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AUTOMATIC IDENTIFICATION SYSTEMS

COST-BENEFIT ANALYSIS OF AN RFID ASSET TRACKING SYSTEM

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INTRODUCTION

This paper outlines the cost-benefit analysis of using Ultra High Frequency (UHF) Radio Frequency Identification (RFID) technology in an asset-tracking application. To facilitate the analysis, RFID will be compared against the incumbent technology, bar-coding. An experiment comparing these two technologies was conducted, and the findings from this experiment are further analysed.

Figure 1: Hierarchy of Needs for Asset Tracking

Number of Assets	Number of Reads per Asset per Year	Annual Labour Cost for Barcode	Annual Labour Cost for RFID	Annual Cost Benefit
10,000	14.11	$12,721.70	$1,361.96	$15,064.00
20,000	14.57	$26,273.45	$2,812.79	$23,685.80
50,000	16.06	$72,398.94	$7,750.90	$65,254.07
100,000	18.71	$168,700.81	$18,060.81	$150,640.00

Table 1: Annual Cost Benefit compared to number of assets

Table 1 lists the annual labour cost savings when comparing bar coding to RFID processes. For an organization with 100,000 assets, the annual labour cost savings exceed $150,000. This cost saving carries forward (future years) into perpetuity.

EXPERIMENTAL METHODOLOGY

The purpose of this experiment is to ascertain the time (and hence cost) savings that can be achieved through the use of RFID in Asset Tracking. This experiment only focuses on operational cost savings that arise due to the day-to-day work activities involved in asset tracking. As well as these definite operational cost savings, other cost savings that are present include:

- Improve utilization rate of existing assets
- Increased productivity through more accurate data recording
- Security and theft prevention

While these cost savings are not insignificant, and can provide primary reasons for an organization to invest in logistics technology, they are outside the scope of this study. The nature of these costs is highly variable across different organizations and industries. It should be stressed that these savings are real, and should be calculated and factored into the investment decision.

As well as cost savings, RFID can benefit a company through revenue enhancements. These revenue enhancements include:

- Reduced Out-of-Stock situations
- Brand Enhancement

As mentioned previously, the scope of this paper is to outline operational time (and hence cost) savings involved in using RFID technology compared to both barcoded systems as well as manual systems.

To this end, a series of repeated tests were run.

Each test involves ten (10) assets of various types inside a typical office meeting room as shown below in Table 2;

Quantity	Asset
4	Office Chair
1	Conference Table
1	Desktop PC Tower
1	Fixed-line telephone
1	Keyboard
1	Television
1	Cabinet

Table 2: Asset List

TEST PROCEDURE

1. Prior to the test, one person (the applier) tagged all ten (10) assets with a RFID label incorporating a barcode printed on the substrate.
2. Another person (not the applier) performed a barcode inventory of these assets. The total time taken to read all ten (10) assets was recorded.
3. The same person then performs the same inventory utilizing RFID functionality. The total time taken to read all ten (10) assets was recorded
4. Repeated steps 2 and 3 with 2 additional people (not the applier)

In order to assure the validity of this test, each of the three testers did not know the exact whereabouts of the tags prior to entering the office room. However, in line with operational processes, each tester did have a list of all tagged assets available to him/her.

This test was performed three (3) times with three (3) different testers to provide increased experimental reliability.

EXPERIMENTAL RESULTS

ID Method	Mean Time (s)	Time Saving over Barcode (%)
Barcode	115.18	0
RFID	10.57	90.82%

Table 3: Raw Results

As can be seen from Table 3, RFID offers significant improvements barcode processing. With a time saving of 90.82%, RFID proves its time and cost savings while performing asset inventories.

BUSINESS ANALYSIS

In order to clarify what savings RFID can provide for an organisation currently utilizing outdated, inefficient logistics technologies, these time savings should be used, along with some general assumptions, to project indicative cost savings.

To facilitate analysis of the labour cost savings associated to implementing RFID processes to an asset tracking context, the life cycle of a *typical* asset is considered. The different types of assets and their individual characteristics are ignored to simplify the analysis.

In order for this document to provide useful figures for a wider range of customers, a basic logistics department with varying asset levels and traffic will be analysed. Some general assumptions are listed:

- **Average warehouse worker** works a 38 hour week and earns a $60,000AU salary.
- **Number of assets** to be tracked:
  - 10,000
  - 20,000
  - 50,000
  - 100,000
- Each tagged asset follows an **assumed asset life cycle**. Numbers of reads associated to each task:
  - **Asset Life** – 3 years
  - **Initial Deployment of Asset:**
    - Manufacturer applies RFID tag to asset
    - Received to Warehouse Stock
      - *2 reads – 1 read into warehouse door, 1 read onto correct shelf/area*
    - Distribution to a Particular Building/Floor
      - *2 reads – 1 read out of warehouse stock, 1 read into building/floor stock*
    - Distribution to Operating Location
      - *1 read – 1 read once asset is deployed in operating location*
  - **Yearly Operational Reads:**
    - Stock take
      - *100% of assets. 1 read per operation.*
    - Redistribution of assets (new teams formed, new employees, leaving employees)
      - *60% of assets. 2 reads per operation – out of operational location, into warehouse, out of warehouse, into operational location*
    - Office Redesign/Relocation
      - *50% of assets (100% of assets once every 2 years equals 50%). 8 reads per operation – out of operating location, into warehouse, out of warehouse, then 5 reads as per initial deployment of asset*
    - Intra-organisation Support/Repair
      - *40% of assets. 4 reads per operation – out of operating location, into support department, out of support department, back into operating location.*
    - Manufacturer Warranty (Replacement or Repair)
      - *5% of assets. 8 reads per operation - out of operating location, into warehouse, out of warehouse back to manufacturer, then 5 reads as per initial deployment of asset.*

- Redundancy of asset
    - *33% of assets (3 year asset life). 8 reads per operation – out of operating location, into warehouse, out of warehouse (disposal), then 5 reads as per initial deployment*
- Searching for lost assets
    - *1% of assets. The expected number of reads in order to find an item is half of the number of assets. Correction (efficiency) factors have been used in order to model the economies of scale that larger logistics organisations obtain through increased categorization and geographical separation of assets. This is modeled by fitting to a logarithmic regression.*

From Experimental Data	
RFID Cost Benefit per Read	$0.0805 or 8.05¢

Table 4: RFID Cost Benefit per Read

Number of Assets	Number of Reads per Asset per Year	Annual Labour Cost for Barcode	Annual Labour Cost for RFID	Annual Cost Benefit
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Table 1: Annual Cost Benefit compared to number of assets

From Table 4, it can be seen that for every single asset read, an organization using RFID will be 8.05¢ better off compared to an organization using bar coding. This may not sound very significant, but after factoring in the amount of times each individual asset is read throughout a year, the annual cost benefit becomes much more sizable.

Table 1 lists the annual labour cost savings when comparing bar coding to RFID processes. For an organization with 100,000 assets, the annual labour cost savings exceed $150,000. This cost saving carries forward (future years) into perpetuity.

SUMMARY

This document aims to inform the reader of the potential labour savings unlocked through the implementation of RFID processes in an asset tracking business activity. The designed experiment tries to quantify definite time savings, which directly lead to significant labour cost savings.