Discrete Events (yes/no)

Can be a rare event or frequent event that happens at a specific instance in time
Internal (machine break down, fire, strike, product failure)
External (weather related, earthquake, etc.)

Continuous Events (a matter of degree)

Internal (performance metrics variability, warranty trends)
External (supply / demand shifts, economic factors)
Sometimes group into buckets

Supply Chain Risk Perspectives



What is Risk Management?

Business Continuity Management (*BCM)*, defined by the Business Continuity Institute as "an holistic management process that identifies potential impacts that threaten an organization and provides a framework for building resilience and the capability for an effective response that safeguards the interests of its key stakeholders, reputation, brand and value creating activities" (BCI, 2005).

Business Vulnerability, defined as an exposure to serious disturbances, arising from risks within the supply chain as well as risks external to the supply chain (Christopher, 2003). Vulnerability is a result of any weakness within a complex system that can seriously jeopardize its activities (Ayyub, 2003).

Enterprise Risk Management *(ERM)* as a set of coordinated actions about protecting and enhancing share value to satisfy the primary business objective of shareholder wealth maximization (Chapman, 2006).

Resilient Enterprise meaning the ability of the company to recover quickly from a disruption (Sheffi, 2005).

Supply Chain Risk Management Defined

Supply chain risk management is the systematic identification, assessment, and quantification of potential supply chain disruptions with the objective to control exposure to risk or reduce its negative impact on supply chain performance.

Potential disruptions can either occur within the supply chain (e.g. insufficient quality, unreliable suppliers, machine break-down, uncertain demand etc.) or outside the supply chain (e.g. flooding, terrorism, labor strikes, natural disasters, large variability in demand etc.).

Management of risk includes the development of continuous strategies designed to control, mitigate, reduce, or eliminate risk.

Supply Chain Disruptions Are a Reality

Mattel had massive recall due to lead content in paint.
United States experienced significant disruptions from Long Beach longshoreman strike.
United States experienced significant disruptions when borders and air transportation shut down after 9/11.
Fuel distribution in the United Stated was disrupted after hurricane Katrina damaged pipelines.
Nokia production shut down due to supplier plant fire.
Kobe earthquake resulted in computer memory shortage, impacting multiple companies
UPS strike severely impacted ability to ship small packages in the U.S.
Others…

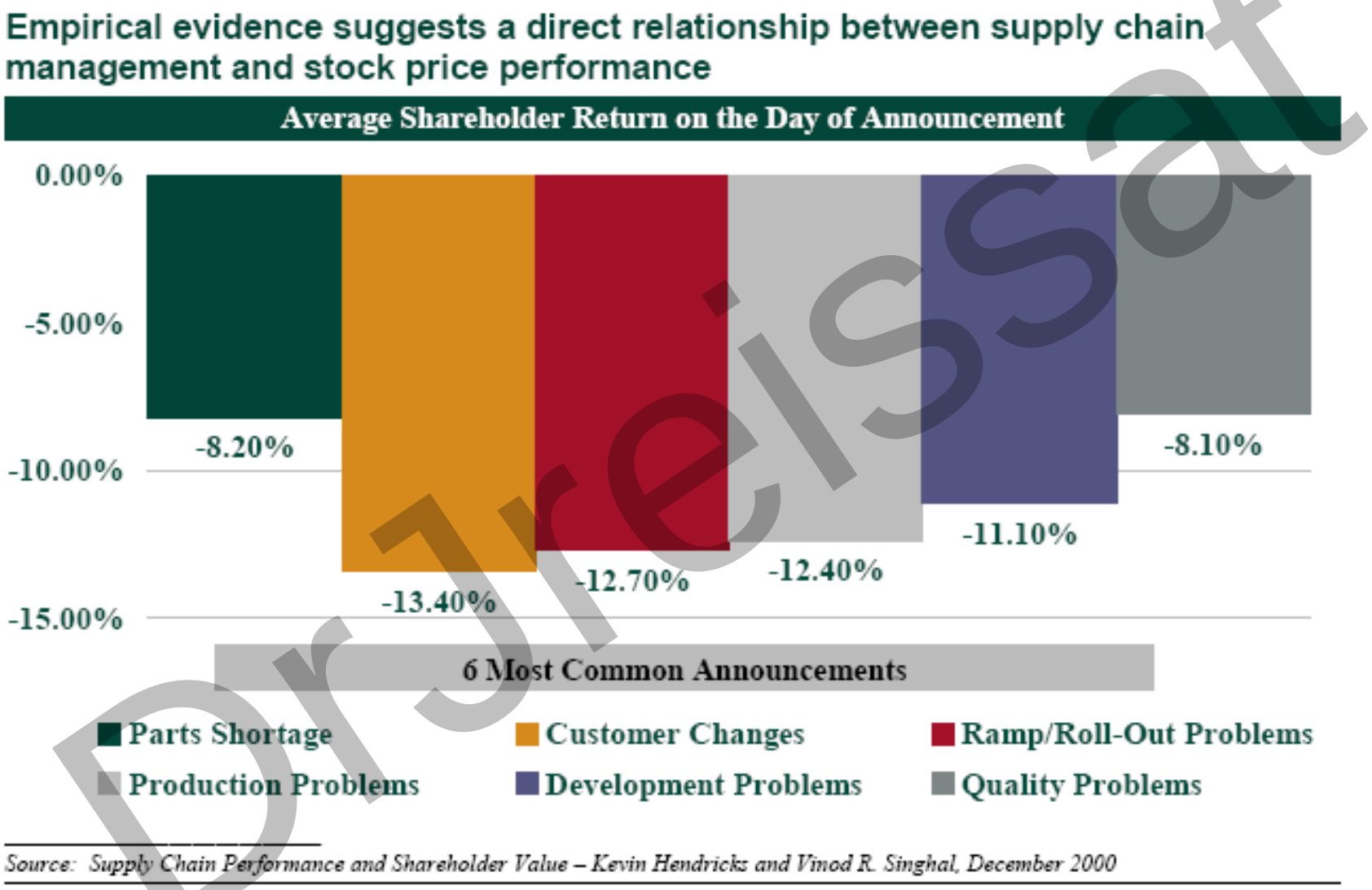
Chrysler Shuts Down Four Plants

GM Halts Work at More Plants Due to Strike at Parts Supplier

Baxter Pulls Remaining Heparin From the Market

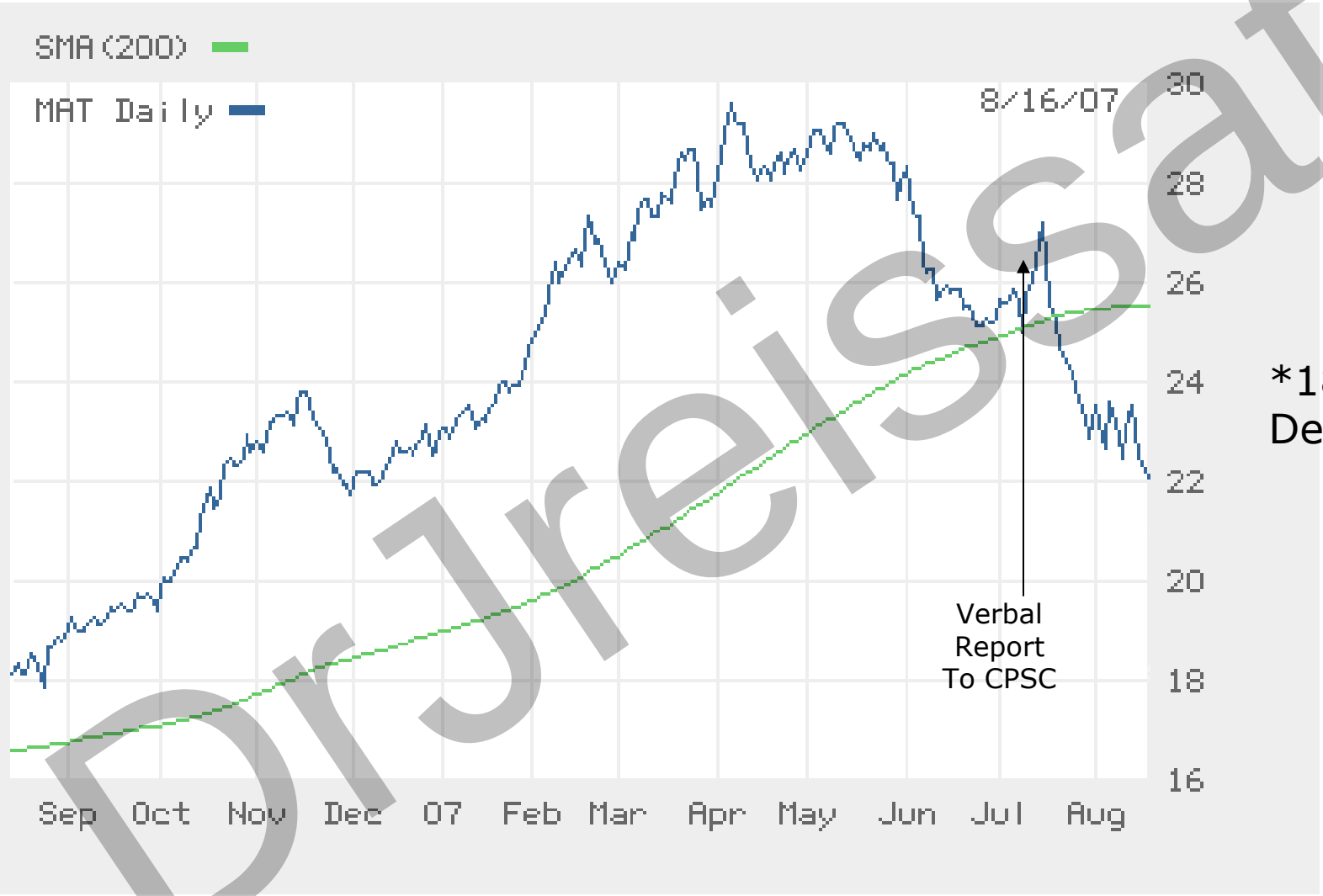
Mattel Toys to Be Pulled Amid Lead Fears

Large Reputation Impacts



Source: *The View of the Supply Chain From Wall Street – J. Stuart Francis - Lehman Brothers, February 2003*

Mattel Toys Pulls Amid Lead Fears

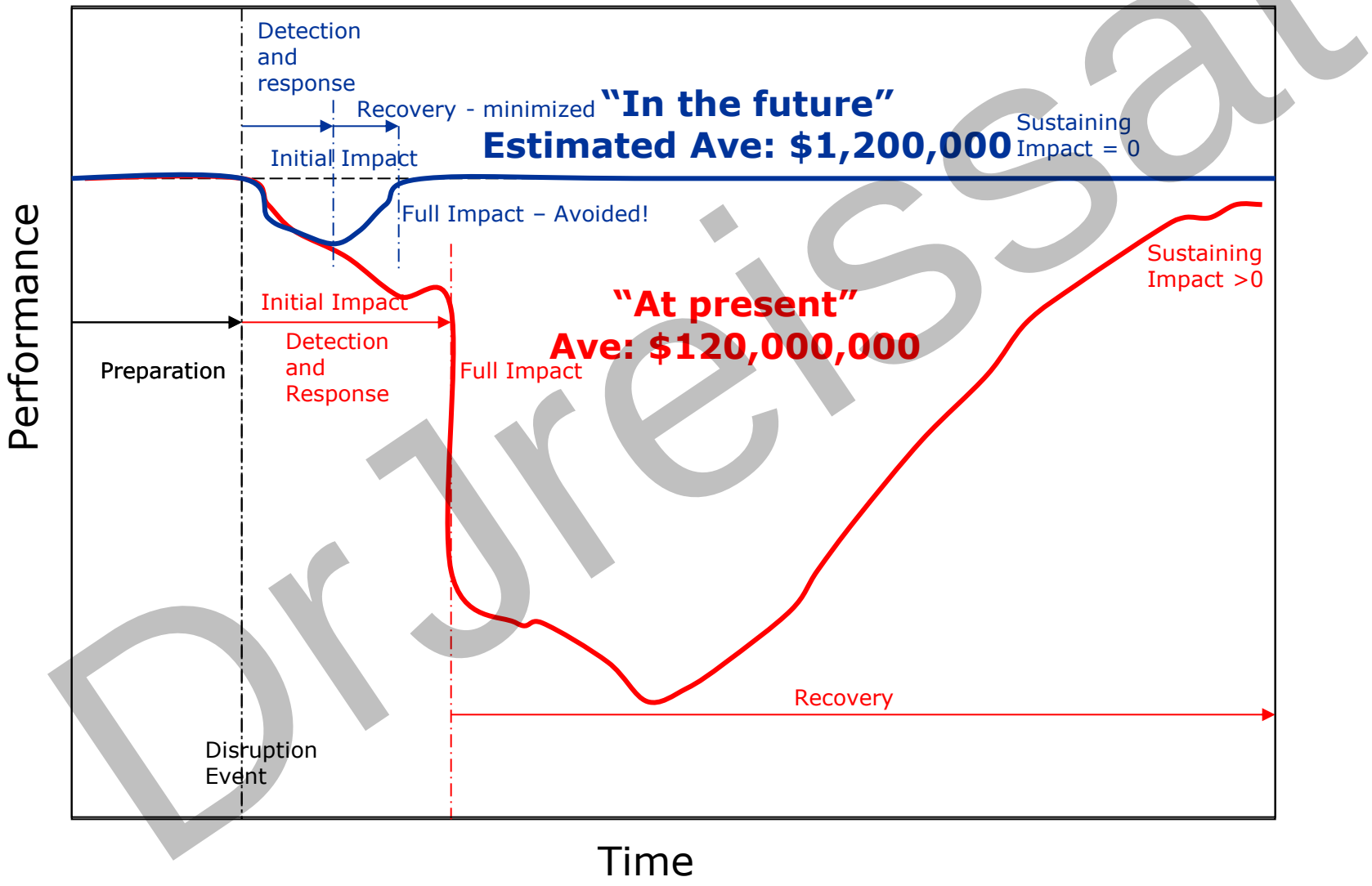


*18.5%
Decline

*On a $10 Billion Market Capital or $1.9 Billion loss

Supply Disruption Profiles

Reference: Supply Chain Risk Management: Minimizing Disruptions in Global Sourcing. Roberts Hanfield and Kevin P. McCormack. Auerbach Publications. 2008

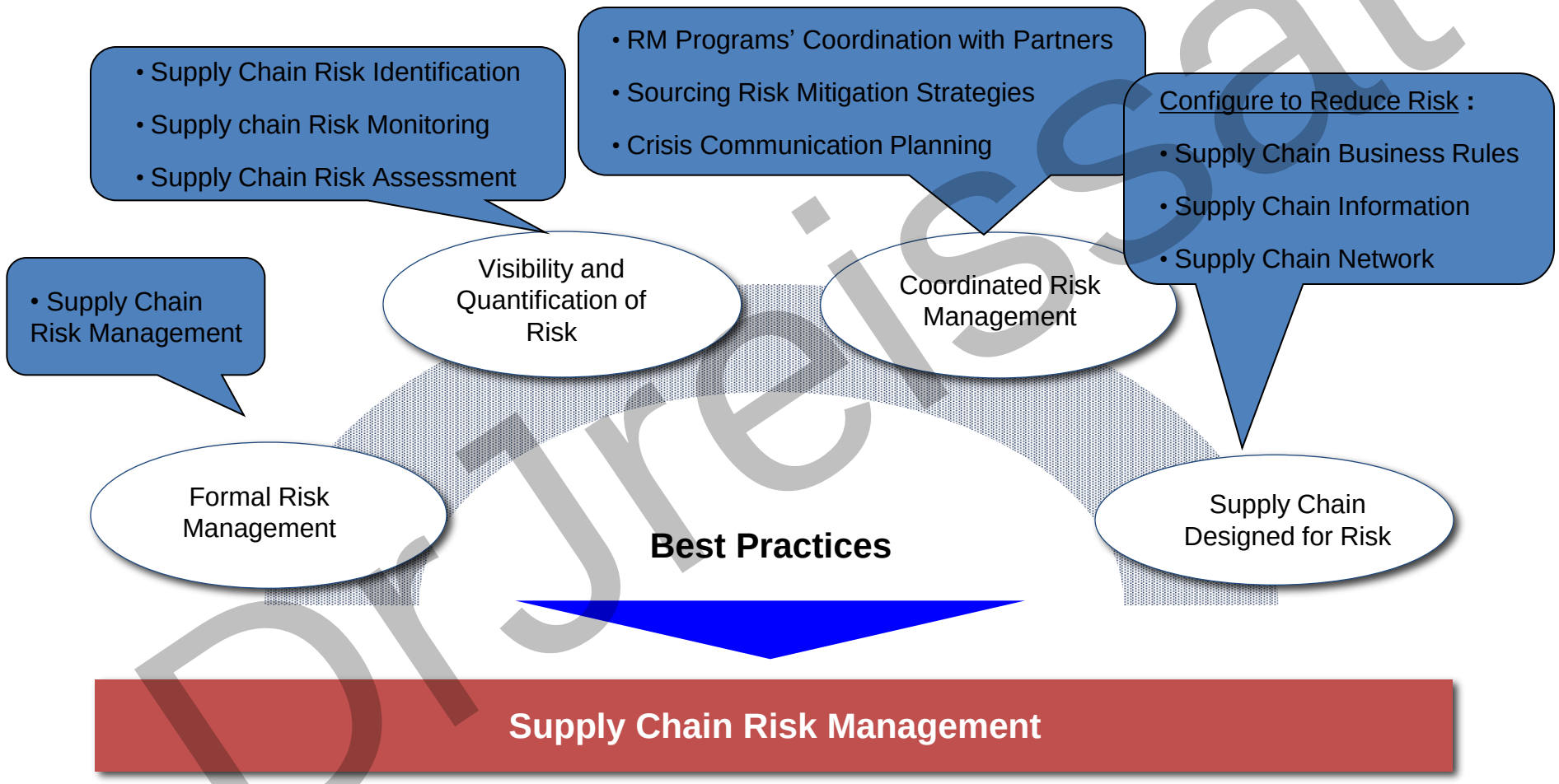


Risk Tolerance

Historically, people and companies have had different tolerances for risks and reacted based on their feelings
Ultimately, the tolerance for risk will determine how much the enterprise will invest in mitigation measures vs. reactive efforts
SCRM helps you to make rational business decisions as opposed to emotional or fear-based reactions

SCRM Best Practices

10 Best Practices under the following categories:



Formal Risk Management

Supply Chain Risk Management (SCRM):

Systematic identifying, assessing, and resolving of potential disruptions in supply chain networks with the objective to reduce their negative impact on the network's performance

Visibility and Quantification of Risk

Supply Chain Risk Identification

Creating of a list potential events that could disrupt or harm any aspect of the supply chain's performance

Supply Chain Risk Monitoring

Monitoring your supply chain's internal and external environment to predict when risk events are becoming more likely. Can use SCOR metrics.

Supply Chain Risk Assessment

Quantifying risk to understanding of where the greatest risks may exist in order to prioritize resources for risk mitigation and management
Measures include Likelihood and Impact.

Coordinated Risk Management

Risk Management Program's Coordination with Partners

Coordinating risk management with your supply chain partners by emphasizing cooperation among departments within a single company and among different companies of a supply chain to effectively manage the full range of risks as a whole
Establishing a Risk Management Coordination Committee

Sourcing Risk Mitigation Strategies

Includes strategies to address source risks, for example multiple sources of supply, strategic agreements with suppliers, and supplier partnerships)

Crisis Communication Planning

Creating a plan for managing a crisis when it occurs.

Supply Chain Designed for Risk

Several things can be configured to reduce risk:

Supply Chain Business Rules

Establishing business rules (e.g., customer priority, supplier priority, production routing, transportation routing, etc.) based on minimizing the risk to the supply chain

Supply Chain Information

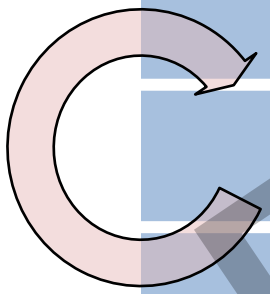
Managing supply chain information networks to minimize the risk to the supply chain. This includes information sharing with partners as well as internal locations. This helps all parties to be quickly informed of a real or potential disruption and respond quickly and appropriately to minimize the disruption impact.

Supply Chain Network

Designing node locations, transportation routes, capacity size and location, number of suppliers, number of production locations, etc. in a fashion that mitigates potential disruptions to the ability to deliver product and service to the end customer

The SCOR Model Five Phase Approach

Phase	Name	Deliverable	Resolves
Initial	BUILD	• Organizational Support • Risk Management Program	Who is the sponsor?
I	DISCOVER	• Supply-Chain Definition • Supply-Chain Risk Priorities • Project Charter/Risk Program definition	What will the program cover?
II	ANALYZE	• Scorecard • Benchmark • Competitive Requirements • Customer service requirements	What are the risk management goals of your supply chain?
III	ASSESS	• Geo Map • Thread Diagram • Risk identification • Risk assessment	Initial Analysis – where and how big are the risks?
IV	MITIGATE	• Mitigation plans • Level 3, Level 4 Processes • Best Practices Analysis	Final Analysis – how will risk be eliminated or mitigated?
V	IMPLEMENT	• Opportunity Analysis • Mitigation Definition • Deployment Organization • Monitoring and response programs	How to deploy mitigations?



Identification

(what (events and entities), where, how)

Phase	Name
Initial	BUILD
I	DISCOVER
II	ANALYZE
III	ASSESS
IV	MITIGATE
V	IMPLEMENT

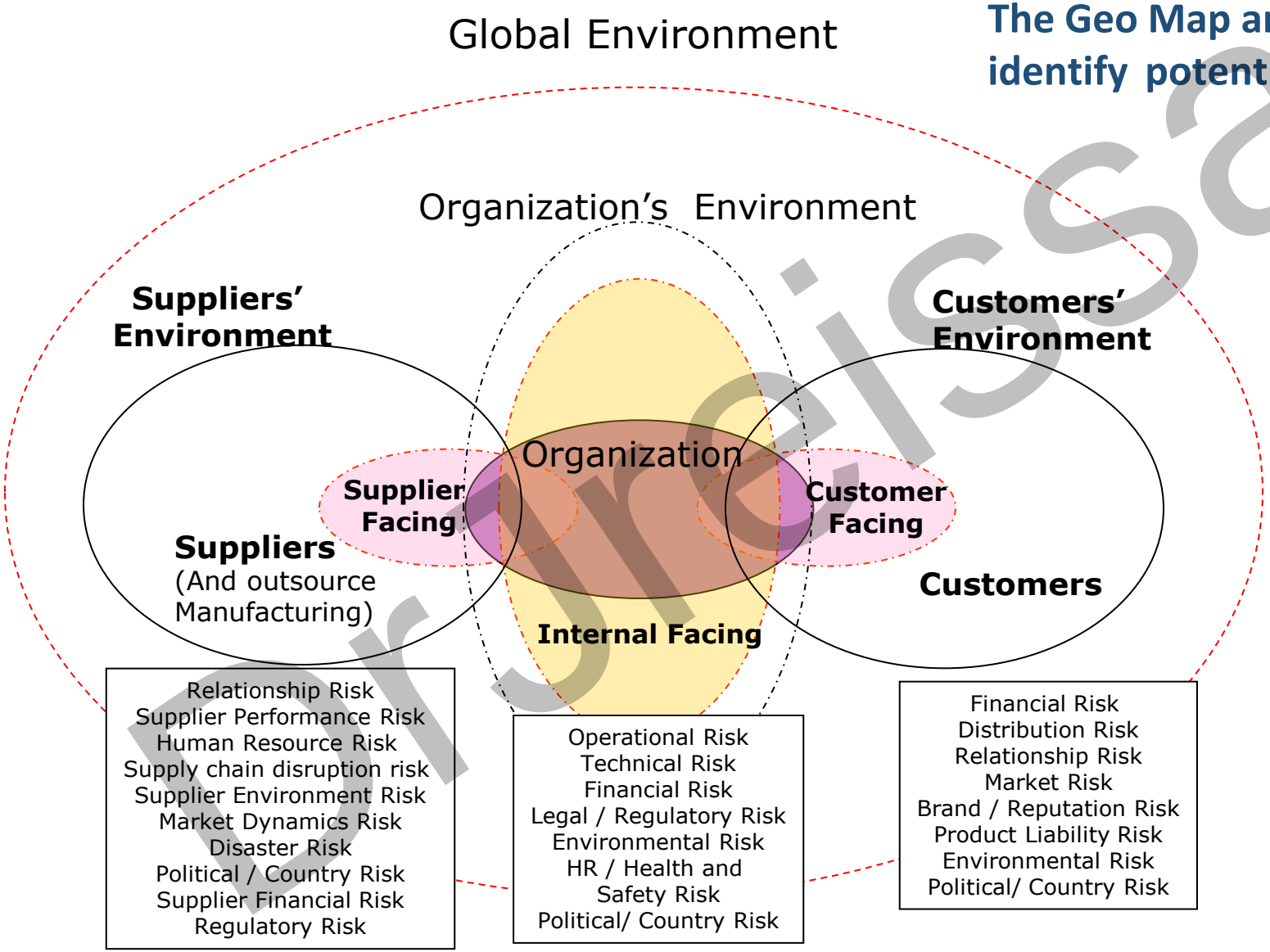
Identification of potential events that could disrupt the supply chain

Multiple methods

Best Practice description includes unique attributes

Types of Risk

Risk can come from multiple sources
The Geo Map and Thread Diagram help identify potential risks in these areas



Risk Identification Techniques

Geomapping/Supply chain mapping – Visual maps of supply chains reveal supply chain structures, dependencies, and handoffs that may contain risk. SCOR mapping and Value Stream Mapping are two types of supply chain mapping that can be used.

Looking at historical problems – Historical problems may have a high chance of recurring. Those problems may have happened to the organization itself or to others.

Researching industry trends – Other organizations and industry groups may have already researched risks that are applicable.

Group of experts brainstorming – People with experience in different areas of your organization and supply chain have lots of knowledge of risks. Getting them together increases the knowledge sharing. (The Delphi method is one technique to conduct expert interviews.)

Assessment surveys – Well designed surveys can be an effective way to quickly gather information on risks in your supply chain.

Site visits – Site visits to supply chain partners allow you to collect detailed and less “filtered” information on risks.

Information audits – Data system audits can reveal issues and trends from the past. It can show areas of the supply chain that have had poor performance in the past and are thus more likely to perform poorly in the future.

Risk Identification Tools

Risk checklists – a list of risks that are common for your environment. It may come from past experience or industry research.

Cause-and-effect diagrams (i.e. fishbone, Ishikawa) – a diagram that traces back the causes for events

Gantt charts – a bar chart showing the precedence and timing of activities. It can help identify the critical path, i.e. the most critical organizations and processes that would be bottlenecks if they experienced a disruption. (It can also be used later during Risk Assessment to determine the effect of disruptions at different points in a supply chain.)

Process Data Analysis

Use data analysis of your nodes and portion of the organization to identify:

Financial Risks
Physical Plant Risks
Information Risks
Quality Risks
Logistics Risks

SUPPLY CHAIN RISK MANAGEMENT

PARTII

INTRODUCTION

- Logistics Managament vs Supply Chain Management
- What is Risk ?
- Risk and Supply Chain
- What is Supply Chain Vulnerability ?

INTRODUCTION

Logistics Managament

“Part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services and related information from the point of consumption in order to meet customer requirements”(Lambert, Cooper, 2000)

INTRODUCTION

Supply Chain Managament

"The integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders"(Lambert, Cooper, 2000)

INTRODUCTION

RISK

"Variation in the distribution of possible outcomes, their likelihoods and their subjective values." (Christopher, Peck, 2004)

INTRODUCTION

RISK & SUPPLY CHAIN

Understanding the Supply Chain

Change as a usual practice

INTRODUCTION

SUPPLY CHAIN VULNERABILITY

"An exposure to serious disturbance, arising from risks within the supply chain as well as risks external to the supply chain" (Christopher, Peck, 2004).

SUPPLY CHAIN
RISK MANAGEMENT

"A managerial activity to identify and so manage the risks of supply chain through a coordinated approach amongst supply chain members to reduce supply chain vulnerability as a whole". (Jüttner, Peck, Christopher, 2003).

Source: Waters, 2007

RISK CATEGORIZATION

Supply Chain Risks Internal to the Firm

Process Risks

"the sequence of value adding and managerial activities undertaken by the firm" (Christopher, Peck, 2004)

"business risks associated with the changes in key personnel, management, reporting structures or business processes" (Kiser, Cantrell, 2006)

manufacturing risks, business risks…

RISK CATEGORIZATION

Supply Chain Risks Internal to the Firm

Control Risks

"the assumptions, rules, systems and procedures that govern how an organization exerts control over the processes" (Christopher, Peck, 2004)

Inadequate planning → Mitigation, Contingency Risks

RISK CATEGORIZATION

Supply Chain Risks External to the Firm but Internal to the Supply Chain Network

Demand Risks

"the potential or actual disturbances through the downstream flow of the product, information, service and cash flows between the focal firm and the market" (Christopher, Peck, 2004).

"the adverse events affecting the likelihood of customers placing orders with the focal firm or variances in volume or assortments desired by the customer" (Manuj, Mentzer, 2008).

RISK CATEGORIZATION

Supply Chain Risks External to the Firm but Internal to the Supply Chain Network

Supply Risks

"the potential or actual disturbances through the upstream flow of product, information, service and cash flows between the network" (Christopher, Peck, 2004).

"the adverse events affecting the ability of the focal firm to meet customer demand in terms of quality and quantity within anticipated costs and time as well as causes threats to customer life and safety (Manuj, Mentzer, 2008).

RISK CATEGORIZATION

Supply Chain Risks External to Network

Environment Risks

"both relate to the upstream and downstream flows through the supply chain or on the marketplace directly" (Christopher, Peck, 2004)

Economic, social, political, technological, climate events…

Shocks like terrorism…

RISK CATEGORIZATION

Supply Chain Risks External to Network

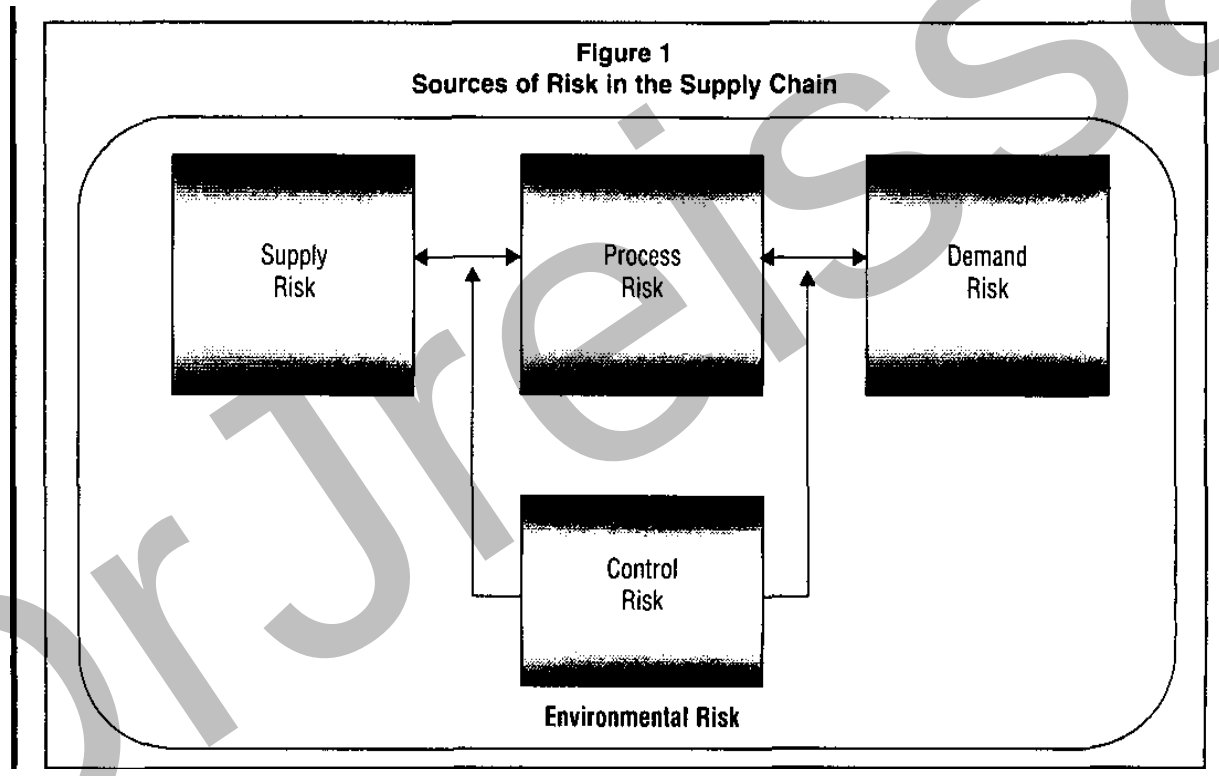
Business Risks

"some business factors like supplier's financial or management stability" (Kiser, Cantrell, 2006)

Physical Plant Risks

"the condition of supplier's facility" (Kiser, Cantrell, 2006)

RISK CATEGORIZATION



Source: Christopher, Martin, Peck, Hellen, (2004), "Building Resilient Supply Chain", *International Journal of Logistics Management,* Vol.15, No.2, pp.1-13

RISK CATEGORIZATION

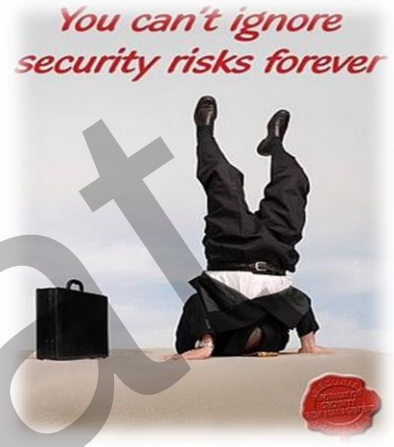
Other Risks

Lack of Visibility : “the lack of a well managed information flow or weakness of interaction through the members of the supply chain” (Christopher, Peck, 2004)

Financial Risks : “the mismanagement of supply chains leading to mismatched inventories like the costs resulting from obsolescence, mark downs and stock outs” (Christopher, Lee, 2004)

Chaos Risks : “mistrust, distorted information or second guessing“ (Christopher, Lee, 2004)

RISK CATEGORIZATION



Other Risks

Market Risks : “miss recognizing the correct signals on the market opportunities and being not responsive enough to the market changes” (Christopher, Lee, 2004)

Security Risks : “adverse events threatening human resources, operations integrity and information systems leading to some outcomes as stolen data, or proprietary knowledge, vandalism, crime and sabotage” (Manuj, Mentzer, 2008).

RISK CATEGORIZATION

Other Risks

Macroeconomic Risks : “the significant economic shifts in wage rates, interest rates and prices” (Manuj, Mentzer, 2008).

Policy Risks : “the unexpected actions of national governments” (Manuj, Mentzer, 2008).

Competitive Risks : “the uncertainty about competitor activities in foreign markets” (Manuj, Mentzer, 2008).

Resource Risks : the unanticipated differences in resource requirements in foreign markets” (Manuj, Mentzer, 2008).

RISK CATEGORIZATION

Other Risks

Lack of Ownership Risk : “unclear responsibility definitions between the buyers and sellers, ending up with increased inventory costs mostly” (Jüttner, Peck, Christopher, 2003).

Total Cost of Ownership : “missing to understand the true cost of buying a particular good or service from a particular supplier could end up with significant risks” (Ellram, 1995).

RISK CATEGORIZATION

Other Components of Risks

Potential Losses

Likelihood of those Losses

Speed and Frequency

RISK CATEGORIZATION

Risk in Global Supply Chain

"the distribution of performance outcomes of interest expressed in terms of losses, probability, speed of event, speed of losses, the time for detection of events and frequency" (Manuj, Mentzer, 2008).

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Improve Supply Chain Resilience

Supply Chain Re-engineering

SC Understanding (CP)

→ Supply Base Strategy (SSP)

SC Design Principles

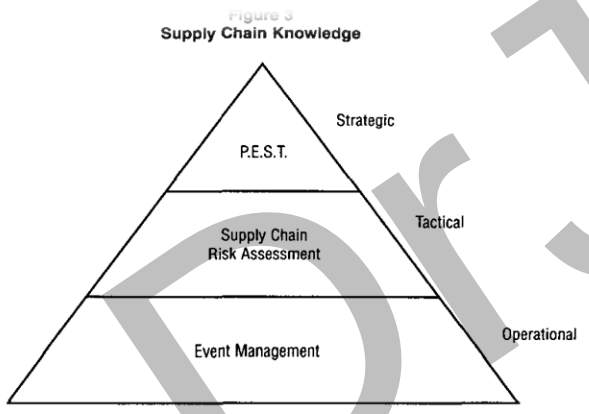
Supply Chain Collaboration

SC Intelligence

Knowledge

P.E.S.T.

→



Source: Christopher, Martin, Peck, Hellen, (2004), "Building Resilient Supply Chain", *International Journal of Logistics Management,* Vol.15, No.2, pp.1-13

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Improve Supply Chain Resilience

Agility

SC Visibility

→ SC Velocity

- Streamlined processes
- Reduced in-bound LTs
- Non-value added time reduc.

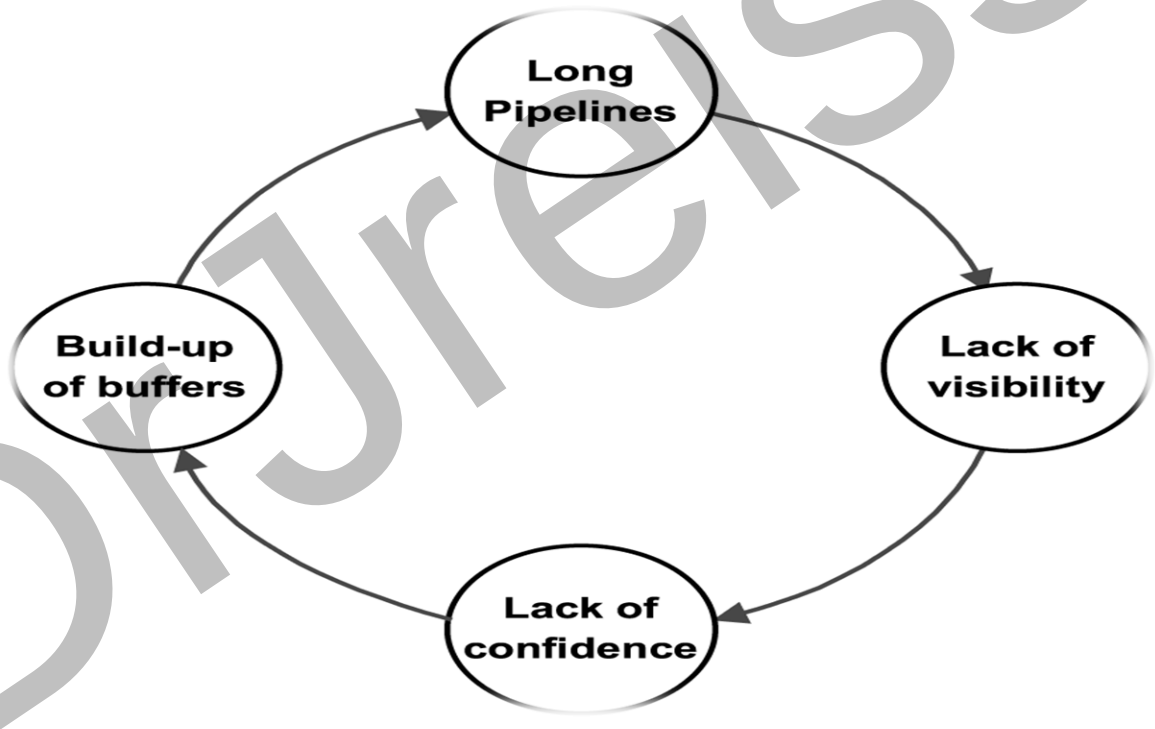
SUPPLY CHAIN CONTINUITY MANAGEMENT…!!!

Source: Christopher, Martin, Peck, Hellen, (2004), "Building Resilient Supply Chain", *International Journal of Logistics Management,* Vol.15, No.2, pp.1-13

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Improve Confidence

The Risk Spiral



METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

Emphasize effect of 3 main factors:

Temporal Focus: the short term focus leading to the adoption of strategies providing quick results while involving lower investments.

SC Flexibility: the ability to change or react immediately in the lowest possible cost by the best possible performance while spending little efforts.

SC Environment: being fit to the external environment.

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

Demand risks	Supply risks: Low	Supply risks: High
Low	$S_L D_L$	$S_H D_L$
High	$S_L D_H$	$S_H D_H$

Source: Lee (2002)

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Postponement: supply chains facing low supply & high demand uncertainty and high supply & high demand uncertainty environments are more likely to adopt form postponement strategies than those facing low supply & low demand uncertainty and high supply & low demand uncertainty environments (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Speculation: supply chains facing low supply & low demand uncertainty and high supply & low demand uncertainty environments are more likely to adopt speculation strategies than those facing low supply & high demand uncertainty and high supply & high demand uncertainty environments (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Hedging: supply chains facing high supply & low demand uncertainty and high supply & high demand uncertainty environments are more likely to adopt hedging strategies than those facing low supply & high demand uncertainty and low supply & low demand uncertainty environments (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Control/Share/Transfer: supply chains facing high supply & low demand uncertainty are more likely to adopt backward integration, supply chains facing low supply & high demand uncertainty environments are more likely to adopt forward integration and supply chains facing high supply & high demand uncertainty are more likely to adopt backward and forward integration (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Security: all types of supply chains will increase the use of security strategies (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics*

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

6 SCRM Strategies:

Avoidance: supply chains operating in all types of environment adopt avoidance strategies. Type 1 avoidance strategy is adopted when a supply chain has an option not to enter a high demand or supply risk environment. Type 2 avoidance strategies is adopted when a supply chain has no option but to enter a high demand and/or supply risk environment (Manuj, Mentzer, 2008)

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies

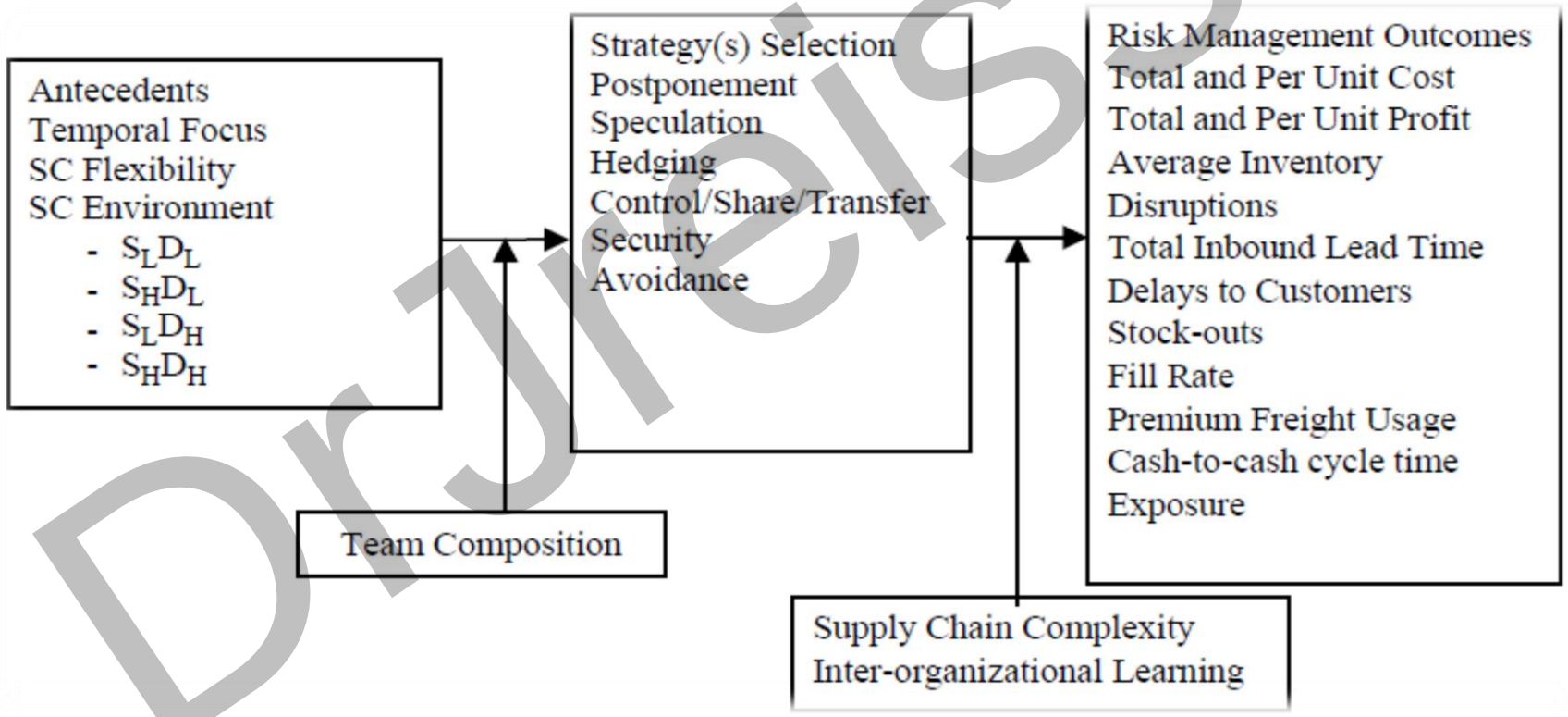
- Team composition affects the relationship between the antecedents and the strategy selected" (Manuj, Mentzer, 2008).

- Greater supply chain complexity lessens the relationship between supply chain risk strategies and risk-related outcomes and greater inter-organizational learning strengthens the relationship between supply chain risk strategies and risk management outcomes" (Manuj, Mentzer, 2008).

Source: Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223-

METHODS FOR MANAGING SUPPLY CHAIN RISKS

Develop SCRM Strategies



GLOBAL SOURCING RISKS

Some companies outsource some or all of their business processes to the firms that ar

located in other countries which are relatively having cost advantages.

This type of outsource activity is called global sourcing.

MAIN CHARACTERISTICS OF GLOBAL SOURCING

Not adjacent

Existing capacity

GLOBAL SOURCING RISK TYPES

Demand Risk: The lack of information between manufacturer and supplier

Enviromental Risk: Natural disasters, fires or diseases etc.

Process Risk: relates to disruptions to processes, which are undertaken by the companies and dependent on internally managed assets.

GLOBAL SOURCING RISK TYPES

Control Risk: Determining the processes is not enough in global sourcing. It should also be controlled strictly.

Mattel case is one of the most important example for control risk.

GLOBAL SOURCING RISK TYPES

Market Volatility Risk: In a new market, there are political risks, currency risks or related risks.

Risk of Incomplete Specifications: Companies find the solution to include more complete specifications when feasible.

GLOBAL SOURCING RISK TYPES

Risk of Inability to Measure Performance:

The more not to make a proper evaluation on the supplier, the more to deal with late delivery problems, customer complaints, demand reductions etc. Just like Mattel.

GLOBAL SOURCING RISK TYPES

Other Risks in Global Sourcing:

- Cultural differences
- Language diversities
- Low personnel knowledge and skills
- Lack of understanding of organization value
- Differences in religions etc.

MITIGATING GLOBAL SOURCING RISKS

Mitigation is a protector against risk

- Keeping buffer inventory
- Planing capacity properly
- Localizing the parts in the destination marketsDual sourcing
- Consolidation
- Avoiding duplications on information flow
- Using TCO (Tool for Competence) approach

SAMPLE CASE

SUMMARY

Telephone AB LM Ericsson

On 17.03.2000, thunderstorms caused a surge in power, which started a fire in Philips' chip-making factory in Albuquerque, New Maxico.

Thousands of chips were destroyed, millions of them held in stock.

Philips is a supplier of Ericsson.

Single sourcing is a key element for Ericsson until that fire.

Firstly, Philips thought that they could return normal in a week.

However, the factory had been shut complete three weeks.

It took six months for production to return, but some equipment took years to replace. In 2001, fire cost was more than $400 million in Ericsson.

Share price fell by %14 in a few hours.

Ericsson's mobile phone division lost $1.7 billion in that year.

After that disaster, Ericsson moved away from single sourcing and ensured that there were always back up suppliers.

They also introduced systems for risk management.

NOKIA

- Nokia was another leader in the communications industry.
- Philips was also a supplier for Nokia.
- Nokia reacted much faster, and more positive.
- Nokia has "supply chain troubleshooter"
- They avoided single-sourcing.
- They immediately contacted Philips and assembled a team.
- They had alternative suppliers in Japan and US.
- Alternative suppliers delivered new chips and 10 million chips were supplied by other Philips' factories.

REMARKS FOR SAMPLE CASE

Proper risk management implementation is the main difference between these two companies.

Ericsson's supply chain;

- Not resilient
- Not agile enough
- No strategy on risk management for controlling and mitigating risks.

Nokia's supply chain;

- Agile enough
- Risk management identification

REMARKS FOR SAMPLE CASE

This case also highlights;

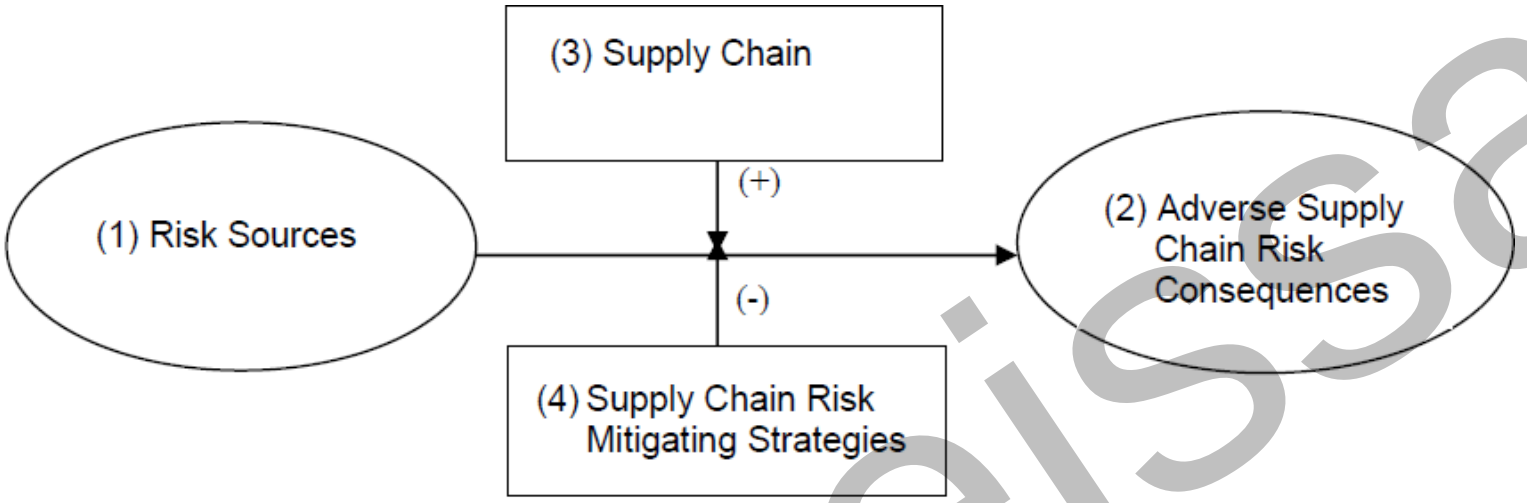
✓Identifying risks.

✓Implementing risk mitigating strategies.

CONCLUSION

Consequences of Risks are very destructive
Global Sourcing as being a key tool for competence (TCO), but carries serious risks ahead as well
Risks have bigger effects as they are transmitted through the members of the SCs
Risk Management process continuity is of vital importance

CONCLUSION



Risk sources to be assessed
SC Risk concept and adverse consequences to be defined
SC strategy to be identified
Risks in the SC to be mitigated

Source: Jüttner, Uta, Peck, Helen, Christopher, Martin, (2003), "Supply Chain Risk Management: Outlining an Agenda for Future Research", *International Journal of Logistics: Research &Applications,* Vol.6, No.4, pp.197-210

CONCLUSION

Logic behind all methods is the same;

- Taking corrective actions and precautions on weak processes through the supply chains prior to occurrence of unpleasant situations
- Mitigating the associated risks to provide a smooth product flow to customers in today's competitive and globalized environment
- Ensuring its continuity should be imposed to the whole processes for long term survival of the companies.

CONCLUSION

BUT PRIOR TO ALL;

awareness on the consequences of risk events is an absolute must for the companies as it raises the main idea which triggers all above mentioned flows addressing to a proper risk management.

CONCLUSION

SO,

Risk concept shouldn’t be HIDDEN in KPI’s…!!!

Risks should be FOLLOWED UP…!!!

Risk concept should be imposed to the CULTURE of the SC…!!!

THROUGH…

Visualizing the Risks clearly in KPI’s….
(like if 2 or 3 risk KPI’s not met, consequences are bigger..)

CONCLUSION

Future Research Studies;

address the importance of risk identification and controlling methods more for not only the big companies having an entity view, but also for the smaller companies with an aim of strengthening their structures to survive in the mid-to-long term

REFERENCES

Lambert, M. Douglas, Cooper, C.Martha, (2000), "Issues in Supply Chain Management", *Industrial Marketing Management,* Vol.29, pp.65-83.

Christopher, Martin, Peck, Hellen, (2004), "Building Resilient Supply Chain", *International Journal of Logistics Management,* Vol.15, No.2, pp.1-13.

Waters, Donald, (2007), "Supply Chain Risk Management Vulnerability and Resilience in Logistics", *The Chartered Institute of Logistics and Transport(UK),* pp.1-272.

Jüttner, Uta, Peck, Helen, Christopher, Martin, (2003), "Supply Chain Risk Management: Outlining an Agenda for Future Research", *International Journal of Logistics: Research &Applications,* Vol.6, No.4, pp.197-210.

Braithwaite, Alan, (2003), "The Supply Chain Risks of Global Sourcing", *LCP Consulting*

Norrman, Andreas, Jansson, Ulf, (2004), "Ericsson's Proactive Supply Chain Risk Management Approach After a Serious Sub-Supplier Accident", *International Journal of Physical Distribution & Logistics Management,* Vol.34, No.5, pp.434-456.

Ellram, M.Lisa, Tate, L.Wendy, Billington, Corey, (2008), "Offshore Outsourcing of Professional Services: A Transaction Cost Economics Perspective *", Journal of Operations Management,* pp.148-163.

Kiser, James, Cantrell, George, (2006), "Supply Chain Management in Six Steps", *www.husdal.com*

Christopher, Martin, Lee, Hau, (2004), "Mitigating Supply Chain Risk Through Improved Confidence", *International Journal of Physical Distribution & Logistics Management,* Vol.34, No.5, pp. 388-396.

Manuj, Ila, Mentzer, T. John, (2008), "Global Supply Chain Risk Management Strategies", *International Journal of Physical Distribution & Logistics Management,* Vol.38, No.3, pp.192-223.

Jüttner, Uta, (2005), "Supply Chain Risk Management, Understanding The Business Requirements From a Practitioner Perspective", *International Journal of Logistics Management,* Vol.16, No.1, pp.120-141.

Hallikas, Jukka, Puumalainen, Kaisu, Vesterinen, Toni, Virolainen, Veli-Matti, (2005), "Risk-Based Classification of Supplier Relationships", *Journal of Purchasing and Supply Management,* pp.72-82.

Zsidisin, A.George, (2003), "A Grounded Definition of Supply Risk", *Journal of Purchasing and Supply Management,* pp.217-224.