Multi-year Expert Meeting
on Transport, Trade Logistics and Trade Facilitation:

Transport and logistics innovation
towards the review of the Almaty
Programme of Action in 2014

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Radio Frequency Identification (RFID)

by

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Importance of RFID in Logistics

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Centre of Excellence for
Supply Chain Improvement

www.derby.ac.uk/sci
MAJOR RFID PROJECTS

- Using RFID technology to optimize distribution operations (2 years sponsored research)
- Good practice for adopting RFID technology in the English healthcare (3 years sponsored research)
- Using RFID to add value in warehousing operations
- Using RFID in door production (KTP project)
- RFID feasibility projects: UAV Engines and jewellery Merrell Casting
- RFID safety features on excavators
- Safety vest – mining industry

CHALLENGES

- To Save time and fight counterfeit
- Inaccurate data causes expensive manual interventions
- To cut costs in the supply chain
- Better options for serving customers
- Visibility and traceability
- Better customer services
- Accurately quantify carbon emission
Radio Frequency Identification

RFID

What is RFID?

- RFID - Wireless automatic identification technology that identifies objects and gathers data without human intervention or entry of data.
- Transfer Data with no physical contact
- It does not require line of sight
**BRIEF HISTORY**

<table>
<thead>
<tr>
<th>Decade</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940 - 1950</td>
<td>Radar refined and used, major World War II Development effort. RFID invented in 1948.</td>
</tr>
<tr>
<td>1950 - 1960</td>
<td>Early explorations of RFID technology, laboratory experiments.</td>
</tr>
<tr>
<td>1980 - 1990</td>
<td>Commercial applications of RFID enter mainstream.</td>
</tr>
<tr>
<td>1990 – 2006</td>
<td>Emergence of standards. RFID widely deployed. RFID becomes a part of everyday life.</td>
</tr>
</tbody>
</table>

**RFID USES**

- Retail & Distribution
- Contactless Payment
- Keyless Entry
- Livestock Tagging
- Pharmaceuticals
- Logistics Assets (containers, trailers)
- Pet Identification
- Secure document application e.g E-passport
**BENEFITS OF RFID**

**Visibility**
- Prevent theft
- Misplaced and lost
- Improve security

**Automation**
- Reduce human errors
- Saves time

**Authentication**
- Product recalls
- Fraud and counterfeit

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- Logistics Assets (containers, trailers)
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**BENEFITS OF RFID FOR SCM**

- Product visibility
- Reduce supply chain Errors
- Reduce out of stocks
- Anti counterfeit (product recall)
- Automatic data entry
- Capacity to handle increased volumes of goods
- Increased throughput with savings in time and without increases in staffing
- Provision of time and attendance management

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**BASIC OPERATION OF RFID**

- Tag enters RF field of reader
- RF signals power tag
- Tag transmits ID and data
- Reader captures data
- Reader sends data to computer
- Computer sends data to reader
- Reader transmits data to tag

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[www.derby.ac.uk/dbs](http://www.derby.ac.uk/dbs)
TYPES OF TAGS

- Tags can be attached to anything
- Pallets or cases of product
- Company assets
- Personal items such as apparel
- Luggage and laundry
- Livestock, pets and people
- Computers, TVs, camcorders etc...
Tags

- Cartons of produce identified with RFID
- New born baby with RFID tag
- RFID tag on a truck trailer to provide near-real-time location information
- Automated Equipment Identification tag and reader antenna for railcar tracking

TYPES OF READERS

- Readers also called interrogators
- Fixed - Doorways, portals or entrance/exit
- Handheld - Portable ergonomic design
- Wireless - Have capability to communicate with external networks such as WIFI
- Mobile - Used by employees or mounted to forklifts
TYPES OF READERS

RFID Readers (examples)

HAND HELD READER

Where is it going? Where has it been? Should it be here?

Where is it? What is it? What is inside the box?
RFID IN SUPPLY CHAIN

TRANSPORT
CARBON EMISSION
ANIMAL TRACKING
RFID
MANUFACTURING
HEALTH
PORT AND HARBOUR

RFID AT PORT

Real time location of all containers
visibility of all containers and their contents

Information on the trucks and the goods they are carrying and the destination (RFID assisted)
RFID REDUCES TRAFFIC DELAYS AT ADANI PORT HARIZA CONTAINER TERMINAL INDIA

- Challenges
- No rail facility: The trucks provide the only means of moving cargo onto or off of ships
- Traffic management: Trucks spent much time to load or unload
- Managers strive to prevent backups in which trucks operators wait to load and unload
- The terminal has only 600 meters (1,970 ft) wharf to accommodate all vehicles

BENEFITS

- Real time location of truck
- Decreased trucks waiting times and labor cost
- Automate the gate entry process for vehicles
- Provides better location data in the shipping yard and the wharf
- Ensure vehicles is at the proper location
- Saved the terminal about £112,000 (6.7 millions lahks) in labour cost
RFID FOR COLLECTION AND PICKING

- Delivery and collection proof of collection
- Visibility of the trucks GPS/RFID
- Security checks information on the car on board inventory and its destination provided before it gets to the barrier
- Sortation and vehicle loading automated with RFID: loading the right trucks with the products

RETAIL RFID

- Warehouse (RFID for picking, receiving, shipping)
- Retail shop automatic updating of inventory and for RTLS
- POS no need for queue (RFID enabled)
RFID HEALTH

Admission (RFID wristband)  Pharmacy RFID for counterfeit control

Point of collection easy access to patient history  Material Management RFID medical inventory control

HEALTH CARE SOLUTION

- Drug supply chain
- Patient tracking
- Waste Material handling
- Hospital RTLS
- Medical devices
- Surgical operation
RFID IN LIBRARY

Benefits of RFID application for SCM:

- **Cost Reduction**
- **For example**
- **Wal-Mart**
- Invested $3 billion in the system.
- Save approximately $8.35 billion annually
RECOMMENDATION
1. Offer research opportunities through funding towards RFID awareness, education and adoption at Universities, research institutes and industrial organisations
2. Provide incentives or benefits to early adopters through recognition, compensation and tax/duties reduction, etc.
3. Enforce or regulate RFID adoption policies in relevant areas in order to promote its use by indicating benefits as ROI
4. Provide shared assistance in vendor market to adopters and other consumers, e.g. share price of RFID project piloting leading to a complete installation
RFID CAPABILITY
RFID keeps track of items on ships and planes leaving global ports or coming into U.S. for security

Customer finds pair of jeans with her size (with chip sewn into label) on store shelf with radio wand provided by store; pays with cell phone RFID technology

RFID IN SCM

Data acquisition
1. Reader triggers a signal.
2. Antenna sends the signal.
3. Tag responds.

Data utilization
4. Reader recognizes the tag and notifies the RFID middleware.
5. The RFID middleware applies local business logic.
6. The RFID middleware passes filtered, clean information to the asset management application.
# FREQUENCY CHART

<table>
<thead>
<tr>
<th>Frequency Type</th>
<th>Frequency Range</th>
<th>Typical Use</th>
<th>Range</th>
<th>Benefits</th>
<th>Drawback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Frequency (LF)</td>
<td>125 - 134 kHz</td>
<td>Animal ID, race time, access control</td>
<td>&lt; .5 or 1.5ft</td>
<td>Works well around water</td>
<td>Short read range</td>
</tr>
<tr>
<td>High Frequency (HF)</td>
<td>13.56 MHz</td>
<td>NFC, smart cards, tickets, and DVD, library books</td>
<td>Near contact</td>
<td>Near contact up to 30 cm</td>
<td></td>
</tr>
<tr>
<td>MICROWAVE (UHF)</td>
<td>2.450 -5.8GHz</td>
<td>Airline Baggage, Electronic toll collection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultra-High Frequency (HF)</td>
<td>433 MHz &amp; 856 - 960 MHz</td>
<td>Pallet tracking, parking lot access, electronic toll collection</td>
<td>3m or 9ft</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CARGO MANAGEMENT
BY IJKING AT ADANI PORT INDIA

RFID helps port achieve 50 percent better cargo-management efficiency than other terminals of the same size.

http://www.impinj.com/Applications/Case_Studies/Improving_Cargo-Management_Efficiency_with_RFID__Adani_Port.aspx

COMPONENTS OF RFID

Host computer contain the middleware
tagged object

host computer

ID read from tag

reader

radio transmissions

tag

tag ID in chip memory

integrated circuit

each tag has a unique number

reader antenna

to host / network
DIFFERENCES BETWEEN RFID AND BARCODE

<table>
<thead>
<tr>
<th>Feature</th>
<th>RFID</th>
<th>Barcode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line of Site</td>
<td>Not required (in most cases)</td>
<td>Required</td>
</tr>
<tr>
<td>Read Range</td>
<td>Passive UHF RFID:</td>
<td>Several inches up to several Feet</td>
</tr>
<tr>
<td></td>
<td>- Up to 40 feet (fixed readers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 20 feet (handheld readers)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Active RFID:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 100's of feet or more</td>
<td></td>
</tr>
<tr>
<td>Read Rate</td>
<td>10’s, 100’s or 1000’s simultaneously</td>
<td>Only one at a time</td>
</tr>
<tr>
<td>Identification</td>
<td>Can uniquely identify each item/asset tagged.</td>
<td>Most barcodes only identify the type of item (UPC Code) but not uniquely.</td>
</tr>
<tr>
<td>Read/Write</td>
<td>Many RFID tags are Read/Write</td>
<td>Read only</td>
</tr>
<tr>
<td>Technology</td>
<td>RF (Radio Frequency)</td>
<td>Optical (Laser)</td>
</tr>
<tr>
<td>Interference</td>
<td>Like the TSA (Transportation Security Administration), some RFID frequencies don't like metal and liquids. They can interfere with some RF frequencies.</td>
<td>Obstructed barcodes cannot be read (dirt covering barcode, torn barcode, etc.)</td>
</tr>
<tr>
<td>Automation</td>
<td>Most &quot;fixed&quot; readers don't require human involvement to collect data (automated)</td>
<td>Most barcode scanners require a human to operate (labor intensive)</td>
</tr>
</tbody>
</table>

DIFFERENT TYPES OF TAGS

Basic Types:

**Active**
- Battery powered memory
- Tag transmits radio signal
- Larger data storage and higher cost

**Passive**
- Reader powered
- Shorter range
- No battery
- Tag reflects radio signal from reader
TYPES OF READERS

Readers also called interrogators

• Fixed - Doorways, portals or entrance/exit
• Handheld - Portable ergonomic design
• Wireless - Have capability to communicate with external networks such as WIFI
• Mobile - Used by employees or mounted to forklifts

<table>
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<tr>
<th>READER</th>
<th>READ RANGE AND USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive UHF</td>
<td>Long read range up to 30 feet</td>
</tr>
</tbody>
</table>
<pre><code>                  | Faster than HF and LF                                         |
                  | Used in retail and supply chain                               |
</code></pre>
<p>| Passive HF   | Read range of under 2 feet                                   |
| Works better around metals and water                         |
| Ideal for factories                                          |
| Passive LF   | Read range of under 1 foot                                   |
| Best at scanning non metallic goods                           |
| For fruits                                                    |
| Active       | Battery on board, read up to 100 feet                         |
| Read range relates to tag power                              |
| Very expensive                                               |
| Used for tracking                                            |</p>
TRACKING OF INVENTORY

INTRODUCTION
Brief history of RFID

TAGS
Types of Tags

READERS/INTERROGATORS
Types of Readers

RFID IN SUPPLY CHAIN
Recommendation
TAGS

- New born baby with RFID tag
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