RFID Applications in Supply Chain Management

presented to
Transportation Research Board
Research Initiatives in RFID Planning Committee

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Agenda

- Key supply chain management challenges
- RFID applications today
- Future opportunities
- Issues
Supply Chain Management

Multiple Suppliers

Multiple Production Operations within a Business

Multiple Customers

Source: The Supply Chain Council, SCOR.
Changing Logistics
Businesses shifting from push-logistics systems to pull-logistics systems to reduce inventory costs

“PUSH” METHODS OF CONTROL
(relative importance)

“PULL” METHODS OF CONTROL
(relative importance)
Supply Chain: Eyewear
NE U.S.A-Italy (Eastward)

Process Handoffs: 4
Total Information Exchanges: 18
Process Duration: 56.50 hrs.
Link Duration: 36.25 hrs.
Segment Duration: 27.50 hrs.
Customs Requirements: U.S., Italy
Exit Port: John F. Kennedy, NY (JFK)
Enter Port: Milan Linate, Italy (LIN)

Supply Chain Process Analysis

Prior Sheet Link #1: Truck –to-Air (Segment 2)

Next Sheet Link #2: Truck –to-Air (Segment 1)

Process Variation
Physical Process
Information Flow
Data Element/Standard
Technology
Time

**U.S. Only**

Key:
FF unique identifier

Unique Tracking # = U.S. 'Customs Entry Number.'

AC, MC destination booking may be completed after consignment departs facility

FF not using pre-existing capacity purchased with AC

Link 1: Truck –to-Air (Segment 1)

Paper, Structured Electronic, E-mail
Telephone, Structured Electronic, E-mail
Paper, Structured Electronic, E-mail
Paper, Structured Electronic, E-mail

Hrs. Elapsed
0.00 08:45
1.25 hrs.
10:00
2.00 hrs.
11:30
3.75 hrs.
13:00
5.25 hrs.
15:00
7.75 hrs.
17:00
10.25 hrs.
19:00
12.75 hrs.
21:00
15.25 hrs.
23:00
17.75 hrs.
01:00
20.25 hrs.
03:00
22.75 hrs.
05:00
25.25 hrs.
07:00
27.75 hrs.
09:00
0.75 hrs.
00:30
1.25 hrs.
02:00
2.00 hrs.
03:00
3.75 hrs.
05:30
5.25 hrs.
08:00
7.75 hrs.
10:30
10.25 hrs.
13:00
12.75 hrs.
15:30
15.25 hrs.
18:00
17.75 hrs.
20:00
20.25 hrs.
22:00
22.75 hrs.
24:00
25.25 hrs.
00:00
27.75 hrs.
02:00

Buyer
Supplier
Freight Forwarder
Seller
AC
Carrier
CA
Customs Authority
MC
Motor Carrier
Logistics Expenditures and GDP
After a long improvement, expenditures have stalled at about 10%

Source: Cass/ProLogis 12th Annual State of Logistics Report, 2000
RFID: Linking Cargo & Assets through Information

Conveyance

Container

Pallet

Multipack

Part

RFID for Supply Chain Management

- At warehouse
- En route
- At point of sale
- Returns, recycling, disposal

Real-time logistics data

Source: MIT Auto ID Center
Key Drivers of RFID Investment

- Retail, distribution centers
  - Wal-Mart requiring top suppliers to put RFID tags on shipping crates and pallets; goal of 1 billion RFID tags with embedded Electronic Product Codes (EPC) for tracking and identifying items at crate and pallet levels
  - Target, Tesco (UK), Metro AG

- Consumer goods manufacturers
  - Gillette purchasing 500 million EPC tags
  - Procter & Gamble, Coca-Cola, Uniliver, United Biscuits
  - Toyota, Ford, GM, Michelin

- Ports, terminals, and carriers
  - Port of Singapore, DHL, Virgin Atlantic
Current Drivers of RFID Investment

- Federal government
  - U.S. Department of Defense mandates RFID for higher value items
  - U.S. Food and Drug Administration -- RFID for pharmaceutical supply chain
  - DHS testing secure trade lane concept in cooperation with 15 ports worldwide
RFID Applications in Use Today

- **At warehouse or retail store**
  - Inventory control
  - Fast checkout
  - Electronic payment
  - Theft prevention
  - Counterfeit detection
  - Access control

- **En route**
  - Asset location and management
  - Load and route optimization
  - Regulatory screening

- **Supply chain-wide**
  - Asset location and management
  - Recall management
  - Recycling and disposal management
  - Chain of possession monitoring
Sample Benefits

- **Walmart:** Potential annual savings of $8.4 billion, primarily from reduced labor requirements for manual bar-code scanning

- **DoD:** RFID avoided $2B in waste during Desert Storm; 90% reduction in containers required for Army compared to 1991 Gulf War
RFID one element of intelligent logistics infrastructure
MIT Auto-ID Lab Approach

- **TAGS** RFID
- **EPC** Electronic Product Code
- **ONS** Object Name Service
- **PML** Physical Markup Language
- **Savant™** Distributed Operating System

Source: Auto-ID Laboratory
Next Step: RFID and Sensors Enable Real-time Tracking of Asset Location and Condition
Use of RFID and Sensors to Track Shelf Life
Example: MREs in Desert Storm

Source: Auto-ID Laboratory
Next Step: Linking RFID to Roadside Systems for Real-Time Freight Management

- Facilitate commercial vehicle traffic and regulatory transactions
  - Link to electronic truck screening, electronic toll collection, port/terminal gate clearance, etc.; Vehicle-Infrastructure Integration initiative

- Enable adaptive logistics and operational decisions that respond to externalities
  - Traffic incidents and other congestion
  - Business disruptions (strikes, blackouts, weather emergencies, quarantines, terrorist attacks, etc.)

- Secure the supply chain by tracking chain of possession and detect intrusions
Example: Hong Kong to US Supply Chain

Pre-planning
- Container No.
- Weight, Size, Type

Terminal Gate
- Vehicle Arrival
- Check seal of the customs
- Scan TID*

Container Yard
- Gantry Cranes
- Ground Containers
- Real-time container Movement and inventory information

Yard Planner
- Information of Yard Area to ground

3P system*

HIT* Systems
- EDI / IES*

Gantry Cranes
- Ground Containers

Radio/Fiber Optics

Interrnal tractor

Terminal Exit Gate
- Inspect Container
- Enter Data (Shipper’s Seal No. & Container No.)
- Scan TID
- Print Terminal Receipt

Terminal Gate
- Vehicle Arrival
- Check seal of the customs

External tractor

Terminal Exit Gate
- Inspect Container
- Enter Data (Shipper’s Seal No. & Container No.)
- Scan TID
- Print Terminal Receipt

Container Yard
- Gantry Cranes
- Ground Containers
- Real-time container Movement and inventory information

External tractor

External tractor

Ocean Carrier

Radio/Fiber Optics

Internal tractor

Pier Checkers & Stevedores

Exchange loading information

Quay Cranes

Load Containers onto a vessel

Pier Checkers & Stevedores

Exchange loading information

Quay Cranes

Load Containers onto a vessel

Transportation company

Hong Kong International Terminal (HIT)

The flow of information

The flow of Containers (or empty tractor)

3P system*

The terminal management system of HIT (Productivity Plus Program)

IES : Information Exchange Service

TID: Tractor Identity Card
Issues

- **Interoperability across supply chain partners at global scale**
  - Technical: frequency, standards
  - Institutional: data exchange protocols

- **Privacy and data use**
  - Individual privacy
  - Competitive access
  - Secondary use for litigation, law enforcement

- **Costs**
  - 5 cents per unit regarded as breakthrough level
Issues

- Data management
  - How much data is too much?

- Technical constraints
  - Accuracy of readings in metal, water environments
  - Ability to read specific items within a larger pack, pallet, container, or conveyance

- Training, human factors