Trends and Future Challenges in the Logistics Sector

Prof Kulwant S Pawar
Nottingham University Business School, UK
Kul.Pawar@nottingham.ac.uk
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** = *Logical* thinking + *Statistics*
- **Logistics** = Materials Management + Distribution + related information
In other words …

Right Products

In the right Quantities

Flexibility

Delivery Reliability

At the right Moment

Delivery Lead-time

At Minimal Costs

Inventory Level

In other words …

Flexibility

Delivery Reliability

At the right Moment

Delivery Lead-time

At Minimal Costs

Inventory Level

11/19/2010
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
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
Typical issues/scenario

- Lack integration → leads to **volatility** in demand → resulting in high inventories, long lead-times and high costs etc.
The magnification of variability in orders in the supply-chain

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.
Uncertainty in inventory management:

Recent events

• 11\textsuperscript{th} 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..
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
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
Strategic inventory & the decoupling point

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

Push, Pull, Driven by Demand, Driven by Forecast

- Buy to order: (manufacturing postponement high)
- Make to order
- Assemble to order
- Make to stock
- Ship to stock: (manufacturing postponement low)

Denotes a Stockholding Decoupling Point
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
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 main 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
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
Lean planning & control, or MRP, or both?

Lean planning & control, or MRP, or both?

Complex structure

Simple structures

Simple routings

Complex routings

Project management

Lean and/or MRP

Lean

MRP

(Slack et al 2010)
The development of ERP

- 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

Increasing impact on the whole supply network

( Slack et al 2010)
ERP integrates several systems

Integrated database

Strategic reporting applications
Sales and marketing applications
Delivery and logistics applications
Service applications
HRM applications
HRM applications

Operations applications
Purchasing and supply applications
Financial applications

Back-office staff
Front-office staff
Supplier
Employees
Employees
Customers

Senior management and stakeholders

(Slack et al 2010)
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

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**
- **Airline Buys Parts**
- **Airline Does Servicing**
Aero Engine: Typical global scenario of ‘power-by-the-hour’

1) A plane makes a scheduled flight from Paris to Hong Kong.
2) The engine monitoring system detects a problem and informs the manufacturer’s headquarters.
3) Information from the engine’s last scheduled check is requested and received.
4) A request for a repair is made to a local service partner.
5) A request for required components is made to a storage facility.
6) Scheduling of maintenance work including people and parts required.
7) Components required for repair are transported to the airport.
8) Following repair, the plane makes a scheduled return flight.
9) A request to replenish the stock of components is made to the engine producer.

Key:
- Information transfer
- Physical transfer (products, components or passengers)

OEM Orchestrates Servicing

Pawar, Beltagui & Riedel (2009)
Logistics Performance Index of 150 Countries

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

(World Bank Report 2007)
Cost of ‘O’ in P-S Systems

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
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)
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)
Thank you