RFID and IoT for Inventory and Warehouse Management 2020

Targeting the Correct RFID/IoT Technology for the Right Project

Ygal Bendavid
Professeur, AOTI
Director IoT Lab.
https://labiot.uqam.ca/

Yasmina Maïzi
Professor, AOTI
Research associate IoT Lab.
https://labiot.uqam.ca/
Objective of the presentation

Understand how RFID/IoT can be used to gain visibility over your inventory?

- Define the RFID/IoT strategy & select the right project
- Use a Methodological approach to solve problems & identify opportunities
- Target the appropriate RFID/IoT technology for your specific case
Main Idea of the presentation
But there is more than one way…
& the right solution for the right RFID/IoT project...
& more than one right solution for the right RFID/IoT project...
1-Define the RFID/IoT strategy

Vision & orientation

– How effective and efficient are the existing operations & business processes?
– What are the Strategic-Tactical-Operational goals of my warehouse/inventory project?
– How can RFID help me reach these goals?

“A vision without a plan is an hallucination”
Select the right RFID project
Project Portfolio Management

- Strategies
- Resource allocation (based on priorities)
- Financials Methods (yes but....)
- Bubble diagrams or portfolio maps
  - Classification XY, E.g. P( technical success) and benefits (NPV))
- Scoring Models
  - Selected criteria's
- Check-lists
  - Yes-No; Go-Kill points (Stage gate)
**Project Definition and planning**

**RFID Project life cycle**

- **Project Front end**
- **Project definition & Planning**
- **Implementati on**
- **POC & Pilot Design Dev.**
- **RFID BPR (As-Is)**
- **RFID BPR (To Be)**

**Project follow up & Operations**

- Project Definition/requirements
- Project initial planning & comm.
- High level Business case / value
- Project / Pilot site pre-selection
- Team building & Education
It all starts with requirement management
Develop Project charter
Develop preliminary project scope management
Develop PM Plan
Etc.

Source: Adapté du PMBOK

Project Integration Management
Project Scope Management
Project Time Management

Project Cost Management
Project Quality Management
Project HR Management

Project Communication Mgt
Project Risk Management
Project Procurement Management

Project Management BOK

RFIDJOURNAL VIRTUAL EVENTS

ESG UQÀM
Objective of the presentation

• Understand how RFID/IoT can be used to gain visibility over your inventory?
  – Define the RFID/IoT strategy & select the right project
  – **Use a Methodological approach to solve problems & identify opportunities**
  – Target the appropriate RFID/IoT technology for your specific case
2-Use a Methodological approach
   To solve problems & identify opportunities

- Set of **practices, procedures & rules** used in the inquiry/investigation of RFID potential
- With the **goal to understand** different situations & acquiring new knowledge
- Based on gathering observable, empirical & measurable evidence in your warehouse!
- It is not a formula!
2-Use a Methodological approach
To solve problems & identify opportunities
2 Methodology

Different Methods & tools at different phases of the project

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

Do not envision an RFID project as a technological project!

2.1 Methodology
Defining the problem – the classics errors!

1. Our problem is that we want to improve ....
2. Our problem is that we want to implement RFID for...
3. Our problem is that procurement wants us to...

It's not about WHAT you want to do, but WHY you want to do it.

“So... How can we blame procurement?”
2.1 Methodology
Defining the problem – the classics errors!

Defining the problem/opportunities & envisioning solutions shouldn’t be an endless process...

It has to be managed as a project! By projects managers! For/with operations managers!

“They’ve supposedly been close to a breakthrough on inventory optimization for 5 years now.”
2.1 Methodology
Defining the problem – key tools

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

- Employee surveys
- Issues Trees
- Root cause analysis
- Cause & Effect Diagrams (Ishikawa)
- (ABC)Pareto analysis
- Impact analysis
- Gap Analysis
- Organization analysis
- Industry analysis
2.1 Methodology
Defining the problem: Key tools
2.1 Methodology & Tools

Defining the problem

- Build a root cause analysis
- Identify where RFID can have an impact

Source: Adapted from EPC Global US, 2005 - EPC Value Model for Consumer products
2.1 Methodology & Tools

Defining the problem

- Higher Revenues
- Lower Costs
- Higher Market Share
- Better quality of Products & Services

Reconciliation/ Deduction

- Theft during Distribution
- Price Issues
- Quality issues
- Process Failure

Carrier
External

Wrong Qty Shipped
Wrong Prod. Shipped
Split Vs. Block Shipment

Real Time alert: mismatch loaded vs. unloaded items
Real Time alert quality issue (temperature, choc, etc.)
Real Time alert: mismatch order vs. loaded items
2.1 Methodology & Tools

Defining the problem… and anticipating tec. requirements

As we define & analyse the problems, we already anticipate the requirements for selecting the technology....

- Temperature sensor
- Automated scanning
- Real-time access
- Unique Serial Number
- Theft during Distribution (carriers/external)
- Wrong Qty Shipped
- Wrong Prod. Shipped
- Split Vs. Block Shipment
- Real Time alert: mismatch loaded vs. unloaded items
- Real Time alert: Temp. control
- Real Time alert: ... order vs. loaded items
- Real Time alert: Temp. control
- Wrong Qty Shipped
- Wrong Prod. Shipped
- Split Vs. Block Shipment
- Real Time alert: mismatch loaded vs. unloaded items
- Real Time alert: Temp. control
- Real Time alert: ... order vs. loaded items
- Real Time alert: Temp. control
- Wrong Qty Shipped
- Wrong Prod. Shipped
- Split Vs. Block Shipment
- Real Time alert: mismatch loaded vs. unloaded items
- Real Time alert: Temp. control
- Real Time alert: ... order vs. loaded items
- Real Time alert: Temp. control
- Wrong Qty Shipped
- Wrong Prod. Shipped
- Split Vs. Block Shipment
2.2 Methodology
Data gathering to document the current situation

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

Operations Management perspective
- Plant tour/audits
- Flow charts/Business Processes
- Pareto charts
- Org. Charts
- ...

Technical perspective
- Site Survey
- IT Infrastructure/system maps
- IT portfolio assessment
- Wireless Network evaluation

2.2 Methodology
Data gathering and ANALYSIS

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

- Value chain analysis
- Business process analysis (BPA) - value analysis
- Use case & requirements identification
- Problem Analysis (SPC Tools)
- Labor productivity
- Etc.

2.2 Methodology

Data gathering: a process perspective

- Use Process Modeling Methods & standards
- Concentrate on core processes (Receive, put away, pick, ...)
- Use KPIs to assess/measure your processes
2.2 Methodology
Process Map & value analysis (and waste)

Reduce the amount of late orders delivery

<table>
<thead>
<tr>
<th>Added value</th>
<th>Non added value (but necessary)</th>
<th>Non added value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A2</td>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
<td>An</td>
<td>A2</td>
</tr>
<tr>
<td>An</td>
<td>A1</td>
<td>An</td>
</tr>
</tbody>
</table>

Monday 17 Jan. (10h-12h)

Waiting time

Over stock

Unnecessary material movement

See: James P. Womack & Daniel T. Jones Lean Thinking: Banish Waste And Create Wealth In Your Corporation
2.3 Methodology

Selection/development of a solution

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

- Market browsing/ Identification of existing solutions/vendors
- Conference/exhibition (RFID Journal Live 😊)
- RFID Journal awards
- Benchmarking analysis
- RFI / RFQ/RFP/...
- Use case & requirements definition
- Computer simulation
- Laboratory experiments/ Pilot
- ...

RFIDJOURNAL VIRTUAL EVENTS
2.4 Methodology

Methods & tools for ROI analysis

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

- Decision Tree
- BP Analysis
- Balance scorecards (BSCD)
- SCM frameworks (e.g. SCOR)
- Infrastructure cost analysis
- Lab. scenario design and testing
- Trade off analysis
- RFID system decision matrix
- etc
2.5 Methodology
Methods & tools for implementation

1. Problem definition
2. Data gathering and analysis
3. Selection/development of a solution
4. Cost Impacts and pay off Analysis
5. Implementation & follow up

- IT Project management guidelines & methodologies (e.g. PMBOK, APMBOK)
- New Product development (e.g. stage gate model)
- ERP/IOS implementation methodologies (BPR)
- Laboratory experiments
- Pilot project
Objective of the presentation

- Understand how RFID/IoT can be used to gain visibility over your inventory?
  - Define the RFID/IoT strategy & select the right project
  - Use a Methodological approach to solve problems & identify opportunities
  - Target the appropriate RFID/IoT technology for your specific case
3 Select the appropriate RFID tech. for your specific case?
The IoT & RFID within the IoT

**Vision** in which objects (living or not) are equipped with **unique IDs**, as with the capacity to **communicate automatically** and in **real time** with their environment.

This opens the door to **new business models**.

IoT Infrastructure

An RFID/IoT solution is not just about tags and readers

**Applications/Analysis/transactions/Visualisation**
(Local application, Cloud/fog/edge based application, Mobile apps)

**Information hosting/access/sharing**
(Local server, Cloud based server, Fog based, Edge based...)

**Data Communication**
(Communication network - LAN, WLAN, WAN, MAN – LoRa, LTE-4G, 5G)

**Data capture**
(RFID readers/antennas, BLE sensors, Wi-Fi, Li-Fi, Cameras, IR, USID, Mobile robots, etc.)

**Identification/Connected objects**

- **Tags RFID**
  Active/ passive/ semi-passive

- **Sensors**
  Movement, Light, Temperature, Etc.

- **Mobile & Mounted devices**
  Phones, Tablets, Mobile computers, lifi tracker, Etc.

- **Wearables**
  Smart watch, fitness tracker, BLE badge

- **None**
  The object as the identifier

**Sources:** Bendavid Y. (2019). Laboratoire IoT [https://labiot.uqam.ca/](https://labiot.uqam.ca/)
An RFID/IoT solution is not just about tags and readers.

- Many scenarios can be envisioned
- Impact on the solution's design
- Trade-off analysis

Visibility

- Capture **data (events)**
- Translate data into **information's**
- Access this information, **accurate, precise, updated**
- Take **event based decisions** based on this information
- To improve **business process performance**

3 Select the appropriate RFID tech. for your specific case?

The technology will support your case – **Requirement management**
- Passive RFID (LF, HF, UHF)
- Semi Passive RFID (BAP)
- Active RFID (proprietary 433Mhz, UWB, RFID/IR, RFID/WIFI)
- Hybrid solutions
- BLE devices
- LiFi
- Robots
- Drones
3 Select the appropriate RFID tech.

Some questions for the design of the “to Be” business & technological Scenarios

• Which application / business process(es)?
  – Which products? What level of tagging?
  – What functionalities are required for the tags/readers?
  – What is the level of process automation? Automated? Semi-automated?
  – Where will items need to be identified?
  – How Many products (tags) at a time?
  – What is the speed (reading, commissioning tags, etc.)?
  – What is the reading/writing distance? Where?
  – What is the required level of Security?
  – With who to share the info? Why?
  – etc
3 Select the appropriate RFID tech.

Selection tools on vendor websites


Product Finder
128 products found

Accessory
Ideal for small item-level tagging

AD-151g2IM
Exceptional performance across a wide range of dielectrics
3 Select the appropriate RTLS

various options on the market

Looking at (relatively) emerging solutions...

RFID Reading Drone Tested in Asia Warehouses

CC BY-4.0. Credit: MIT Media Lab/Fadel Adib and Jimmy Day
http://www.rfidjournal.com/articles/view?16560

Nothing can be more annoying than unfaithful software. Our interfacing function streams data down from the UAV to a ground computer in real time. Easy to use software allows the user to monitor scanned inventory live and can export these readings directly into the user’s servers for further processing or analytics.

https://www.aerolion.com/warehouse-management
Look at (relatively) new solutions…

Robot Employs RFID to Manage Warehouse Inventory

BY CLAIRE SWEDBERG

Fetch Robotics has built Sick RFID technology into its TagSurveyor robot, with which logistics providers and retailers can gain data about tagged inventory without requiring handheld or fixed readers.

May 09, 2018  Several logistics companies and retailers are either piloting or deploying an RFID-enabled version of their software systems that counts inventory—in some cases 24 hours a day, seven days a week—in and among personnel and moving equipment. For example, the TagSurveyor robot, from California automation technology company Fetch Robotics, leverages UHF RFID readers as the Freight100 robot base from sensor company Sick. The two firms demonstrated their technology at RFID Journal Live last month in Orlando, Fla.

Fetch Robotics, founded in 2014, released its first robot a year later. These autonomous machines deliver freight.
(relatively) new ones?

*Passive RTLS (RF Controls)*

Passive RTLS @ the IoT lab. using RF Controls antennas and Avery Dennison Tags [https://labiot.uqam.ca/projets/]
More simple W&IM solutions?

An Excel based example
Evaluating different options & Selecting the right technologies - *Build your scenarios (an example for receiving)*

**What type of tags?**
- Truck arrived
- Download products
- Mr. Y
- Auto. read RFID tags
- Tags read
- Location 123
- RFID Readers
- RFID Tags IDs

**What type of readers?**
- Products downloaded
- RFID Tags IDs
- Auto. read RFID tags
- RFID Readers
- Tags read
- Location 123

**What type of Middleware platform?**
- Transfer RFID data to WMS
- RFID Tags IDs
- RFID Middleware
- RFID data transferred
- Verify products (tags) vs. BOL
- RFID Tags IDs
- Tags ID = BOL?
- Tags ID ≠ BOL
- Tags ID # BOL
- WMS

**What type of data formats?**
- RFID data transferred
- Verify products (tags) vs. BOL
- RFID Tags IDs
- Tags ID = BOL?
- Tags ID ≠ BOL
- Tags ID # BOL
- WMS

**What type of communication?**
- RFID data transferred
- Verify products (tags) vs. BOL
- RFID Tags IDs
- Tags ID = BOL?
- Tags ID ≠ BOL
- Tags ID # BOL
- WMS

**What type of feedback devices?**
- RFID Tags IDs
- Tags ID = BOL?
- Tags ID ≠ BOL
- Tags ID # BOL
- WMS

**What type of WMS integration?**
- RFID data transferred
- Verify products (tags) vs. BOL
- RFID Tags IDs
- Tags ID = BOL?
- Tags ID ≠ BOL
- Tags ID # BOL
- WMS
Selecting the right technology

Build & assess your scenarios - Using simulation tools

RFID and IoT for Inventory and Warehouse Management 2020

Targeting the Correct RFID/IoT Technology for the Right Project
THANK YOU