

# Systems Modelling and Simulation (5)



## **Analysis of Supply Chain System**



# Today's discussions

- Basic concepts and elements of Supply Chain Management
- Reverse Logistics Supply Chain

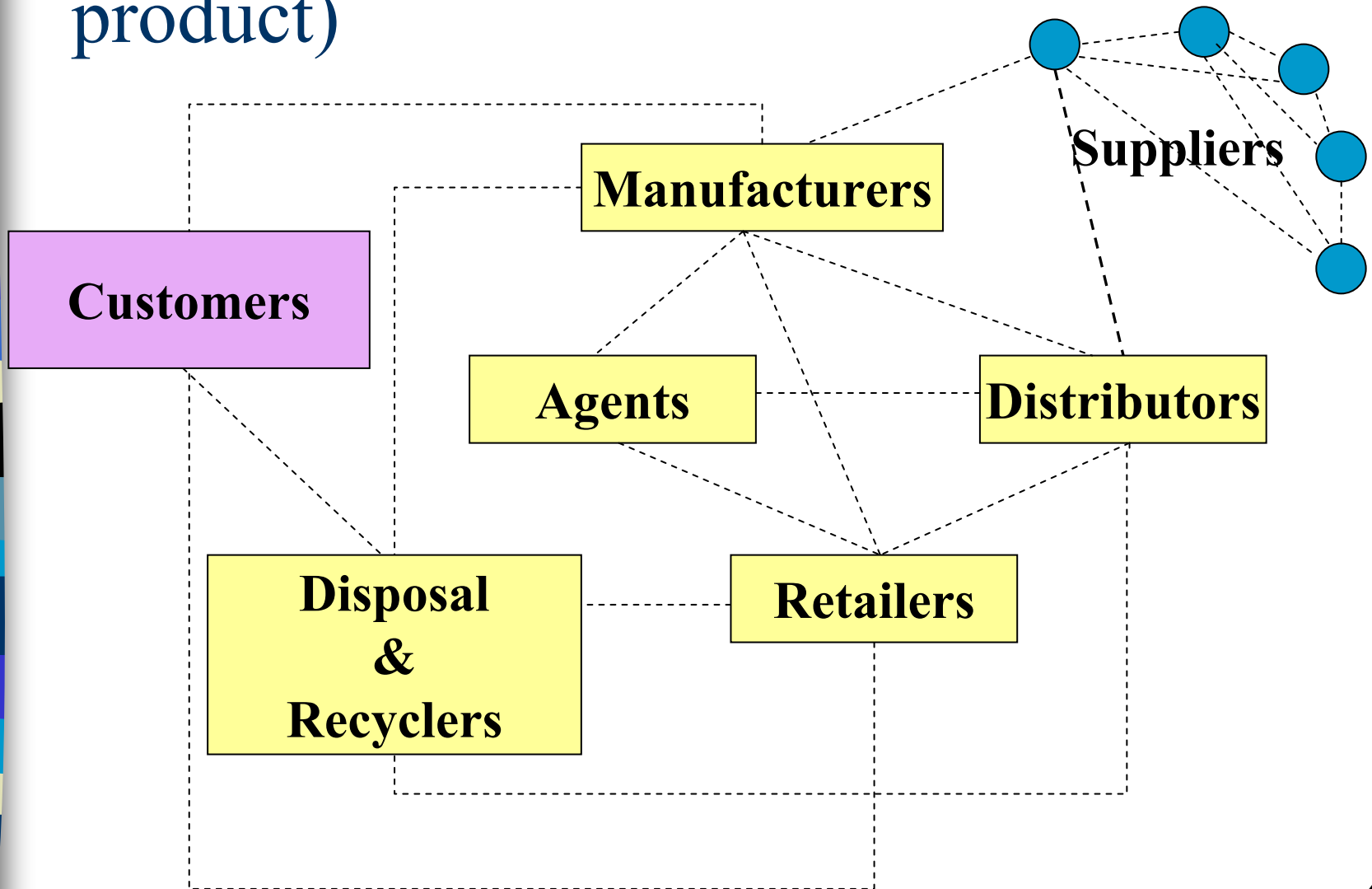


# Supply Chain Management

A **Supply Chain** is a network of different organisations such as suppliers, retailers, distributors, agents, and manufacturers that cooperate (strategic or opportunist) to add value.

**Supply Chain Management** can be defined as a set of approaches utilised to efficiently integrate the supply chain so that the products or services can be delivered to the customer **at the right time, to the right place, with minimal cost to the maximum satisfaction of customers**

# Supply Chain (flow of information & product)





# Reverse Supply Chain (RSC)

- Product return has become a factor in supply chain flow management
- Companies are now assessed on their RSC/RL capability
- Up to 50% product returns and End-of-life regulations
- In specific large quantity of online sales



# Return of product

- From the Supply Chain (defective or damaged)
- Reverse supply chain
- Waste stream (discarded)
- Major product recalls

# 5 steps of RSC

1. Product disposition
2. Reverse logistics
3. Inspection and disposition
4. Reconditioning
5. Sales



# Modelling Approached to RCS

## (Rommert, 2003)

<b>Topic</b>	<b>Methodology</b>	<b>Related traditional models</b>
<b>Product return forecasting</b>	Time series analysis	Demand forecasting models
<b>Reverse logistics network design</b>	Mixed Integer Linear programming (MILP), stochastic programming, continuous approximation	Facility location models Logistics costs models
<b>Production planning for product recovery</b>	MILP, continuous optimisation	MRP, aggregate production planning
<b>Inventory valuation</b>	Net present value analysis	EOQ, stochastic inventory control models
<b>Coordination in closed-loop supply chains</b>	Game theory	Supply chain contracts
<b>Stochastic inventory control in product recovery</b>	Markov decision processes Stochastic optimisation	Stochastic inventory control models News vendor models





# Importance and Challenges of Reverse Logistics Supply Chain

- Effective use of returns to **maximise value** of resources
- **Large losses** accrued due mishandling returned products (in US alone \$35-\$42 billion annually)
- Product return (RSC) is totally **independent** of the SC so every element should be well thought of and designed
- Without a **proper RSC / RL** model the costs would soar on the SC
- SC are designed for **outbound flow** – reverse may require a **separate flow**
- RL programme can **reduce costs** and **increase customer satisfaction**



# Finally

- Supply Chains
- Reverse Supply Chains and RL
- Modelling issues