Impact Analysis of RFID on Financial SCM

Tatsuya INABA
Keio University/Auto-ID Lab. Japan
Agenda

• Summary
• Background of the study
• Introduction of financial process in SCM
• Business Process Improvement of Financial Dept.
• Evaluation
  – Simulation
  – Requirements analysis
• Conclusion
• Evaluate the impact of RFID on financial process in SCM
  – Many logistics application studies but few financial application study
  – Utilization of corporate asset location data (e.g., product) to improve processes done by financial mgmt dept.

• Propose a multi-application approach to increase returns from RFID system
  – Most RFID implementations are single purpose and not sufficient returns
  – Realize financial applications by using RFID event data from logistics applications
Background of the Study

- **Current industry situation**
  - Recognize the value of RFID
    - Accurate process
    - Efficient process
    - Revolutionizing application
  - Wait & see until …
    - Standardization
    - Establishment of best practices
    - Commonization of equipment/software (cost)

*See the value but not enough to roll-out*

"*How to make ROI positive*" is the Challenge!
Return on Investment?

- How can we make ROI positive?
  - Make investment small
    - Difficult in the early stage of the technology deployment
  - Make return large
    - May be possible if we can realize multiple applications with a single RFID system (share burden among applications)
Multiple Application Approach:
Sharing of Product location Info among Applications

• What kind of applications can we realize?
  – Assume that RFID is primarily used to improve SCM logistics process
  – First target is SCM financial process

• What kind of impact do we have in SCM financial process?
  – Analyze impact of product location information in financial process

• How effective are the RFID applications?
  – Evaluate based on a hypothetical (but realistic) scenario

• How can we share product location information among applications?
  – Analyze the requirements
Introduction of Financial Process in SCM

- **Financial process (done by financial mgmt dept.)**
  - **Planning phase**
    - Financial mgmt dept. collects budget plans from other depts.
      - Investment
      - Sales
      - Production
    - Financial mgmt dept. forecast necessary cash amount
  - **Operation phase**
    - Financial mgmt dept. monitors whether business activates are executed as planned (Budget is spent as planned)
    - If not, financial mgmt dept. adjust financial plan
    - Develop financial statement (P/L, B/S)
    - Financing with less cost
Financial Process b/w MFG & Supplier

**Planning Phase**
- Manufacturer
  - Financial plan/mgmt
  - Prod. plan
- Supplier
  - Sales plan
  - Prod. plan

**Operation Phase**
- Manufacturer
  - Financial mgmt
  - Design
  - Parts. selection
  - Quotation
  - Supplier selection
  - Receipt
  - Inspection
- Supplier
  - Financial mgmt
  - Credit check
  - Quotation
  - Inv. mgmt

**Credit check**
- Manufacturer
  - Financial mgmt
- Supplier
  - Financial mgmt

**Contract agreement**
- Manufacturer
  - Prod. prep.
  - (Production)
  - Shipment
- Supplier
  - Prod. prep.
  - (Production)
  - Shipment

**Invoice**
- Manufacturer
  - Payment
- Supplier
  - Invoice

**Payment**
- Manufacturer
  - Contract situation check
- Supplier
  - Contract situation check
• Improvement of financial management operation

• Reduction of financing cost
  – Enhancement of existing financing schemes
  – Realization of new financing schemes

• Improvement of financial statement
  – Improvement of asset utilization
  – Reduction of corporate assets/costs
• Financial mgmt dept monitors whether planned activities are executed as planned
  – Project mgmt system/in person
  – AIDC (e.g., RFID)
Reduction of Financing Cost

• **Enhancement of existing financing schemes**
  - Make service providers reduce risks with location information and reduce service charge
    - Account Receivables (A/R) factoring: sell A/R to bank to get cash
    - Shipment information lowers the risks
    - Utilization of A/R factoring reduces days of sales outstanding (DSO)

• **Realization of new financing schemes**
  - Common to use immovables (e.g., real estate) as collateral
  - RFID enabled asset mgmt enables corporate asset as collateral (ABL: Asset Based Lending)
Improvement of Financial Statement

- **Improvement of asset utilization**
  - Financial mgmt dept make accurate cash management with granular information of corporate activities
  - Improve indices of financial statement
    - Working capital utilization
    - Days of sales outstanding (DSO)
    - Days of sales in inventory (DSI)

- **Reduction of corporate asset/costs**
  - Monitor utilization of corporate asset
    - If utilization is low, reduce the number of the assets (Corporate asset)
  - Reduce costs by corporate asset location information
    - Mitigate risk of transportation (Insurance cost)
    - Reduce expired products and recalled products (Reserves, Extraordinary losses)
Evaluation
“How Effective are the applications?”

• Difficult to evaluate …
  – Prove theoretically?
  – Implement?

• Show feasibility by …
  – Simulation with a hypothetical scenario
    • Improvement of financial mgmt operation case
  – Compare three cases in two situations
• **Hypothetical Scenario**
  - A Japanese manufacturer (MFG-A) sells products to users in Japan
  - MFG-A has a factory in China and purchases parts from a local supplier (SUP-B)
  - MFG-A employs build-to-order (BTO) production system
  - SUP-B employs make-to-stock (MTS) production system
  - Users of MFG-A pays to MFG-A within 6 weeks after inspection
  - MFG-A pays to SUP-B within 8 weeks after inspection
  - Lead time between MFG-A’s factory and users is volatile
  - Lead time between SUP-B and MFG-A’s factory is stable
Three Cases for Comparison

Evaluate the value of RFID application in financial process by comparing three cases:

i. **RFID information is not available**: Financial mgmt dept forecasts the number of products sold based on the historical data and develops a financial plan by using the forecast.

ii. **RFID information is available at shipment**: Financial mgmt dept modifies the number of products sold based on the shipment information captured at its factory and also modifies the financial plan based on the modified forecast.

iii. **RFID information is available at receipt by users**: Financial mgmt dept modifies the number of products sold based on the receipt information captured at the users and also modifies financial plan based on the modified forecast.
Two Situations for Comparison

- Two situations:
  a. Variation of transportation lead time
     - Transportation lead time between the factory and the users gets longer than forecast
     - Shipping across ocean
     - Clearing customs
  b. Variation of demand
     - Demand becomes more fluctuated than forecast
     - The shorter the product lifecycle becomes, the more difficult forecasting of demand becomes
     - Synchronization of demand makes demand more fluctuated
## Simulation Parameters

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<tr>
<th>Parameter</th>
<th>Value</th>
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| Demand          | - Forecasted demand: Seasonal demand (Demand of end of the season is twice of that of the beginning), when equalized, mean is 200 item/month and standard deviation is 50 item/month  
                   - Actual demand: Seasonal demand (Demand of end of the season is twice of that of the beginning), when equalized, mean is 200 item/month and standard deviation is 10 – 100 item/month |
| Lead time       | - Forecasted/actual production lead-time: Mean is 7 [days]. Standard deviation is 2 [days].-score  
                   - Forecasted transportation lead-time: Mean is 7 [days]. Standard deviation is 3 [days].- Actual transportation lead-time: Mean is 7 – 12 [days]. Standard deviation is 5 [days].  
                   - Forecasted/actual inspection lead-time: Mean is 7 [days]. Standard deviation is 2 [days]. |
| Price           | - Price of the product is $1,000. Price of the parts is $500. (We ignore other costs, such as labor, because they have less uncertainty.) |
| Period          | - 12 months (excluding 6 months warm-up period)                                                                                                                                                  |
| Method          | - Monte Carlo method (run 200 times)                                                                                                                                                              |
Result
(a) Variation of Transportation Lead Time

• Compare mean ($\mu$) and standard deviation ($\sigma$) of cash amount forecast error
  – (i) $\mu$ and $\sigma$ become larger as mean of actual lead time gets longer
  – (ii) Only $\sigma$ becomes larger as mean of actual lead time gets longer
    (Realization of lead-time variation is after shipment)
  – (iii) Both $\mu$ and $\sigma$ are stable

![Graph showing forecast using historical data, modified forecast (Shipment info), and modified forecast (Receipt info)]
Result
(b) Variation of Demand

- Compare mean ($\mu$) and standard deviation ($\sigma$) of cash amount forecast error
  - (i) $\mu$ and $\sigma$ become larger as mean of actual lead time gets longer
  - (ii), (iii) Both $\mu$ and $\sigma$ are stable
“How can we share product location information among applications?”

- **Two fundamental requirements**
  - Mechanism to share RFID captured event data among applications
    - Shared RFID system (RFID R/W, Middleware)
    - Utilize data by multiple application systems
    - Loosely coupled (since implementation of applications is not simultaneous)
  - Mechanism to retrieve available information
    - Directory
    - Late comers find available RFID information

*Demo implementation for the first requirement*

*With Web-service based publisher/subscriber mechanism*  
*(Web service Notification)*
RFID Event Data Sharing Demo
“How can we share product move information among applications?”

- **Show feasibility of sharing RFID business event data among multiple applications**
  - Technology is available…

![Diagram of RFID event data sharing]

- Subscribe “if ReaderId = 200002”
- Subscribe “if OrderId = 300002”

Reference of WSMG: Extreme Lab at Indiana University, WS-Messenger (WSMG)
(http://www.extreme.indiana.edu/xgws/messenger/)

- RFID edge system emulator (publisher) (ReaderId: 20001)
- RFID edge system emulator (publisher) (ReaderId: 20002)
- WSMG (Broker)
- SCM logistics AP system (DB)
- SCM financial AP system (DB)
- Message subscriber
- Message subscriber

OS: Linux (RedHat 8.0)
DB: MySQL ver 4.0.20
Language: Java
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  - Most RFID implementations are single purpose and not sufficient returns
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7. EPCglobal Inc, EPC Information Services (EPCIS) Version 1.0
8. Extreme Lab at Indiana University, WS-Messenger (WSMG) (http://www.extreme.indiana.edu/xgws/messenger/)
9. W3C, XML Path Language (XPath) Version 1.0
Questions?