

Session 8: **Logistics & Supply** **Chain Management**

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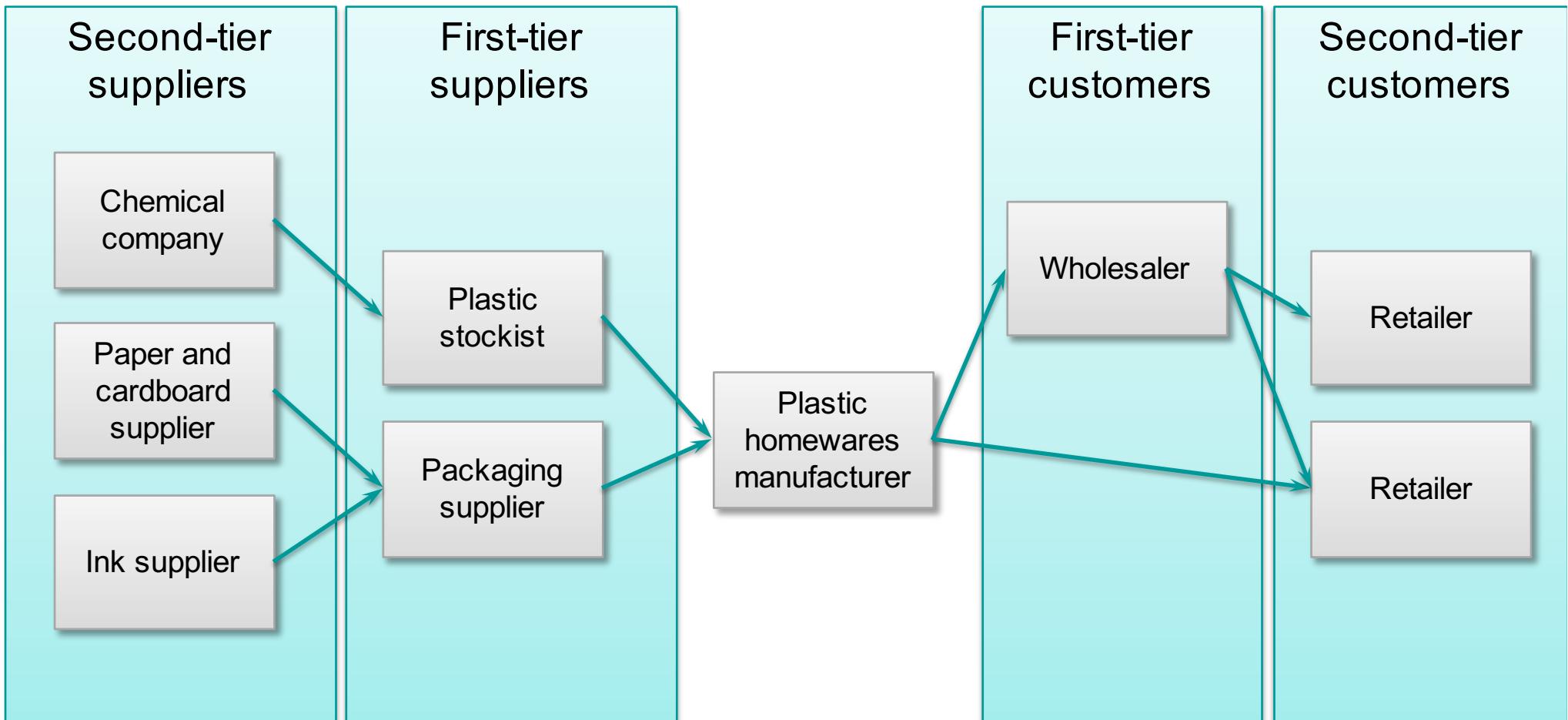
Some Key Questions

1. What does a supply network look like?
2. How should the network be configured and what factors influence that?
3. Should we make parts or products in house or outsource?
4. Where should key operations in the network be located?
5. How much to distribute, and to where?
6. What distribution strategy to use?

1. Introduction to Supply Networks

Homewares Manufacturer's Supply Network

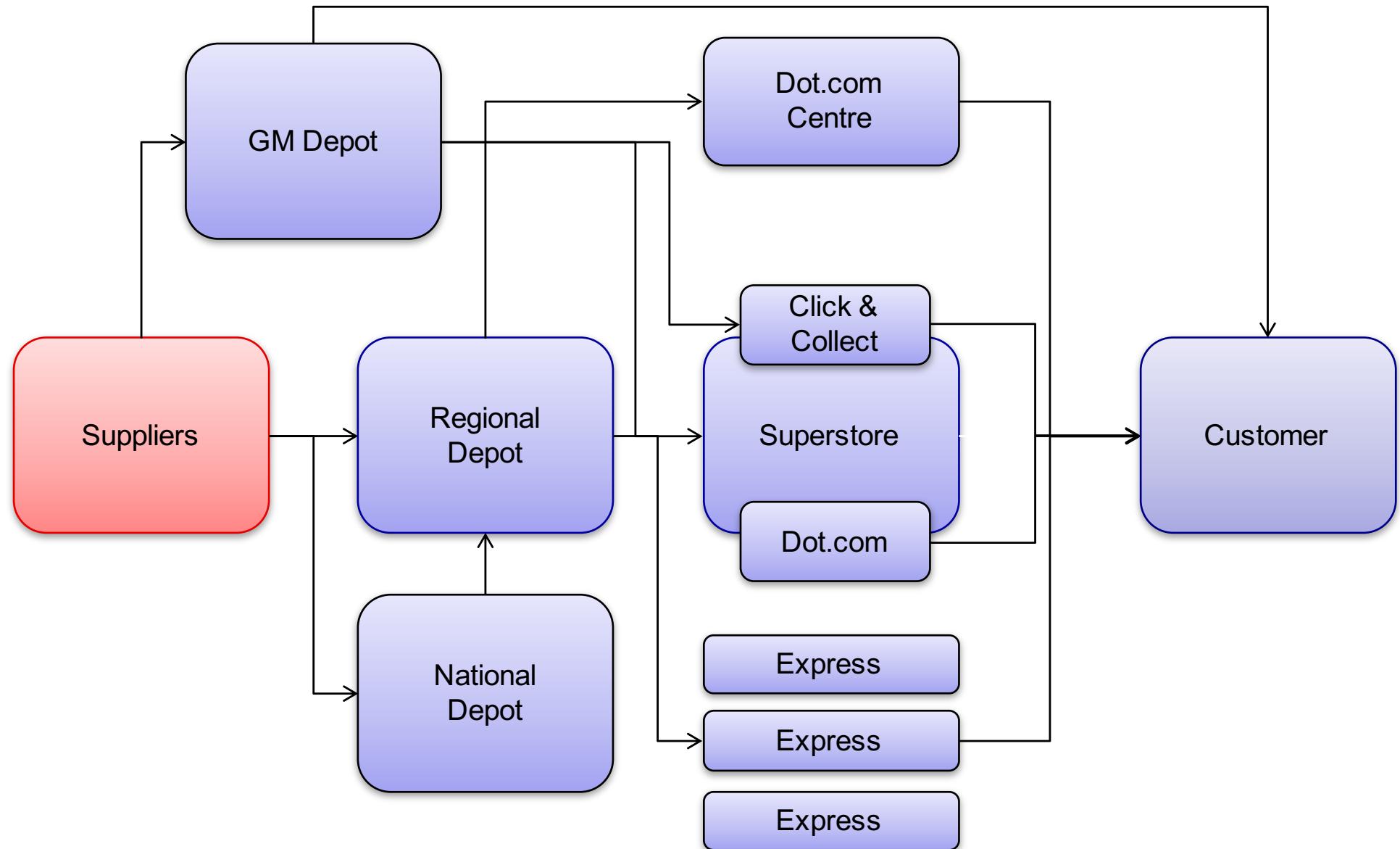
Flow of information and money



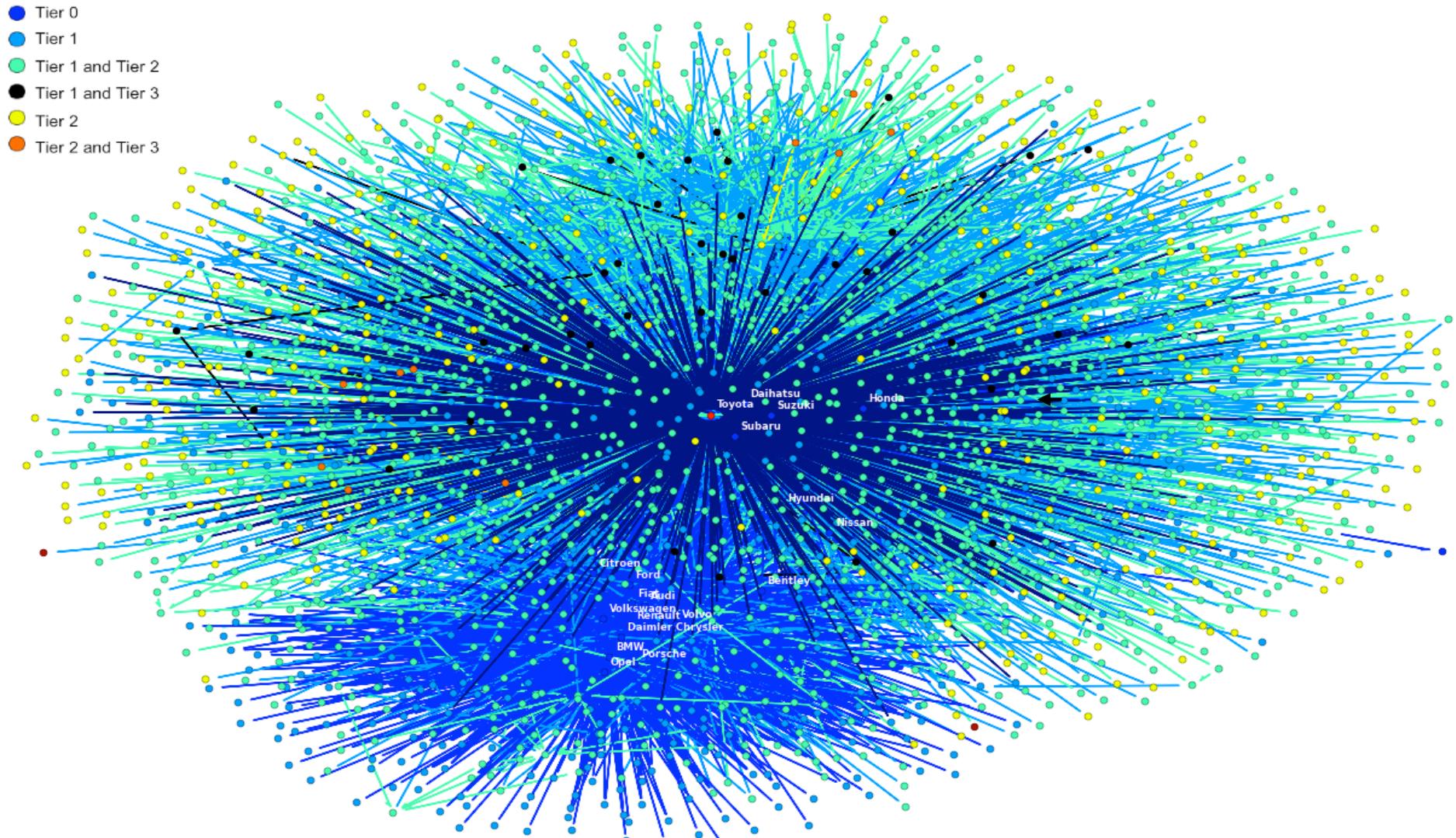
Flow of goods

(Source: Slack et al.)

Tesco Supply Network

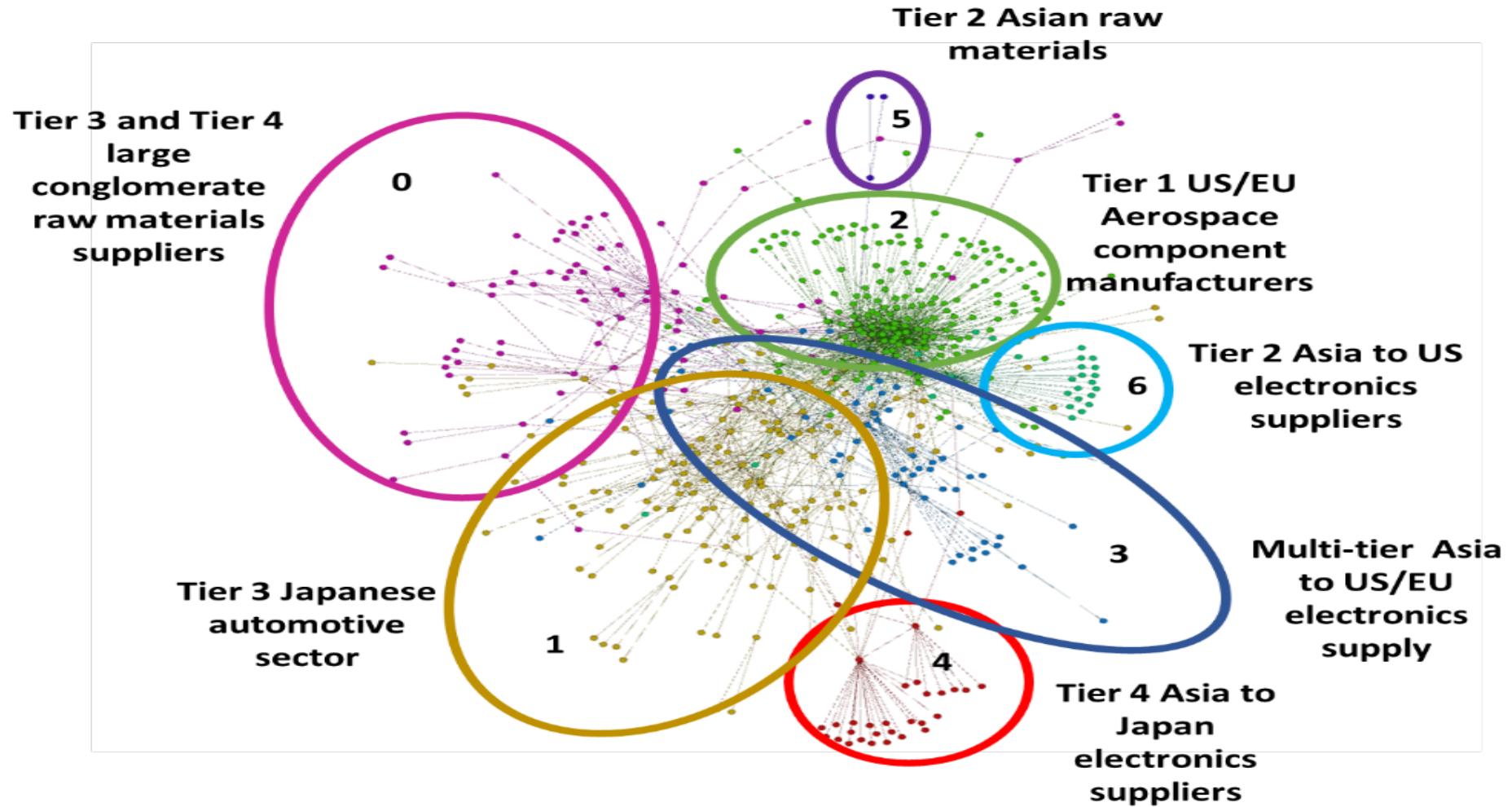


Toyota Japan Supply Network



Source: Brintrup et al. (2013)

Aerospace Supply Network



Source: Brinrup (2015)

2. How Should the Networks be Configured?

Configuration “Choices”?

- Number of tiers
- Number of suppliers at each tier?
- Number of alternative suppliers?
- Level of control over tiers?

Freedom in making these “choices” depends on many issues:

- Company size
- Number of available suppliers
- Standard vs. specialised components, etc.

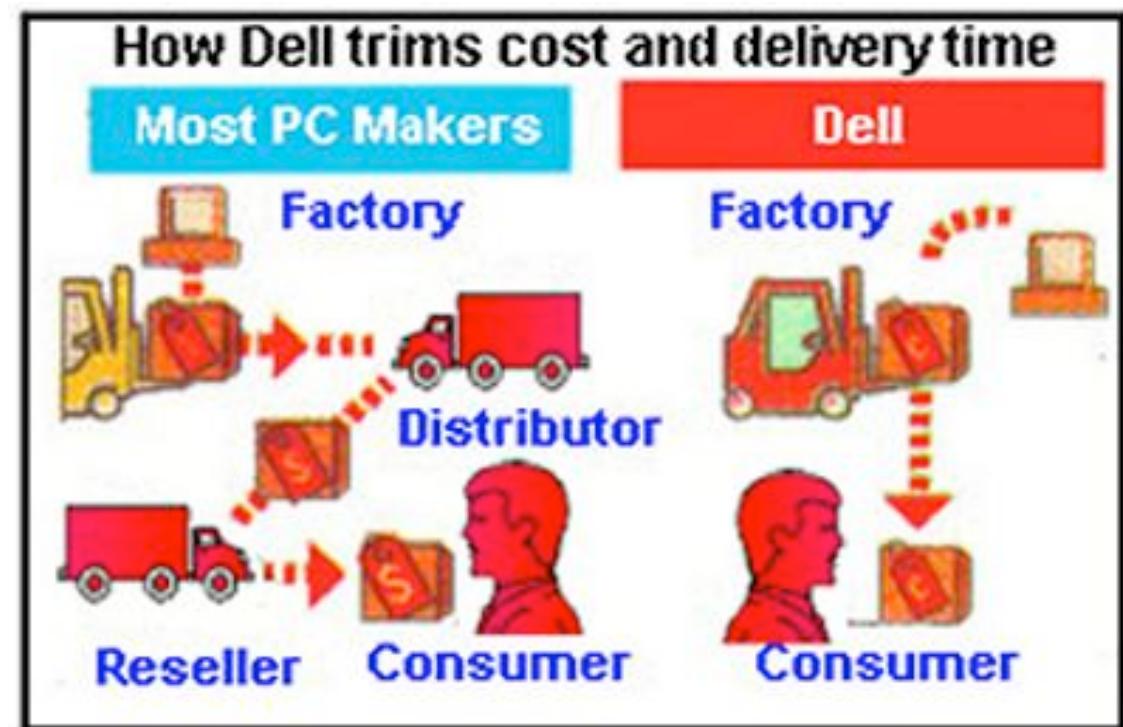
Number of Tiers: Dell [2000s]

Customer Side

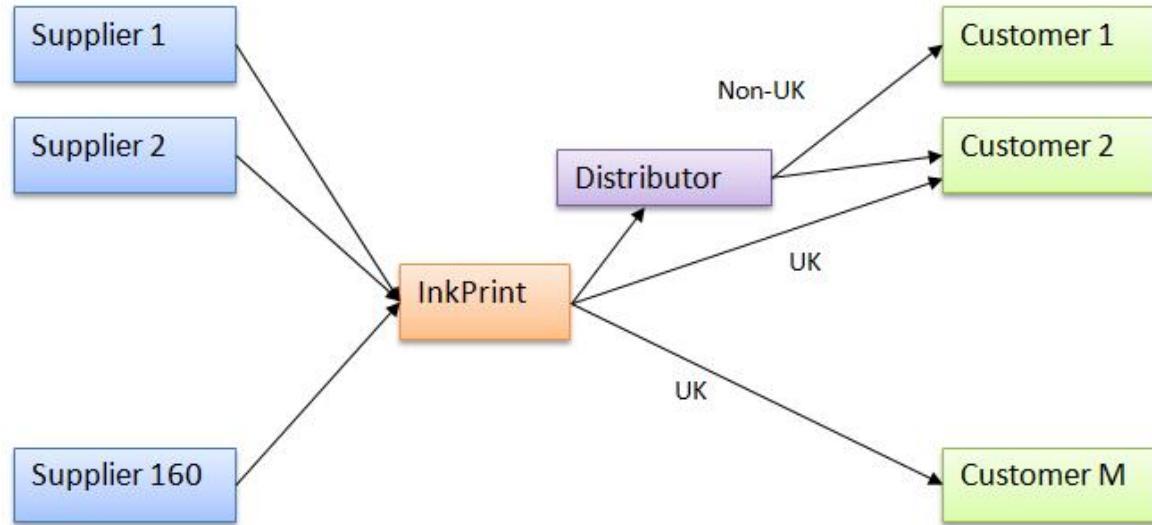
- Disintermediation or “cutting out the middle men”
- Exploiting the power of internet

Supply Side

- Modular product design
- Late customisation
- “Platform” design



Number of Suppliers at Each Tier: Domino

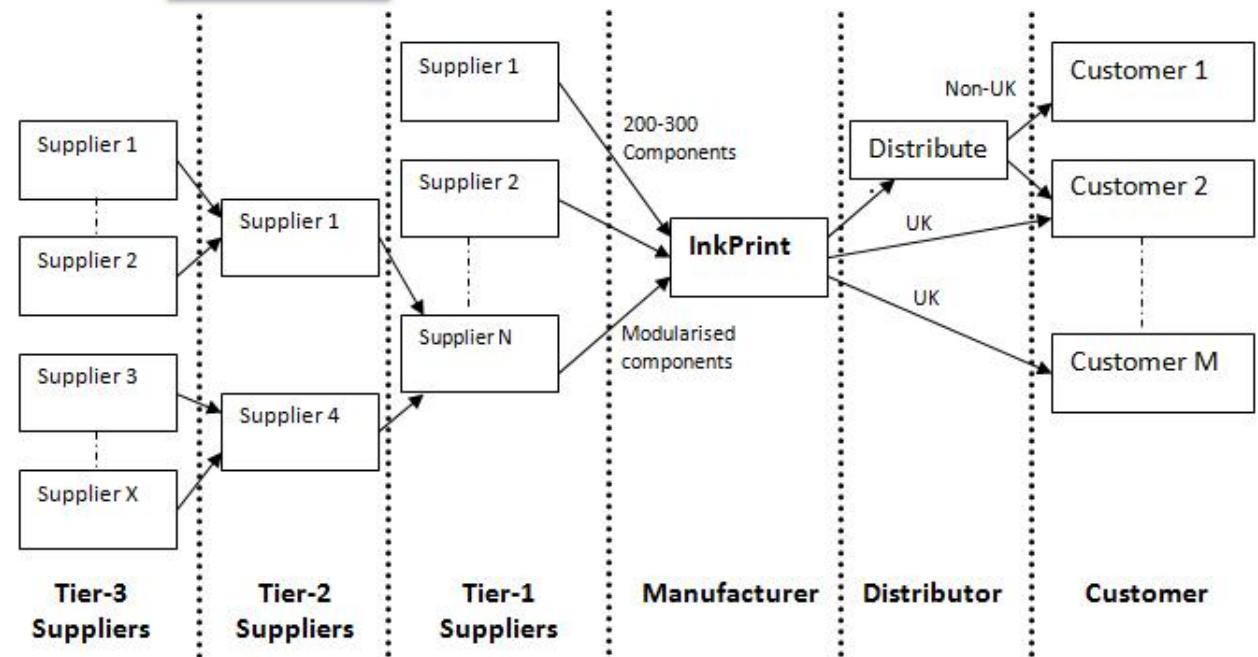


"Flat" supply network structure

- 300 to 400 basic components
- 160 suppliers, 60% of suppliers in the UK

Tiered supply network structure

- Outsource manufacturing of modules to China
- Less than 10 core modules
- Less than 20 suppliers for modules and other basic components



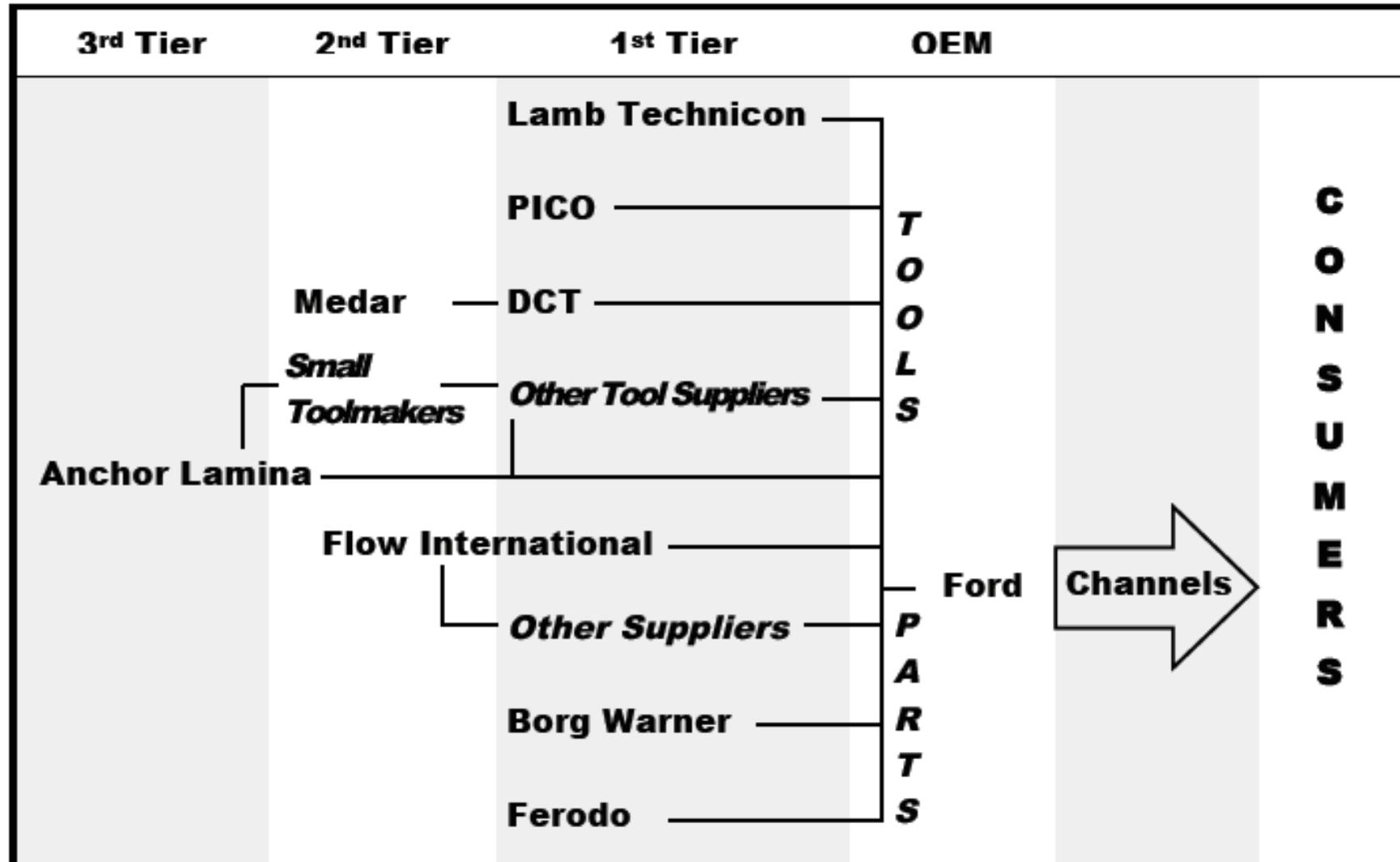
Number of Alternative Suppliers: Nokia / Eriksson & Philips Fire

In short ...

- Philips factory in New Mexico
- Producing radio frequency chips
- 40% of output went to Nokia, Eriksson
- Lightning strike caused fire in 2000
- Contaminated much of stock
- Limited alternatives globally available
- Nokia acted faster to buy up all global stock
- Losses → Eriksson went out of cell phone manufacturing business ...



Level of Control over Tiers: US Automotive SC Structures

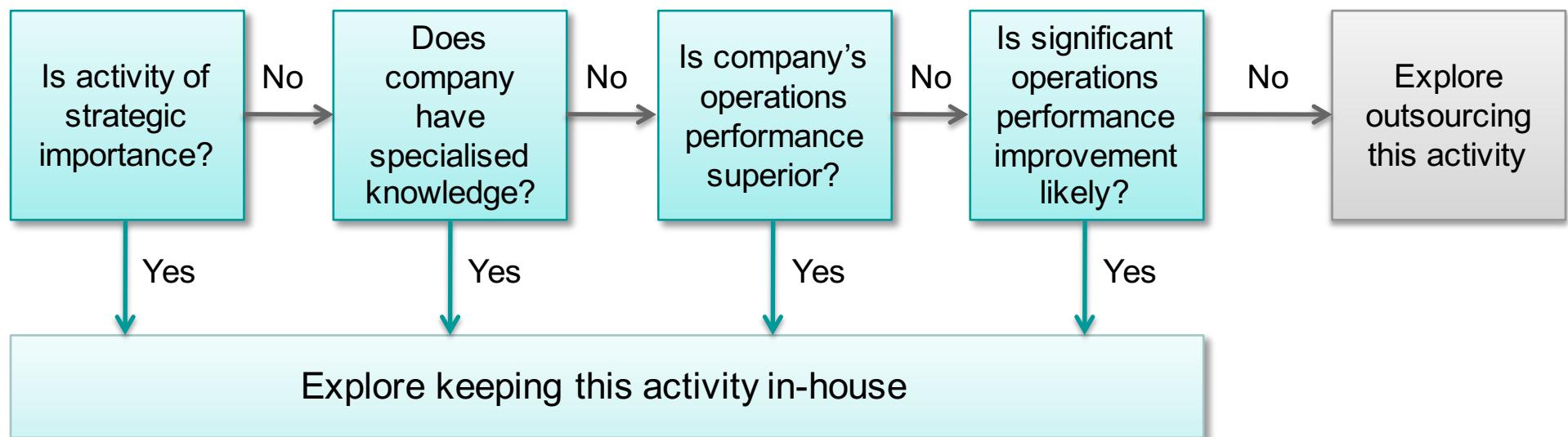


How Should The Network be Configured?

- Simplicity
- Appropriate number of suppliers
- Number of supplier tiers dependent on complexity of product
- Number of customer tiers dependent on selling channels
- Resilient vs. efficient supply chain considerations

3. Make or Buy?

Insource or Outsource?



Outsourcing

Pros

- Focus on core competences
- Harness lower labour cost at supplier
- Access to technology
- Stable and predictable financial planning in fee-for-transaction services
- Less investment risk

Cons

- Loss of control over process
- Limited ability to improve processes
- Risk of opportunistic behaviour of supplier
- Loss of human capital and tacit knowledge

Insource or Outsource?

Performance objective	Do it yourself [CONTROL]	Get it done [SPEED, FLEXIBILITY]
Quality	<ul style="list-style-type: none"> Better traceability Risk of complacency Lack of expertise might affect quality 	<ul style="list-style-type: none"> Supplier may have specialised knowledge Communication of quality problems difficult
Speed	<ul style="list-style-type: none"> Closer synchronisation of schedules If the operation has external customers, internal customers may receive low priority 	<ul style="list-style-type: none"> Speed of response can be built into the contract May be significant transport delays
Dependability	<ul style="list-style-type: none"> Easier communications improves dependability Similar issues as in speed with priority for external customers 	<ul style="list-style-type: none"> Late delivery penalties in the contract can encourage good delivery performance Distance and organisational barriers might inhibit communication
Flexibility	<ul style="list-style-type: none"> Easy to alert when change is needed Ability to respond may be limited by the scale and scope of operations 	<ul style="list-style-type: none"> Contract suppliers likely to have wider capabilities Communication delays might hamper Conflicting needs of different customers
Cost	<ul style="list-style-type: none"> Potential for sharing costs between departments Do not have to make the margins required by outside suppliers Economies of scale difficult to achieve 	<ul style="list-style-type: none"> Economies of scale Motivated to reduce their costs Extra costs of communication, transportation and coordination

4. Location

Location, Location, Location ...

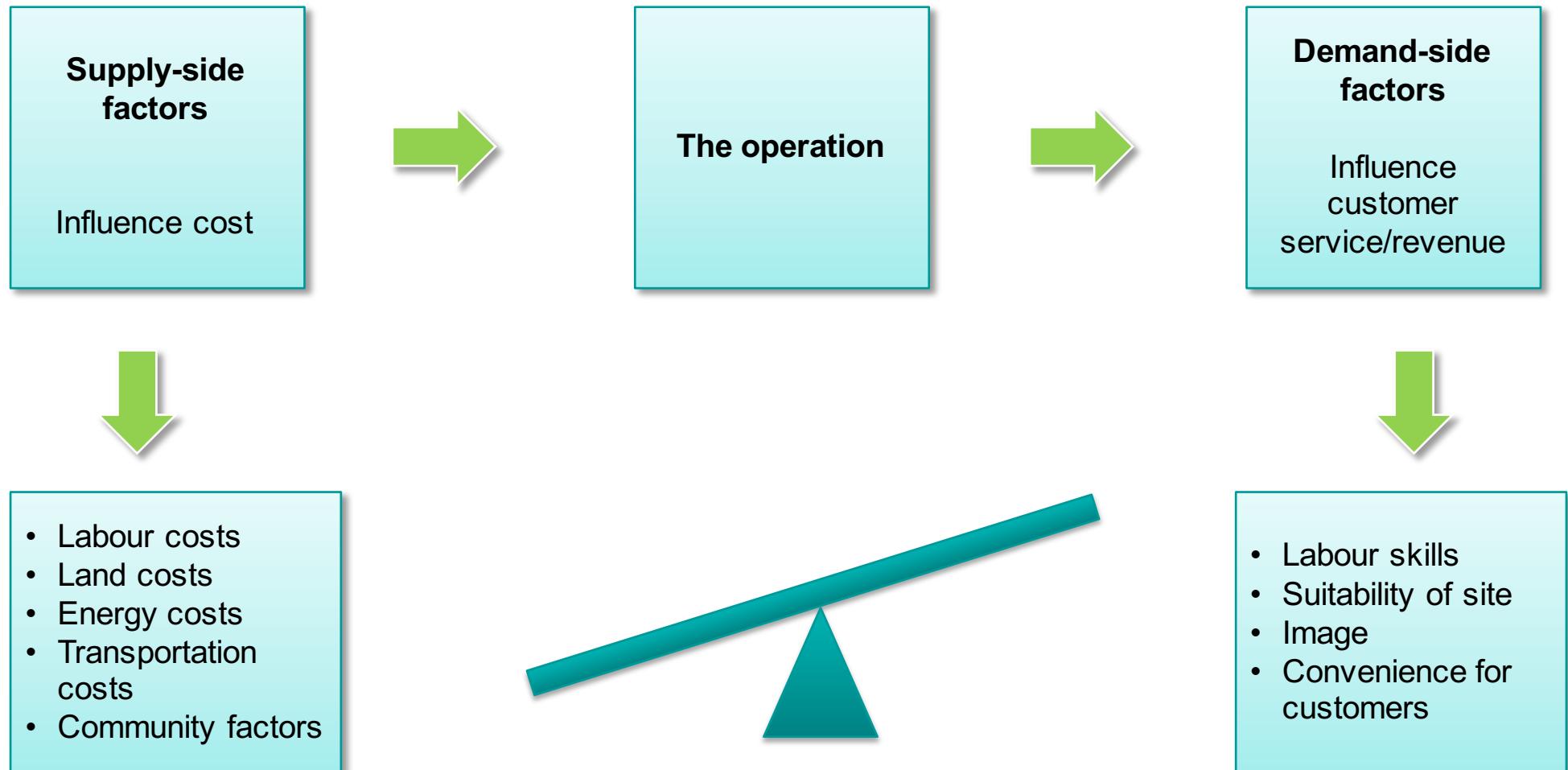


[Location is] the geographical positioning of an operation relative to the input resources, other operations or customers with which it interacts.

Location, Location, Location ...

- **Impact:** The choice of location can have significant impact on profitability
 - E.g., retailing: a few metres can make the difference between profit and loss
- **Driver:** Location changing decisions are prompted by:
 - Changes in demand for goods and services
 - Changes in supply of inputs to the operation
- **Objective:** To achieve an appropriate balance between:
 - Spatially variable costs of the operation
 - The service the operation is able to provide to its customers
 - The revenue potential of the operation
- So how to choose where?

Factors Affecting Location Decisions



Location Choice: Absolut Vodka



Absolut Vodka sells two-thirds of its production in North America. Yet when increasing its capacity, it chose to retain all production in Sweden. In the premium vodka market, quality is essential and authenticity is also important. Producing all vodka in Sweden ensures high quality and maintains the product's brand image.

Levels of Location Decision

- Region/country
 - Area within country/region
 - Specific site



Where to Locate?

Financial/Regulatory

Financial

- Duties and tariffs
- Taxes
- Shipping costs

Regulations

- Employment
- Environmental
- Construction

Stability/Risk

Risk

- Political stability
- Economic stability
- Social stability

Labour force

- Costs
- Education/skill

Local culture

- Ethics
- Language

Proximity to Markets

People/ Market

Infrastructure

Infrastructure

- Transportation
- Utilities

Opportunities for expansion

Within country

- Access to ports
- Location relative to transportation network
- Location relative to supplies

5. How Much to Distribute, and to Where?

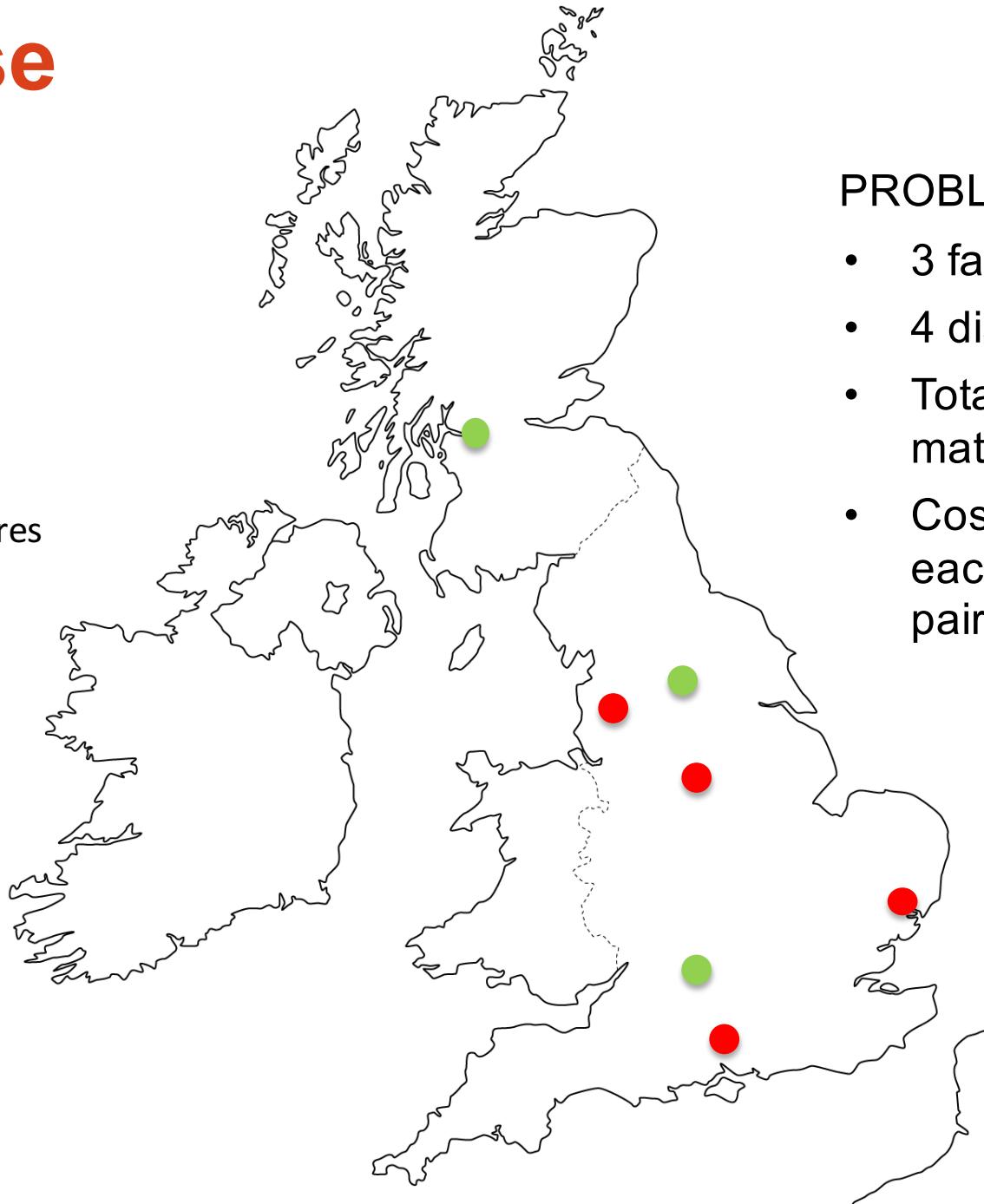
Distribution Decisions

- How much to distribute, to where?
- At least three ways to solve the problem:
 - Simulation
 - Optimisation (Mathematical Programming)
 - Heuristics
- We will focus on one heuristic: “NorthWest Corner”
 - Simple “rules of thumb” that seem to work
 - Easy to understand (common sense)
 - Can be efficient
 - Not necessarily optimal (but “good enough”)
 - May not be evident why they work

Exercise

● Factories

● Distribution Centres



PROBLEM:

- 3 factories
- 4 distribution centres
- Total supply/demand matched
- Costs provided for each factory/DC pairing

Example: Distribution Matrix

	Demand			Cost	“Rim conditions”		Supply
	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)			
Glasgow (A)		2	2	11		7	6
Leeds (B)		1	0	6		1	2
Swindon (C)		5	8	15		9	10
Required at distribution points	7	6	3	2			18

The NorthWest Corner Method

- Create a matrix of sources and destinations
- Set initial allocation from NW corner
 - Fulfil as much of demand from first destination from the first source as possible
 - If supply from first source > demand from first destination, allocate excess to second destination
 - If supply from first source < demand from first destination, fulfil demand from second source (and so on ...)

NW Corner Initial Solution

Allocation



	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2	2	11	7	6
Leeds (B)	1	0	6	1	2
Swindon (C)	5	8	15	9	10
Required at distribution points	7	6	3	2	18

Total cost: $2*6+1*1+0*1+8*5+15*3+9*2 = £116$

Finding An Improved Solution

- Calculate the change in cost of supplying one unit from each currently empty cell while preserving demand/supply rim conditions (opportunity cost)
 - Determine a closed path, starting at the empty cell being evaluated and stepping from squares with assignments back to the original cell
 - Right angle turns in this path are permitted only at cells with assignments and the original empty cell
 - Because only the cells at the turning points are considered to be on the closed path, both empty and assigned cells maybe skipped over
 - Add and subtract the transport costs of each cell on the closed path as necessary to preserve the rim conditions (i.e., you add a unit in one cell, then you should subtract a unit from the next cell on the closed path, so that the row and column totals remain unchanged)
- Reallocate the maximum possible quantity (subject to rim conditions) to the lowest cost cell, following the path evaluated
- Solution is optimal if all the opportunity costs are zero or positive

Evaluation of Square AX for Possible Improvement

Improvement

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	(-) 2 6	(+) 2	11	7	6
Leeds (B)	(+) 1 1	(-) 0 1	6	1	2
Swindon (C)	5	8 5	15 3	9 2	10
Required at distribution points	7	6	3	2	18

Possible improvement: $+2-0+1-2 = +1$

Evaluation of Square AY for Possible Improvement

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	(-) 2 6	2 +1	(+) 11	7	6
Leeds (B)	1 1 (+)	0 -1 (-)	6	1	2
Swindon (C)	5	(+) 5 - 8	15 -3 (-)	9 2	10
Required at distribution points	7	6	3	2	18

Possible improvement: $+11-15+8-0 +1-2= +3$

Evaluation of Rest of The Cells

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2 6	2 +1	11 +3	7 +5	6
Leeds (B)	1 1	0 1	6 -1	1 0	2
Swindon (C)	5 -4	8 5	15 3	9 2	10
Required at distribution points	7	6	3	2	18

How many can you shift to CW?

Limiting cell

Improving The Solution: Shifting 1 Unit to CW

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2 6	2	11	7	6
Leeds (B)	1	0 2	6	1	2
Swindon (C)	5 1	8 4	15 3	9 2	10
Required at distribution points	7	6	3	2	18

Total cost: $2*6+5*1+0*2+8*4+15*3+9*2 = £112$

Evaluation for Further Improvement

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2 6	2 -3	11 -1	7 +1	6
Leeds (B)	1 +4	0 2	6 -1	1 0	2
Swindon (C)	5 1	8 4	15 3	9 2	10
Required at distribution points	7	6	3	2	18

Improving The Solution: Shifting 4 Units to AX

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2 2	2 4	11	7	6
Leeds (B)	1	0 2	6	1	2
Swindon (C)	5 5	8	15 3	9 2	10
Required at distribution points	7	6	3	2	18

Evaluation for Further Improvement

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2 2	2 4	11 -1	7 +1	6
Leeds (B)	1 +1	0 2	6 -4	1 -3	2
Swindon (C)	5 5	8 +3	15 3	9 2	10
Required at distribution points	7	6	3	2	18

Improving The Solution: Shifting 2 Units to BY

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2	2 6	11	7	6
Leeds (B)	1	0	6 2	1	2
Swindon (C)	7	5	8 1	15 2	9
Required at distribution points	7	6	3	2	18

Degeneracy In Distribution Problems

- Heuristic methods may not be able to find solution if
 - there are less than $m+n-1$ assignments
 - when shifting assignments, to achieve improvement, more than one assignment goes to 0
- Can be solved by regarding one of the unallocated squares as having an extremely small ϵ allocation
 - Does not affect rim totals
 - Treated exactly the same as other allocations
 - But makes it possible to meet $m+n-1$ condition

Evaluation for Further Improvement

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2	2	11	7	6
	+4	6	+3	+5	
Leeds (B)	1	0	6	1	2
	+5	ε	2	+1	
Swindon (C)	5	8	15	9	10
	7	-1	1	2	
Required at distribution points	7	6	3	2	18

Final Optimal Solution

	Preston (W)	Sheffield (X)	Ipswich (Y)	Winchester (Z)	Available from factories
Glasgow (A)	2	2 6	11	7	6
Leeds (B)	1	0	6 2	1	2
Swindon (C)	7	5	8 1	15 2	9
Required at distribution points	7	6	3	2	18

Issues in Distribution Problems

- Unequal supply and demand
 - If supply > demand, create dummy distribution points with zero transportation cost to represent surplus supply
 - If demand > supply, create dummy factory with zero transportation costs to represent unsatisfied demand

Unbalanced Matrix

Total demand = 71; Total supply = 100

	Aberdeen (V)	Preston (W)	Sheffield (X)	Ipswich (Y)	Available from factories
Glasgow (A)	18	16	12	28	46
Leeds (B)	24	40	36	30	20
Swindon (C)	22	12	16	48	34
Required at distribution points	27	16	18	10	

Unbalanced Matrix: Solution

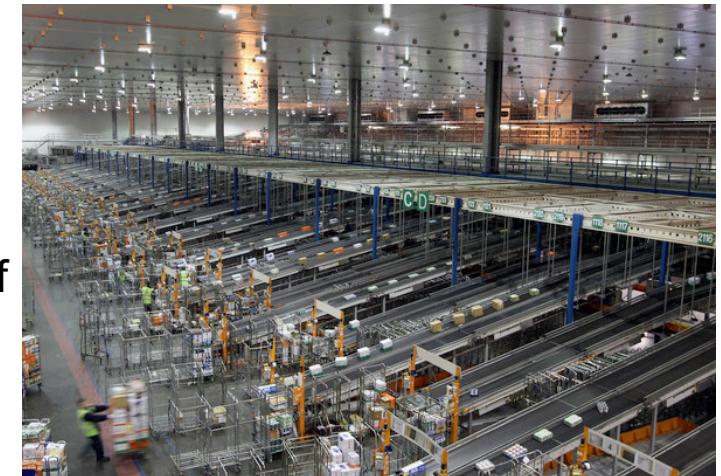
Add an extra “demand” point with zero cost to absorb surplus supply

	Aberdeen (V)	Preston (W)	Sheffield (X)	Ipswich (Y)	Surplus (Z)	Available from factories
Glasgow (A)	18	16	12	28	0	46
Leeds (B)	24	40	36	30	0	20
Swindon (C)	22	12	16	48	0	34
Required at distribution points	27	16	18	10	29	100

6. What Distribution Strategy to Use?

Distribution Strategies

- **Direct shipping** (mostly used for perishable items, high volume goods, high bulk items, and speciality products)
- **Warehousing** (remote production, variable finished-goods demand)
 - Centralised vs. distributed facilities depend on speed, risk, cost of transport
- **Cross-docking** (mass retailers)
 - Items distributed continuously from suppliers through warehouses to customers
 - Warehouse rarely keeps items for more than 10-15 hours
 - Requires
 - Close linkages between all participants in supply chain
 - Fast transportation
 - Large distribution volumes
- **Transhipment** (retailer)
 - Shipment of items between facilities at the same level of supply chain



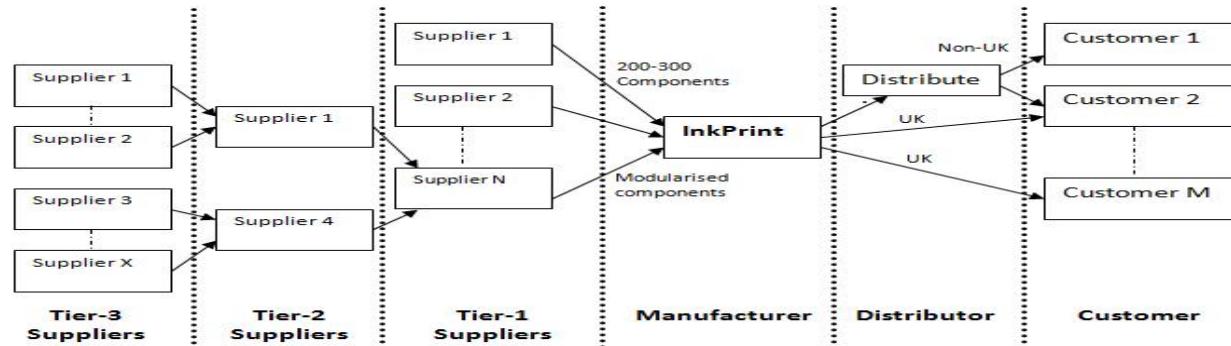
Supply Chain Management

Some Key Issues

- How do you measure the performance of the supply chain (SC)?
- What causes variations in the supply chain?
- How do you manage/reduce supply chain variability?
- How do companies communicate with each other across the supply chain?
- How can two companies in a supply chain collaborate better?
- Which IT system does what?

Objectives for SC Operations

OBJECTIVE	CHALLENGE / ISSUE
Quality	Quality at customer → Quality of materials, manufacturing, distribution, retail ... And even that is not sometimes enough
Speed	1. Service Time – time customer waits 2. Cycle Time – time for a product to move through SC
Dependability	Ability to deliver goods <u>on time, in full</u> regularly
Cost	Balance Source / Make / Deliver cost contributions
Resilience	Response to disruptions / changes



Matching SC Objectives and Demand

SC OBJECTIVES

DEMAND

	FUNCTIONAL PRODUCTS <i>[predictable, few changes, low variety, low margin, long]</i>	INNOVATIVE PRODUCTS <i>[unpredictable, many changes, high variety, high margin, short LT ...]</i>
EFFICIENT SUPPLY CHAIN <i>[Low cost, high use, low inv.]</i>	LEAN SUPPLY CHAIN	mismatch
RESPONSIVE SUPPLY CHAIN <i>[Fast response, low throughput, flex suppliers]</i>	mismatch	AGILE SUPPLY CHAIN

Examples: designer jeans, sugar, mobile phones, tissues, bananas, fighter aircraft

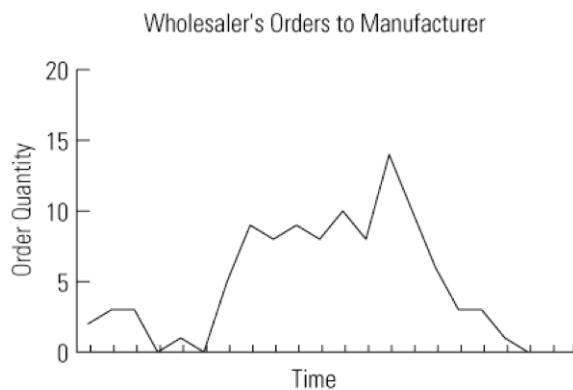
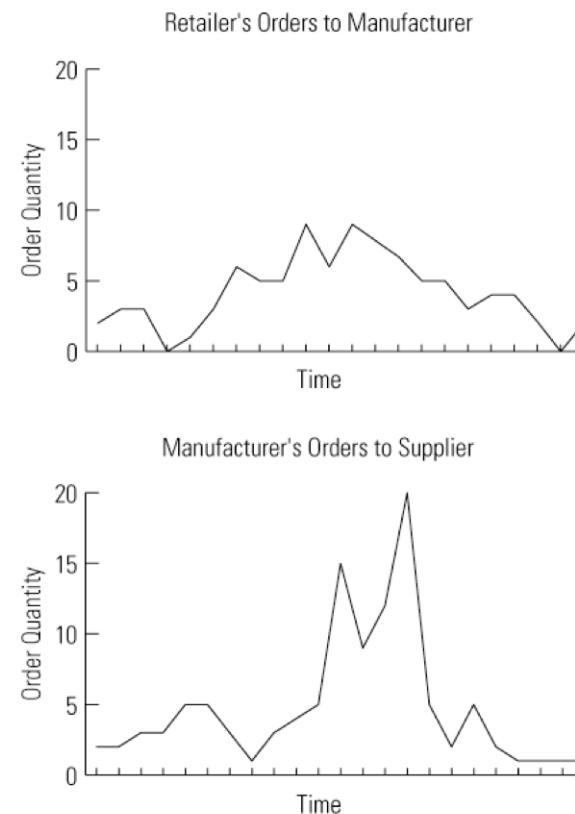
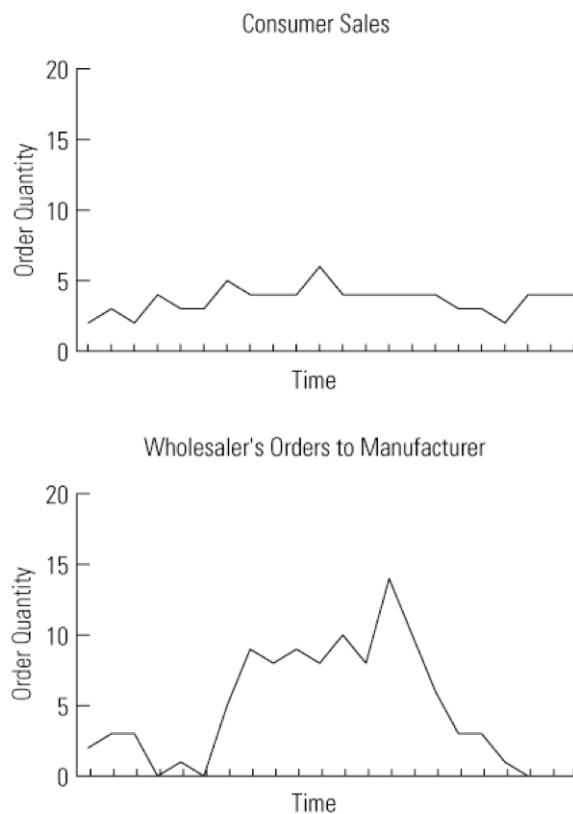
Outline

- Objectives for Supply Chain Performance
- **Issues in Supply Chain Dynamics**
- Mechanisms for Collaboration Between SC Partners
- Mechanisms for Communication Between SC Partners
- IT Systems to Support SC Operations

Supply Chain Dynamics

- Demand variability drives dynamics
 - **increases** as one moves up the supply chain away from the end consumer
 - **small** changes in consumer demand can result in large variations in orders placed upstream.
 - **timing** of variations can also vary
- Supply network can have very large swings as each organisation in the supply chain seeks to solve the problem from its own perspective
- This effect has been observed in many industries, resulting in:
 - Increased costs
 - Reduced service levels
 - Poor use of resources
 - Increased inventory levels

Example: Impact of Consumer Sales Variation



What Causes these SC Dynamics?

Forecast Variations

- Demand forecast inaccuracies along chain
- No visibility of actual consumer demand.
- Promotions – result in forward buying to benefit from lower prices



Poor Communications

- Lack of communication and coordination up and down the supply chain
- Long lead times (for material and information flow)



Inappropriate Decisions

- Decisions made locally (by one business) not globally (by the whole supply chain)
- Conservative decision-making
 - Managers are generally risk-averse
 - Risks are usually not symmetric – stockout hurts



Limited Response Capabilities

- Order batching – larger orders result in more variance
- Capacity Limits

Managing Supply Chain Behaviour?

- Better forecasting
- Share information
- Coordinate/collaborate with suppliers
- Efficient supply chain management systems [LT, inventory]
- Flexibility in operations

CHALLENGE: generally no single point of control

Outline

- Objectives for Supply Chain Performance
- Issues in Supply Chain Dynamics
- **Mechanisms for Collaboration Between SC Partners**
- Mechanisms for Communication Between SC Partners
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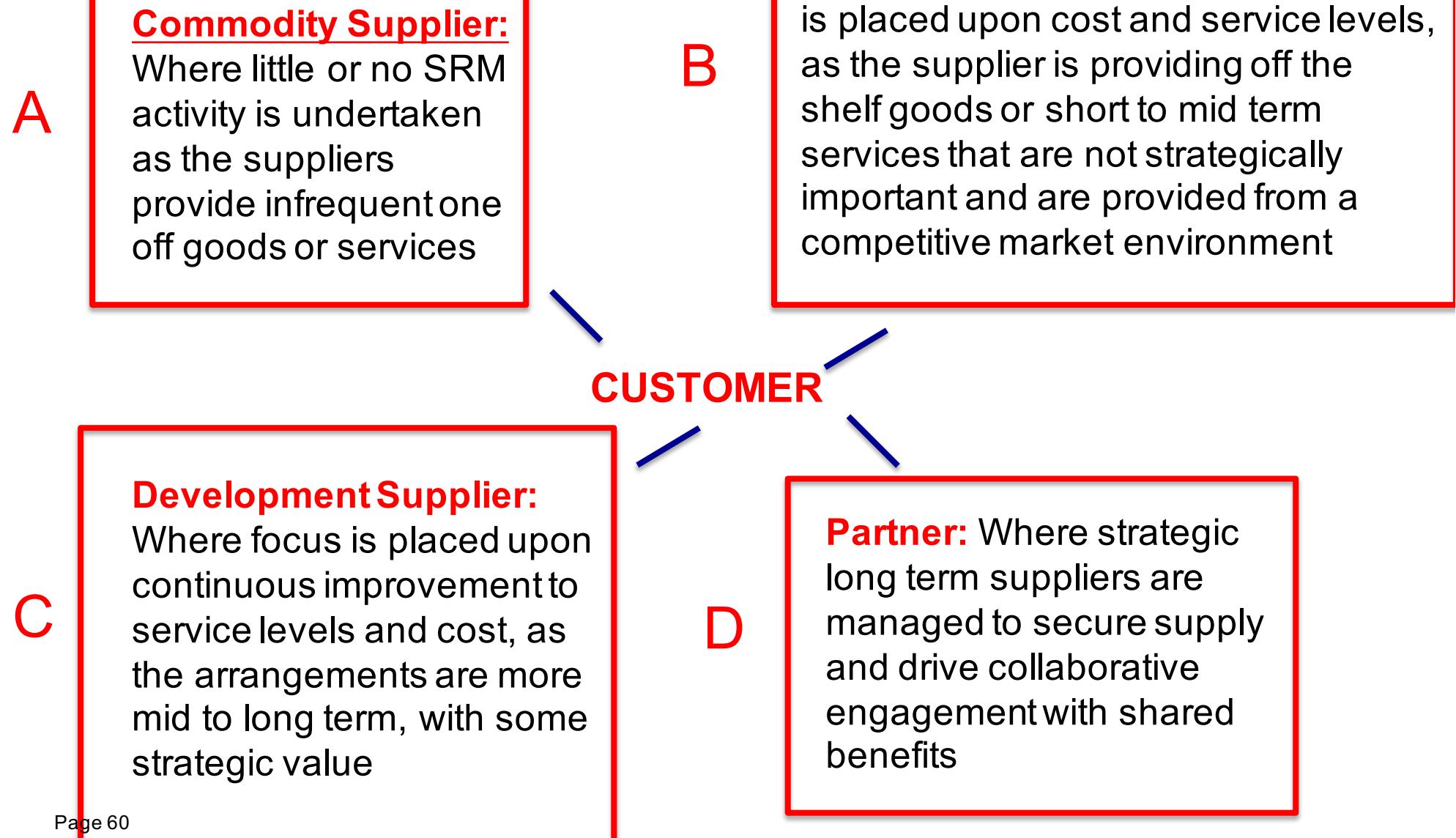
Mechanisms for Collaboration Between SC Partners

GOAL: Closer, more informed and effective relationship between customer and supplier

APPROACHES:

- Supplier Relationship Management [Customer – Many suppliers, supplier centric]
- Vendor Managed Inventory [Customer – Many Suppliers, customer centric]
- Collaborative Planning Forecasting Replenishment [Customer – Supplier Partnership]

Supplier Relationship Management



Vendor Managed Inventory (VMI)

VMI = Supplier embedded in customer operations

- Supplier decides on inventory levels for customer (within bounds) and manages inventory at customer site
- The financial responsibility associated with the inventory is retained by the supplier, thus reducing the retailer's risk
- eliminates customer oversight of orders



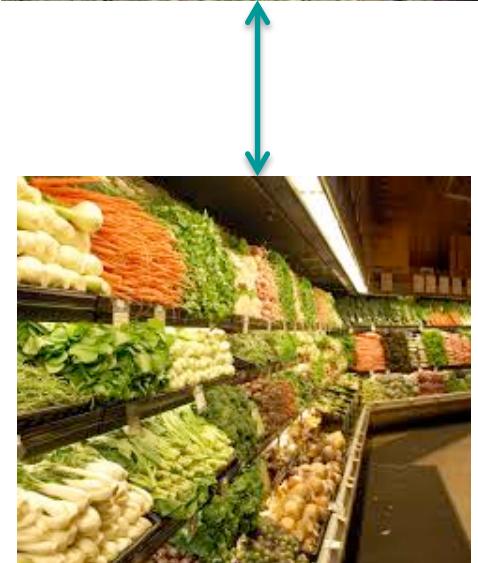
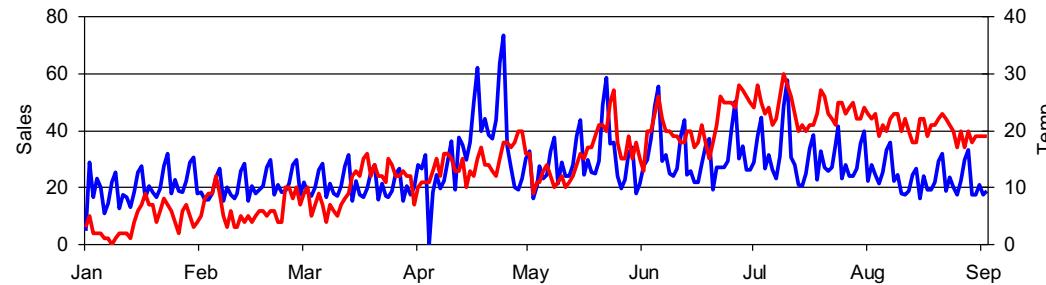
Also, **Category Management**

- Supplier responsible for all products in retail outlet of a particular category

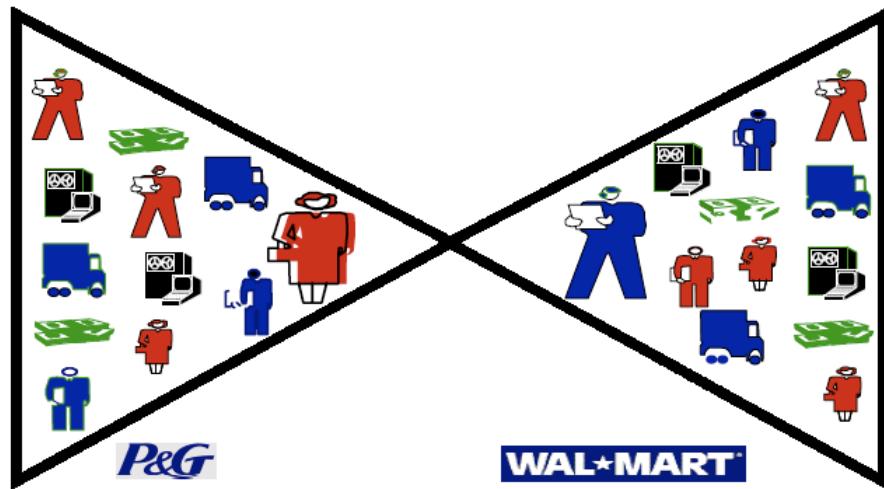


Collaborative Planning Forecasting and Replenishment (CPFR)

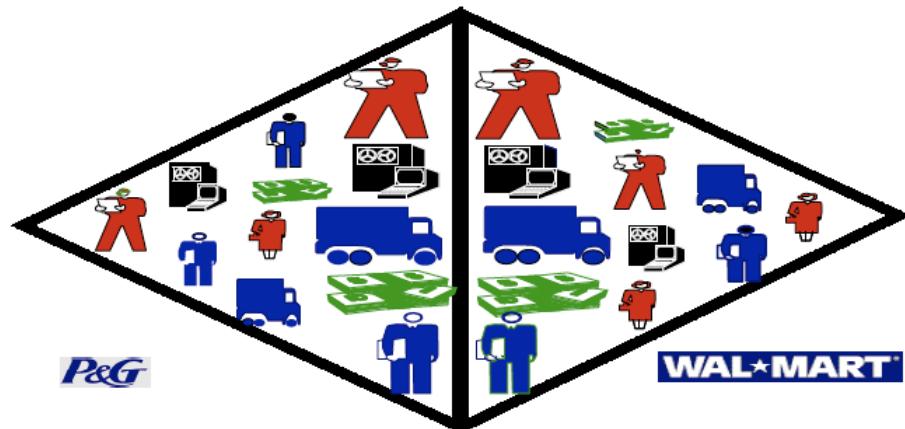
- Combines the intelligence of multiple partners across the supply chain in the planning and fulfilment of customer demand
- Core elements:
 - Information sharing
 - Coordinated production planning
 - Joint demand forecasting
 - Coordinated shipments
- Also risk sharing, e.g. on promotions



“Reversing the Bow Tie”



(a)



(b)

Pros and Cons of Tighter Collaboration?

Advantages of collaboration

- Greater efficiency
- Reduced variability
- Reduced contract costs
- Mutual learning
- Greater stability for supplier
- Greater visibility of supplier for customer

Disadvantages of collaboration

- Cost of communication
- Risk of opportunism
- Reduced flexibility in supplier selection
- Information leakages

Outline

- Objectives for Supply Chain Performance
- Issues in Supply Chain Dynamics
- Mechanisms for Collaboration Between SC Partners
- **Mechanisms for Communication Between SC Partners**
- IT Systems to Support SC Operations

Communication Between SC Partners

- *Information Sharing Services* **BUSINESS**
- *Electronic Data Interchange* **ORDER**
- *Barcode/RFID item data* **PHYSICAL**

Collaboration & Data Sharing Environments

- What?

Enable access to procurement/forecast data

- How?

Network accessible databases

- Why effective?

- Market efficiency
- Increases visibility



Retail Solutions Announces Launch of a Supplier Data Sharing Program with Delhaize Belgium

"Vendor Pulse" Program Mirrors the Successful Implementation of Similar Program at Delhaize US, Focused on Improving Supplier Collaboration

Mountain View, CA (PRWEB) January 04, 2012

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A screenshot of the APA Engineering website. The header features the company logo, "APA ENGINEERING", and "automechanika 2012" information. Below the header is a banner with the text "Global Sourcing Made Easy..." and a circular diagram with various service components. To the right is a sidebar titled "Source Smart" containing a list of services. At the bottom are navigation tabs for "Sourcing", "Inspection", "Engineering Services", "Information Technology", and "Multimedia".

[Home](#) | [Community](#) | [The Ariba Network](#)

THE ARIBA NETWORK

More than just a supplier network, the world's business commerce network is a global community where your company can collaborate with any other — large or small, from anywhere in the world — whenever you're buying, selling, or managing cash.

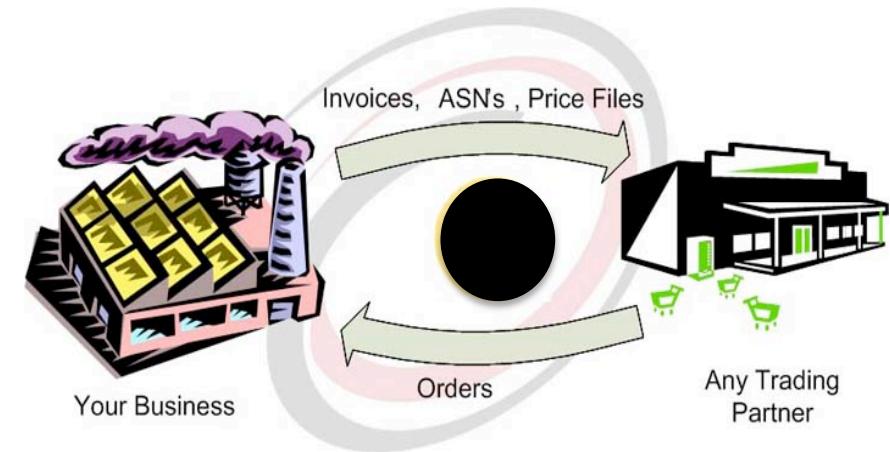
ANNUAL TRANSACTION VOLUME **\$500 BILLION** CONNECTED COMPANIES

1 MILLION+ YOUR THE ARIBA NETWORK

RATE AT WHICH NEW SUPPLIERS ARE ADDED **31,600+** DIVERSITY OF GREEN SELLERS
1 EVERY 2 MINS **65M** INVOICES PROCESSED ANNUALLY

Electronic Data Interchange (EDI)

- **What?**
 - electronic transmission of purchasing requirements
 - Including purchase orders, invoices, delivery notices, etc.
- **How**
 - Using common proprietary formats
 - May use private comms networks
- **Why effective?**
 - Input directly into trading partner's information systems
- **Where Used?**
 - *Everywhere! EDI comprises 85-90% of business to business transactions*



Paper Purchase Order				
Purchase Order				
Sold To: XYZ Company	PO Number:	4768		
123 Main Street	PO Date:	9/30/2012		
Fairview, CA 94168				
Item No.	Quantity	Unit of Measure	Price	Product ID
1	100	EA	27.65	331896-42
Total Items: 1			Total Quality: 100	

ANSI EDI Purchase Order

ST*850*540001■
BEG*00*SA*4768*65*20120930■
N1*SO*XYZ Company■
N3*123 Main Street■
N4*Fairview*CA*94168■
PO1*1*100*EA*27.65**VN*331896-42■
CTT*1*100■
SE*8*54001■

Item Data: RFID/BarCoding/DM/QR

What?

- Transfer of item/part information between supplier and customer



How

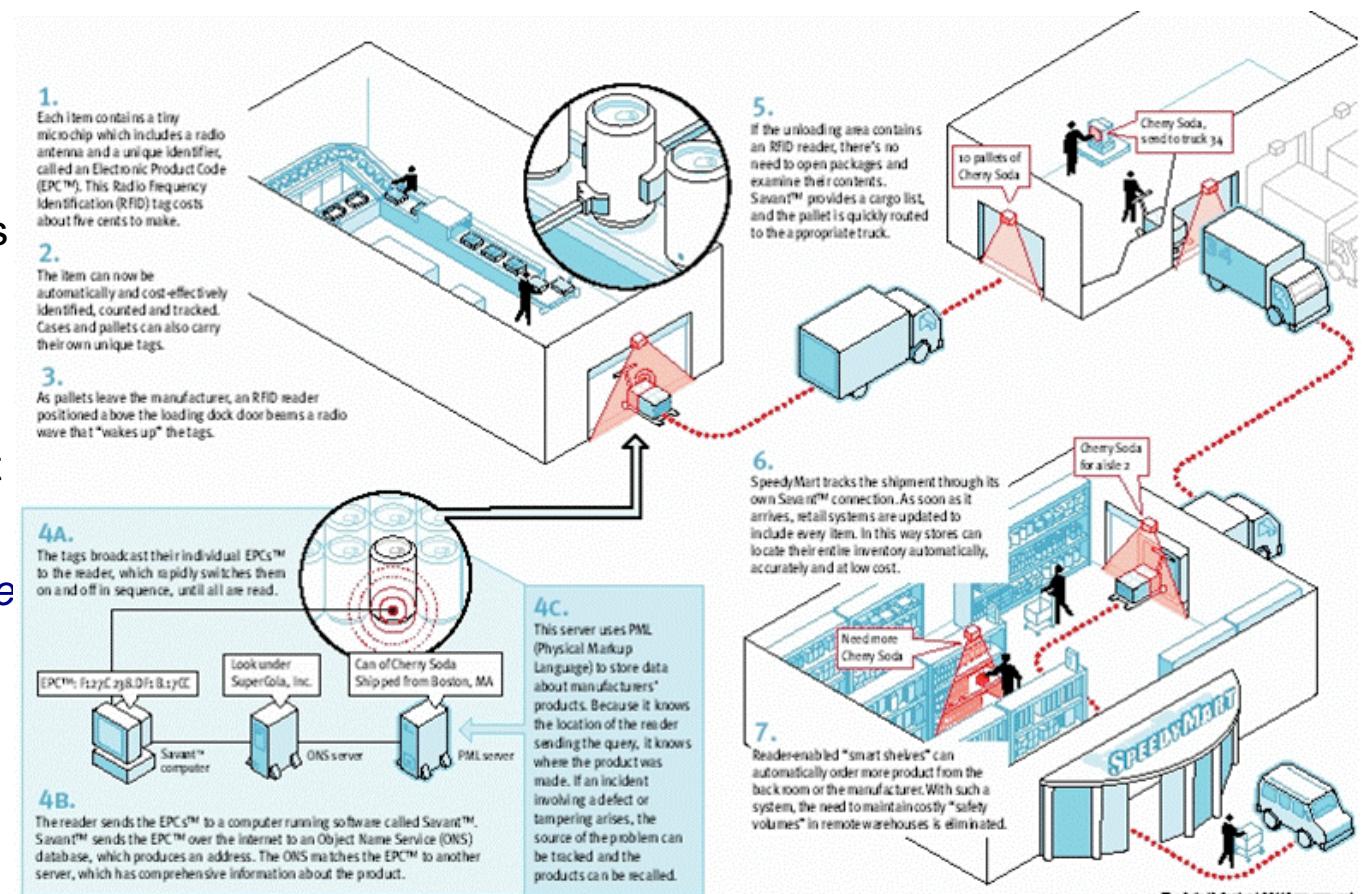
- Standardised ID [GS1]
- ID as a pointer to networked data bases

Why effective?

- Cheap
- Ubiquitous
- RFID non line of sight

Where Used?

- *Bar codes everywhere*
- *QR emerging*
- *RFID in high value supply chains*



1.

Each item contains a tiny microchip which includes a radio antenna and a unique identifier, called an Electronic Product Code (EPC™). This Radio Frequency Identification (RFID) tag costs about five cents to make.

2.

The item can now be automatically and cost-effectively identified, counted and tracked. Cases and pallets can also carry their own unique tags.

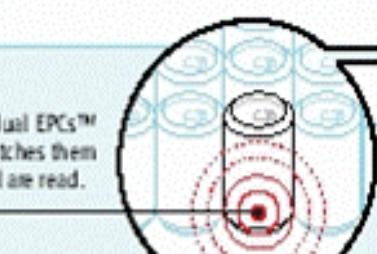
3.

As pallets leave the manufacturer, an RFID reader positioned above the loading dock door beams a radio wave that "wakes up" the tags.

4A.

The tags broadcast their individual EPCs™ to the reader, which rapidly switches them on and off in sequence, until all are read.

EPC™: Fz7Czj8.Dfj8.1y/GC



Look under SuperCola, Inc.

Can of Cherry Soda
Shipped from Boston, MA



ONS server

PML server

4B.

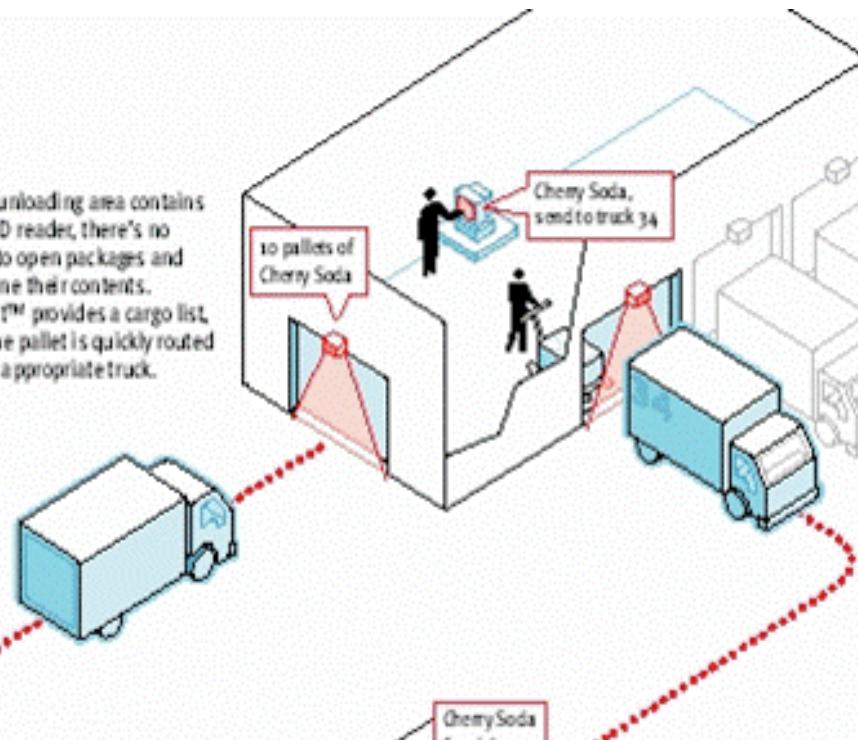
The reader sends the EPCs™ to a computer running software called Savant™. Savant™ sends the EPC™ over the internet to an Object Name Service (ONS) database, which produces an address. The ONS matches the EPC™ to another server, which has comprehensive information about the product.

4C.

This server uses PML (Physical Markup Language) to store data about manufacturers' products. Because it knows the location of the reader sending the query, it knows where the product was made. If an incident involving a defect or tampering arises, the source of the problem can be tracked and the products can be recalled.

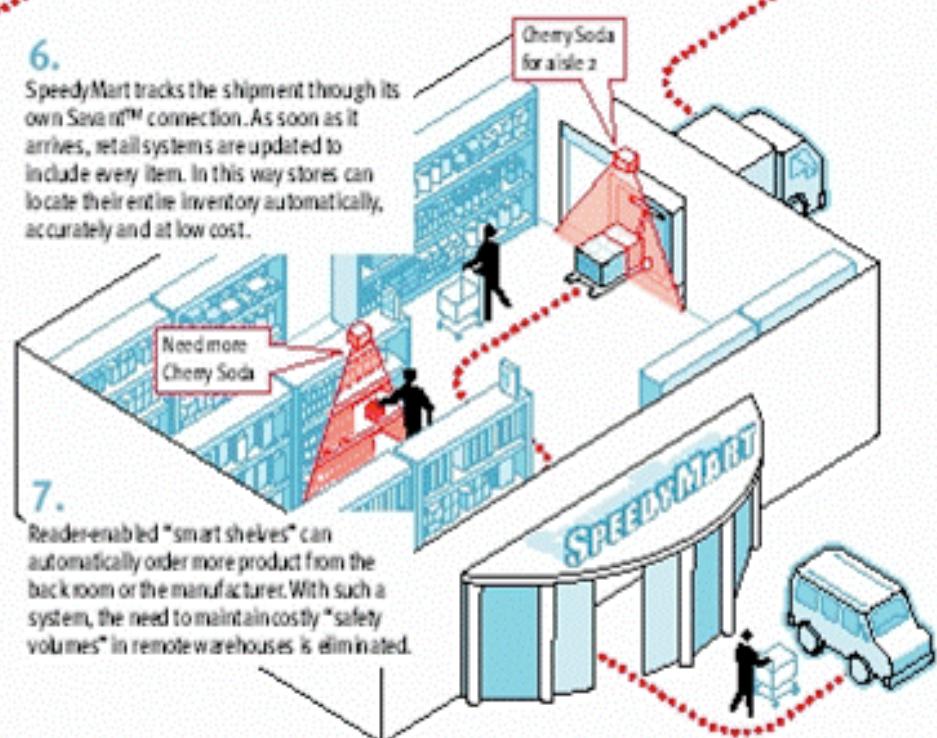
5.

If the unloading area contains an RFID reader, there's no need to open packages and examine their contents. Savant™ provides a cargo list, and the pallet is quickly routed to the appropriate truck.



6.

SpeedyMart tracks the shipment through its own Savant™ connection. As soon as it arrives, retail systems are updated to include every item. In this way stores can locate their entire inventory automatically, accurately and at low cost.



7.

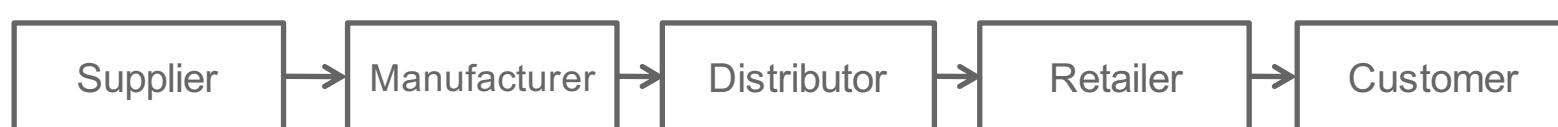
Reader-enabled "smart shelves" can automatically order more product from the back room or the manufacturer. With such a system, the need to maintain costly "safety volumes" in remote warehouses is eliminated.

Outline

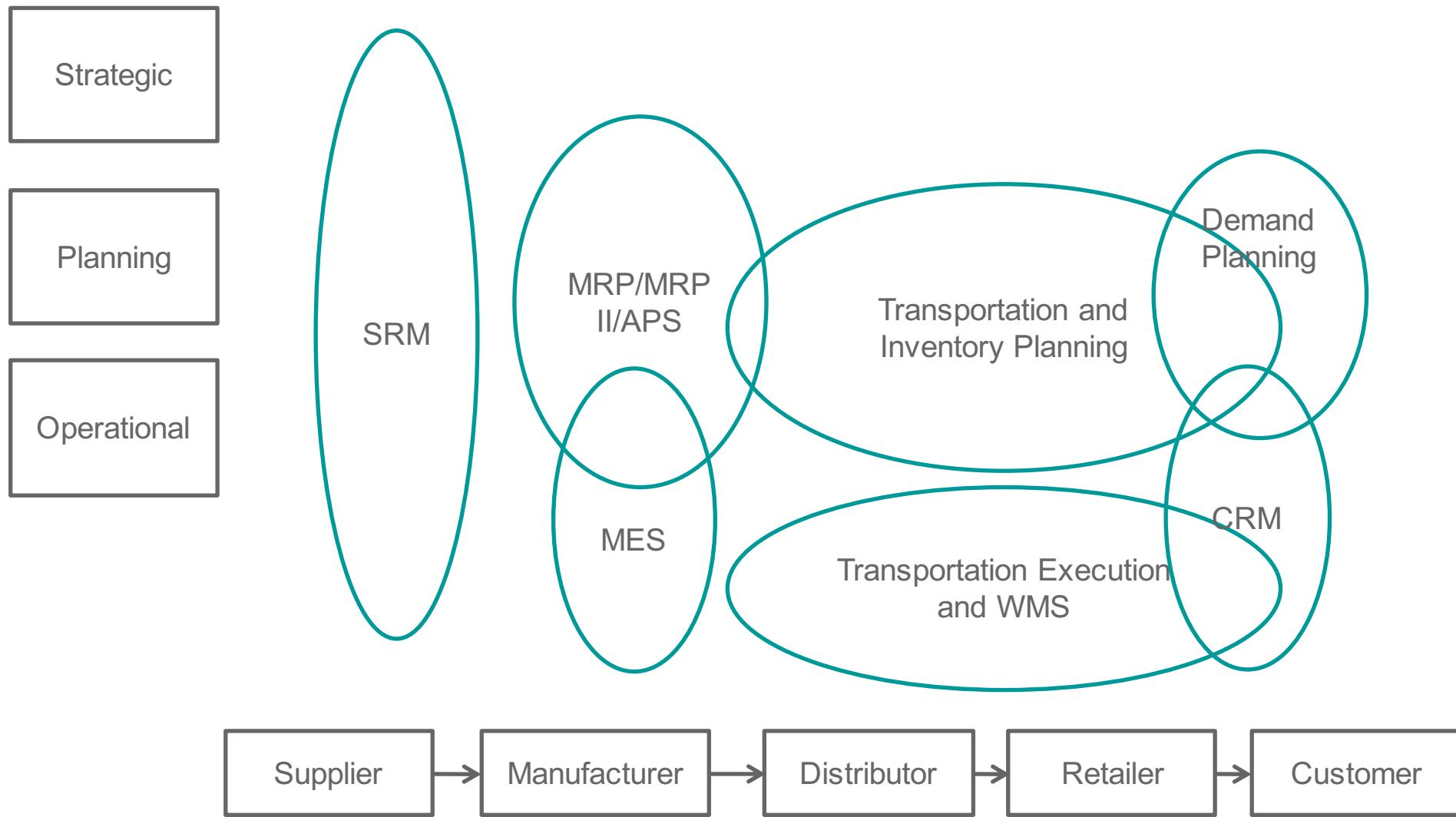
- Objectives for Supply Chain Performance
- Issues in Supply Chain Dynamics
- Mechanisms for Collaboration Between SC Partners
- Mechanisms for Communication Between SC Partners
- **IT Systems to Support SC Operations**

Supply Chain Management Matrix

Strategic [Long-term]	<ul style="list-style-type: none"> Materials programme Supplier selection 	<ul style="list-style-type: none"> Plant location Production system spec Capacity planning 	<ul style="list-style-type: none"> Physical distribution structure Warehouse location 	<ul style="list-style-type: none"> Product programme Strategic sales planning 	<ul style="list-style-type: none"> Market modelling
Planning [Mid-term]	<ul style="list-style-type: none"> MRP Contracts 	<ul style="list-style-type: none"> MPS Capacity planning 	<ul style="list-style-type: none"> Distribution planning Warehouse capacity planning 	<ul style="list-style-type: none"> Mid-term sales planning 	<ul style="list-style-type: none"> Category sales forecast
Operational [Short-term]	<ul style="list-style-type: none"> Personnel planning Ordering / receiving materials 	<ul style="list-style-type: none"> Lot-sizing Machine scheduling Shop floor control 	<ul style="list-style-type: none"> Warehouse management Transport planning 	<ul style="list-style-type: none"> Short-term sales planning 	<ul style="list-style-type: none"> Sales forecast



Supply Chain Information Systems Landscape



Summary: SC Information Systems

- A supply chain is not an entity
- Hence there is no supply chain IT system!!
- Each IT system is owned by one company
- Hence only achieve
 - Data sharing
 - Cooperation
 - Supply chain optimisationwhen it suits one or more companies to do so regardless of the IT system!
- Little or no IT support for strategic SC decisions [data analytics coming]

Wrap Up on Supply Chains

- Some puzzles:
 - Supply chains are really supply networks
 - Supply networks overlap with other supply networks
 - No one owns a supply network
 - No one controls the whole supply network
 - The behaviour of the supply network is emergent – it can be influenced but not managed
- Hence, why do supply networks work???
 - Pull of profits/sales [consumer electronics SCs]
 - Dominant players [auto manufacturer]
 - Mutual benefits [P&G and Walmart]

Operations Management

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