Trends and Future Challenges in the Logistics Sector

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Agenda

- History and Context
- Intra and inter - organisational Inventory and materials management
  - Supply side
  - Internal
  - Distribution
- Communication
- Case study
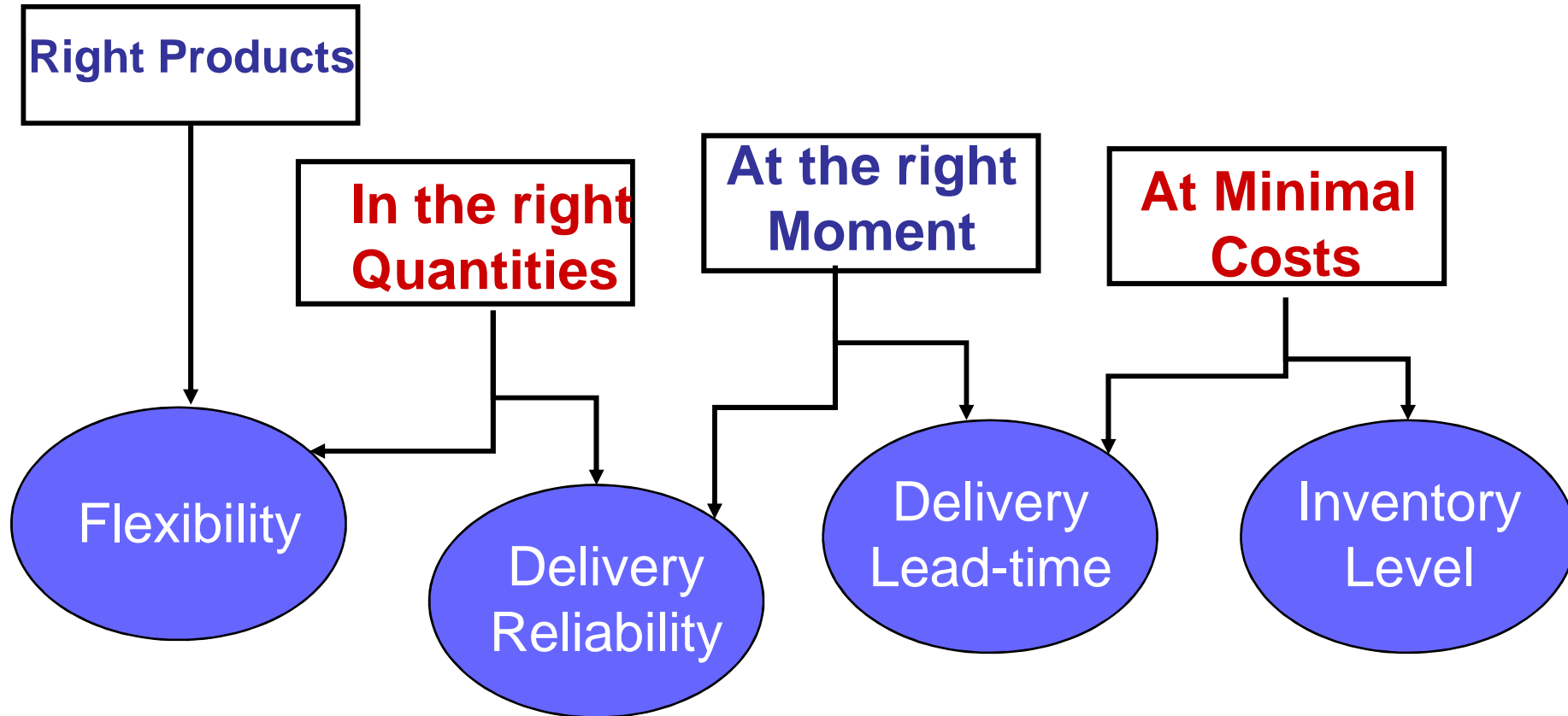- Future Trends

Logistics Definition

"Logistics is the process planning, implementing and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements" – Council of Logistics Management

- Logistics = **Logi**cal thinking + Stati**stics**
- Logistics = Materials Management + Distribution + related information

In other words …

```
Right Products
```

```
In the right
Quantities
```

```
At the right
Moment
```

```
At Minimal
Costs
```

- Flexibility
- Delivery Reliability
- Delivery Lead-time
- Inventory Level

Historical Evolution of Logistics

- **Around 2700 B.C.** – Material handling of building blocks using hoisting equipment in the construction of pyramids in ancient Egypt

- **Around 300 B.C.** – Development of the revolutionary Greek rowing vessels that laid the foundation of intercontinental trade

- **Around A.D. 700** – Procurement logistics from all parts of Islamic empire for the construction of Mezquita Mosque in Spain

- **Around 1500** – First progressive postal service via shipping introduced in Europe

- **Around 1800** – Invention of vehicles, railroads, steam-engine ships and crude oil discovery offered greater opportunities for logistics activities

- **Around 1940** – Military logistics during the World War I & II and transfer of military logistics concepts to the business world

Historical evolution of Logistics Cont.

- **Around 1956** – Invention of sea container; the structural evolution of world trade and boom of international flow of goods

- **Around 1970/1980** – Kanban and JIT concept was introduced by Toyota in Japan to link logistics to other operational functions

- **Around 1990 –** Quick Response (QR) and Efficient Consumer Response (ECR) technologies developed with emphasis on moving goods instead of storing goods

- **Today – Logistics** an aspect of **supply chain management** (SCM); which is integrating and linking entire logistics chain from suppliers to end customers

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Drivers of change in Logistics & SCM

Social factors

- Increase in population
- Changes in working hours and leisure time
- Changes within and between social hierarchies
- Increase in ICT use in the society

Environmental factors

- Increased number of vehicle kilometres
- Increased attention for reusing (raw) materials
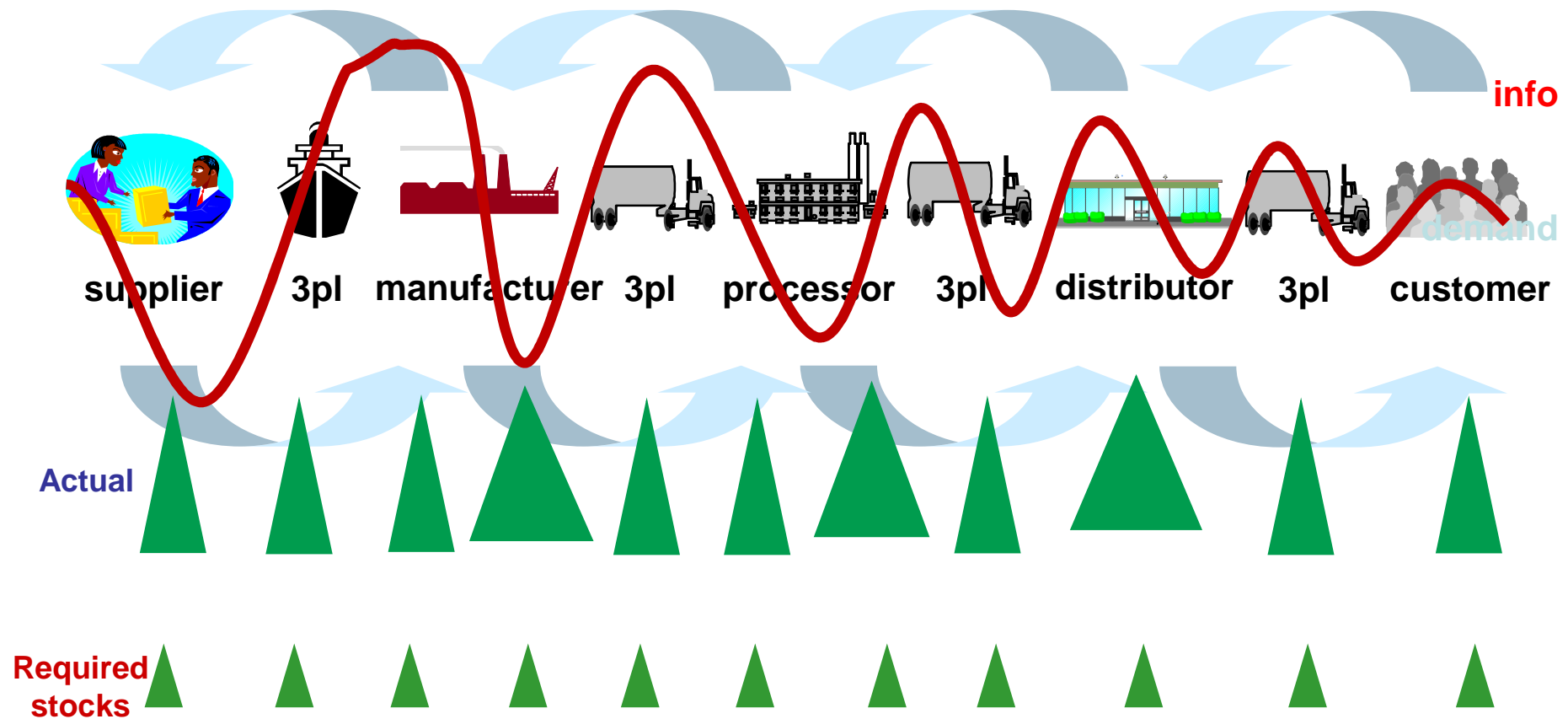- Increased attention for low carbon emission

Political factors

- Harmonization and regulations of laws across countries
- Transport industry deregulation
- Elimination of cross-border customs requirements
- Reduction of tariff barriers

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Typical issues/scenario

- Lack integration → leads to volatility in demand →resulting in high inventories, long lead-times and high costs etc.
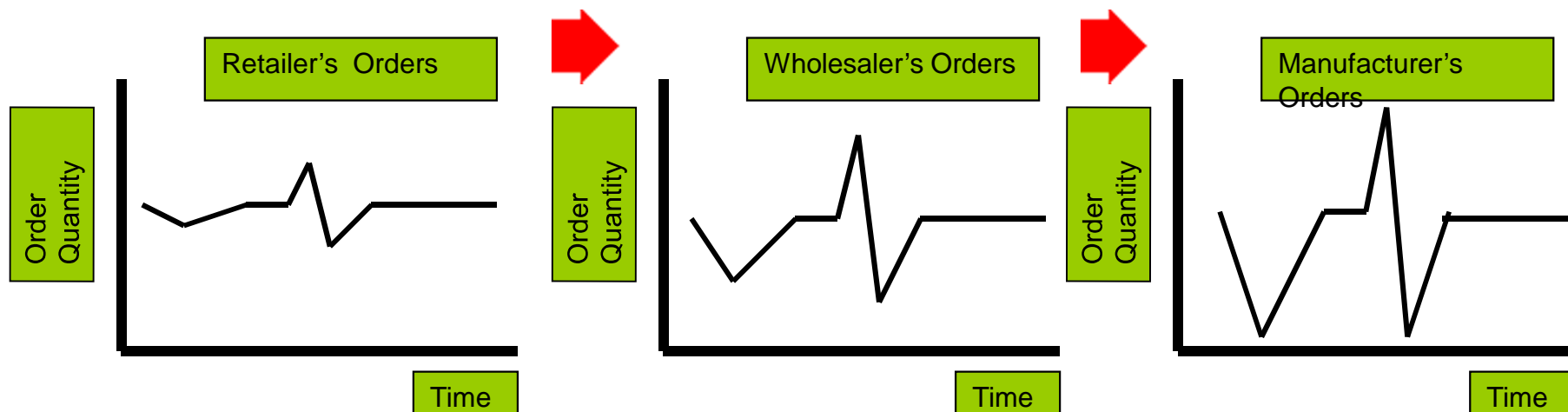

info

demand

supplier   3pl   manufacturer   3pl   processor   3pl   distributor   3pl   customer

Actual

Required stocks

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Bullwhip Effect (Chase et al 2008)

The magnification of variability in orders in the supply-chain

Retailer's Orders	Wholesaler's Orders	Manufacturer's Orders

Order Quantity / Time (three graphs)

A lot of retailers each with little variability in their orders….

…can lead to greater variability for a fewer number of wholesalers, and…

…can lead to even greater variability for a single manufacturer.

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Uncertainty in inventory management:
Recent events

- 11th September 2001
- USA West Coast dock strike 2002
- SARS 2003
- Madrid Train Bombing (2004)
- Tsunami disaster (2004)
- London Bombing (2005)
- Hurricane Katrina, USA (2005)
- Earthquake, Kashmir (2005)
- Earthquake, China (2008)
- Volcanic Ash Cloud, Europe (2010)
- Floods in Pakistan (2010)
- BP Oil well, USA (2010)
- Cargo security alert, Yemen (2010)
- Such events are unpredictable and outside of our control..

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Research Focus in Logistics & SC

- **Configuration theory** – structure/footprint, key elements, archetypes

- **Capability development** – assessment, intrinsic capabilities, through-life

- **Visualisation** techniques - mapping supply chains, VC analysis

- **Radical change** – transformation strategies, network re-design,

- **Continuous improvement** – network integration, process maturity, performance measurements

- **Futures** – new supply network models, changing industry structures, trends

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Network design: key issues

- **Strategic Level**
  - Determination of the optimal number, location, and size of new plants, distribution centres and warehouses
  - Acquisition of new production equipment and the design of working centres within each plant
  - Design of transportation facilities, communications equipment, data processing means etc.
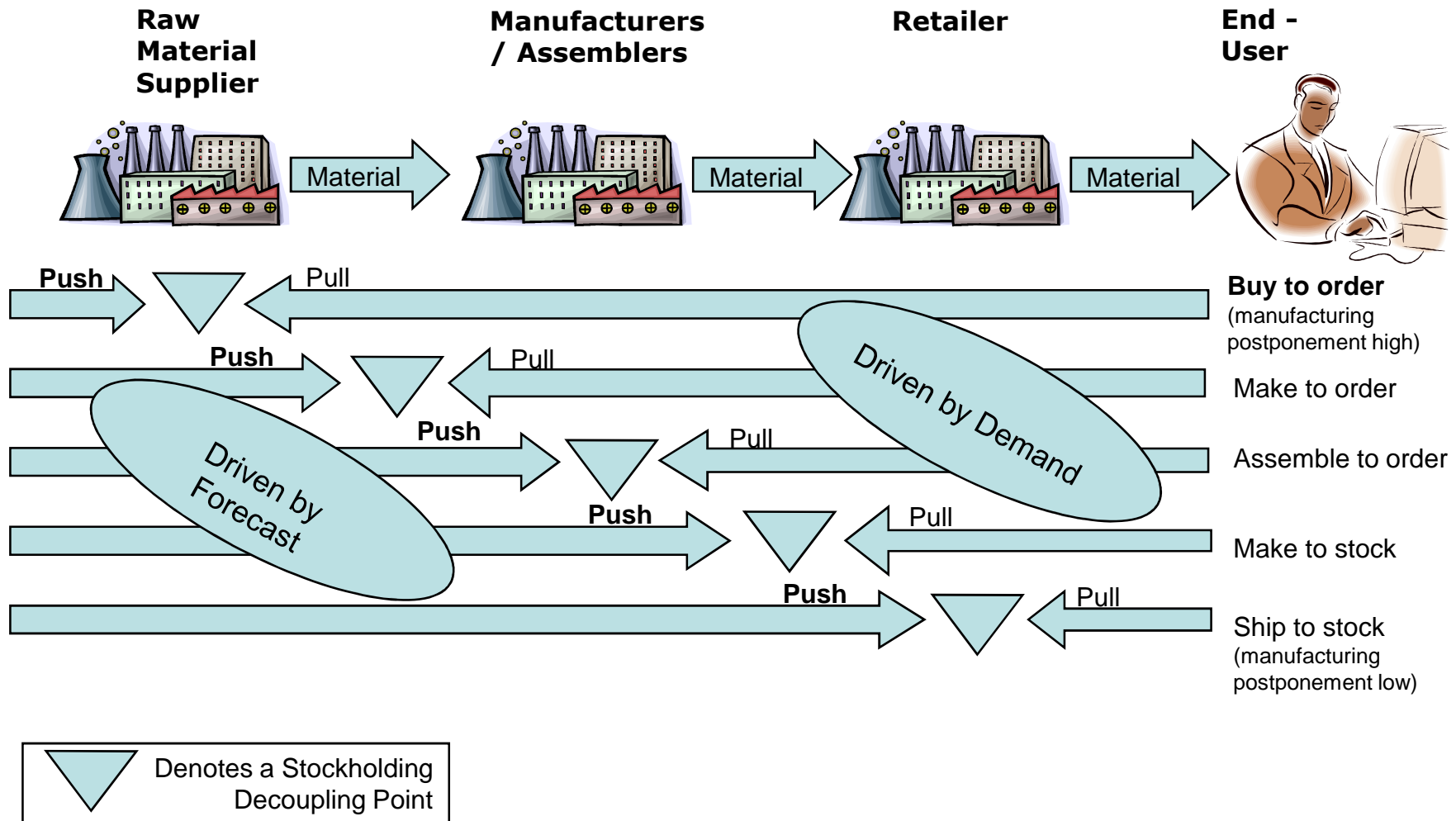- **Tactical Level**
  - Work-force size
  - Inventory policies
  - Determine best distribution channels (which warehouses should service which customers)
  - Selection of transportation and trans-shipment alternatives
  - Determine optimal sourcing strategy (which plant / vendor should produce which product)
- **Operational Control Level**
  - The assignment of customer orders to individual machines
  - Dispatching, expediting and processing orders
  - Vehicle routing and scheduling

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Strategic inventory & the decoupling point

Raw Material Supplier → Material → Manufacturers / Assemblers → Material → Retailer → Material → End-User

Push | Pull — **Buy to order** (manufacturing postponement high)

Push | Pull — Make to order

Push | Pull — Assemble to order

Push | Pull — Make to stock

Push | Pull — Ship to stock (manufacturing postponement low)

Driven by Forecast

Driven by Demand

▽ Denotes a Stockholding Decoupling Point

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Research evolution in Inventory management in manufacturing

- **Traditional high stock holding method through periodic purchase**
  - due to fear of stock-out, higher buying cost, suppliers unreliability, etc.
  - Varying replenishment and order quantity per time
  - High stock holding cost and inventory planning only at finished goods end of activity

- **Stock replenishment based on Economic Order (Batch) quantity (EOQ/EBQ)**
  - attempt to balance order cost and stock holding costs
  - The larger the order quantity the more the storage time and cost
  - Used mainly in a push system and for products with independent demand

- **Inventory management through demand forecasting and MRP**
  - Forecasting influenced by trend, season and random fluctuation in a push system
  - Computerized forecasting of material requirements based on master production schedules

- **Inventory management by MRP and Distribution Requirement Planning (DRP)**
  - Wider concept incorporating entire manufacturing schedules
  - Reduced inventory holding and shorter production lead times
  - DRP pull products through distribution system once demand is identified

- **Lean and Just In Time approach (JIT):** No inventory holding, time compression and waste elimination
  - Driven by ERP, efficient ICT system and committed partners along the value chain

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Research areas in Inventory management in retail industry

- **Vendor management inventory (VMI)**

  - Mainly used in retailing and inventory targets are agreed
  - Supplier/manufacturer monitors and control inventory level at the retailers distribution centre and even in stores
  - Driven by accurate and timely information and suitable computerized systems

- **Continuous replenishment (CRP)**

  - Free-flowing order fulfillment and delivery systems that help reduce pipeline inventory
  - Focusing on end-user requirements via use of real-time demand from electronic point-of-sale

- **Quick Response (QR)**

  - Further development of JIT approach aimed at linking manufacturer closer to actual demand at retail level
  - Emphasis on time compression, small batch sizes and frequent supply to help respond to changes in demand in a short timescale
  - Used by leading retailing company – See example of Benetton Group in later slides

- **Efficient consumer response (ECR)** – Originally developed and run in USA grocery industry

  - Aimed at improving service and reducing cost across the entire supply chain
  - Manufacturer and retailer working together in joint planning and forecasting
  - Heavy use of EDI, cross-docking, sales-based ordering and direct store deliveries
  - Greater cooperation with suppliers using CMI (co-managed inventory) or VMI
  - Strategies are speedier and right product replenishment, assorted product mix, quicker NPI to consumers

Research areas in Inventory management in retail industry

- **Collaborative planning, forecasting and replenishment (CPFR)**

  - ➢ Combines multiple trading partners in the planning and fulfillment of customer demand. Four man areas of CPFR collaboration are:

    - ∗ **Strategy and planning:** Identifying and agreeing on the collaborative rules

    - ∗ **Demand and supply management:** forecasting consumer demand at POS

    - ∗ **Execution:** Placing orders, delivery shipments, restocking in the 'order-to-cash' cycle

    - ∗ **Analysis:** Monitoring exception orders, calculating KPIs and assessing continuous improvement opportunities

NOTE: All these recent developments are supported and made possible by new and effective ICT

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Optimisation & Simulation models

- **Optimisation models**: to analyse decision options, goals, commitments, and resource constraints.

    - **Linear Programming (LP) & Mixed-Integer Programming (MIP) models**

- **Simulation models:** to study and run models to investigate dynamic behaviour over time.

    - **Deterministic simulation models**: dynamic behaviour has no random effects

        - By experimenting with different parameter values, one attempts to determine an effective inventory policy.

    - **Stochastic simulation models** also known as Monte Carlo simulation: dynamic behaviour has random effects e.g. simulate supermarket checkouts
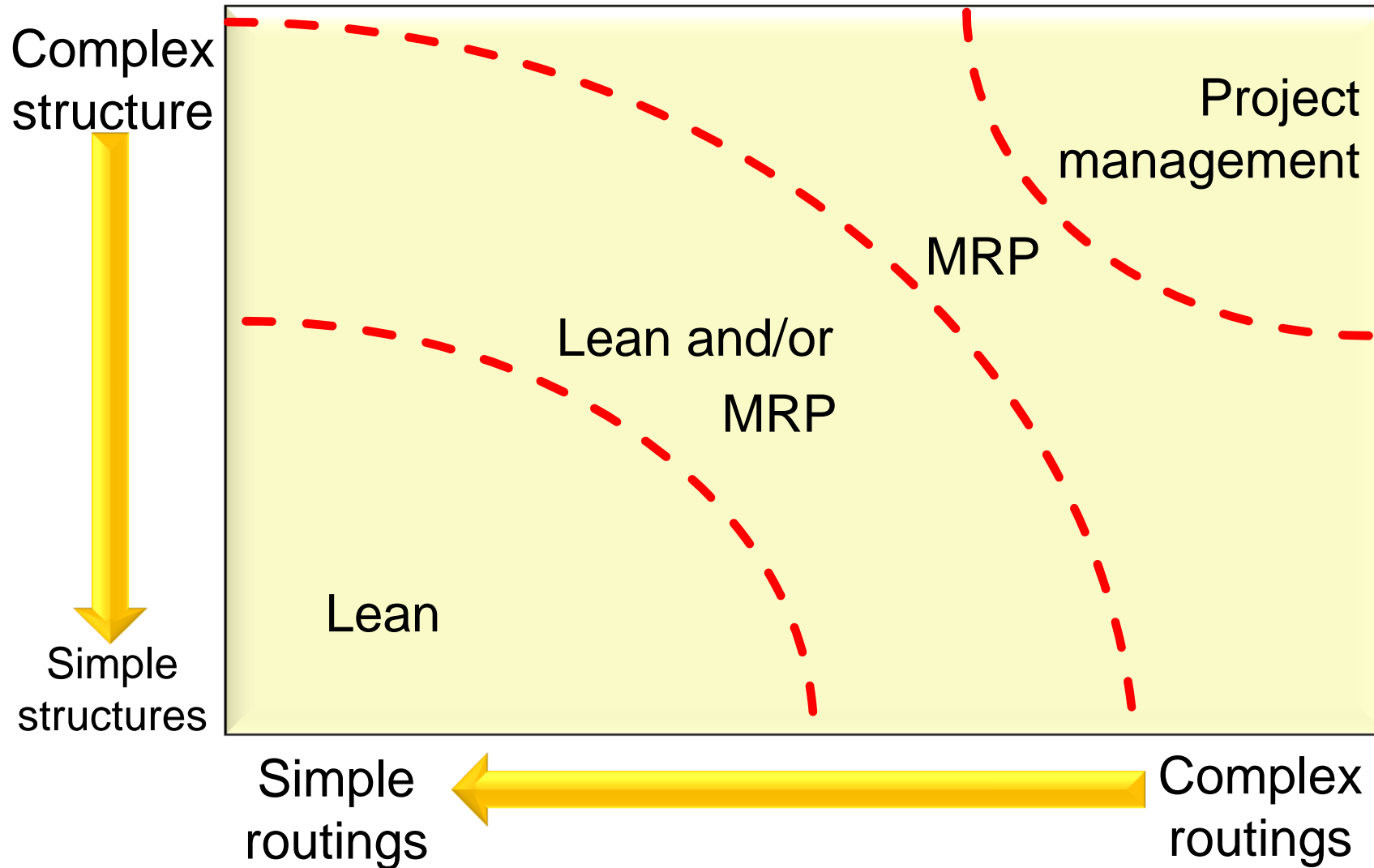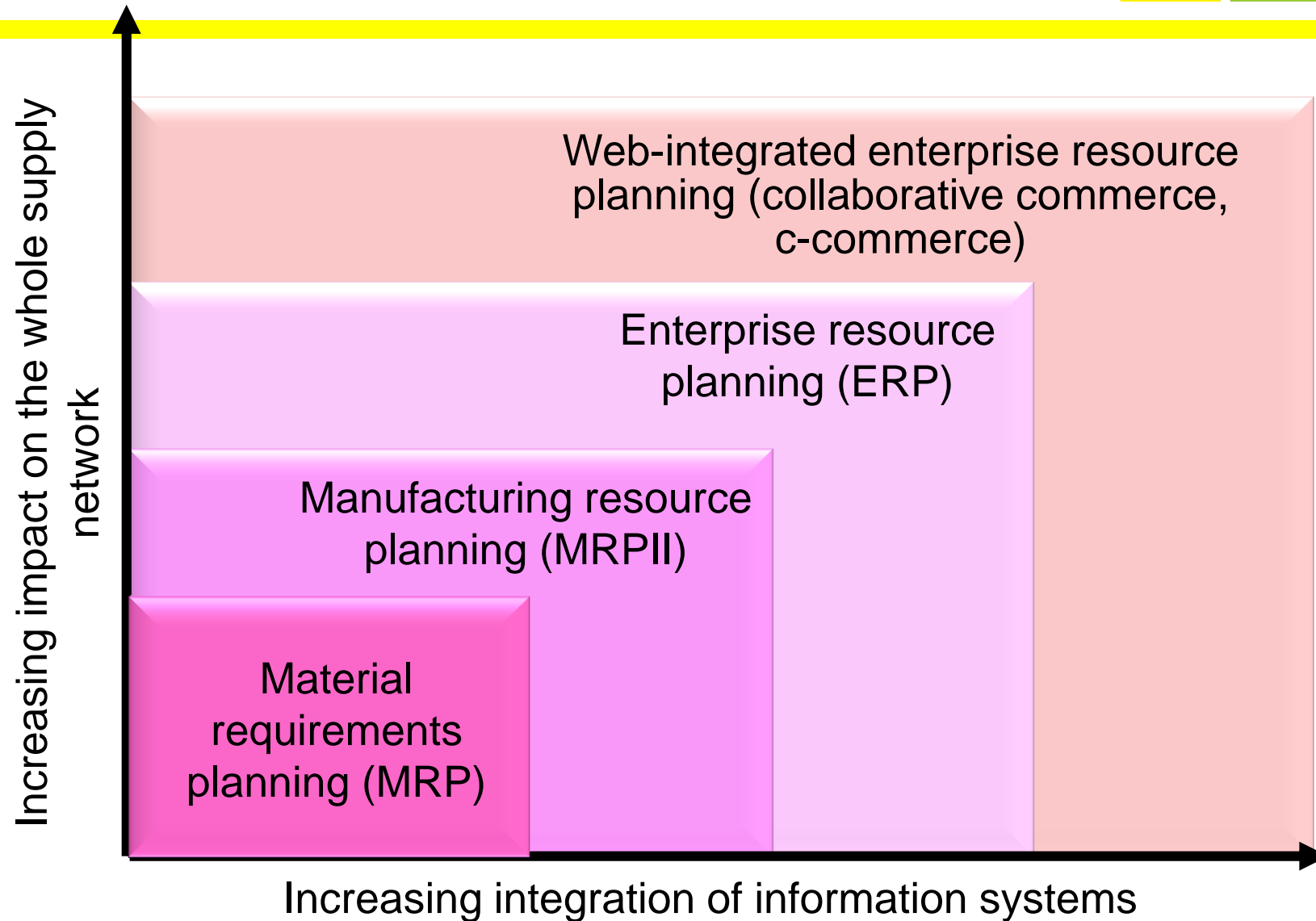
Key areas of research focus in Logistics & SCM

- Logistics and Supply Chain Integration
- Supply chain flexibility, agility and reliability
- Track and Trace Capabilities (Barcodes, RFID, etc.)
- 3PL and 4PL growth and expansion
- Reverse Logistics
- Green Logistics & Carbon Footprint
- Just-in-time (JIT)
- Customization and postponement and decoupling point
- Lean principle and practice
- Global Outsourcing & its implications on Logistics
- International movement of goods by sea, air, road, rail etc.
- Time compression and risks mitigation in Logistics and supply chain
- Performance Measurement of logistical operations

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Lean planning & control, or MRP, or both?

Complex structure → Simple structures

Complex routings → Simple routings

- Project management
- MRP
- Lean and/or MRP
- Lean

(Slack et al 2010)

The development of ERP

Increasing impact on the whole supply network →

Web-integrated enterprise resource planning (collaborative commerce, c-commerce)

Enterprise resource planning (ERP)

Manufacturing resource planning (MRPII)

Material requirements planning (MRP)

Increasing integration of information systems →

(Slack et al 2010)

ERP integrates several systems

Senior management and stakeholders

- Strategic reporting applications
- Financial applications
- Sales and marketing applications
- Operations applications
- Integrated database
- Delivery and logistics applications
- Purchasing and supply applications
- HRM applications
- Service applications

Supplier

Back-office staff

Front-office staff

Customers

Employees

Employees

(Slack et al 2010)

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E-Supply Chains

- **Infrastructure for e-SCM**
  - Electronic Data Interchange (EDI)
  - Extranets
  - Intranets
  - Corporate portals
  - Workflow systems and tools
  - Groupware and other collaborative tools
- **Activities and Infrastructure of e-SCM**
  - Supply chain replenishment
  - E-procurement
  - Supply chain monitoring and control using
  - Collaborative planning
  - Collaborative design and product development
  - E-logistics
  - Use of B2B exchanges and supply webs

Reverse Logistics – research areas

Drivers
- Economic
- Legislation
- CSR
- Technology

Reasons of Return
- Manufacturers
- Internal – Leftovers, Scrap, Defectives
- External – Excess product
- Retailers - Defective, Damaged, Unwanted, Incorrect, Warranty Returns, Customer Dissatisfaction

Types of Return
- By-Products Returns
- Functional Returns
- Reimbursement Returns
- Service Returns
- End-of-Life Returns
- End-of-Use Returns

Reverse Logistics

Processes of Return
- Integration of Forward and Reverse
- Logistics Closed-Loop Supply Chain
- Combine Existing Operations
- Outsource to 3PLs

Participants
- Returners
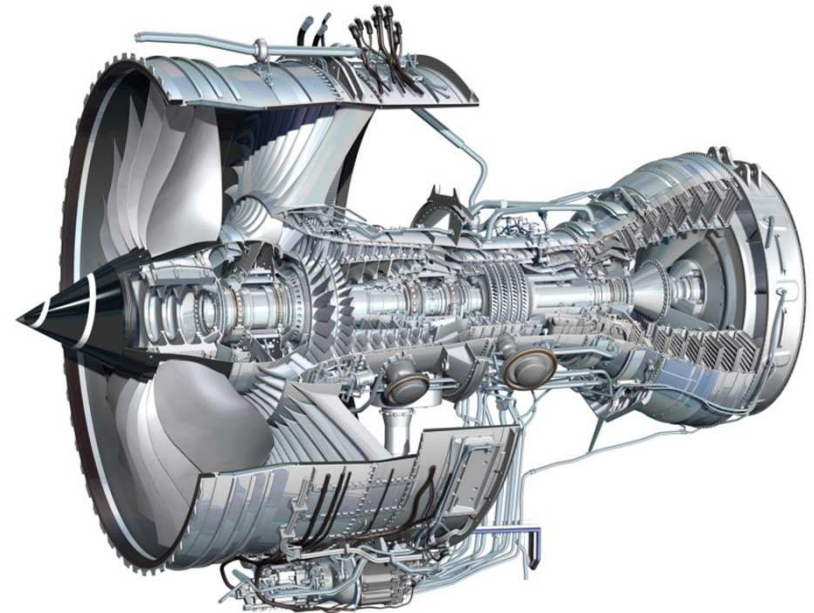- Receivers
- Internal Parties
- External Parties

(Adapted: De Brito, 2003)
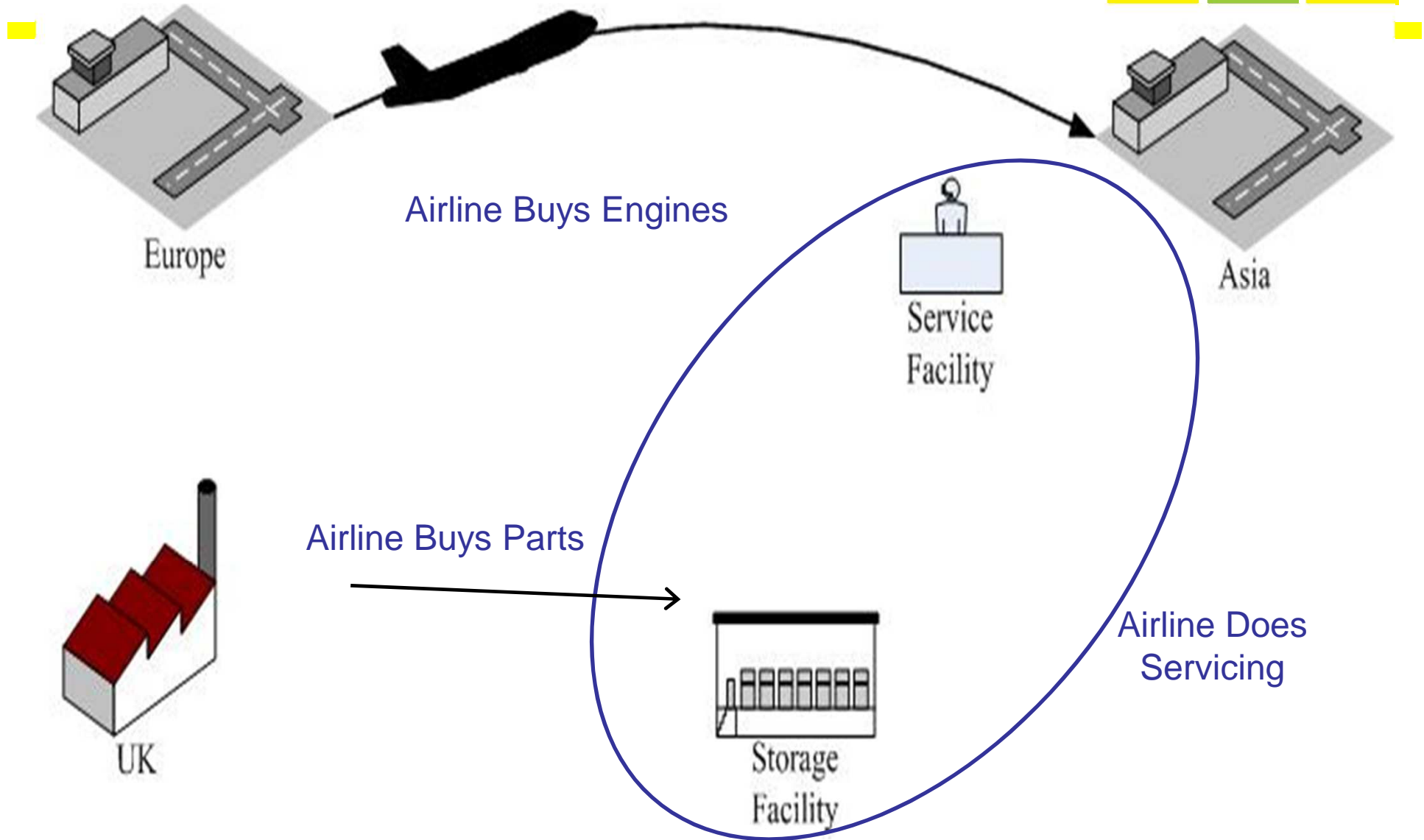
Case Study: Product-Service-Organisation

- Long term service contracts, guarantee access to functional product – "fly by the hour"
  - Not engines –> "power"
  - Not products –> "the promise of a solution"

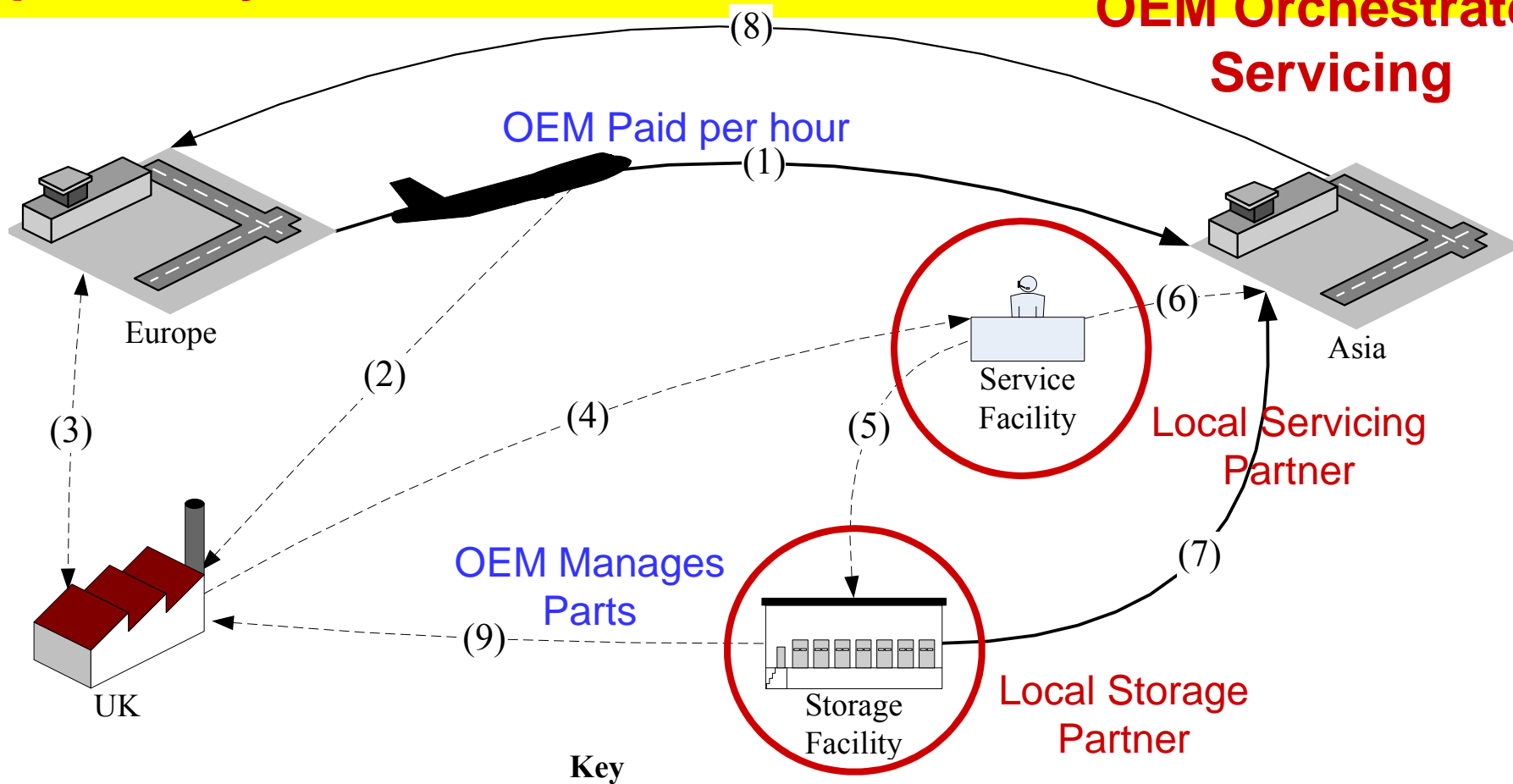# Typical Scenario: Before Power-by-the-hour

Airline Buys Engines

Europe

Asia

Service Facility

Airline Buys Parts

Storage Facility

Airline Does Servicing

UK

Pawar, Beltagui & Riedel (2009)

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Aero Engine: **Typical global scenario of 'power-by-the-hour'**

OEM Orchestrates Servicing

Key

- - - → Information transfer
- ———→ Physical transfer (products, components or passengers)

Pawar, Beltagui & Riedel (2009)

Logistics Performance Index of 150 Countries

Performance Score (Y-axis): 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5

Countries (X-axis) — Country and Rank:
Singapore (1), Germany (3), Japan (6), United Kingdom (9), USA (14), Australia (17), France (18), Taiwan (21), South Africa (24), China (30), India (39), Argentina (45), Mexico (56), Brazil (61), Zambia (100), Afghanistan (150)

(World Bank Report 2007)

Country and Rank
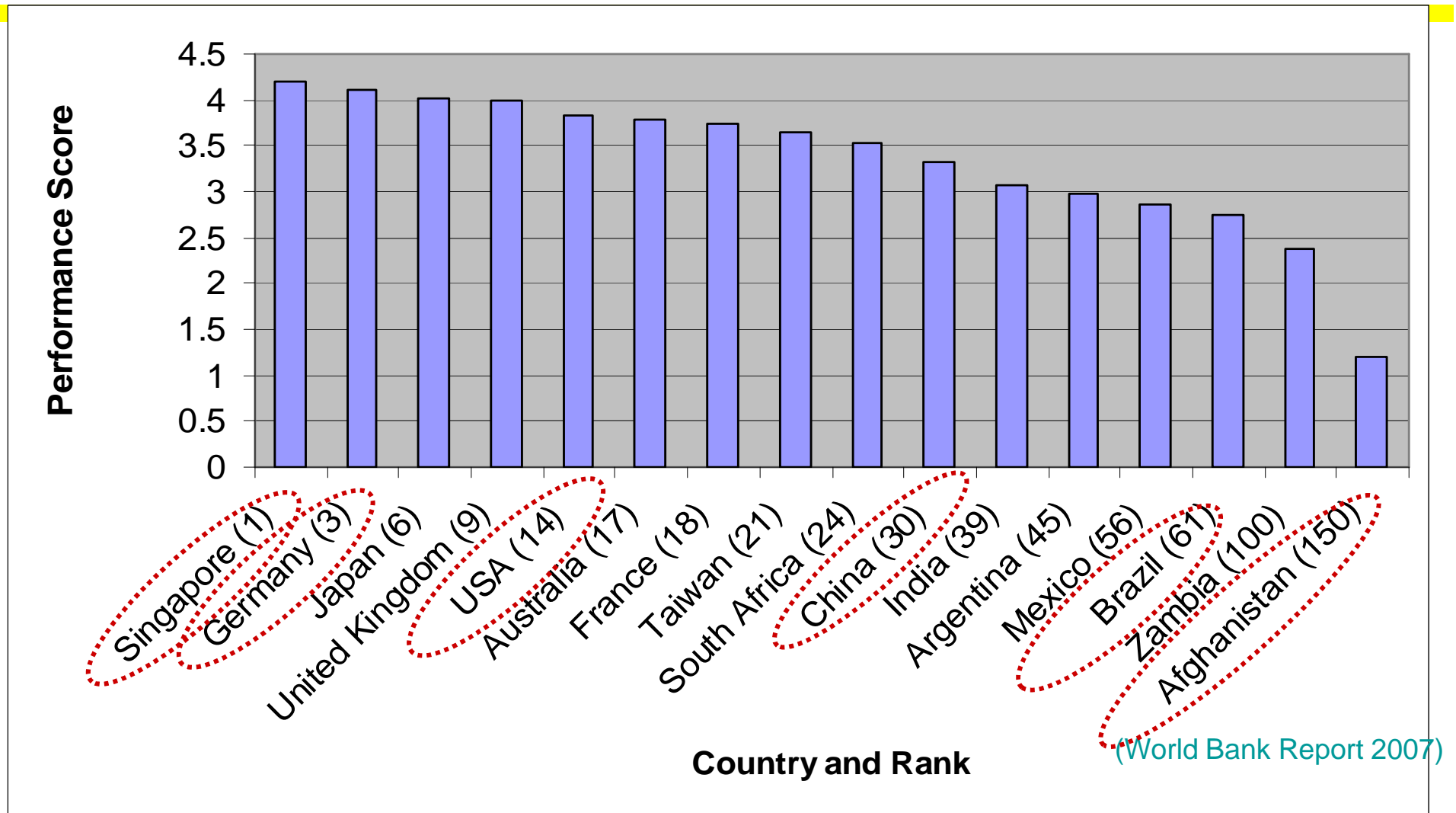
Factors included: Customs, Infrastructure, International shipments, Logistics Competence, Timeliness, Tracking and Tracing, Domestics Logistics Costs etc.

27   12/1/2010

Cost of 'O' in P-S Systems

Components

Raw Material

Warehouses

Repair Shops

Sub assemblies

Finished Products

Customers

Pull to assembly?
"JIT"?
Buffer stock?

Just-in-case?
Demand?
Location?
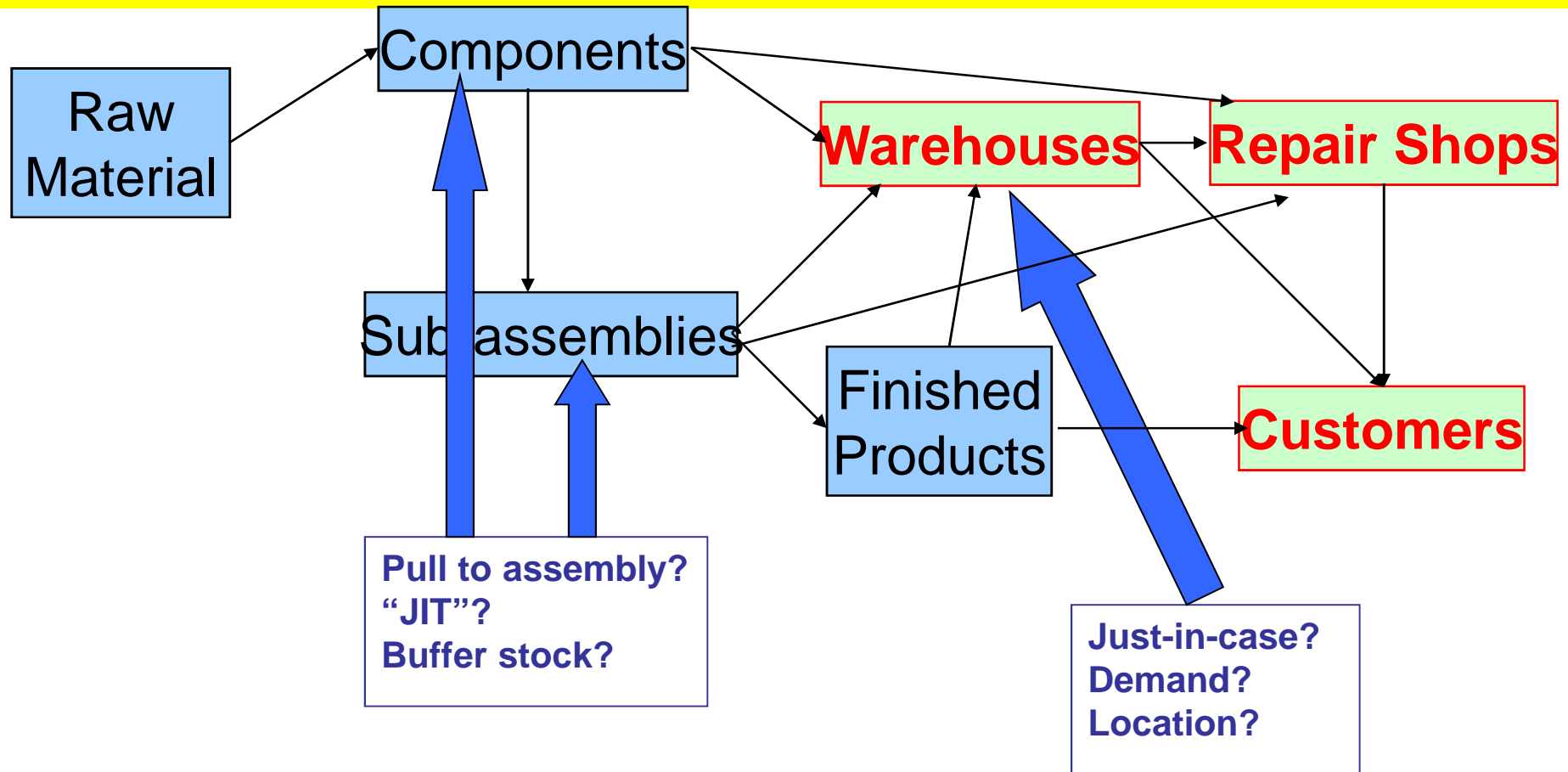
Rolls Royce pipeline inventory is £2.4billion to service 'power by the hour' agreements

Future Thoughts & Challenges

- What is the true operational model?

- How do we embed 'O' into P-S Systems?

  - Real lead-times at each stage

  - Cost and value added at each stage

  - Constraints, bottle-necks and risks

  - Develop global partnerships and relationships for service excellence within a local 'cultural' context

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Next-Generation Supply Chains (Nex-Gem, IBM)

- Strategic importance
- Accountability
- Transparency on environmental issues
- End-to-end visibility
- Social responsibility
- Risk & Security problems
- Financial sophistication
- Master volatility
- People, Talent, Training and skills
- Resource planning and utilisation (Impact of global climatic change! E.g. Energy, water and food prices)

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Future Challenges

- Green Logistics (green corridors, CO2 reduction, carbon footprint, etc.)
- Collaborative coordination and contracts within the Supply Chain
- Ideal configuration structures for different sectors
- Collaboration and learning within the Supply Chain -
- Urban and Interurban Transport, Intermodal Transport, Freight transport.
- Reverse logistics
- Information & Communication Technologies & Systems
- Humanitarian Logistics
- Global Health Supply Chains & implication for logistics
- Food Logistics & Supply Chains
- People, people, people…. (training and skill development)

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Thank you