Supply Chain

Overview

Professor Gad Allon

Agenda

(1) Strategic framework

(2) Supply chain risk and resilience

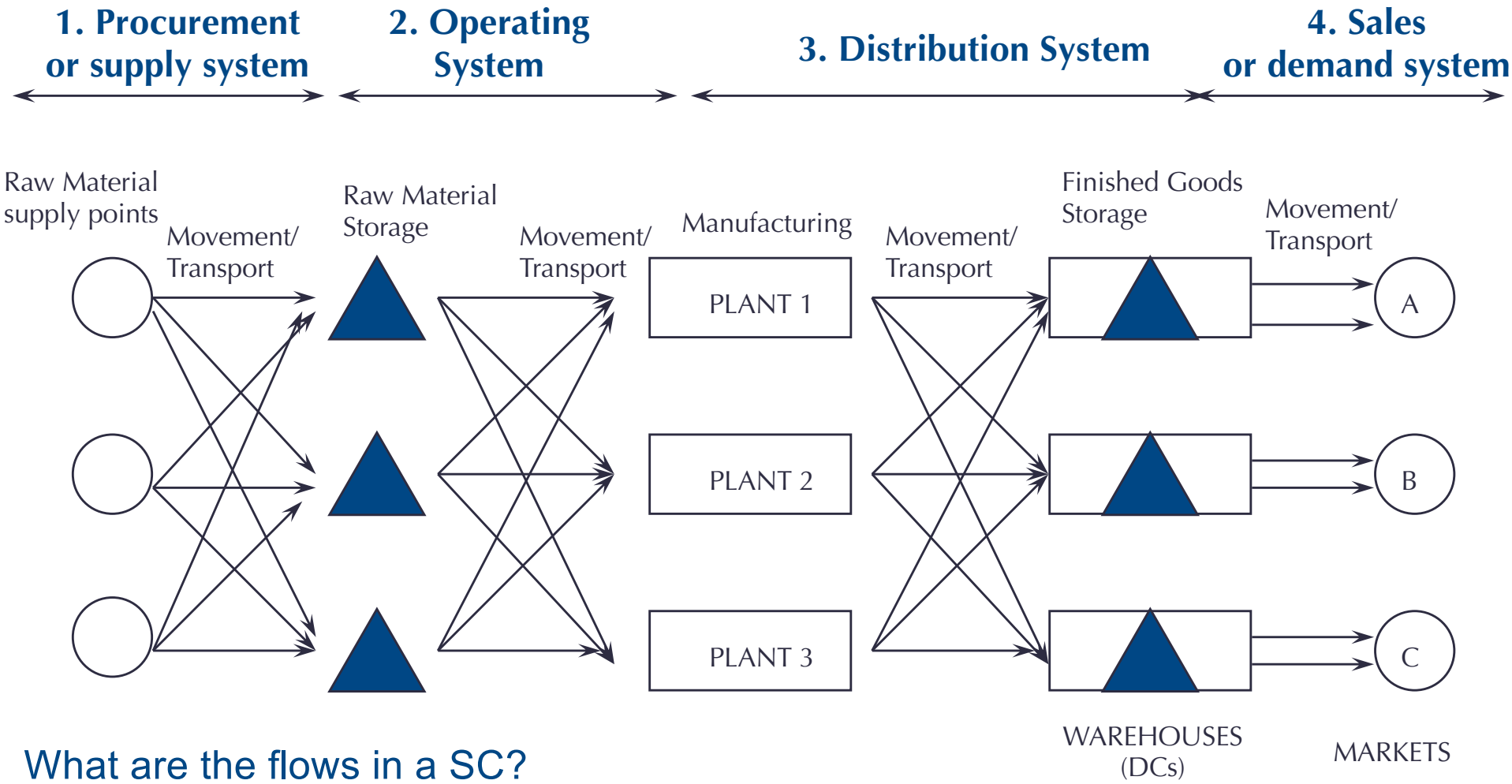
(3) Global supply chains

What is a supply chain?

Supply Chain

A supply chain is a network between a company and its suppliers to produce and distribute a specific product to the final buyer. This network includes different activities, people, entities, information, and resources. The supply chain also represents the steps it takes to get the product or service from its original state to the customer.

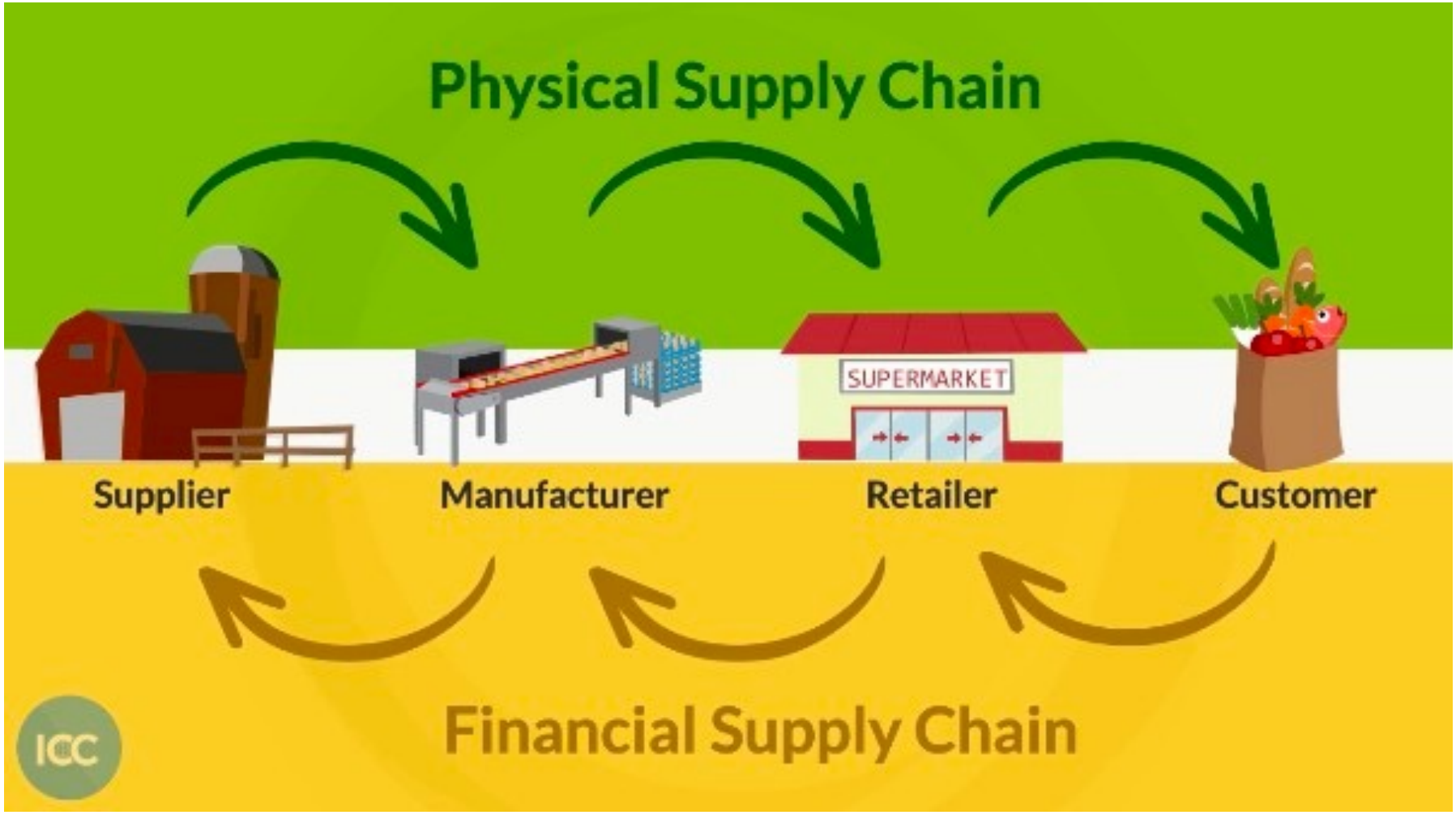
Supply Chain



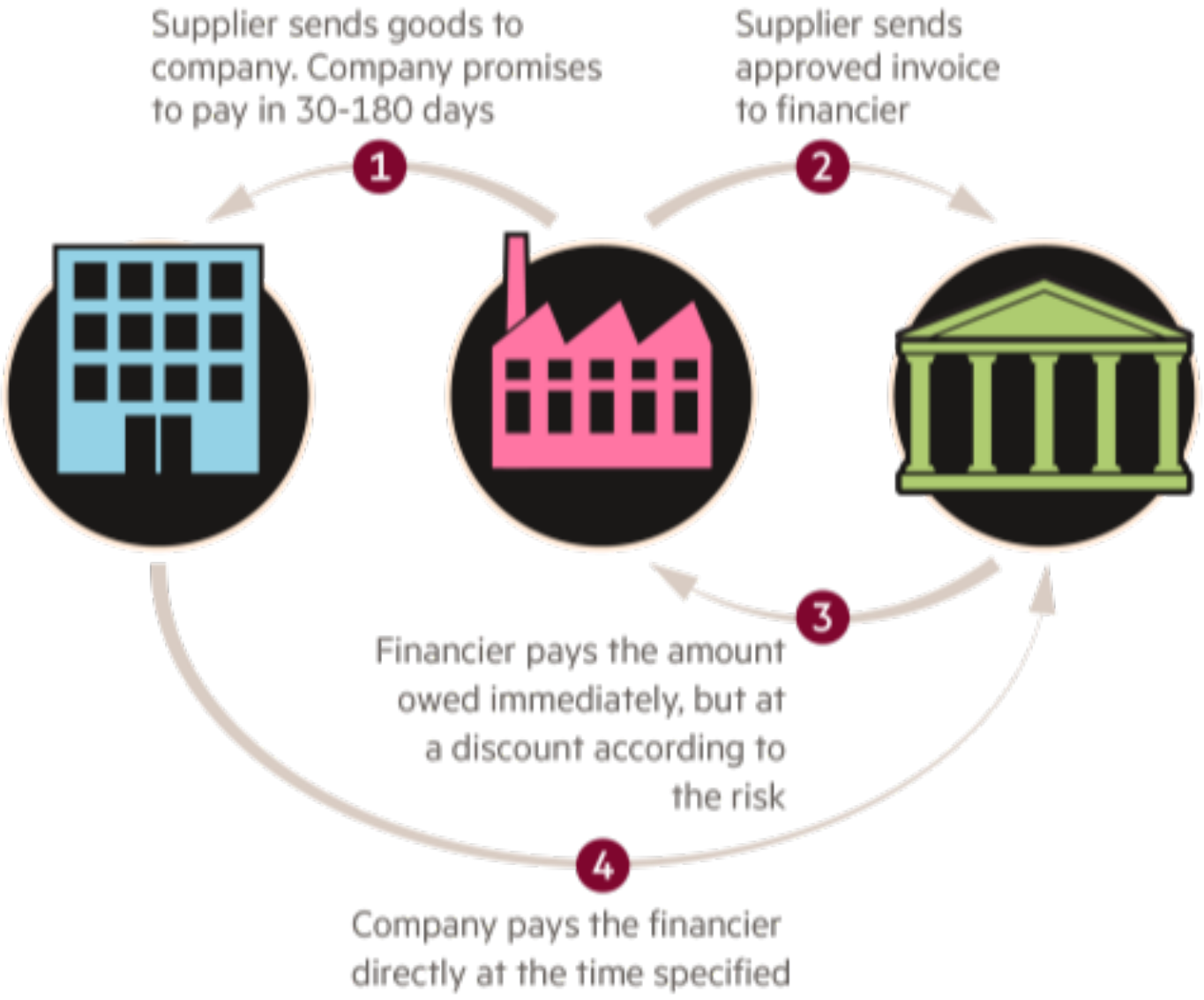
What are the flows in a SC?

Reverse Logistics

Financial Flows

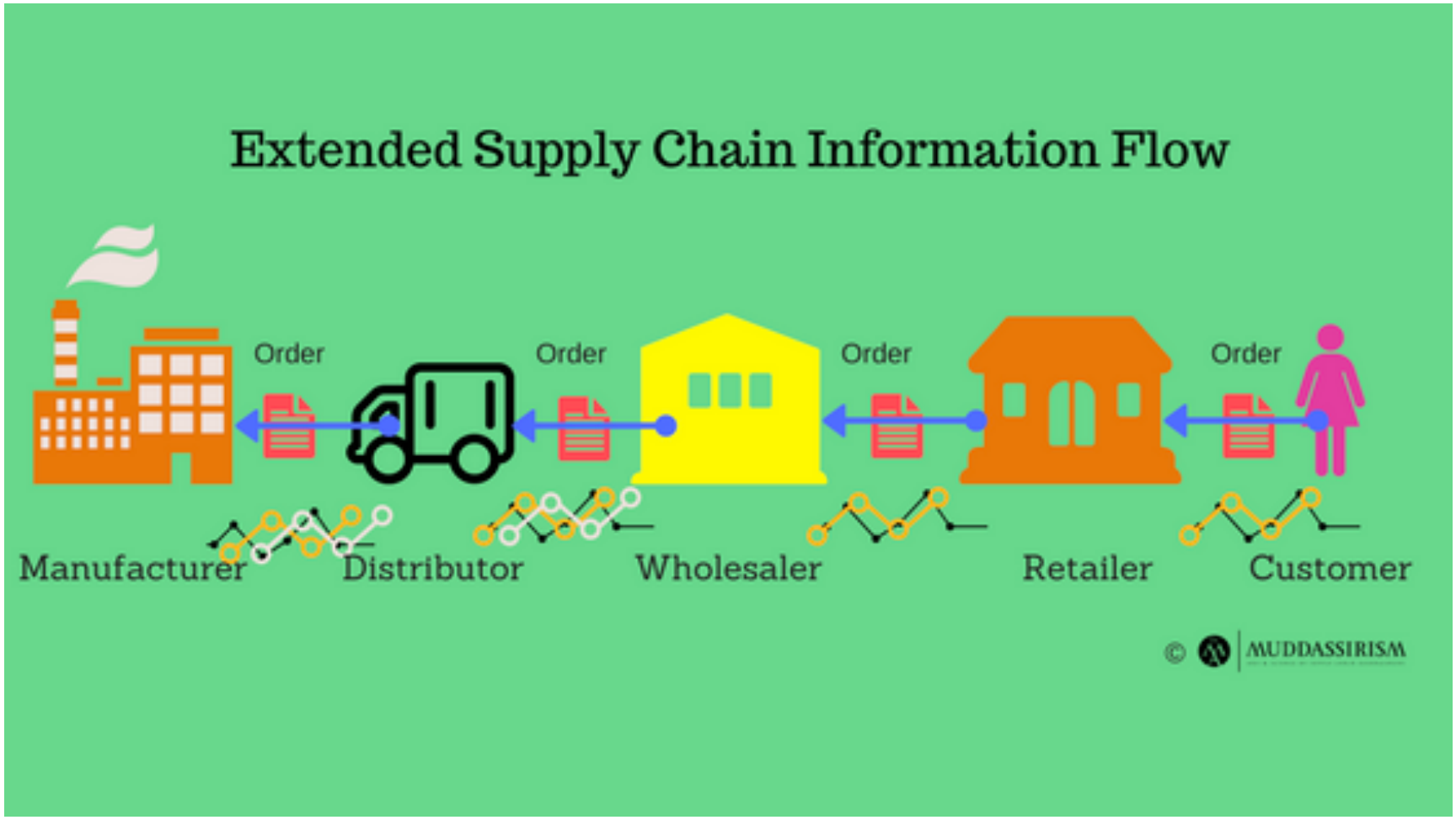


How supply chain finance works



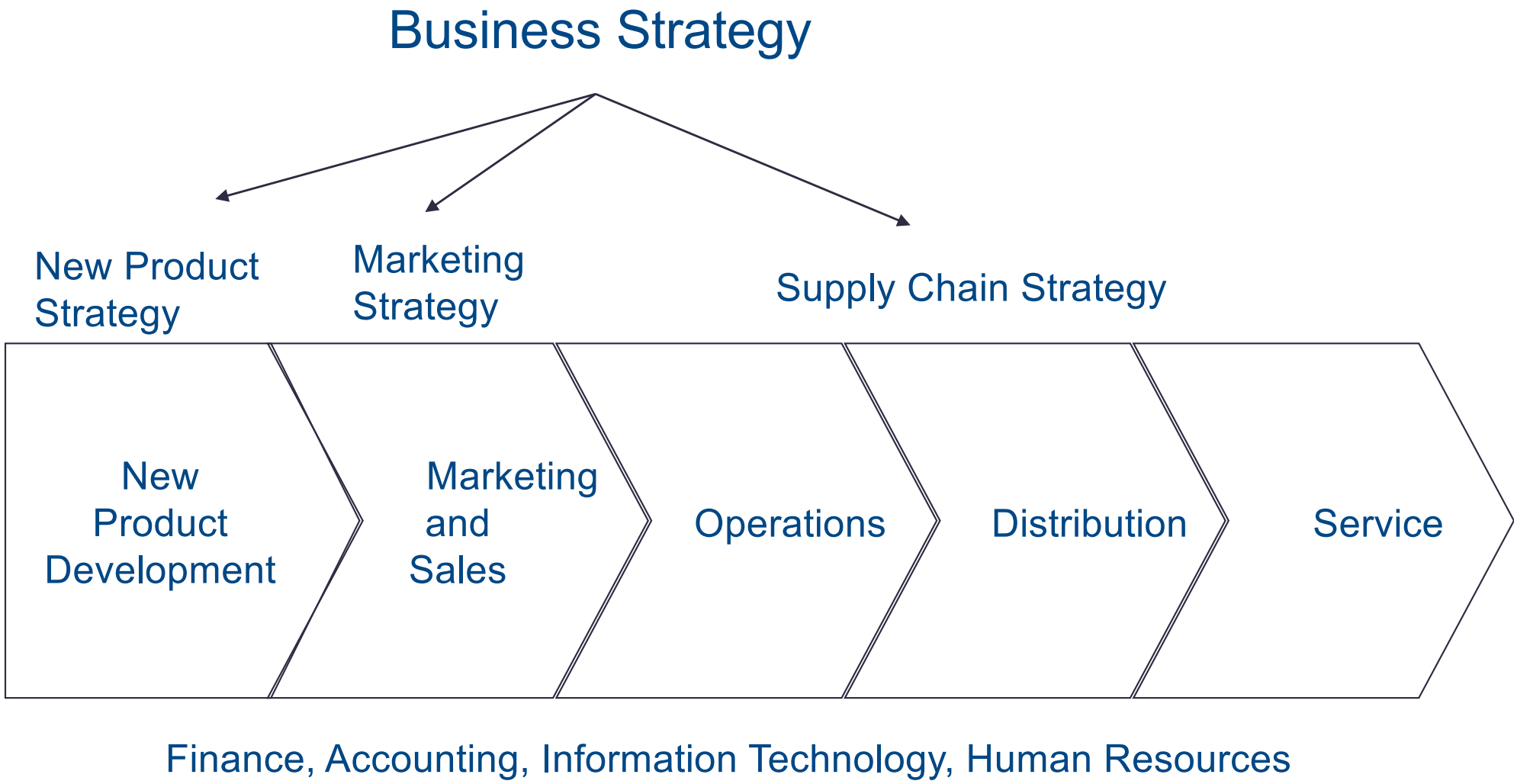
Source: FT research

Information flows



What is the goal of a Supply Chain?
What makes for a “good” Supply Chain?

Maximizing Supply Chain Surplus: The Value Chain



How is Strategic Fit Achieved in Supply Chains?

Step 1: Understanding the customer and supply chain uncertainty

Step 2: Understanding the supply chain capabilities

Step 3: Achieving strategic fit

Step 1: Understanding the Customer and Supply Chain Uncertainty

Identify the needs of the customer segment being served by the following attributes:

- Quantity of product needed in each lot
- Response time customers will tolerate
- Variety of products needed
- Service level required
- Price of the product
- Desired rate of innovation in the product

Understand Demand uncertainty: uncertainty of customer demand for a product

Impact of Customer Needs on Implied Demand Uncertainty

Customer Need	Causes implied demand uncertainty to increase because …
Range of quantity increases	Wider range of quantity implies greater variance in demand
Lead time decreases	Less time to react to orders
Variety of products required increases	Demand per product becomes more disaggregated
Number of channels increases	Total customer demand is now disaggregated over more channels
Rate of innovation increases	New products tend to have more uncertain demand
Required service level increases	Firm now has to handle unusual surges in demand

Step 2: Understanding the Supply Chain

How does the firm best meet demand?

Dimension describing the supply chain is supply chain responsiveness

Supply chain responsiveness -- ability to

- respond to wide ranges of quantities demanded
- meet short lead times
- handle a large variety of products
- build highly innovative products
- meet a very high service level

Step 2: Understanding the Supply Chain

There is a cost of achieving responsiveness

Supply chain efficiency: cost of making and delivering the product to the customer

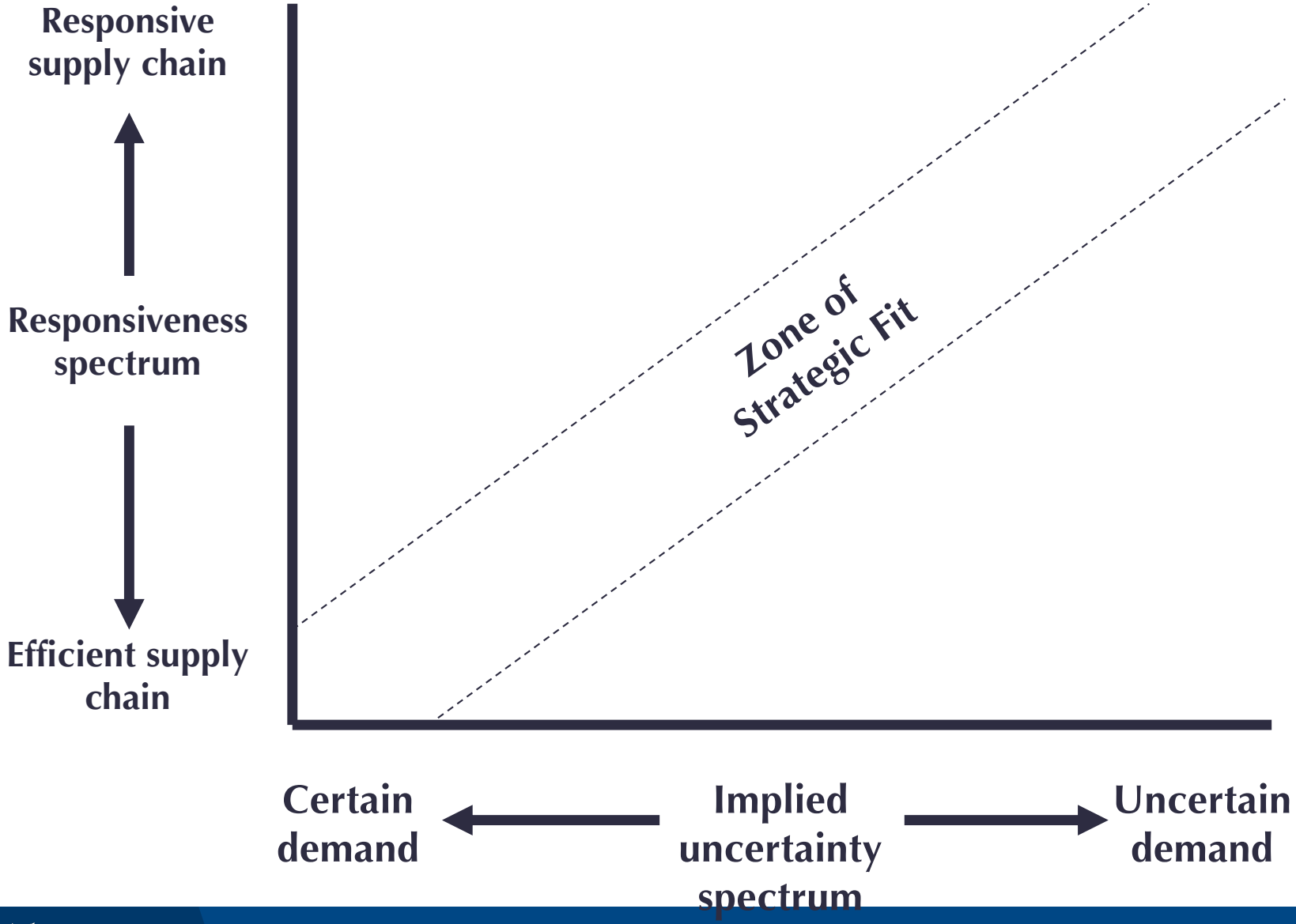
Increasing responsiveness results in higher costs that lower efficiency

Second step to achieving strategic fit is to map the supply chain on the responsiveness spectrum

Step 3: Achieving Strategic Fit

Ensure that what the supply chain does well is consistent with target customer's needs

Achieving Strategic Fit Shown on the Uncertainty/Responsiveness Map



Comparison of Efficient and Responsive Supply Chains

	Efficient	**Responsive**
Primary goal	Lowest cost	Quick response
Product design strategy	Min product cost	Modularity to allow postponement
Pricing strategy	Lower margins	Higher margins
Mfg strategy	High utilization	Capacity flexibility
Inventory strategy	Minimize inventory	Buffer inventory
Lead time strategy	Reduce but not at expense of greater cost	Aggressively reduce even if costs are significant
Supplier selection strategy	Cost and low quality	Speed, flexibility, quality
Transportation strategy	Greater reliance on low cost modes	Greater reliance on responsive (fast) modes

Supply Chain and Risk

Inside the Great Kettlebell Shortage of 2020

They’re sold out everywhere. How complicated could it be to just make some more? Turns out, very.

New York City’s Kettlebell Shortage: ‘People Are Kind of Freaking Out’

After fitness enthusiasts were forced to reimagine how they could keep in shape, demand led to a shortage of workout equipment.

Rogue prides itself on manufacturing and selling American-made goods, but the company's kettlebells are normally manufactured overseas. Most of the kettlebells that you could have ordered before March 13 were; it's probably not surprising that, in 2020, there are few American foundries eagerly pumping out large bulbs of iron. But

The irony is that Cumberland Foundry doesn't really want to be in the kettlebell business. Cumberland isn't automated, and its president, Tom Lucchetti, estimates that it takes a full day to produce 40 to 50 kettlebells (with Rogue handling last steps, like painting the bells). Rogue typically buys internationally-produced kettlebells by the shipping container. "I've been clear with them from the start that isn't something we can keep up with," Lucchetti says.

Besides, Lucchetti has no illusions about the current, likely fleeting situation. Foundries in America have, since the '80s, been decimated by globalization. "We're a country that off-shored most of our heavy industry and manufacturing, and now look at what that's caused," he says. "We can't even make paper masks. I just saw the news report that the [New England] Patriots sent a plane to get a million paper masks from China. It's pathetic that our manufacturing in America is where it is."

LOGISTICS REPORT

Drugmakers Race to Build Covid-19 Vaccine Supply Chains

Supply shortages, specialized handling and tight transportation capacity will make it harder to distribute hundreds of millions of vaccine doses

Supply Chain Risk:

McKinsey&Company

Understanding supply chain risk

Executives believe they face growing risk from disruptions to their supply chains—yet many are unprepared to manage those risks.

Deloitte.

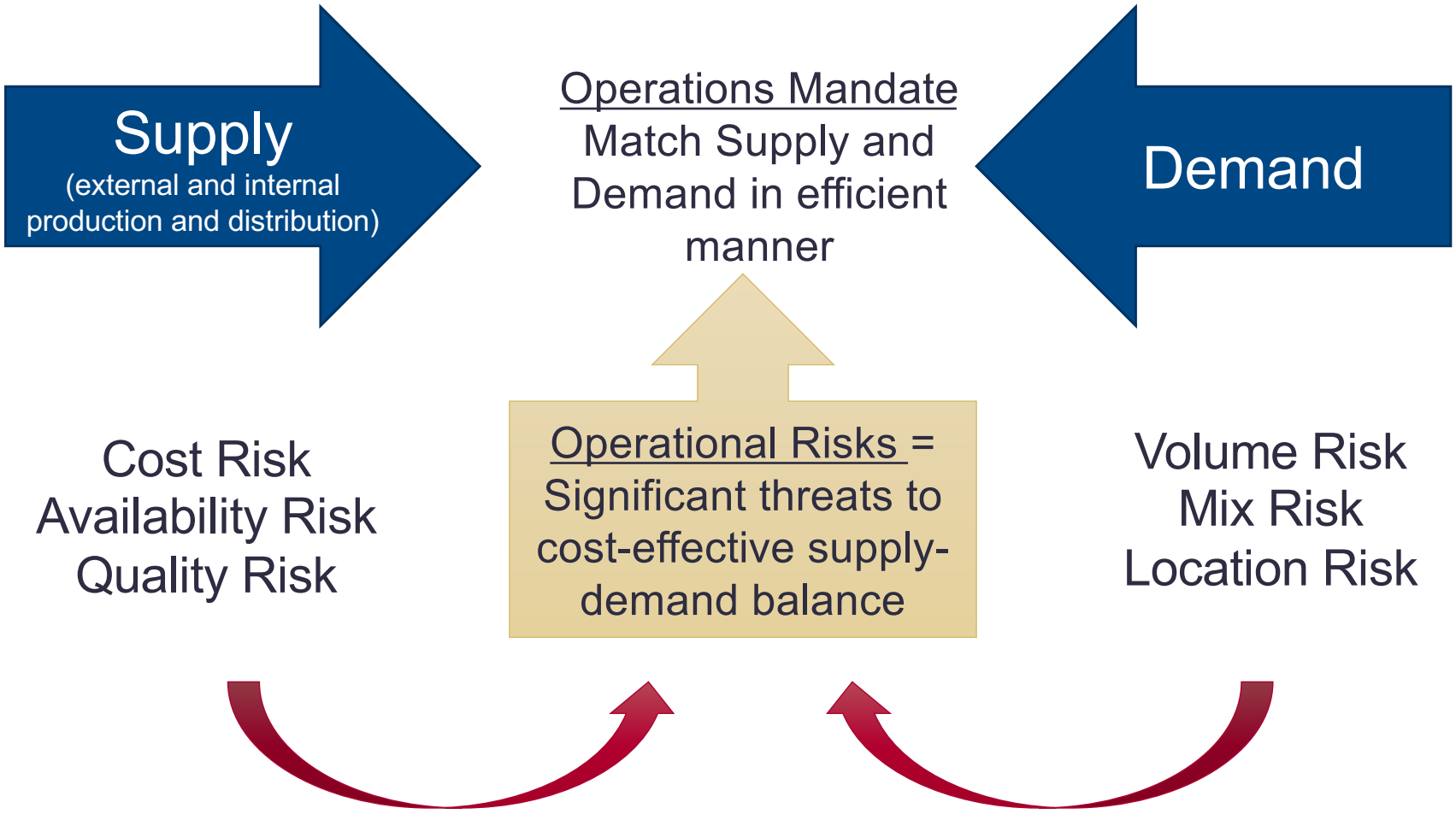
Supply Chain Risk Management

Supply chain risk management (SCRM) forms the link between your organization, customers, suppliers and your business environment: it reduces dependency and promotes synergy. Existing supply chain management theories are enhanced by means of greater focus on the unpredictable factors. SCRM represents a new broom sweeping through your supply chain.

Operational Risk
The Enterprise Risk Management Perspective

Source: Table adopted from page 23 of Enterprise Risk Management by James Lam.

Operational Risk:
A Broader Perspective



Availability Risk - Disruptions

Natural Disasters

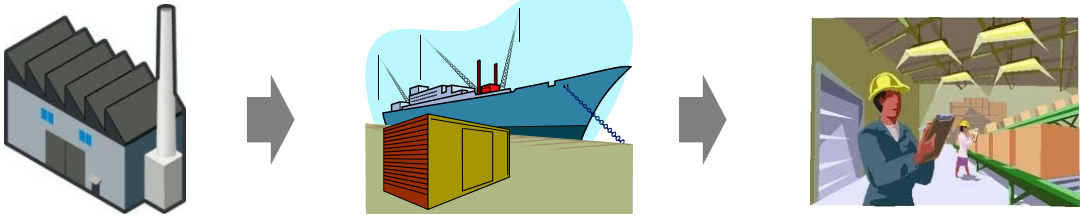
Trade Disputes

IT system vulnerability

Fire

Govt. mandated shutdown

Temporary Interruption of Supply/Production/Transportation



Terrorism

Pandemic

Supplier bankruptcy

Labor Stoppage

Infrastructure Failure

Thailand Floods 2011 – Western Digital

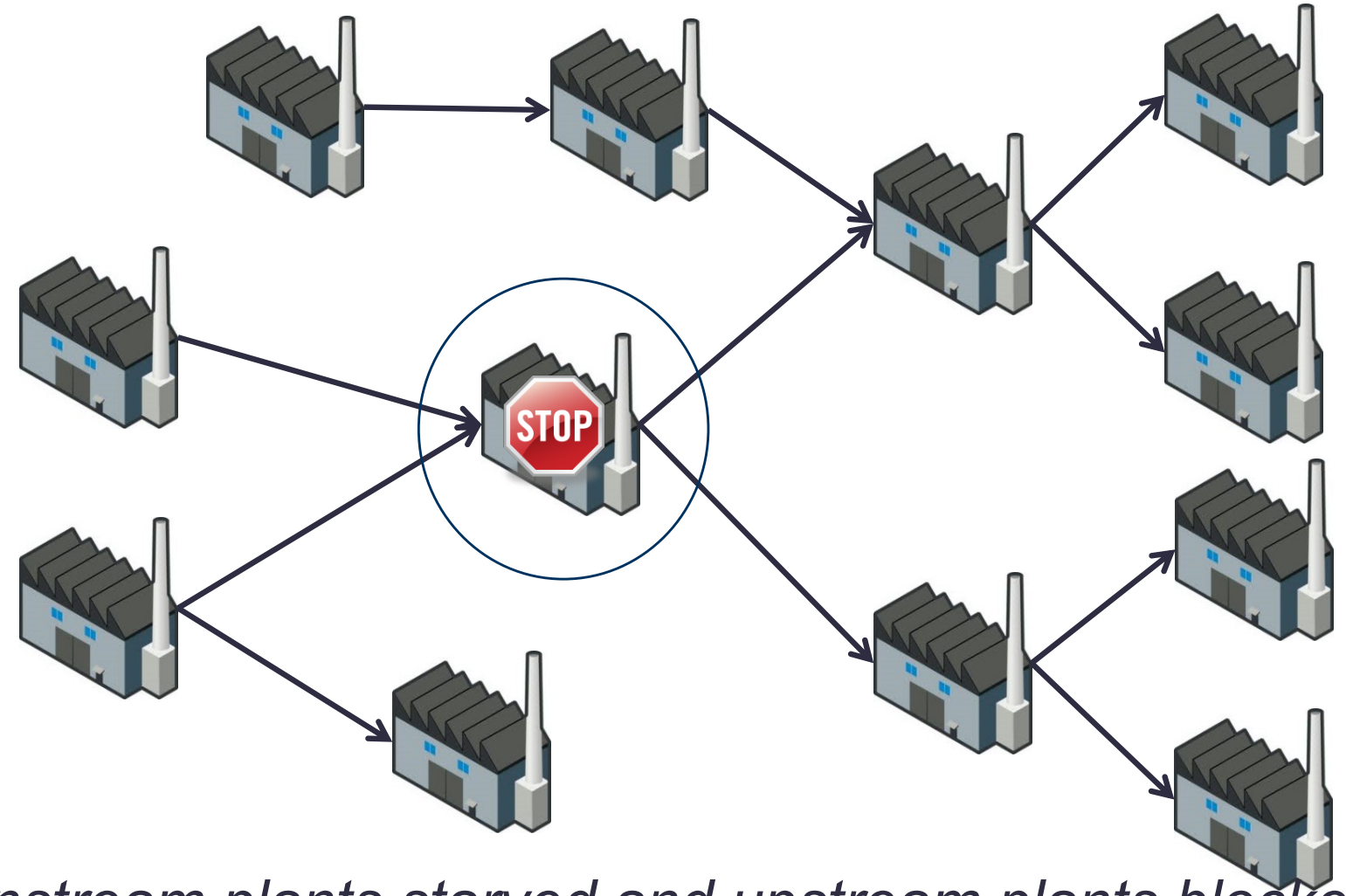
40-45 % of the world's hard disk drives are produced in Thailand. Western Digital accounts for 33% of global hard-drive market. Western Digital produces 60% of its hard drives in Thailand.

"Until the floodwaters came, a single facility in Bang Pa-In owned by Western Digital produced one-quarter of the world's supply of "sliders," an integral part of hard-disk drives."[2]

In January 2012 John Coyne, the president and CEO of Western Digital, said that "*production in the company's factories in Thailand would not return to pre-flood levels until September*."[3]

"The shortage is not entirely bad news for the disk-drive business, especially for those companies whose facilities were not damaged, such as Seagate, which has a factory high and dry on a plateau in northeastern Thailand. Mr. Monroe said price increases will help lift industry profit margin to about 30 percent from about 20 percent before the floods."[2]

Network Effects: Cascading Stoppages



Downstream plants starved and upstream plants blocked

Note: Here, specifically I am assuming a plant failure. Similar analogy hold for a transportation link failure.

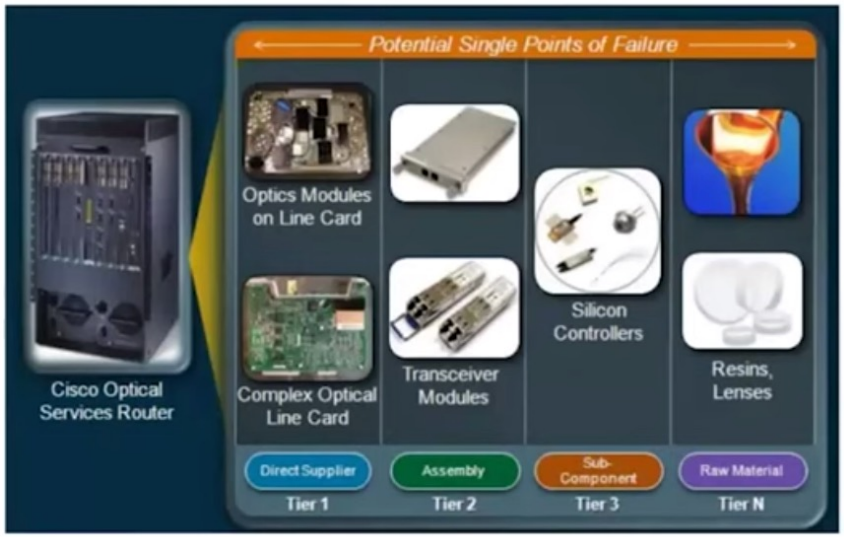
What can you do? (before and after)

Assessment	Prevention	Mitigation	Initial response	Recovery

What can you do? (before and after)

Assessment	Prevention	Mitigation	Initial response	Recovery
Supply Chain mapping				
Risk analysis: Time to Recovery (TTR), Revenue at Risk				

Cisco risk identification



Markets

Ford Throws Lifeline to Auto-Parts Suppliers Facing Cash Crunch

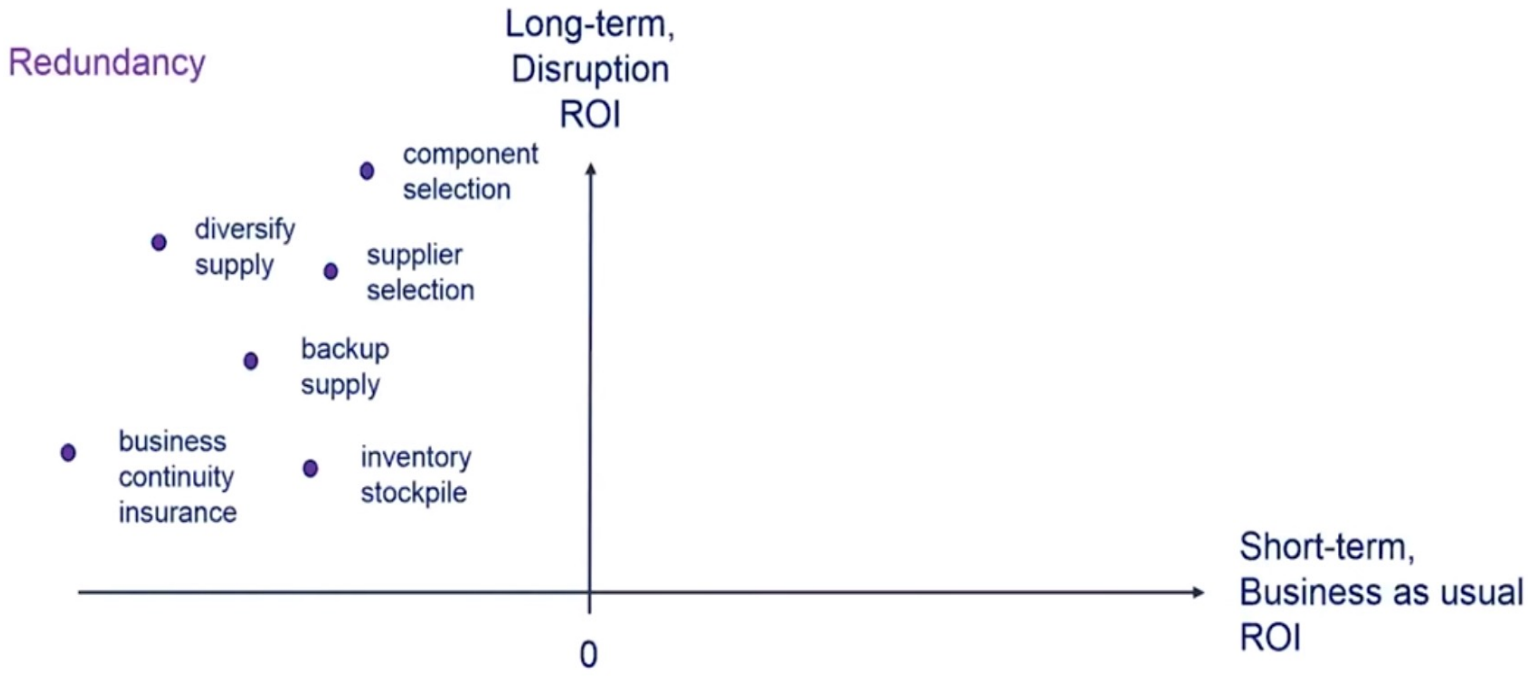
By Keith Naughton

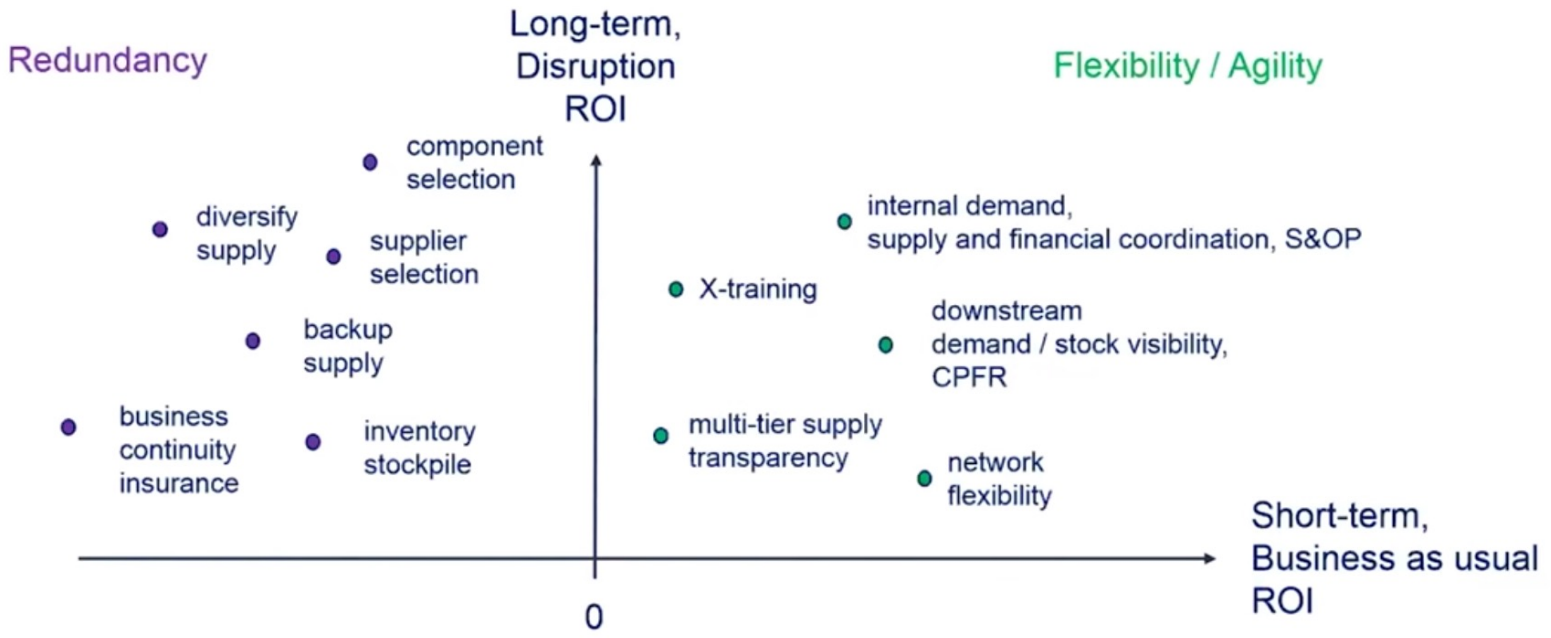
May 21, 2020, 6:56 PM EDT

> "In light of current market conditions, Ford is creating an early-payment program for our supply base," Jennifer Flake, a company spokeswoman, said in an emailed statement. "This new voluntary program creates access to cash flow and working capital to Ford suppliers."

What can you do? (before and after)

Assessment	Prevention	Mitigation	Initial response	Recovery
Supply Chain mapping	Strategic sourcing	Supplier diversification	Information assessment	Manage demand
Risk analysis: Time to Recovery (TTR), Revenue at Risk	Supplier selection (location) Network Design	Dual sourcing	Secure capacity and logistics	Modify product Plan excess capacity
	Product design (modular architecture)		Damage prevention	Financing options


Redundancy
Long-term,
Disruption
ROI
component
selection
diversify
supply
supplier
selection
backup
supply
business
continuity
insurance
inventory
stockpile
0
Short-term,
Business as usual
ROI

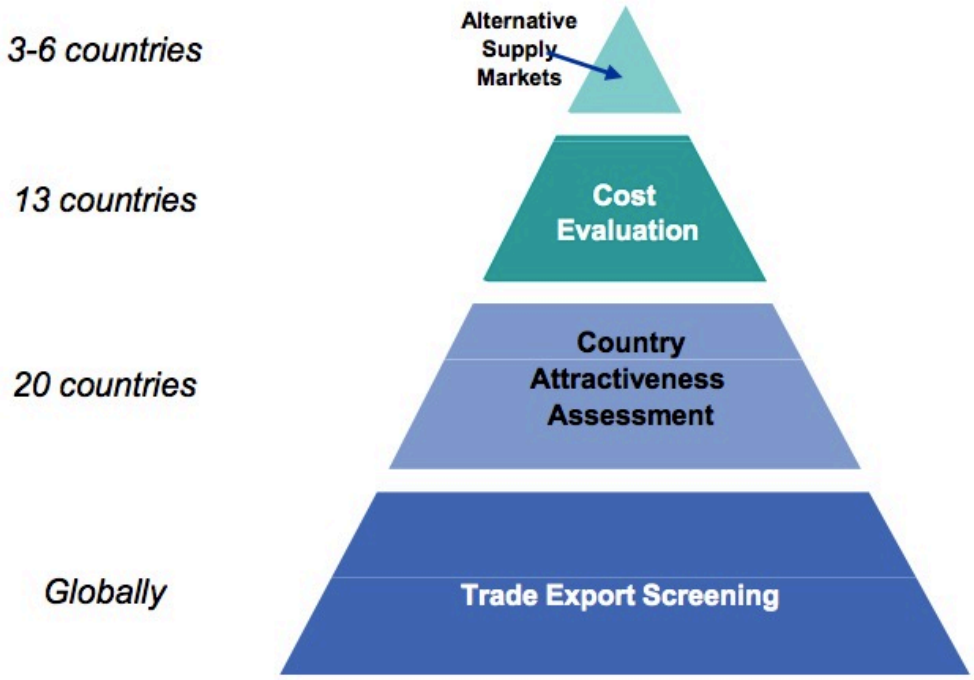

Redundancy
Long-term,
Disruption
ROI
Flexibility / Agility
component
selection
diversify
supply
supplier
selection
backup
supply
business
continuity
insurance
inventory
stockpile
internal demand,
supply and financial coordination, S&OP
X-training
downstream
demand / stock visibility,
CPFR
multi-tier supply
transparency
network
flexibility
Short-term,
Business as usual
ROI
0

Global Supply Chains

How do we identify alternative global supply markets for now and institutionalize the capability to do so again in the future?

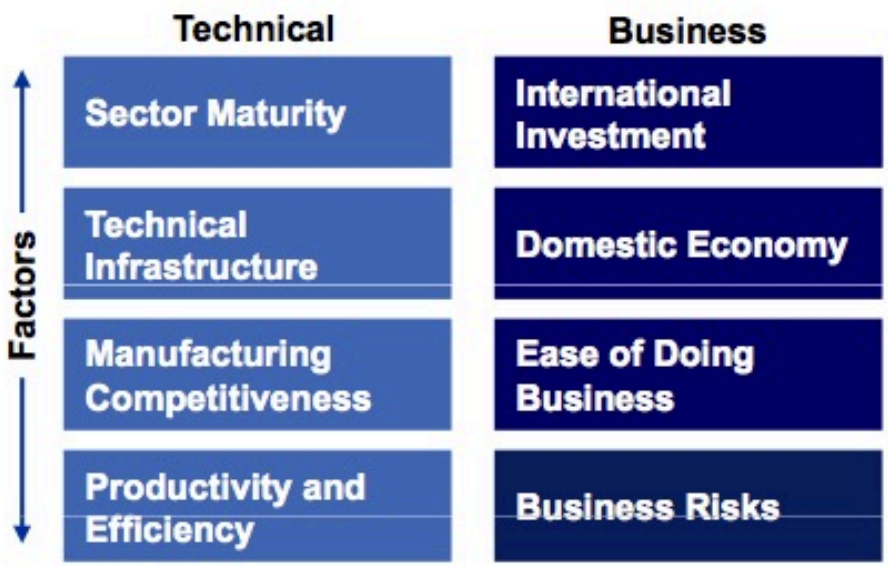
How do we identify alternative global supply markets for now and institutionalize the capability to do so again in the future?

OUR APPROACH



- Alternative supply markets were selected based on attractiveness, cost advantage and strategic fit
- Total Landed Cost model was built to analyze alternate sources of supply
- A Country Segmentation model was built to rank countries' attractiveness
- Global assessment of industry presence was conducted through trade export analysis for plumbing related industries

Export data of nine trade codes were analyzed to assess industry presence



Country Segmentation Model

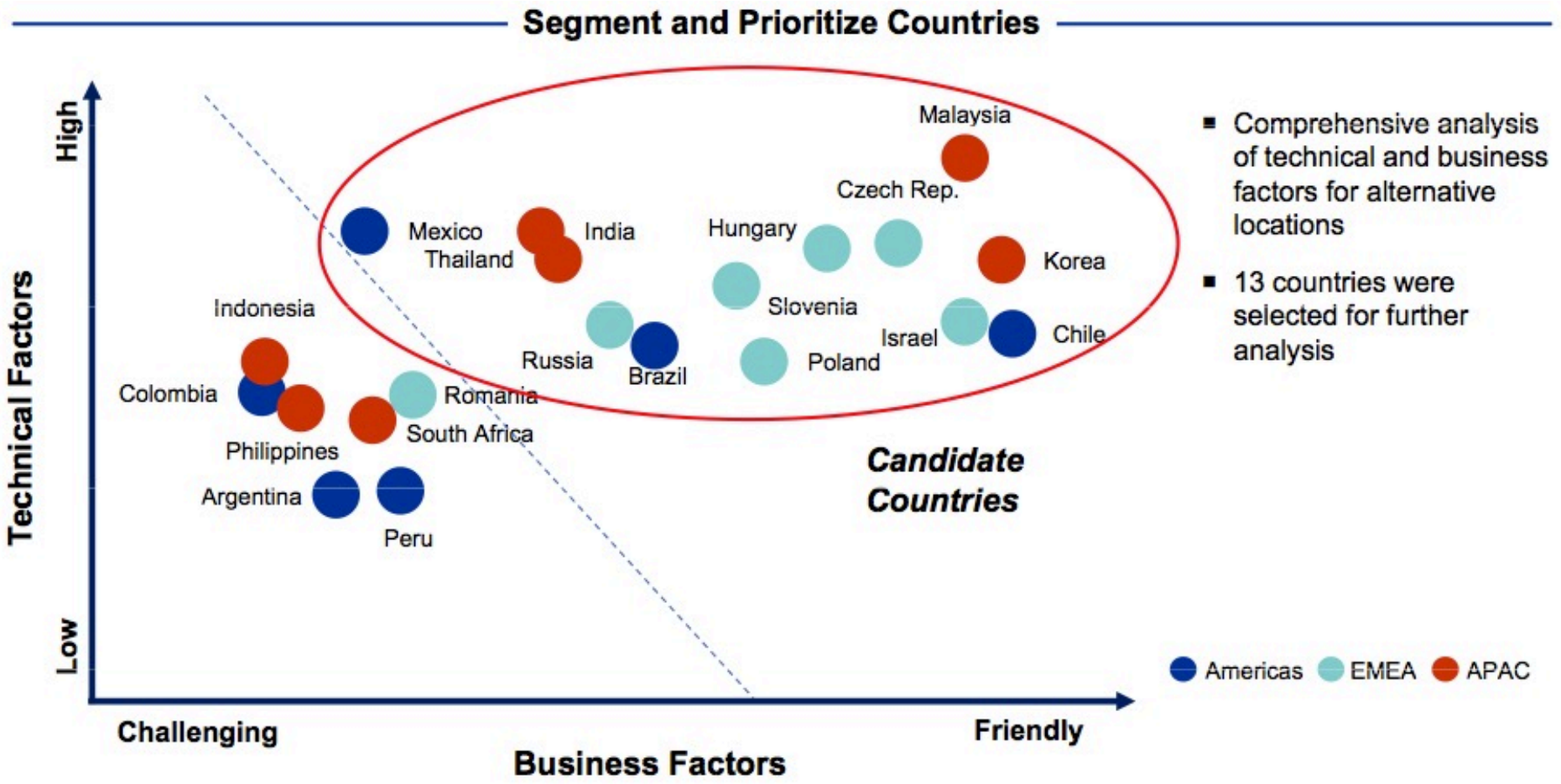
Factors	Sub-Factors	Source		Argentina	Brazil	Chile	China	Colombia
Technical Competency - Industry/Sector Presence								
Overall Manufacturing Maturity			*Score*	3.3	3.3	3.7	4.3	3
	Manufacturing /GDP ratio	IMD		31.70%	26.90%	47.10%	49.20%	29.10%
			score 1-5	3	3	5	5	3
	Manufacturing % of total export	IMD		48.60%	63.10%	71.20%	88.30%	70.30%
			score 1-5	2	3	3	5	3
	Employment % in manufacturing sector	IMD		N/A	28.8%	23.3%	25.2%	19.3%
			score 1-5	5	4	3	3	3
Sector			*Score*	1.8	1.8	1.8	3.8	1.8

Country Assessment Scoring Model

Rate each country "1" through "5" for every factor

			Argentina	Brazil	Chile	Colombia
50%	Business Environment		2.41	2.97	3.69	2.24
	30% Economic Performance		2.08	3.58	2.35	1.92
	40%	Domestic Economy	2.7	3.7	2	2.3
	50%	International Investment	1.5	3.5	2.5	1.5
	10%	Employment	2.5	3.5	3	2.5
	40% Business Efficiency		3.04	2.99	4.13	2.66
	30%	Productivity and Efficiency	3.5	3.5	5	2.5
	40%	Ease of Doing Business	2.5	2	3.5	2
	30%	Labor Market	3.3	3.8	4.1	3.7

Segment and Prioritize Countries



Detailed Cost Evaluations

Approach to Total Cost Evaluation

- Alternative markets were analyzed across Proxima's end-to-end supply chain costs

Factors	Costs	Macroeconomics
	Raw Material	Wages
	Labor	Productivity
	Overhead	Producer Prices
	Freight / Tariffs	Currencies

Total Landed Cost Tool

Total Landed Cost Model Roll-up and Scenario Modeling

Value Chain Activity	Baseline (2008) USD	Baseline (2008) %	Scenario 1 (2008) USD	Scenario 1 (2008) %
Raw Component Manufacturing	$ 200.0	46%	$ 205.2	47%
Value-Add Processing	$ 200.0	46%	$ 200.0	46%
Inbound Freight	$ 1.8	0%	$ 2.9	1%
Tariffs and Duties	$ 4.0	1%	$ -	0%
Outbound/Inter-facility Freight	$ 1.2	0%	$ 1.2	0%
Distribution	$ 30.5	7%	$ 28.0	6%
Department Overhead	$ 0.7	0%	$ 0.7	0%
Total Landed Cost	$ 438.1		$ 438.6	
Savings	0	0%	$ (0.4)	0%

Future Adjustment Factors	2009	2010	2011	2012	2009	2010	2011	2012
Future Landed Cost	$ 454.2	$ 469.3	$ 486.8	$ 506.4	$ 442.8	$ 445.0	$ 452.6	$ 459.6
Savings $	$ -	$ -	$ -	$ -	$ 11.4	$ 24.3	$ 34.2	$ 46.8
Savings %	0%	0%	0%	0%	3%	5%	7%	9%
% increase in TLC	3.7%	3.3%	3.7%	4.0%	1.0%	0.5%	1.7%	1.5%

Global Networks: Total Landed Cost

TLC = total end-to-end cost to transform inputs at sourcing location to outputs at customer locations

Track flow units through the process (ABC-like): e.g. offshoring

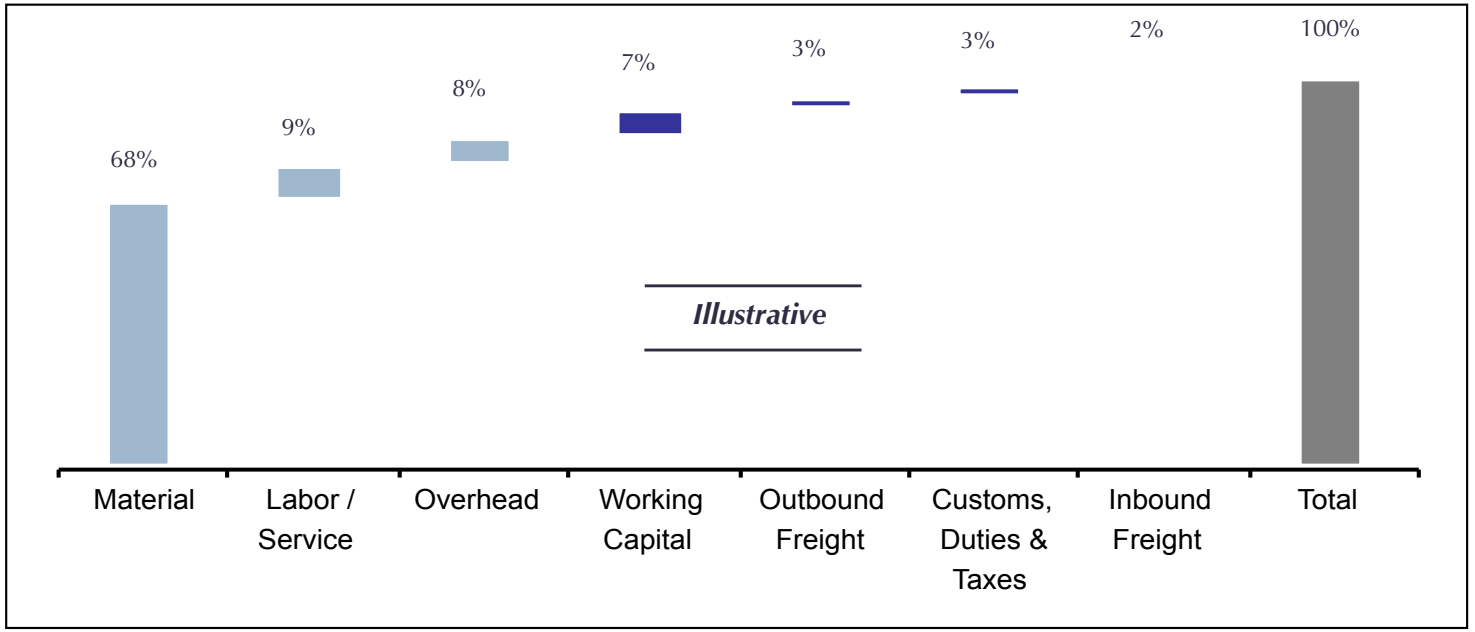
1. Inbound RM and services purchased at offshore plant
2. Inbound logistics of moving inputs to offshore plant
3. Processing and inventory cost at offshore plant
4. OH at offshore plant and domestically
5. Logistics from offshore plant to domestic DC: consider cost and leadtimes for

   Offshore plant > offshore port > domestic port > DC

   Consider working capital (both cash cost and pipeline inventory)
6. Outbound fulfillment from DC
7. Include any other costs that are impacted by increased activity in end-to-end

Total Landed Cost is a key global dual sourcing tool

Total Landed Cost Analysis



Source: Deloitte Research and Projects

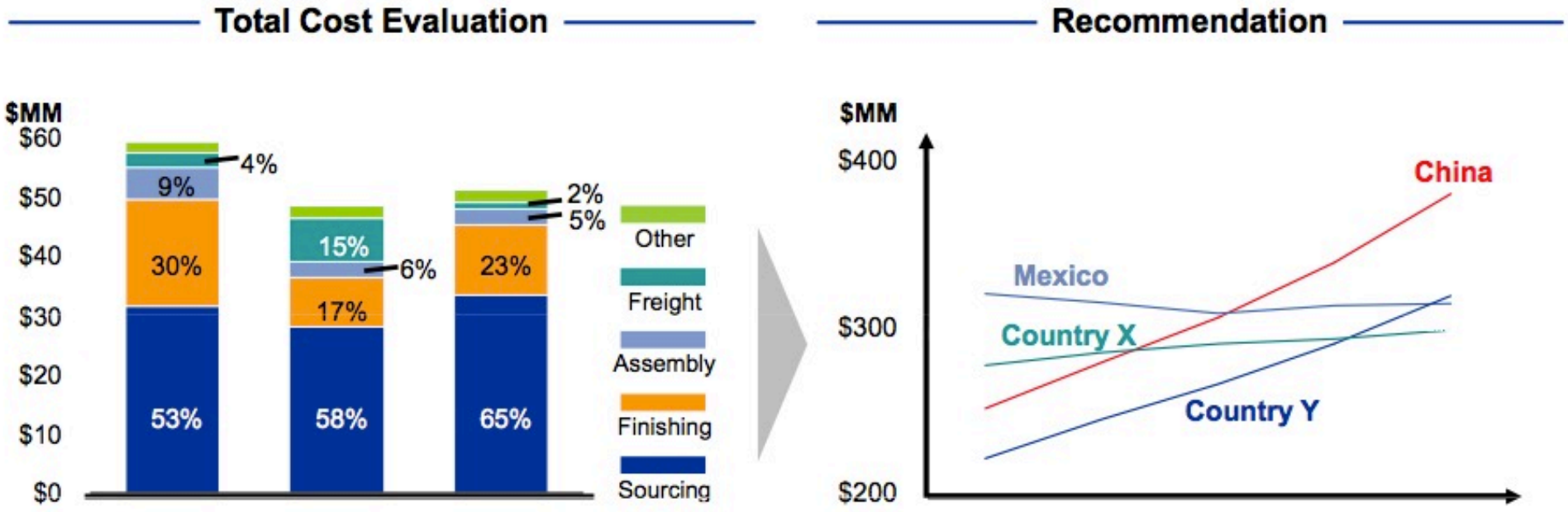
Cost elements associated with traditional cost of goods

Cost elements included in the development of the TLC model

Total Landed Costs provides the lens to true sourcing costs and serves as the basis for evaluating sourcing alternatives.

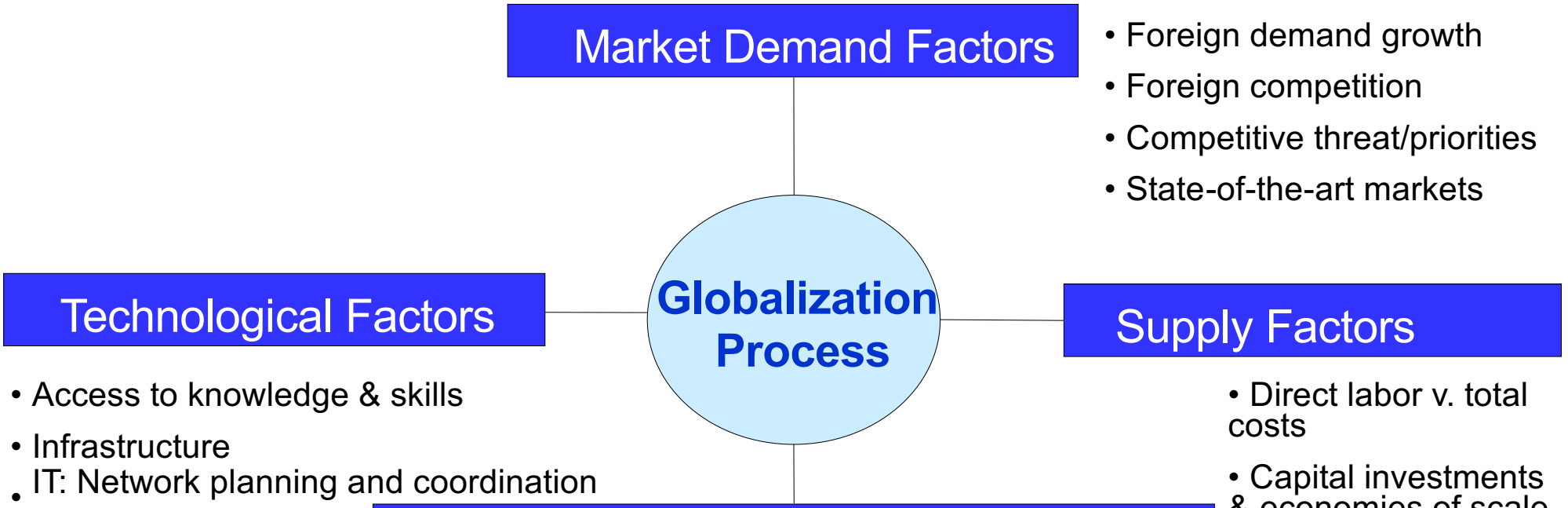
TLC analysis enables improved business decisions without sacrificing customer service

Detailed Cost Evaluations



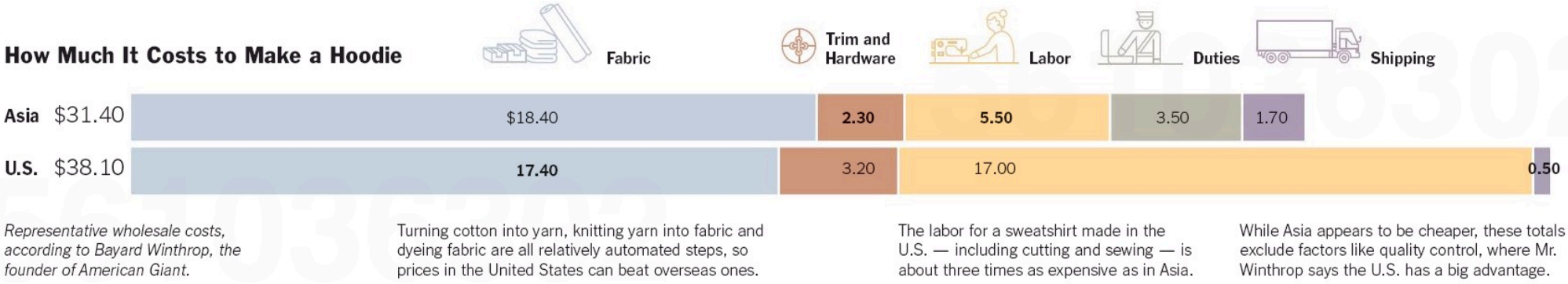
Capacity Location

Globalization and operations



Kouvelis and Niederhoff (2007)

TLC in Apparel:
Bayard Winthrop, founder of American Giant



Representative wholesale costs, according to Bayard Winthrop, the founder of American Giant.

Turning cotton into yarn, knitting yarn into fabric and dyeing fabric are all relatively automated steps, so prices in the United States can beat overseas ones.

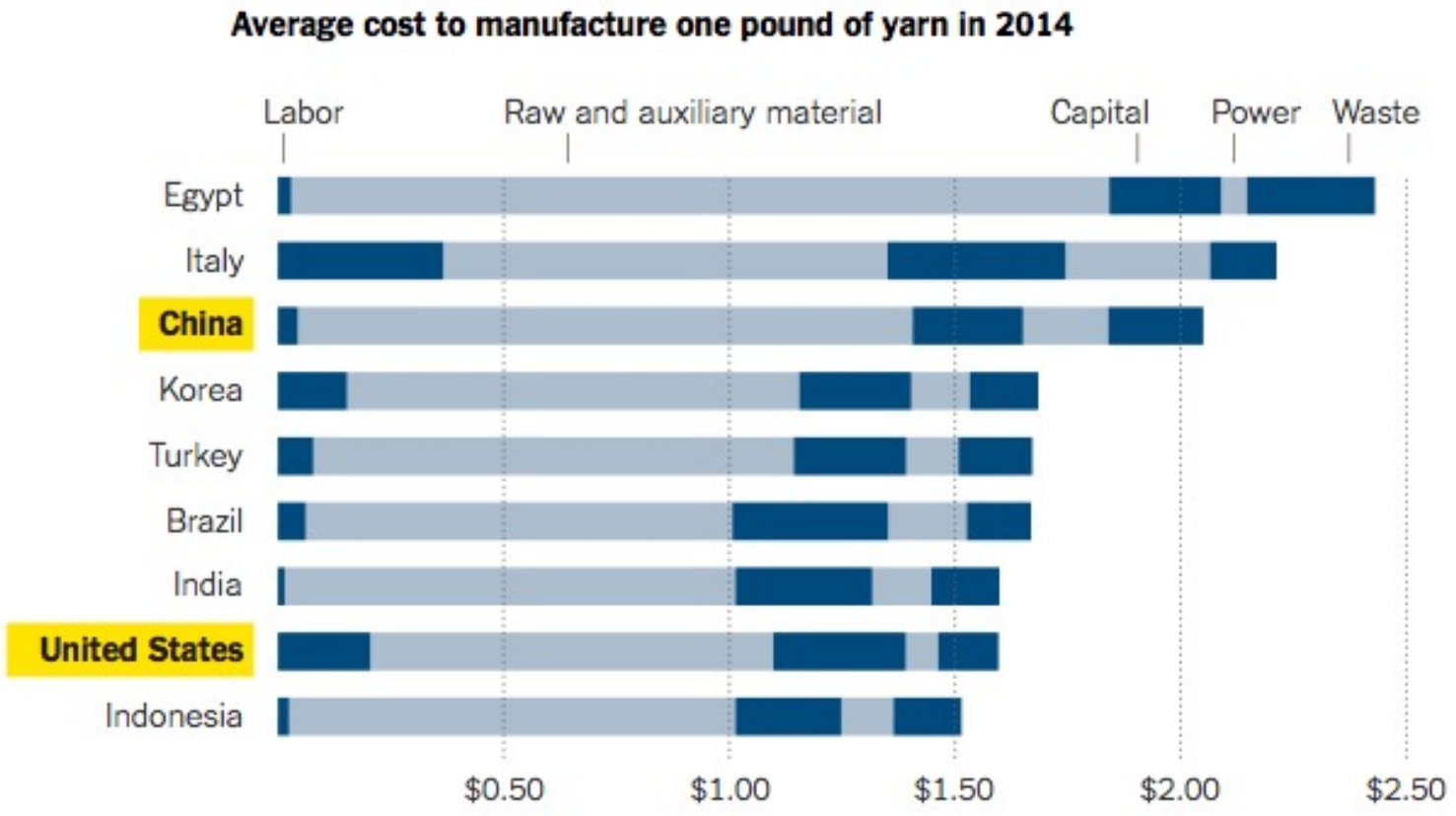
The labor for a sweatshirt made in the U.S. — including cutting and sewing — is about three times as expensive as in Asia.

While Asia appears to be cheaper, these totals exclude factors like quality control, where Mr. Winthrop says the U.S. has a big advantage.

New York Times, Sep 20, 2013

Global total cost comparison for making yarn

Although labor costs are relatively low in **China**, other costs like the price of raw materials and electricity have made it more expensive to make yarn there than in many other countries, including the **United States**.



The New York Times | Source: International Textile Manufacturers Federation

Global Supply Chains Face Challenges

Demand Volatility

- What product and customer traits drive demand fluctuations?
- How can sourcing decisions be tailored in light of shifting demand patterns?

Supply Risk

- What are the hard and soft costs of supply chain risk?
- How can sourcing be responsive to mitigate risk?

Cost Visibility

- What are the hidden costs of global sourcing?
- How can my total landed cost be determined?

Execution Complexity

- How do I make product to plant allocation decisions?
- What criteria should drive those decisions?

After The Crisis

Coronavirus Will Stretch, Not Break, Global Supply Chains

Trading networks have a remarkable ability to heal themselves and continue along their previous paths.

By David Fickling
May 16, 2020, 8:00 AM EDT

Cargo Culled
Even before coronavirus struck, global trade volumes were falling for the first time since the 2008-2009 financial crisis

Source: CPB World Trade Monitor
Note: Shows y/y change in seasonally adjusted world trade volumes index.

Learning Points

- How can supply chain strategy best deliver on the corporate profit and productivity goals combined with the customer service and responsiveness promises?
- Consider the Total Landed Cost which adds working capital considerations (inventory investment and service) to COGS.

Summary

- Strategic framework
  - 3 Floes
  - Efficient vs Responsive Supply Chain

- Supply chain risk
  - Cost-Resilience Tradeoff
  - Risk Assessment: Visibility

- Global supply chains
  - Total Landed Cost
  - Challenges: Volatility, execution and visibility