

WHITE PAPER

The Auto-ID Calculator: An Overview

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ABSTRACT

The Auto-ID Calculator is an easy to use web-based tool created by the Auto-ID Center. It enables users to quickly estimate the impact of applying Auto-ID technologies in their company. Potential users are executives and analysts who work in the areas of supply chain management and operations. The tool focuses on applications of Auto-ID technologies in a supply chain.

Although the Auto-ID Calculator is a beneficial tool that can estimate the impact of Auto-ID, each supply chain is unique, and the tool itself cannot replace a more in-depth analysis of the impact that Auto-ID technologies will have on an organization. However, there are common benefits and cost drivers by application as described in the calculator. The Auto-ID Calculator provides a framework for calculating the financial benefit of individual applications and the associated costs. In order to have more accurate results, users can enter their own company and supply chain data. The results are then calculated using this information. In the case that data is not available, default values based on various industry sources are provided. Cost assumptions have been validated with Auto-ID Center technology sponsors.

The calculator assumes a supply chain that consists of a retailer, a distributor, and a manufacturer. There are three different levels of tracking that can be selected: item-, case-, or pallet-level tracking. The benefits are calculated individually for each supply chain partner as companies are likely to invest in the technology only if there is a net benefit for each of them. The tag cost may also be shared within the supply chain.

This report gives a short overview of the Auto-ID Calculator. It explains the general logic of the calculator and the flow of screens. The actual use of the calculator is illustrated with a scenario of a retailer considering item-level tracking. This report illustrates how benefits can be calculated with a positive net present value. In some cases, the calculator may result in a negative present value. The report then further proposes measures on how to deal with situations where a positive net present value may not be calculated. Furthermore, the report provides some background information on the data sources used to derive the underlying assumptions and default values.

The Auto-ID Calculator is available under the URL <http://www.autoidcenter.com/calculator/calculator.asp> on the public section of the Auto-ID Center website.

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The Auto-ID Calculator: An Overview

Biography



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Christian Tellkamp is PhD student at the Institute of Technology Management at the University of St. Gallen and research assistant for the M-Lab and the Auto-ID Center at the University of St. Gallen. Previously, Christian worked as project manager for an internet consultancy and as analyst in the equity research division of a leading European bank. He holds a master's degree in industrial engineering and management from the University of Karlsruhe. His work for the Auto-ID Center focuses on assessing the business impact of Auto-ID technologies.

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1. INTRODUCTION

Auto-ID technologies will redefine how companies make, buy, and sell their products. These technologies will give greater visibility into supply chains, allow to track and trace products, optimize and secure supply chains, and increase customer satisfaction.

The Auto-ID Calculator is an easy to use web-based tool created by the Auto-ID Center. It enables users to quickly estimate the impact of applying Auto-ID technologies in their company. Potential users are executives and analysts who work in the areas of supply chain management and operations. The tool focuses on applications of Auto-ID technologies in a supply chain. It is available under the URL <http://www.autoidcenter.com/calculator/calculator.asp> on the public section of the Auto-ID Center website.

The Auto-ID Calculator provides a framework for calculating the financial benefit of individual applications and the associated costs. Users can enter data on their company and supply chain. The results are then calculated using this information. In case data is not available, default values based on various industry sources are provided. Cost assumptions have been validated with Auto-ID Center technology sponsors. The more accurate information provided, the more reliable the results in gauging the success of Auto-ID in a specific environment.

Each supply chain is unique. The Auto-ID calculator is no substitute for a thorough analysis of the impact of Auto-ID technologies on a company's supply chain. Benefits and cost of an Auto-ID solution can vary considerably. There are a number of issues that companies have to consider when examining the potential use of Auto-ID technologies. This includes checking technical feasibility, working out changes to existing business processes and information systems, and examining whether the initial benefits and cost estimates hold under close examination.

This report is structured as follows: It starts with a short description of the general logic behind the calculator. Then, the flow of screens is described. The actual use of the calculator is illustrated with a scenario of a retailer that considers item-level tracking. The report concludes with proposed measures how to deal with situations in which the current inputs do not indicate a positive net present value (NPV). In the appendix, some background information on the data sources used to derive the underlying assumptions and default values is provided.

2. GENERAL LOGIC

The calculator assumes a supply chain that consists of a retailer, a distributor, and a manufacturer. There are three different levels of tracking that can be selected: item-, case-, or pallet-level tracking. The benefits are calculated individually for each supply chain partner as companies are likely to invest in the technology only if there is a net benefit for each of them.

Although each partner benefits individually from using Auto-ID technologies, a coordinated effort from all partners in the supply chain is needed. We assume that all supply chain partners use the same radio frequency identification (RFID) tag. This requires that the companies have agreed on an identifier (such as the electronic product code EPC) to uniquely identify objects (i.e. items, cases, or pallets) that move through the supply chain. The manufacturer attaches the RFID tag at some point during the production process, depending on whether items, cases, or pallets are tagged. As long as the other supply chain partners are not willing to carry some of the tag cost (e.g. via price increases), the cost stay with the manufacturer.

3. FLOW OF SCREENS

On the following pages, the flow of screens the user sees when going through the Auto-ID Calculator is described.

We focus on the following screens:

- “Introduction” Screen
- “Selection of Supply Chain Position and Tracking Level” Screen
- “Selection of Benefits” Screen
- “Inputs” Screen
- “Settings” Pop-Up Window
- “Results” Screen
- “Printable Report” Pop-Up Window

The explanations deal mainly with the aim of the screen, the tasks the user is expected to perform, and how to proceed.

3.1. “Introduction” Screen

The “Introduction” screen (see figure 1) is meant to give users an overview of the purpose and the time needed for the Auto-ID Calculator.

We estimate that it takes people no more than 20 minutes to use the tool. However, depending on the level of detail and accuracy, some people may spend more time with the calculator. Especially, some time may be required in order to gather some company specific inputs.

Figure 1: “Introduction” Screen



3.2. “Selection of Supply Chain Position and Tracking Level” Screen

On this screen (see figure 2), the user selects the supply chain position (i.e. retailer, distributor, or manufacturer) of her company as well as the relevant level of tracking (i.e. item, case, or pallet). Furthermore, the user can select the currency and measurement system that best suits her. For the purposes of this report, we are using the scenario where the user is a retailer interested in item-level tracking.

If the user is not sure about the most suitable level of tracking, a link is provided that opens a pop-up window. The window contains criteria that may help the user determine the appropriate tracking level.

Clicking the “Continue” button leads to the next screen.

Figure 2: “Selection of Supply Chain Position and Tracking Level” Screen

Auto-ID Center - How To Adopt - Microsoft Internet Explorer von Lycos Europe

File Edit View Favorites Tools Help

Address http://www.autoidcenter.org/calculator/CPage1.asp

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Auto-ID Calculator Step 1 of 3

Auto-ID, a revolutionary technology will allow users to have more visibility into their supply chains.

Please answer the following questions to help us understand your supply chain position and at what level you would like greater visibility of your product.

What is your preferred currency?
[USD - US Dollars] All costs, benefits and default values will be shown in your chosen currency.

Which measurement system do you want to use?
[feet and square feet] All measurement of length and area will be shown in your chosen units.

Which category best identifies your company?
[Retailer]

What level would you like to track your product?
[Item] [Click Here](#) if you are not sure what level you would like to track.

Scenario name (optional) - will appear on results / report pages
[Text Field]

Continue >>>

3.3. “Selection of Benefits” Screen

Based on the position in the supply chain and the level of tracking, Auto-ID technologies offer different potential benefits to a company. On this screen (see figure 3), the user can select the benefits (also called applications) that her company is interested in. Following our retail example, benefits for the retailer are separated into benefits at the retail outlets and the distribution centers. It is assumed that the distributor can realize benefits at its distribution centers and the manufacturer at its warehouses.

There are many potential benefits when introducing Auto-ID to a company's supply chain. The Auto-ID calculator is able to determine the financial impact to an organization based on a number of benefits or applications. Please know that the list is not exclusive, as there is an infinite number of benefits that can be achieved with Auto-ID.

The following applications of Auto-ID technologies are considered in the calculator:

RECEIVING EFFICIENCY AND ACCURACY

- Reduction of processing time and labor costs spent checking-in products and verifying received products against data contained within the Bill of Lading, Advanced Shipment Notice, Packing List, etc. without sacrificing accuracy.
- Matching goods and the quantity of goods to what was ordered and the terms of sale. Increased accuracy safeguards against the incorrect receipt of products that would lead to direct losses of money paid for products not received.
- Auto-ID technology offers the potential to speed-up the receiving process, save time for checking deliveries, and increase the accuracy of deliveries.

IMPROVED STOCK VISIBILITY

- The ability to see backroom inventory levels, so that restocking/replenishment can be performed quickly and effectively.
- Auto-ID technology offers the potential to reduce the time spent on searching for products in a facility.

REDUCTION IN INVENTORY

- The ability to reduce excessive inventory held due to lack of inventory and demand information visibility.
- Auto-ID technology offers the potential to reduce inventory levels by increasing the accuracy of real inventory at hand (in contrast to information on available inventory from information systems).

PHYSICAL INVENTORY COUNTING EFFICIENCY

- Labor cost savings of not having to physically count inventory. Auto-ID technology offers the potential to eliminate the need for physical inventory counts.

PICKING EFFICIENCY

- Decrease in labor costs associated with the picking process in the warehouse/backroom.
- Auto-ID technology offers the potential to speed-up the picking process.

SHIPPING EFFICIENCY AND ACCURACY

- Matching goods and the quantity of goods to exactly what was ordered and the terms of sale. Increased efficiency and accuracy safeguards against the incorrect shipment of products that would lead to direct losses associated with shipping products not ordered.
- Auto-ID technology offers the potential to speed-up the shipping process, save time for checking and correcting outgoing deliveries, and increase the accuracy of deliveries.

REDUCTION IN THEFT

- Reduction in losses due to internal and external theft along an individual company's supply chain.
- Auto-ID technology offers the potential to reduce theft along the supply chain.

REDUCTION IN UNSALEABLES

- Reduction in products that cannot be sold because they are damaged, out-of-date, discontinued, promotional, or seasonal products.
- Auto-ID technology offers the potential to reduce the amount of unsaleable products.

REDUCTION IN OUT-OF-STOCK

- When a product is not present for a consumer to purchase. An out-of-stock is equivalent to a lost sale.
- Auto-ID technology offers the potential to increase on-shelf-availability of products.

POINT-OF-SALE EFFICIENCY

- Labor cost savings due to reduction of checkers needed.
- Auto-ID technology offers the potential to install automatic self check-out terminals for customers.

A click on the “Continue” button (not shown in figure 3) leads to the next screen.

Figure 3: “Selection of Benefits” Screen

Auto-ID Calculator Step 2 of 3

Based on the information you have entered, your company can be best described as a retail store interested in item level tracking. The following list describes specific benefits that can be achieved using Auto-ID.

Select the benefits that would most interest your company.

To review specific information of specific benefits, please click [here](#).

Benefits at Retail Distribution Centers

- ☒ Receiving Efficiency and Accuracy
- ☒ Improved Stock Visibility
- ☒ Reduction in Inventory
- ☒ Physical Inventory Counting Efficiency
- ☒ Picking Efficiency
- ☒ Shipping Efficiency and Accuracy
- ☒ Reduction in Theft
- ☒ Reduction in Unsaleables

Benefits at Retail Outlets

- ☒ Receiving Efficiency and Accuracy
- ☒ Improved Stock Visibility
- ☒ Reduction in Inventory
- ☒ Physical Inventory Counting Efficiency
- ☒ Picking Efficiency

3.4. “Inputs” Screen

The “Inputs” screen is where the user can enter her company specific data (see figure 4). There are different kinds of inputs needed from the user. First, some general information on the company (i.e. yearly sales, average margin etc.) is needed. Some of the input fields vary by the company’s position in the value chain. Second, a number of values for each application must be estimated in order to calculate an initial value for the application. In order to do this two types of information are needed:

1. Selected status information for specific process steps (e.g. number of inventory counts conducted annually)
2. User’s estimates of the potential improvements achievable with Auto-ID technologies compared to current processes (e.g. reduction in theft, time saved to check deliveries for errors).

For each input field, a default value is provided. The data sources for the default values and the calculator settings are discussed in the appendix. The default values are based on industry sources where available. Furthermore, a number of assumptions, called calculator settings, are necessary for the calculation. These assumptions are mainly needed to calculate the cost of the solution. The user can view (and alter) the calculator settings by clicking on a link provided on the current screen. The calculator settings are then displayed in a pop-up window.

Clicking the “Calculate” button (not shown in figure 4) begins the calculation of data provided to estimate the financial impact. The financial impact is described in the “Results” page.

Figure 4: “Inputs” Screen

Auto-ID Calculator Step 3 of 3

The following benefits are most important to your company:

- Retrieving Efficiency and Accuracy at Distr. Centers
- Improved Stock Visibility at Distr. Centers
- Reduction in Inventory at Distr. Centers

In order to calculate the Auto-ID financial implications based on the benefit selected, please provide us with the following information. If any information is unavailable, we have provided you with industry average defaults.

[Click here to view/change calculator settings](#)

General:

Number of distribution centers	Number of shipping and receiving dock doors (per distribution center)
4	20
Average size of distribution center	Inventory in distribution centers (% of sales)
430,560.0 square feet	6.5
Average value of item	
1.750 USD	
Number of retail outlets	Average margin (% of sales)
200	11
Average size of outlet	
53820 sq. feet	
Inventory in backroom (% of sales)	
6.0	
Yearly sales	Implementation start year
3,800.0 million USD	2003

3.5. “Settings” Pop-Up

As mentioned above, the “settings” pop-up (see figure 5) contains a number of assumption that are mainly needed to calculate the cost of the solution. These assumptions can be monetary values (e.g. cost estimates for RFID tags and readers, or hourly wages) or non-financial values (e.g. the number of readers required to equip a shelf in a retail outlets). All settings can be altered by the user.

Figure 5: “Settings” Pop-Up Window

Settings

General:

Planning horizon	7.0 years
Time before solution is fully available	2.0 years
Cost of capital	10.0 %
Average hourly wage in distribution center	20.0 USD
Average hourly wage in outlet	10.0 USD
Length of aisles	91.4 feet per 1000 sq. feet
Check-out counters in outlet	0.4 per 1000 sq. feet
Working hours per day	8.0
Working days	360.0 per year
Cost for truck waiting time	100.0 USD/hr
Average daily wage for trainers or installation personnel	500.0 USD

Cost per tag and reader:

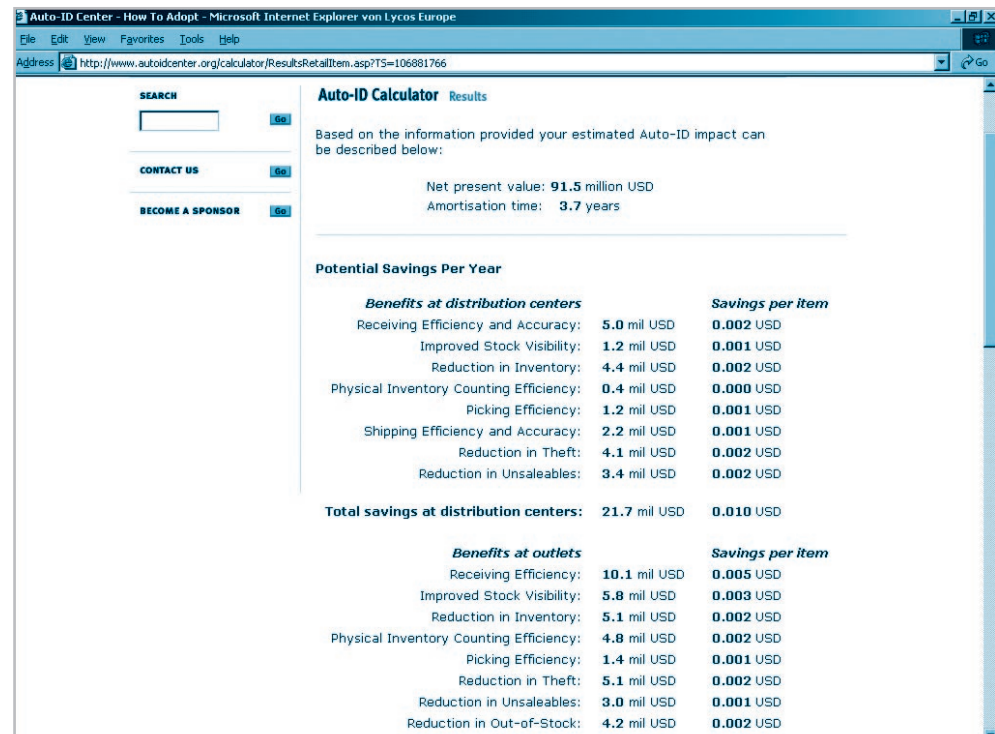
Cost per reader 2002	500.0 USD
Cost per reader 2003	250.0 USD
Cost per reader 2004	150.0 USD
Cost per reader 2005	100.0 USD
Cost per reader 2006	70.0 USD
Cost per tag 2002	0.4 USD

3.6. “Results” Screen

The “Results” screen (see figure 6) shows the calculated net present value, amortisation time, break-down of benefits by application, one-time as well as recurring cost.

If the net present value is negative, the calculator will indicate some of the critical parameters that may be reviewed by the user. For example, the cost for equipping shelves in retail outlets can be substantial. If the benefits that can potentially be achieved from this (e.g. a reduction in unsaleable items or out-of-stock situations) are comparatively low, it is suggested to re-consider tracking items on the shop floor.

Figure 6: “Results” Screen



On the bottom part on the “Results” page (see figure 7), the user can vary selected parameters (e.g. the system integration cost) in order to determine the sensitivity of results to changes in these parameters. As mentioned before, it is initially assumed that the cost for RFID tags are entirely carried by the manufacturer. The retailer and the distributor can calculate here what happens when they have to carry some of the tag cost. A similar functionality is available for the manufacturer. Furthermore, a company might start with only selected products (e.g. high value and high margin products where potential benefits are high) and grow the percentage of products that are tagged over time.

A click on the “Re-Calculate” button starts the re-calculation process.

A click on the “Printable Report” button opens a pop-up window that contains all data that was used for the calculation.

Figure 7: "Results" Screen (continued)

You may test the sensitivity of your result by modifying the following inputs:

System integration cost: mil USD
 Cost of capital: %

Currently, the assumption is that tag cost is absorbed during manufacturing. In order to view the potential impact if the tag cost is shared amongst your trading partners or in cases where reusable tags are used:

Sharing of RFID tag costs with supply chain partners: %
 Reuse of RFID tags: %

You may consider starting with a subset of your product range (e.g. high value, high margin products) and expand the use of RFID tags over time:

Initial set of products: (% of sales)
 Average price of initial products: USD
 Margin on initial products: (% of sales)
 Growth: (% of year)

Re-Calculate

The results give an initial estimate of what the potential cost and benefits of implementing Auto-ID technology may be. Individual benefits may vary by company.

The calculations are no substitute for a thorough analysis. You can also print or download the results.

For more information about the value of Auto-ID, please read our business case papers or information on applications or for information specific to the technology.

3.7. "Printable Report" Pop-Up Window

An overview of all inputs, calculator settings, estimated benefits by application, one-time and ongoing cost estimates, as well as the estimated net present value and amortisation time is available in a pop-up window for print-out (see figure 8). The data can also be copied from here into other programs (e.g. Excel) for further use.

If a scenario name has been assigned, it is displayed here in order to help keep track when different calculations are performed.

Figure 8: "Printable Report" Pop-Up Window

Auto-ID Calculator

You indicated that you are a retailer interested in item-level tracking.

The following benefits have been selected:

Benefits at distribution centers:
 Shipping Efficiency and Accuracy
 Reduction in Theft
 Reduction in Unsaleables

Inputs Entered:

General:
 Number of distribution centers: 4
 Number of shipping and receiving dock doors: 20
 Average size of distribution centers: 430,560.00 square feet
 Inventory in distribution centers: 6.5 % of sales
 Number of retail outlets: 200
 Average size of outlet: 53,820.00 square feet
 Inventory in backroom and on shop floor: 6.0 % of sales
 Yearly sales: 3,800.00 million USD
 Average value of item: 1.75 USD
 Average margin: 11.0 % of sales

4. SCENARIO: RETAILER AND ITEM-LEVEL TRACKING

After having described the general logic of the Auto-ID Calculator and the flow of screens, we now present a usage scenario for a retailer that is considering item-level tracking. This scenario illustrates how the calculator may actually be used. If not stated otherwise, the default values are used for the calculations. For real applications, the cost and benefits may vary considerably.

4.1. The Default Scenario

For the retailer, item-level tracking is worthwhile in our model when all benefits can be realized as expected and the default values are used. The Auto-ID Calculator returns a positive net present value of 91.5 million USD and an amortisation time of 3.7 years. The benefit per item is estimated at 0.032 USD for an average item value of 1.75 USD.

The one-time cost are calculated at close to 100 million USD. Approximately 95 percent of RFID reader cost accrue at retail outlets, mainly for equipping shelves. The cost for equipping a retail outlet with a RFID infrastructure are estimated at 0.44 million USD. It is assumed that the applications (such as monitoring on-shelf-availability, expiry dates, or theft within the store) – with the exception of the receiving process – require smart shelves that are equipped with RFID readers. A description of the scenario and the results of the calculation are shown in table 1.

Table 1: Result of default scenario for retailer and item-level tracking when all benefits can be realized

RETAILER TRACKING AT ITEM-LEVEL SUMMARY		
SCENARIO DESCRIPTION	– Retailer with annual sales of 3.8 billion USD, 200 outlets and 4 distribution centers – Tracking level: Item – Average value of item 1.75 USD – All benefits selected for distribution centers and outlets – All RFID tag cost carried by supply chain partners – Project start 2003 – Planning horizon 7 years	
RESULTS		
NET PRESENT VALUE	91.5 million USD	
AMORTISATION TIME	3.7 years	
	TOTAL	PER ITEM
ANNUAL BENEFIT AT DISTRIBUTION CENTERS	21.7 million USD	0.010 USD
MAIN BENEFIT AT DISTRIBUTION CENTERS	Receiving efficiency and accuracy, Reduction in inventory, Reduction in internal theft	
ANNUAL BENEFIT AT OUTLETS	46.9 million USD	0.022 USD
MAIN BENEFIT AT OUTLETS	Receiving efficiency, Point-of sale efficiency, Improved stock visibility	

Continuation of Table 1

	TOTAL	PER ITEM
ANNUAL COST	10.0 million USD	0.005 USD
THEREOF: COST OF TAGS	0 USD	0 USD
ONE-TIME COST	99.6 million USD	
THEREOF: SYSTEM INTEGRATION COST	8.6 million USD	
THEREOF: READER COST (INCL. INSTALLATION)	91 million USD	

4.2. The Impact of Tag Cost

Initially, it is assumed that the manufacturer carries the RFID tag cost. If the retailer has to carry some of the tag cost, the cost for item-level tracking may become higher than the benefits for the retailer.

If the portion of tag cost carried by the retailer changed from zero to 25 percent, it comes as no surprise that the net present value turns negative. Assuming tag cost of 0.05 USD, we are talking about annual RFID tag cost of almost 110 million USD in our example that have to be distributed within the supply chain.

Tagging at item-level may therefore start with only selected products. We may assume that initially products equaling 20 percent of sales are tagged at the item-level with an average value of 6 USD per item and an average margin of 15 percent, and that this percentage grows by 20 percent a year. (This means that by the end of 2012, finally all products are tagged.) These figures can be entered on the results page. A recalculation of the results returns a slightly positive net present value, i.e. these values indicate a break-even point for an investment in Auto-ID technologies. There are a number of reasons why the net present value turns positive: 1. Huge volumes of RFID tags are only needed when tag prices have fallen significantly from today's level. 2. Fewer RFID reader are initially needed to equip shelves, and reader cost are expected to decline as well. 3. Investment cost are postponed which results in a lower present value.

The example illustrated in the scenario above was only on the retailer who was interested in item-level tracking for all benefit applications. There are many individual or aggregate combination of benefits that can be selected for the retailer, manufacturer, or distributor. Results will vary depending on the combination selected and data entered.

5. HOW TO DEAL WITH NEGATIVE RESULTS

There are instances where users may initially derive a negative result, as we have seen in the retailer and item-level tracking scenarios above. This does not necessarily mean that the use of Auto-ID technologies is not worthwhile. In many instances, results can turn positive when a number of parameters are reconsidered or when the focus for applying Auto-ID technologies is changed. (Of course, there might also be companies or supply chains for whom the use of low-cost RFID tags is not relevant at the moment and who find it hard to see a positive financial return at present.) Table 2 proposes a number of measures on how to deal with negative results for item-, case-, and pallet-level tracking. Some of the proposed measures are generic and may be relevant for the retailer, distributor, and manufacturer, others are relevant for only one of the supply chain partners. It is important to keep in mind that a solution based on Auto-ID technologies is likely to be introduced only if the net benefit for each supply chain partner is positive.

Table 2: Proposed measures on how to deal with a negative NPV

TRACKING LEVEL	POSITION IN SUPPLY CHAIN	PROPOSED MEASURES
ITEM-LEVEL	ALL	– Re-consider magnitude of benefits – Consider further benefits if not all benefits were initially selected – Focus on selected products only, e.g. high value products, or products where potential benefits of Auto-ID are high (e.g. in reducing theft or product obsolescence) – Postpone item-level tracking until tags and readers have become cheaper – Start with case-level tracking
	RETAILER	– Focus on Auto-ID for backroom operations to avoid cost of equipping shelves with RFID readers
	MANUFACTURER	– See whether part of the tag cost can be carried by supply chain partners
CASE-LEVEL	ALL	– Re-consider magnitude of benefits – Consider further benefits if not all benefits were initially selected – Focus on selected products only, e.g. high value products, or products where potential benefits of Auto-ID are high (e.g. in reducing theft or product obsolescence) – Postpone case-level tracking until tags and readers have become cheaper
	MANUFACTURER	– See whether part of the tag cost can be carried by supply chain partners – Check whether RFID tags can be re-used (e.g. if returnable boxes are used)
PALLET-LEVEL	ALL	– Re-consider magnitude of benefits – Consider further benefits if not all benefits were initially selected – Consider omitting certain applications with low financial benefit to avoid investment cost – Consider case-level tracking in order to potentially realize higher benefits
	MANUFACTURER	– See whether part of the tag cost can be carried by supply chain partners – Check whether RFID tags can be re-used (e.g. if returnable pallets are used)

6. APPENDIX

6.1. Development Process and Sponsor Involvement

Feedback on the Auto-ID Calculator was gathered at two stages during the development process: First, two rounds of interviews with sponsors were conducted on the initial concept and design. Second, sponsors were invited to test the final web-based tool online.

The following Auto-ID Center sponsors provided feedback on the calculator at various stages of the development process: Accenture, Alien Technology, Chep, CVS, IBM, Kodak, Metro, OAT Systems, Thing Magic, Unilever. We would like to thank all sponsors for their valuable input and feedback.

The Auto-ID Calculator and this report would not have been possible without the contribution of Joyce Lo, Program Manager for the Business Case Action Group. She coordinated the project, facilitated access to sponsor companies and provided valuable input to the calculator design and various drafts of the report. Special thanks also go to Mark Harrison from the Auto-ID Center at the University of Cambridge. He not only implemented large parts of the logic but also made a lot of valuable suggestions that led to significant improvements in the calculator. The design of the calculator and some of the initial implementation were done by Studio Luminosity.

6.2. Default Values and Data Sources

There are different kinds of assumptions included in the Auto-ID Calculator. They concern the

- configuration of the supply chain,
- general data for a company,
- benefits of an application,
- one-time and recurring cost for an Auto-ID solution, and
- planning horizon and discounting.

¹ see www.autoidcenter.org/aboutthetech_research.asp

The default values assume an average product that is sold in a supermarket. We could draw on a number of industry and academic publications to derive a number of default values (e.g. average value of an item sold in supermarkets, average size and sales of supermarkets, average level of theft in supermarkets). However, there is limited quantitative data available regarding the benefits and costs associated with an Auto-ID solution in a supply chain. Several of these default values were estimated based on information gathered during interviews with Auto-ID Center sponsors or derived from selected Auto-ID Center publications. The Auto-ID Calculator was validated against data from the Auto-ID Center business cases published by Accenture and IBM to see whether the results are consistent by and large with their findings¹. Metrics compared included cost per retail outlet, cost per warehouse, labour savings, system integration cost. The reader and tag cost assumptions are similar to the ones used in these Auto-ID Center reports. Nevertheless, we were not able to justify all default values. For example, for the specific applications and cost, the default values can only be “best educated guesses” and must be treated with caution. To a large extent, the benefits and cost are going to be company specific, based on existing product mix, processes etc. The numerical values are meant to give users some initial orientation, and users are encouraged to enter their own numbers. Whereas all numerical values used in the calculator can be altered, the configuration of the supply chain and the specific calculation logic cannot be changed.

The sources on which the different kinds of assumptions were based are now discussed in more detail.

Configuration of Supply Chain

The supply chain consists of a retailer, a distributor, and a manufacturer. It is assumed that an “average” product moves through the supply chain. Tagging happens either on the item, the case, or the pallet-level. Each company in the supply chain can use the tags to realize certain applications. In order to realize the benefits, each company has to invest e.g. in a reader infrastructure at its premises and in the integration into its legacy systems. The RFID tags are applied by the manufacturer, and the cost for the RFID tags are initially carried by the manufacturer.

General Data for a Company

There are default values provided for each company which include data on sales, value of an “average” item, “average” margin etc. and some other inputs which depend on the company’s position in the supply chain.

² www.fmi.org

For some of the general data, especially the retailer, information is publicly available. For example, the Food Marketing Institute² provides useful data on the average value of a product sold in supermarkets, the average size of a supermarket, average sales per supermarket, inventory turns, hourly earnings per employee etc. that could either be used directly or to derive certain inputs.

Benefits of an Application

The application areas were derived from the various Auto-ID Center reports. We have selected main application areas within the “primary” supply chain from manufacturer to retailer that can easily be quantified. Hard to measure benefits (e.g. increased product quality, increased warranty compliance) or benefits not directly related to supply chain operations (e.g. reduced sales due to counterfeit products) were not considered.

We have cross-checked our benefit estimates with results presented by IBM where applicable. (Accenture reports focus on case studies that show benefits for specific products (e.g. cosmetics, beverages) for one company only. The estimates of benefits for these products are not comparable with the benefits for the “average” product that we consider.) For example, for item- and case-level tracking the reports provide data that allows for a comparison of the total savings on a per-item basis for the retailer and the manufacturer. Furthermore, we compared the estimates of working hours saved per week at the retailer for item- and case-level tracking.

³ Hollinger, R.C. and Davis, J.L. (2001), National Retail Security Survey, Department of Sociology and the Center for Studies in Criminology and Law, University of Florida

⁴ Raman, A., DeHoratius, N., Ton, Z. (2001) “Execution: The Missing Link in Retail Operations”, California Management Review, Vol 43, No 3, pp. 136–52

There are some sources that provide estimates on the current magnitude of problems in the supply chain. For example, there is data from the Food Marketing Institute on the level of unsaleables in supermarkets, for distributors and for manufacturers. The data on the level of theft in supermarkets stems from the 2001 National Retail Security Survey of the University of Florida³. Furthermore, there are various sources that estimate the out-of-stock level in supermarkets. The figure presented here is derived from an article published in the California Management Review⁴. These figures are presented in the Auto-ID Calculator as an orientation, although they are not used in the calculation itself.

Cost of Auto-ID Solution

For estimates of RFID reader and tag cost, we relied on Auto-ID Center cost estimates.

The assumptions for the number of RFID readers and antennas needed in supermarkets, distribution centers and warehouses as well as for installation and integration cost were derived from discussions with Auto-ID Center technology sponsor companies.

As for the benefits, we have cross-checked our cost estimates with results published by Accenture or IBM where applicable. For example, we compared cost per outlet and per distribution center as well as integration cost with comparable figures provided by both Accenture and IBM for the former and Accenture only for the latter.

The number of readers required differs by application. Therefore, the number of readers (which can be substantial e.g. when shelves in supermarkets are to be equipped) varies, depending on the selected applications.

Planning Horizon and Discounting

We assume that a certain time is needed after the solution is implemented until the benefits are fully realized. The discount rate can be interpreted as a risk-free rate plus risk premium.

6.3. Disclaimer

Given the uniqueness and complexity of individual supply chains, this tool does not replace a more in-depth analysis of the impact Auto-ID will have on a company's business.

The Auto-ID Center makes no warranties, express or implied, and the Auto-ID Center specifically disclaims any warranty of merchantability or fitness for a particular purpose. The Auto-ID Center does not guarantee that the Auto-ID Calculator will meet "all requirements" of a user's business. The Auto-ID Center shall not be responsible for any damages, consequential or otherwise, that may be suffered by user's or its employees or agents.

