



UNIVERSITY OF
CAMBRIDGE
Institute for Manufacturing

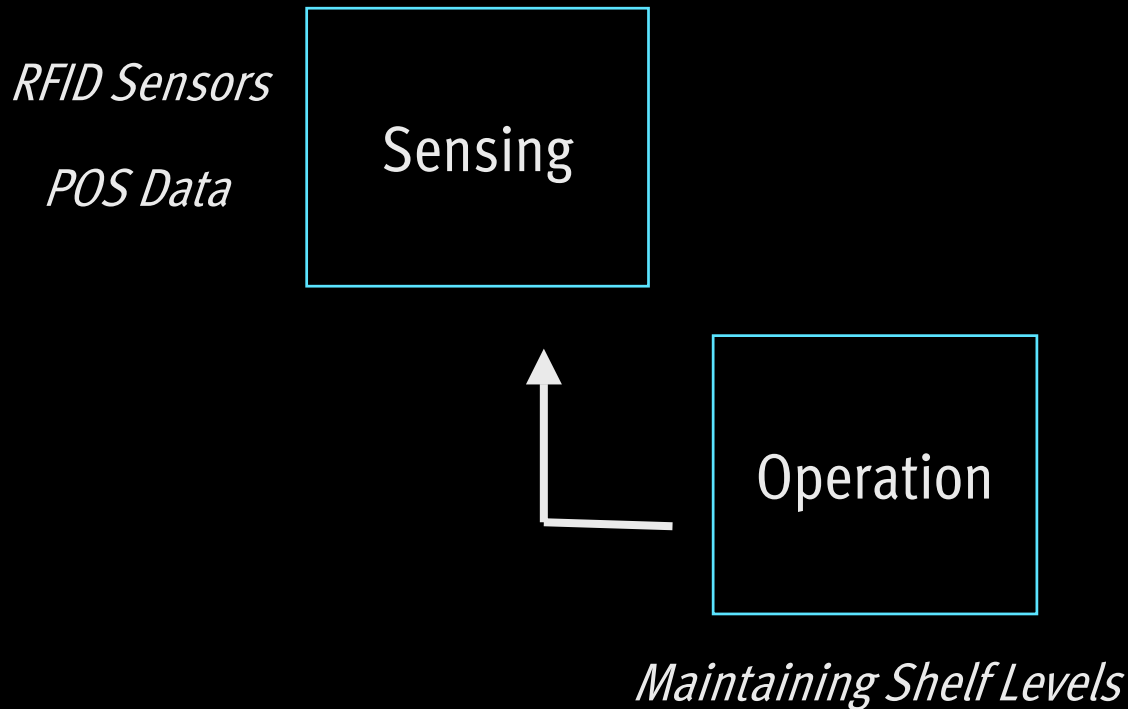
Automating EPC: The Role of EPC in Supply Chain Control

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– Cambridge Lab



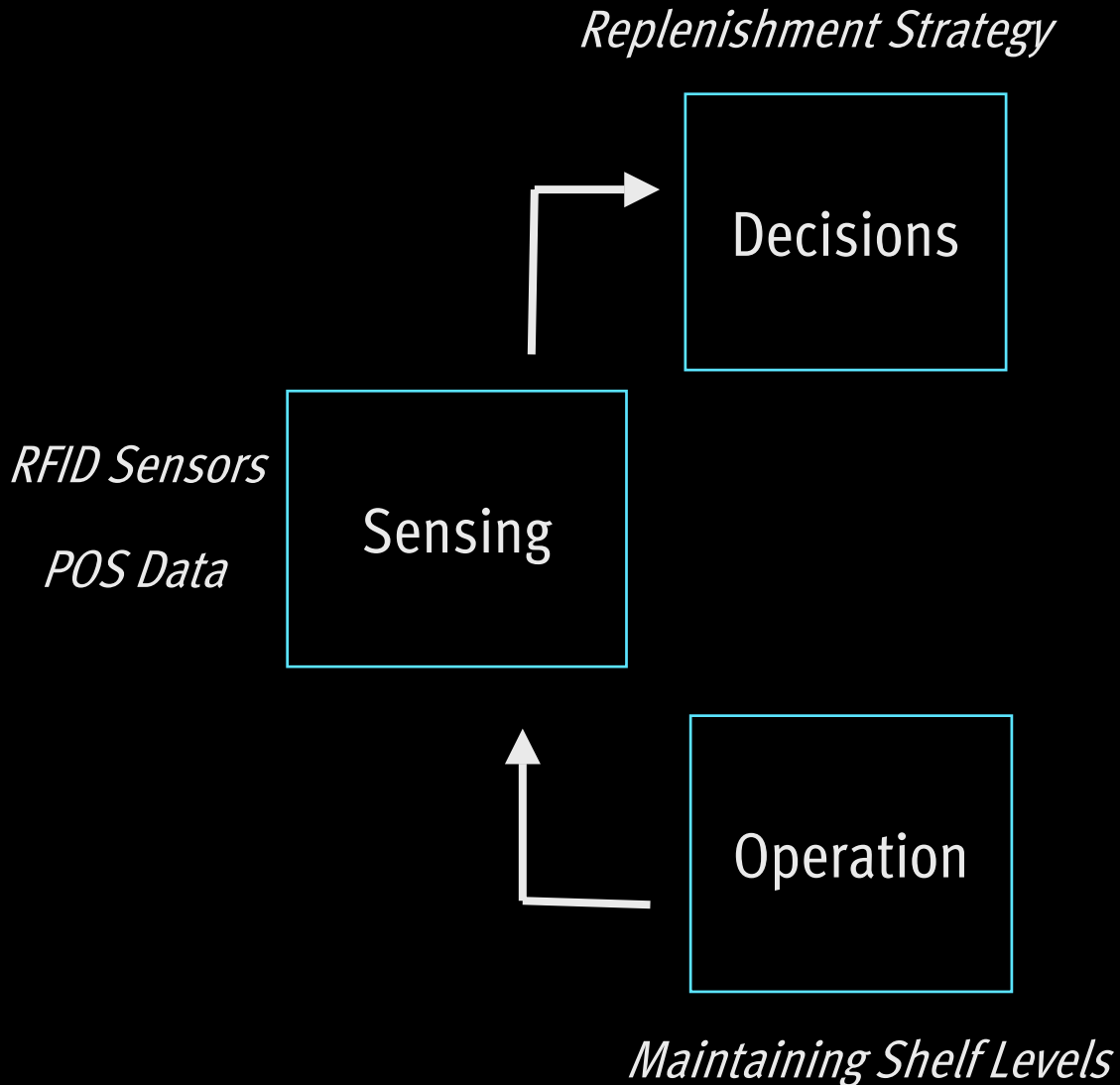


INFORMATION INTO ACTIONS



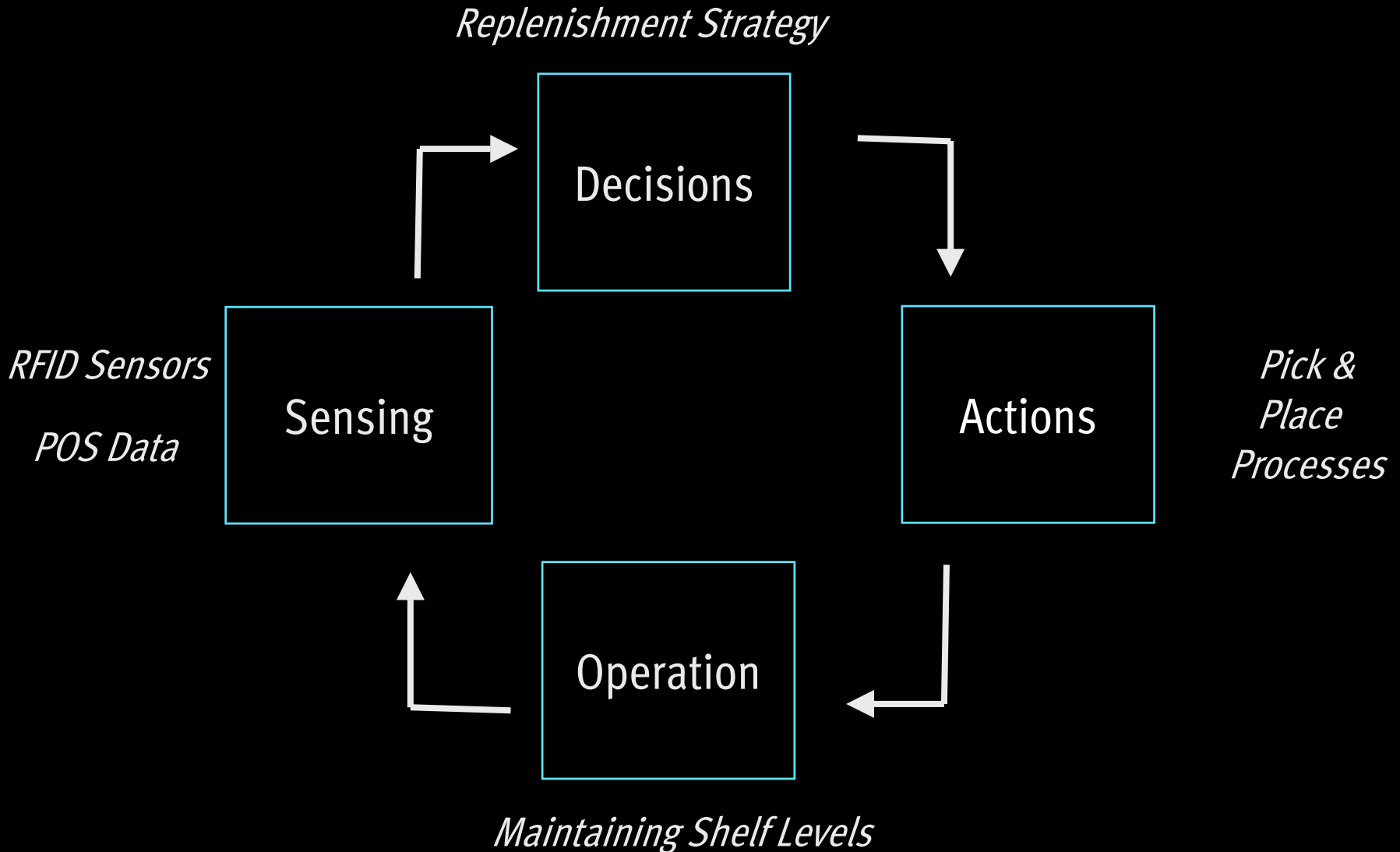


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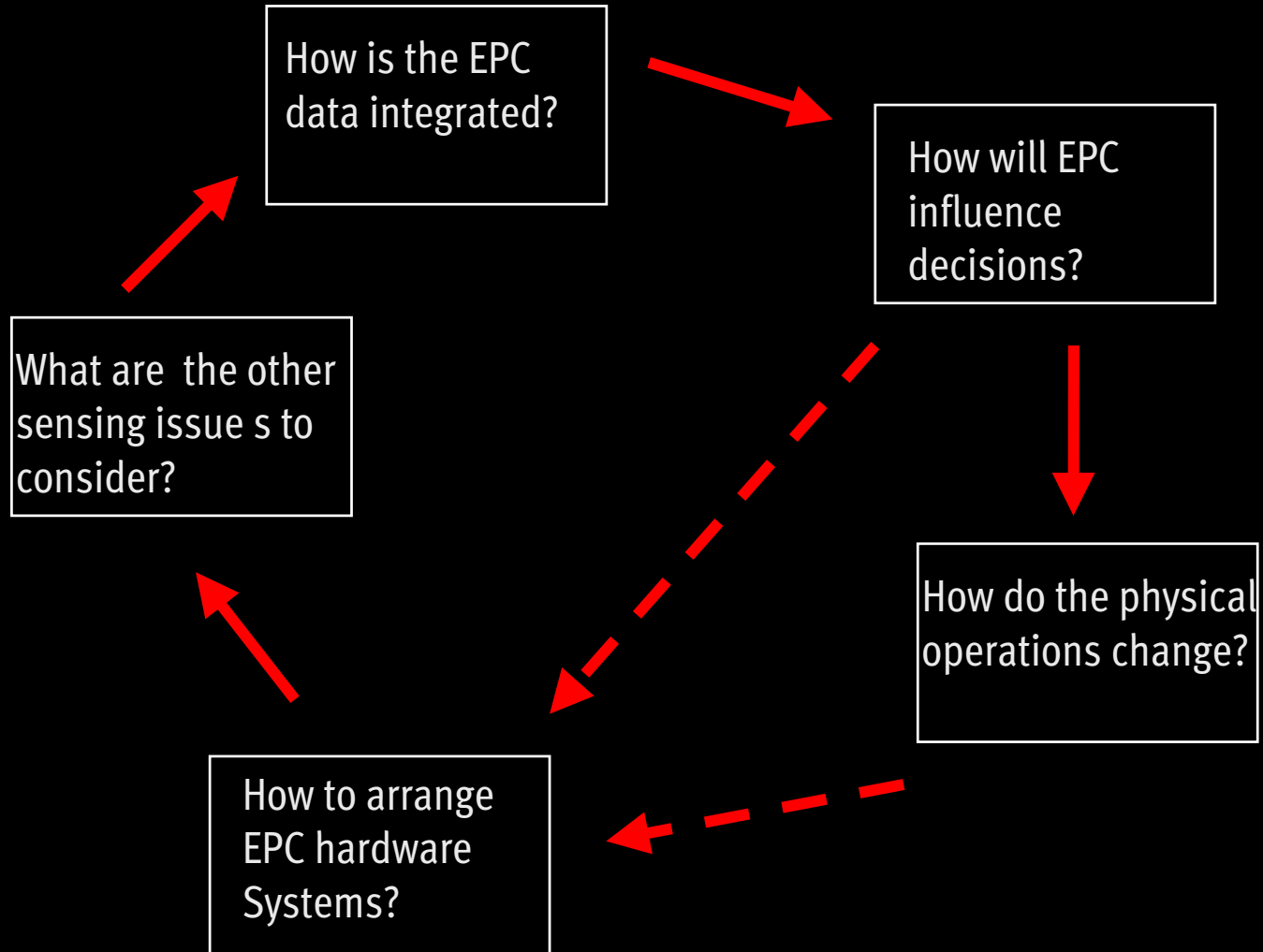


INFORMATION INTO ACTIONS





INFORMATION INTO ACTIONS





- Arranging EPC hardware
- Other Sensing Requirements
- Integrating EPC Data
- Influencing Decisions
- Enhancing Physical Operations



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ARRANGING EPC HARDWARE

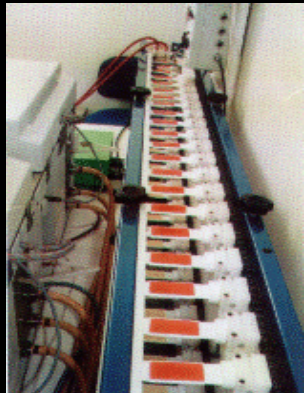
- Technological issues impact on hardware
 - Read ranges
 - Communications capacity
 -
- BUT Operational needs are the real driver for an EPC solution configuration
- Desired “Visibility” is a relative term dependent on decisions and operations needed





ARRANGING EPC HARDWARE

- **Visibility In Space** - ability to distinguish between locations of item



- **Visibility In Time** - ability to distinguish between items at different times

- **Visibility In Identity** - ability to distinguish between items with different identity





ARRANGING EPC HARDWARE

Guidelines:

- Determine which decisions / operations are dependent on the availability of EPC data?
- For each decision assess Reads/sec/m²
- determine:
 - How many readers/antennae?
 - Acceptable Reader ranges / accuracy / frequency/reliability?
 - Where to locate readers / antennae?





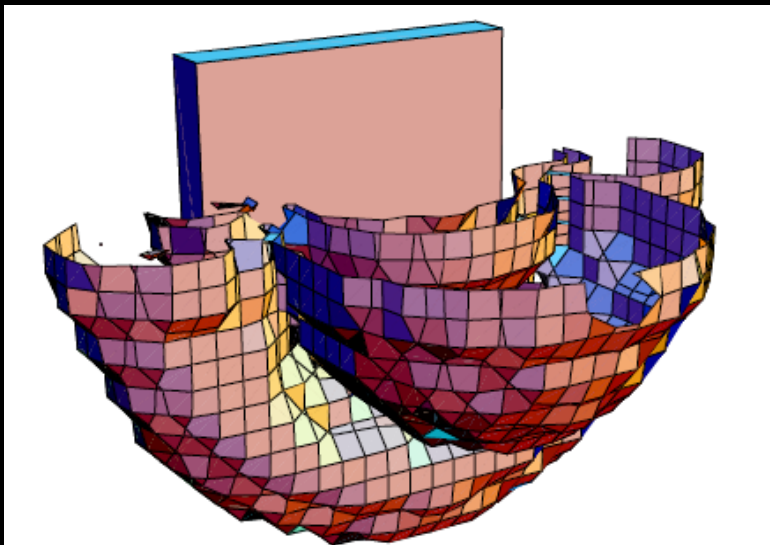
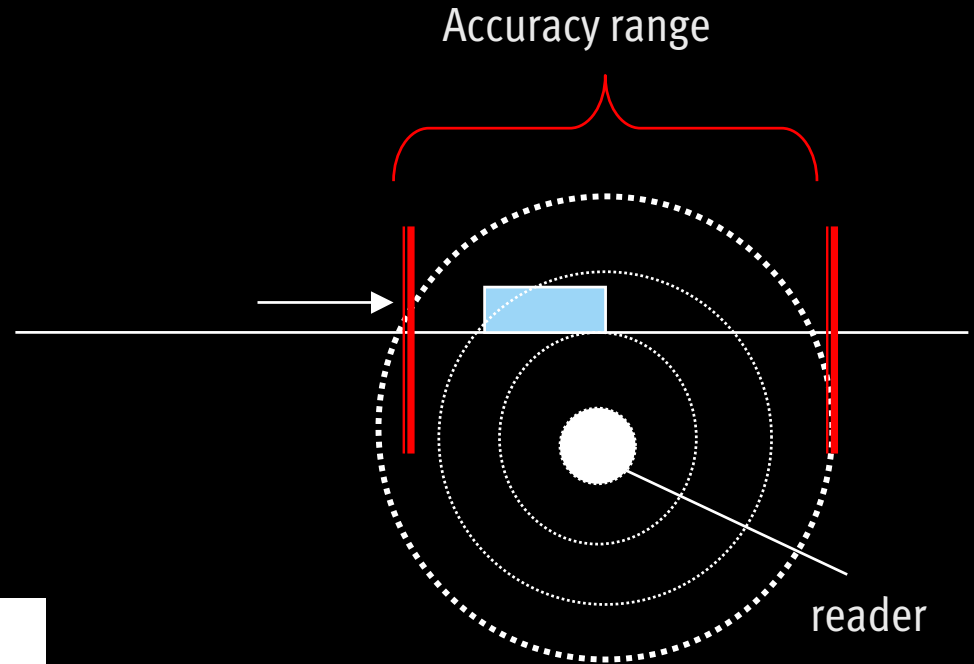
- Arranging EPC hardware
- **Other Sensing Requirements**
- Integrating EPC Data
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OTHER SENSING REQUIREMENTS

- an RFID based EPC Solution provides
 - Item ID
 - Size
 - History
 - Instructions
 - *Coarse* product Location Information
- an RFID based EPC Solution DOESN'T provide
 - Accurate product location
 - orientation
 - Other sensory information: temperature, humidity
- Location / identity synchronisation particularly critical

OTHER SENSING REQUIREMENTS



- + Proximity sensors
- Cameras
- Tracking models
- Physical constraints



OTHER SENSING REQUIREMENTS

Guidelines: (Location)

- Determine fixed conditions of operation (line speed, shelf spacing)
- Establish location accuracy requirements
- Assess whether RFID alone can deliver
 - Constrain physical movement
 - Create physical movement
 - Use additional position sensing
- Establish auxiliary sensory needs and coordinate collection with EPC system



- Arranging EPC hardware
- Other Sensing Requirements
- **Integrating EPC Data**
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INTEGRATING EPC DATA

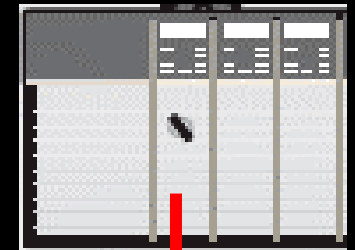
Product



- Application type?
- Real Time?
- EPC Data required (EPC / PML)
- Existing IT infrastructure



Business



Operations

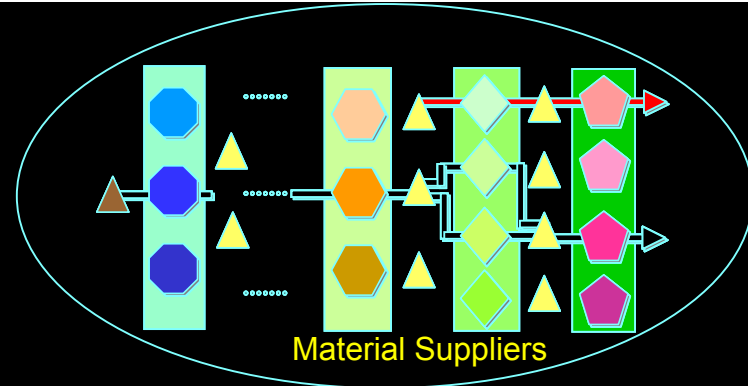




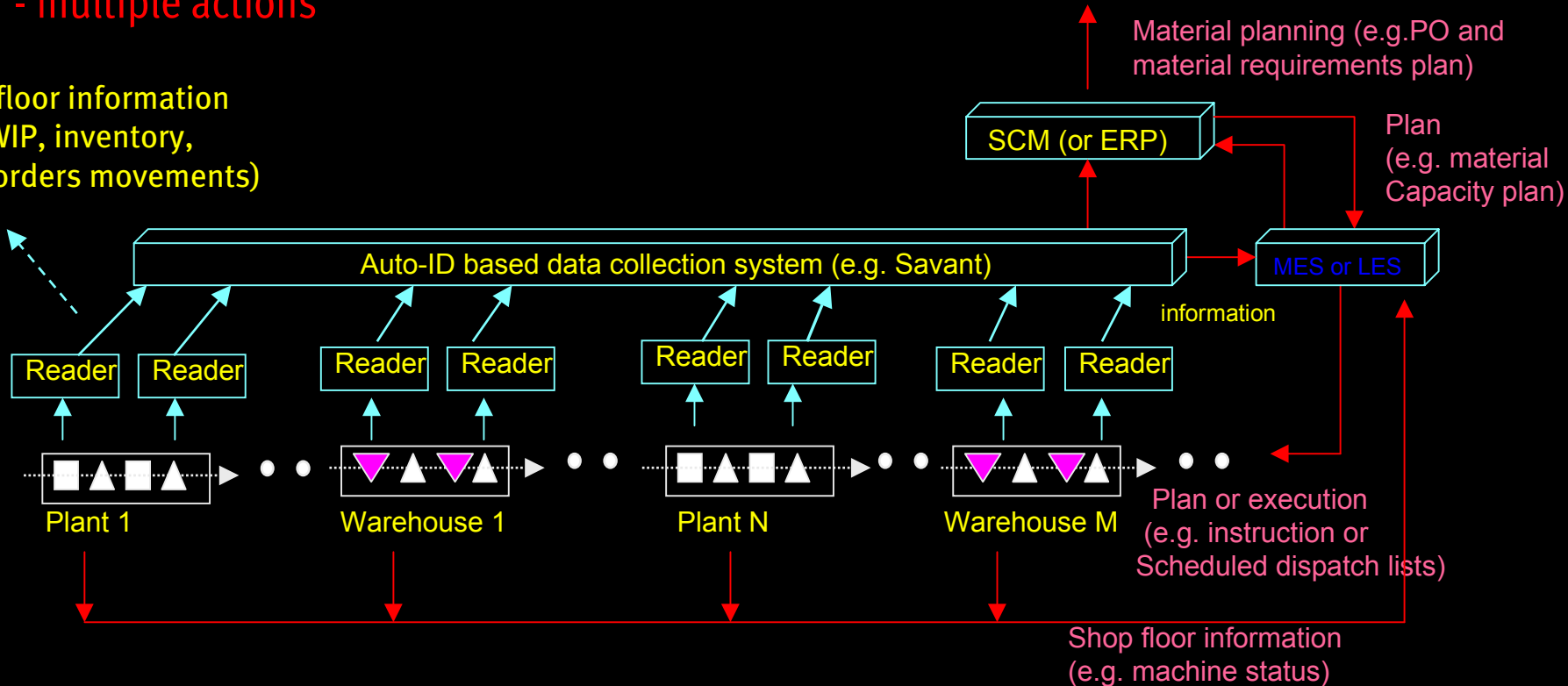
INTEGRATING EPC DATA

Manufacturing Case Study

- multiple data streams
- multiple destinations
- multiple actions



Shop floor information
(e.g. WIP, inventory,
shop orders movements)





INTEGRATING EPC DATA

Guidelines:

- Determine applications requiring EPC data
- For each
 - RT/non RT
 - Control / Monitor
 - Classify EPC data type
- Build Use Cases
- Establish EPC system processing needs
- Establish IT systems interface to EPC data stream



- Arranging EPC hardware
- Other Sensing Requirements
- Integrating EPC Data
- **Influencing Decisions**
- Enhancing Physical Operations



INFLUENCING DECISIONS

Using EPC data to create improvements in Supply Chain Decision making processes (Ordering, Planning, Scheduling, Inv Management)

- more timely/accurate product data:
 - => e.g. more dynamic response
- high fidelity:
 - => e.g. improves capability for customisation
- increased data “range”:
 - => e.g. use full life cycle information



INFLUENCING DECISIONS

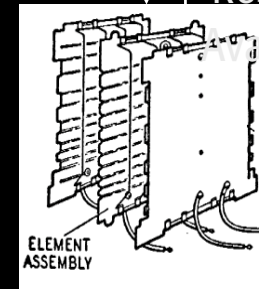
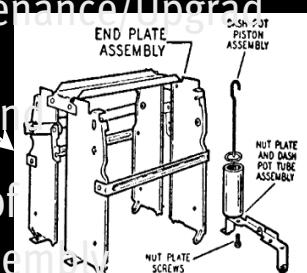
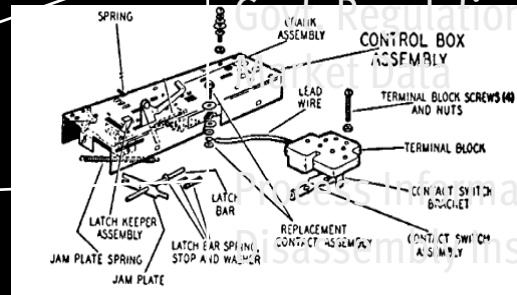
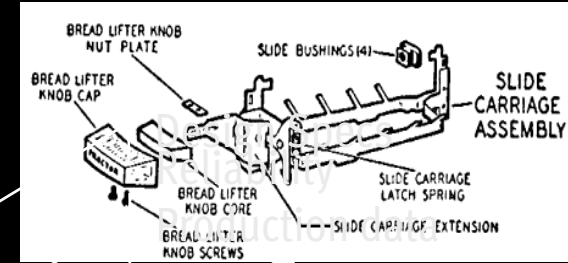
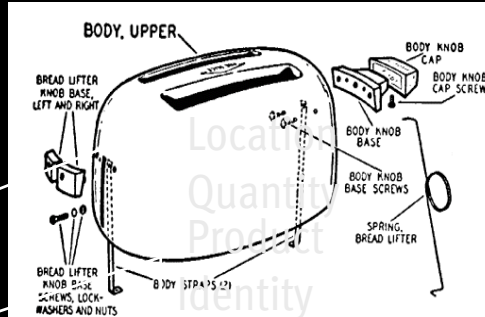
Late Customised Manufacturing:
Towards the interactive customer order

- order generates network connection to materials
- order escorts product through production
- order expresses preferences / priorities

INFLUENCING DECISIONS

“Ideal” EOL Decisions

- Collection
- Sorting
- EOL Option
- Disassembly
- Disposal



Product Quality

Govt. Regulations
Material Information

Usage

Maintenance/Upgrade

Demand

Price
Cost of

disassembly

Resource

Availability

Instructions

Govt. Regulations

Material Information

Product Quality

Govt. Regulations

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Govt. Regulations

Material Information



INFLUENCING DECISIONS

Guidelines:

- Consider proposed EPC system with existing decisions
- Identify potential opportunities for improving efficiencies, flexibilities
- Adapt decision processes & evaluate
- Re assess EPC hardware configurations



- Arranging EPC hardware
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- **Enhancing Physical Operations**



ENHANCING THE PHYSICAL OPERATIONS

- The facilities myth
orderly = efficient!
- Excess buffering / time delays / slack periods to add resilience
- Opportunities for increasing flexibilities not fully exploited



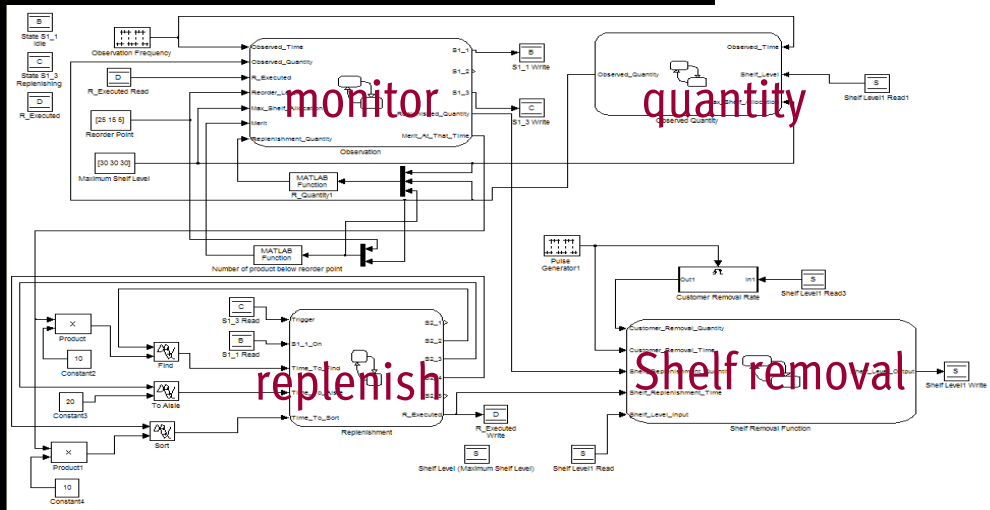
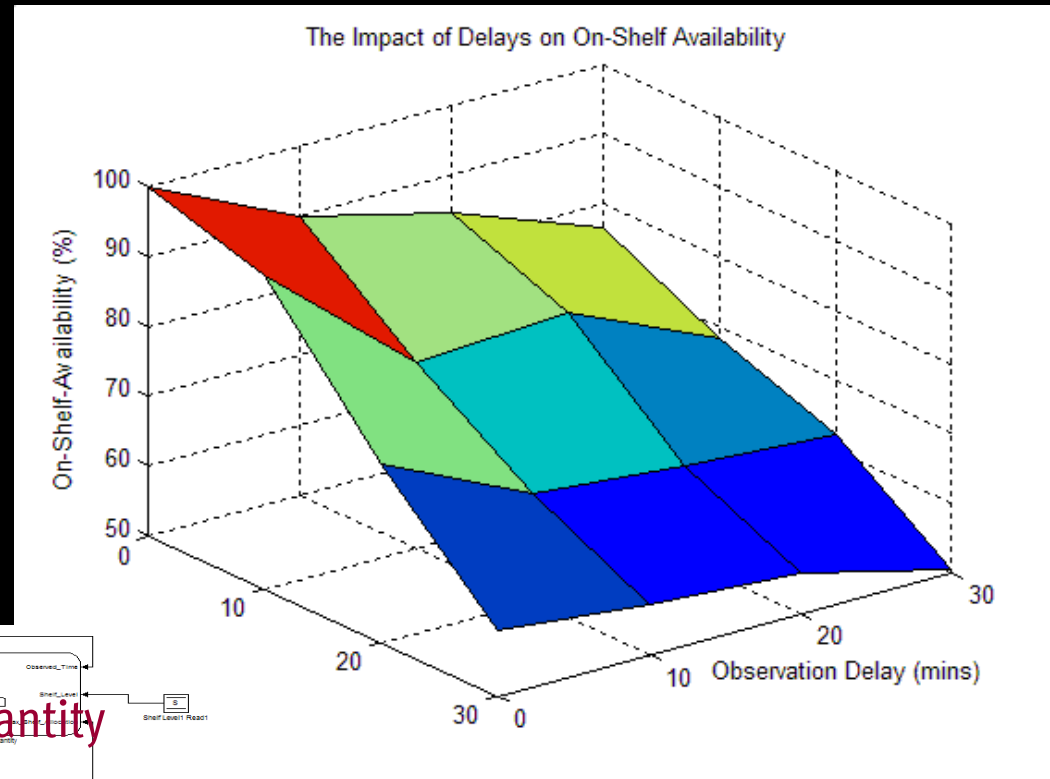
RETAIL SHELF REPLENISHMENT

Issue:

Analysis of the impact of accurate and timely item level information on shelf replenishment policies

Approach:

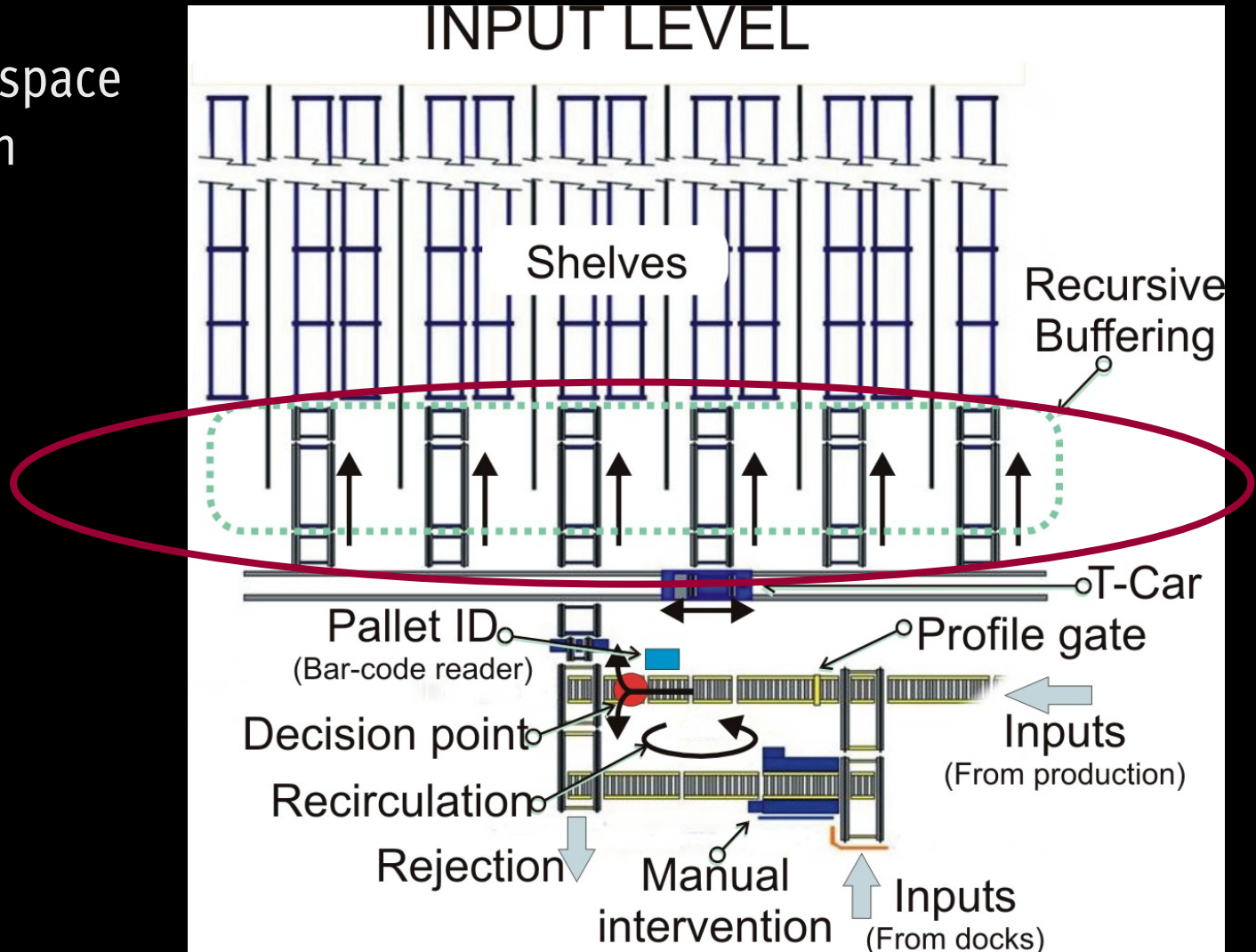
Dynamic retailer simulator





ENHANCING THE PHYSICAL OPERATIONS

Warehouse space
optimisation





ENHANCING THE PHYSICAL OPERATIONS

Guidelines:

- Consider proposed EPC system with existing decisions
- Identify potential opportunities for
 - Reducing buffering / delays / slacks
 - improving flexibilities
- Adapt physical processes & evaluate
- Re assess EPC hardware configurations



MINI SUPPLY CHAIN DEMONSTRATION

Auto ID Lab – Cambridge University

Auto ID Driven Supply Chain Demonstration



MINI SUPPLY CHAIN DEMONSTRATION

- EPC Hardware: reader locations at gates / loading / storage
- Location/Orientation Sensing: proximity sensors / fixtures / casing
- IT Integration: EPCs for control / PML for order management
- Decisions: Dynamic order planning, latest commitment scheduling, flexible control
- Physical Layout: flexible routing / distributed storage



MINI SUPPLY CHAIN DEMONSTRATION





MINI SUPPLY CHAIN DEMONSTRATION

packing





MINI SUPPLY CHAIN DEMONSTRATION

recall





MINI SUPPLY CHAIN DEMONSTRATION

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INFORMATION INTO ACTIONS

- EPC deployment goes beyond installing basic building blocks
- systematic approach needed to integrating EPC systems
- Deployment is not necessarily a linear process
- Consider two phases of deployment
 - Existing systems
 - New Business Processes
- Value is yet to be fully identified in manufacturing