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Focus on the Supply Chain: Applying Auto-ID within the Distribution Center

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ABSTRACT

Imagine a store where your product is on the shelf each and every time consumers reach for it. Imagine a warehouse where perishables don't perish, where theft is fully detectable, where your systems exactly match physical inventory counts, and where transfers with trading partners are automated and precise. Imagine product visibility, transparency and a supply chain built on real-time demand and supply information – imagine the impact on your inventory and working capital. Don't think it can happen? Remember the impact of the bar code some 25 years ago, and now, imagine the impact of Auto-ID today.

Auto-ID represents a truly transformational technology with the ability to revolutionize the face of the supply chain, retail operations and consumer-facing processes. It has the potential to drive enormous shareholder return benefits across a breadth of key metrics including revenue growth, operating margin, working capital and capital expenditures. Just imagine the possibilities...

IBM Business Consulting Services, in conjunction with the Auto-ID Center, has worked with over 20 leading players in the consumer goods and retail sectors to develop a series of white papers around this exciting and emerging technology. Our research is based on current leading practices, which makes the value proposition for Auto-ID all the more compelling.

We encourage you to read our Auto-ID Prelude prior to diving into our series of white papers. The Prelude provides a compelling business-case discussion for the adoption of the Auto-ID system across the consumer goods and retail value chain and addresses important issues around adoption and migration paths. The individual white papers illustrate the impact of the Auto-ID system on specific pain points faced by companies in the consumer goods and retail value chain.

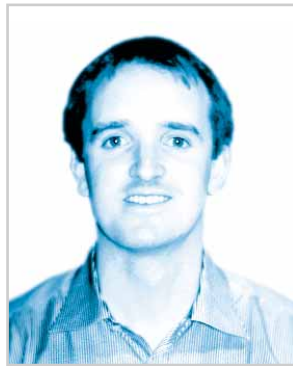
We are confident that you will be excited about Auto-ID and we urge you to consider its power to transform your own organization, as well as those of your trading partners.

IBM Business Consulting Services (www.ibm.com/services) is one of the world's leading providers of management consulting and technology services to many of the largest and most successful organizations, across a wide range of industries. With offices in 160 countries, IBM Business Consulting Services helps clients solve their business issues, exploiting world-class technology for improved business performance.

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Biographies



Keith Alexander
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Tig Gilliam, Consultant, IBM Business Consulting Services has more than 15 years in delivering intra- and inter-enterprise transformation solutions for global CPG companies. His client experiences encompass a broad range of large-scale strategic, operational improvement, technology and change management programs for CPG companies and their trading partners. Tig earned a B.S. in Systems Engineering and Finance from the University of Virginia, and an MBA in Finance and Operations from Columbia University.



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Kathryn Gramling, Consultant, IBM Business Consulting Services has over 14 years of experience and specializes in retail and consumer packaged goods marketing strategies, including B2B strategies, B2C marketing mix, consumer trends research, global retail trends analysis, and eRetailing. Most recently Kathryn has played a leadership in the Collaborative Value Chain practice helping clients with their B2B strategy and eMarkets participation go-to-market approach. She earned a Bachelor of Arts degree in Government from the College of William and Mary and a Master of Business Administration degree, with a concentration in International Marketing, from The American Graduate School of International Management, Thunderbird.

IBM BUSINESS CONSULTING SERVICES

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Biographies



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Dhaval Moogimane
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Dhaval Moogimane, Consultant, IBM Business Consulting Services has over 7 years of international consulting experience working with clients in assessing the impact of information technology investments on business operations and shareholder value. Dhaval has worked for clients in the Consumer & Industrial Products, Utilities and Financial Services Industries. His key areas of focus include: information technology strategy, technology management, and supply chain management. Dhaval received a B.E in Electrical Engineering from Bombay University, and an MBA in Strategy and Finance from Indiana University, Bloomington.

IBM BUSINESS CONSULTING SERVICES

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Mike Schultz, Consultant, IBM Business Consulting Services has more than 11 years experience with consulting assignments involving technology strategy, process improvement, software selection, system implementation and system integration. He has extensive package software selection and implementation experience in the Supply Chain technology space. Mike has a Bachelor's degree in Computer Science from the University of Illinois and a MBA in Finance from the University of Georgia.



Maurice Woods
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Maurice Woods, Consultant, IBM Business Consulting Services brings over thirteen years of business experience including strategy assessment, organization design and marketing activities targeted at increasing shareholder value. Prior to that, Maurice spent eight years with a Consumer Packaged Goods (CPG) company with increasing responsibilities across a number of business functions. He received his B.S. in Finance from California State University – Sacramento, and a MBA in Finance and Management & Strategy from Northwestern University.

IBM BUSINESS CONSULTING SERVICES

Focus on the Supply Chain: Applying Auto-ID within the Distribution Center

Contents

Auto-ID Prelude	5
1. Introduction	12
1.1. A Formidable Challenge	12
1.2. The Next Great Leap	13
2. Where Does it Hurt?	13
2.1. Warehouse & Distribution Pain Points and Auto-ID Remedies	13
2.2. Other Direct and Indirect DC Challenges	18
3. Where Do we Start?	19
3.1. The Route Forward for Auto-ID Adoption	19
3.2. Final Thoughts on Auto-ID Implementation	19
4. The Benefits Case for Warehouse & Distribution	20
4.1. Collaborative Value Chain Benefits for ABC Manufacturer and XYZ Retailer within their DC Networks	21
4.2. Benefits for ABC Manufacturer's DC Network	21
4.3. Benefits for XYZ Retailer's DC Network	22
4.4. Technology Insight	22
5. Conclusion	24
5.1. Answering the Challenge	24
Appendix	25

AUTO-ID PRELUDE

Auto-ID: Raising the Bar (code)

Sell one, replenish one, sell one, replenish one...

Or better yet, sell one, make one. That is the ideal value chain vision: synchronize activities across the chain from point-of-purchase all the way back through raw material delivery and, in doing so, achieve a perfect demand driven and networked economy.

How can we achieve this vision?

It starts with synchronizing trading partner operations, aligning goals and demand signals, and creating a truly intelligent value chain where information visibility is achieved through common accepted standards.

Enter Auto-ID:

a collaborative effort, driven by some of the world's leading consumer goods and retail companies, academic institutions, systems integrators and technology hardware providers, to create a unified product identification and tracking system that will benefit and, indeed, revolutionize the entire value chain just as the bar code did 25 years ago.

The vision provides consumer goods and retail companies with the opportunity to transform their supply chain and consumer facing activities and, in so doing, reach the next level of commercial performance and shareholder value.

The vision is clear.

But questions remain, including "How will Auto-ID enable the components of this vision? What form will it take? What is the value proposition? How soon will it happen?"

IBM Business Consulting Services has been working closely with the Auto-ID Center to study the adoption of Auto-ID technology. Based on our analysis, we believe that the adoption of Auto-ID is close at hand and that the business case behind it is exciting and compelling. Our findings and recommendations are based on extensive research including interviews and workshops with more than 20 major industry participants.

In the course of our research, IBM Business Consulting Services has driven the business case for commercial adoption of Auto-ID to a new level by analyzing value-chain-wide costs and benefits at the pallet level, case level and item level. Our "base case" research is built upon the Auto-ID Center's current tag cost assumptions and a fully compliant network using the Auto-ID Center's recommendations around the Electronic Product Code (EPC)[™], Object Naming Service (ONS) and Physical Mark-up Language (PML). Our analysis articulates how adoption curves differ significantly by product categories, and how the business case for low priced items, such as a can of soup, is very different than that of higher priced items, such as health and beauty products.

In terms of numbers, our base case is built around the "average shopping basket item," valued at \$1.75¹. We believe that this is the acid test; if you can prove the case at this price point, you should be able to prove it anywhere. Even at this price point we show a compelling business case for pallet and case-level adoption, as well as a quick migration to item-level adoption for higher priced/margin retail goods.

[IBM Business Consulting Services business case analysis suggests a compelling near-term business case for pallet and case-level adoption for most product categories, and item-level adoption for some product categories.](#)

¹ Source: IBM Business Consulting Services analysis

Moreover, our analysis is based on research that included a large number of the world's leading consumer goods and retail companies. In this context, a compelling value proposition is all the more credible.

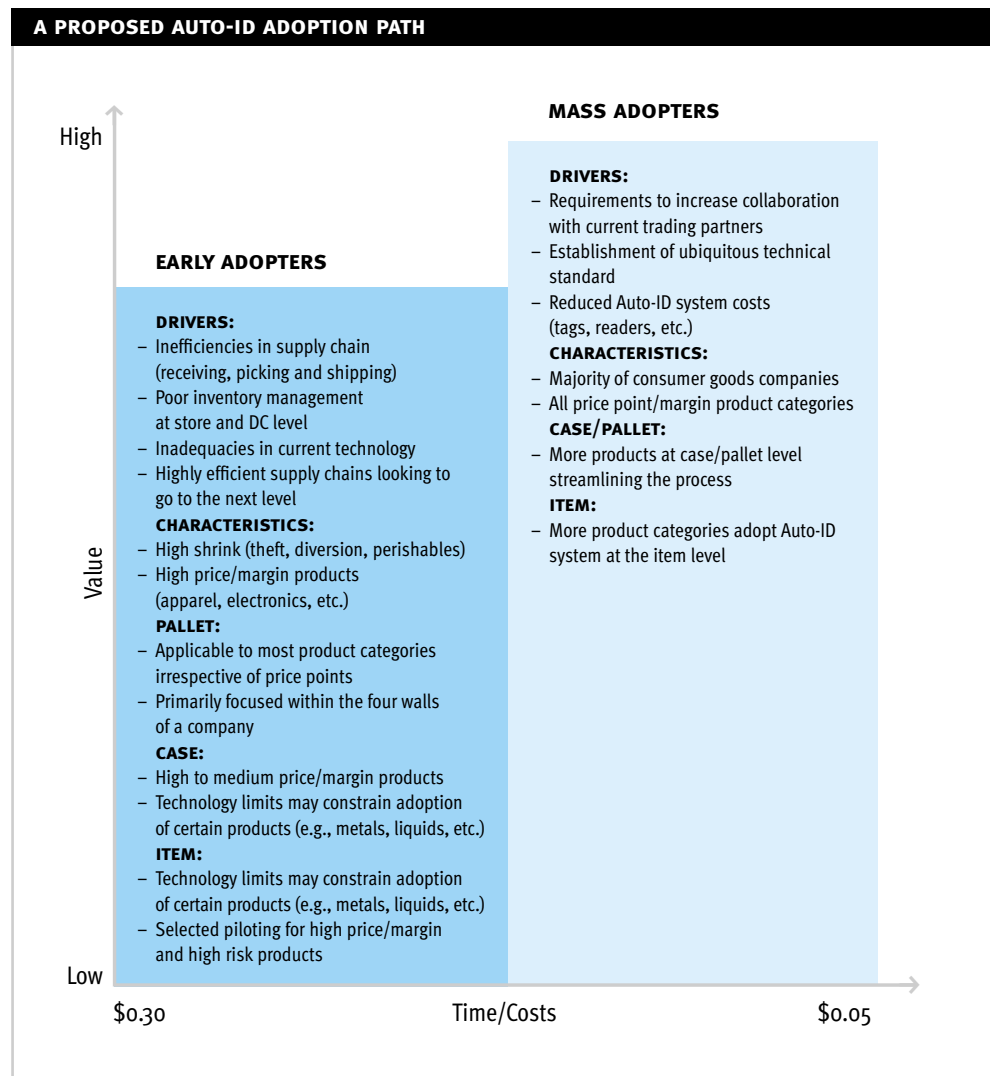
In the subsequent sections of the Auto-ID Prelude, we will introduce:

- IBM Business Consulting Services proposed generic adoption path for Auto-ID technology
- The Business Case for Auto-ID
- The IBM Business Consulting Services Auto-ID White Paper Series

The Auto-ID Adoption Path

Tag costs constitute the majority of the Auto-ID system implementation costs and, therefore, are the dominant variable when reviewing business cases for adoption. Price points, product characteristics, current business performance, current infrastructure and physical attributes of products all are contributing factors to determining the time and scope of adoption. See Figure 1.

Figure 1

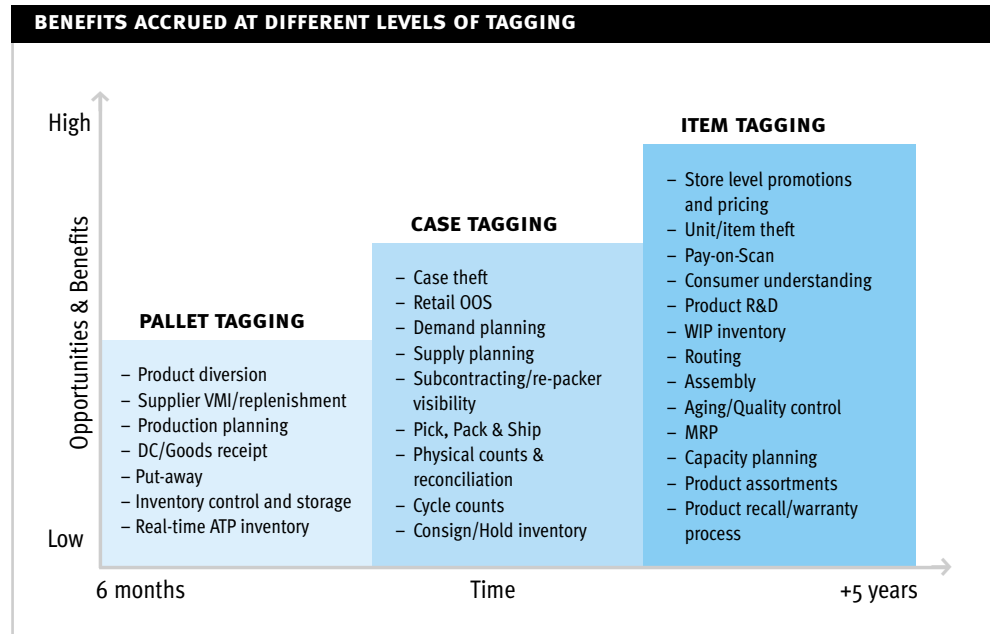


We have identified key company drivers and characteristics that lend themselves to various adoption strategies. In general, early adopters will tend to be those that can improve supply chain efficiency and inventory management by implementing Auto-ID at the pallet and case level within the four walls of their organization. Mass adoption at the item level will be driven by reducing tag costs, adoption of ubiquitous technology standards, and by an environment that fosters collaboration and information sharing.

For some companies, existing supply chain inefficiencies may lead to early, item-level adoption by piloting certain high-margin and high-risk products. On the other hand, some companies will wait for the establishment of a ubiquitous technical standard and lower technology costs before choosing to adopt the Auto-ID system at the item level.

The benefits of the Auto-ID system will increase significantly as companies transition from pallet, to case, to item-level tagging, and increase the degree of collaboration and sharing with trading partners. Figure 2 introduces the associated opportunities and relative benefits realized across the consumer goods and retail value chain by moving towards a more granular level of tagging.

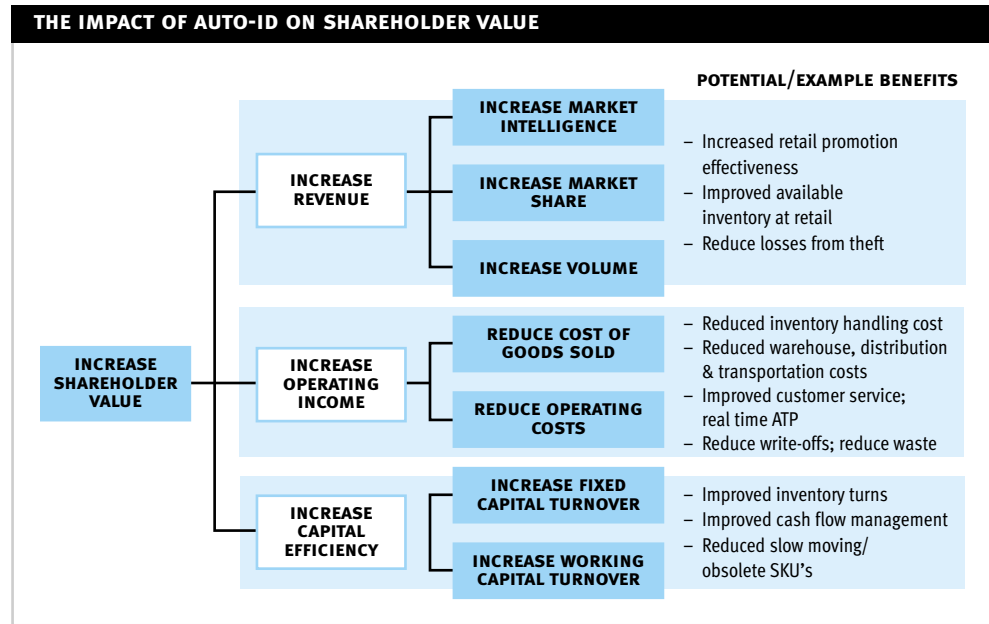
Figure 2



The Business Case for Auto-ID

The Auto-ID system is transformational to industries and key participants and can drive people, process and technological improvements that impact overall shareholder value. The Auto-ID system can have tangible impacts on key shareholder value levers as shown in Figure 3.

Figure 3



In developing our business case for the Auto-ID system, we have utilized a four-phased framework. This framework draws upon our experiences in developing emerging technology business cases for clients in the consumer goods and retail industries. The Four-Phased Framework is as follows:

Phase 1: Define Objectives

Overall objectives for Auto-ID were defined and categorized. During this phase, we identified the existing “pain points” in the value chain and their impact on both financial and non-financial measures.

Phase 2: Develop Preliminary Model

In order to develop a point of view around the feasibility of an Auto-ID business case, a hypothetical manufacturer-retailer system was set up to reflect the flow of 400 million cases from manufacturer through to the consumer (at point of sale). Industry benchmarks, IBM Business Consulting Services surveys such as the Industry Week-Census of Manufacturers Survey, interviews with participant companies, IBM Business Consulting Services experience and insight, and other published information were used to arrive at the characteristics of the hypothetical system, which included manufacturer plants, manufacturer DC’s, retailer DC’s and retailer stores.

This type of system allowed us to quantify the impact of various Auto-ID benefit areas and to understand the impact of Auto-ID on the system as a whole, while at the same time protecting individual data provided by participant companies. Our model does not represent any particular company or companies, or even any specific product category. Instead, it represents a scenario that most readers will find relevant, to some degree, to their business.

Phase 3: Validate Assumptions

After the system was set up, possible benefit areas were identified and quantified through research. Where quantification was not practical, benefits were categorized as “soft” benefits. We expect that these soft benefits, when quantified for an individual company’s business case, will make the case for Auto-ID even more compelling.

The cost assumptions were derived from data provided by the Auto-ID Center. The majority of the costs are associated with the variable cost of the tags, while reader systems contribute to a high percentage of the fixed cost. The Auto-ID costs were developed based on assumptions regarding the degree of adoption. It is assumed that if the adoption curve shifts significantly there will be a corresponding change in the cost estimates.

Phase 4: Develop Business Case

Based on the costs and benefits identified, Net Present Values (NPVs) were calculated to examine the feasibility of Auto-ID. Because Auto-ID is a new technology, the NPV was calculated out only on a seven-year period (rather than a longer period) and no perpetual value number was assumed. A discount rate of 12% was used. In calculating the NPV at the case level, an accrual of benefits was assumed at an increasing rate, with only 50% of the benefits being assumed in Year 1, 75% in Year 2, and 100% from Year 3 onwards. At the item level, the rate of assumption of benefits was 25% in Year 1, 50% in Year 2, 75% in Year 3 and 100% from Year 4 onwards. Similarly, one-time implementation costs were split up, with 70% of the costs being allocated in Year 1 and 30% in Year 2.

The IBM Business Consulting Services White Paper series does not constitute an Auto-ID business case for any one company. Benefits and costs are presented at the “system level”, or value-chain level. We conducted our analysis for a generalized consumer products value-chain system with the following broad characteristics: 8 billion items, 4 manufacturing plants, 10 manufacturing DC’s, 5 retail DC’s, 800 retail stores and an average retail price per item of \$1.75 (See Figure 4). Developing your own strategy, migration path and business case must reflect the specific characteristics of your value chain, products, current performance and capabilities, as well as overall business objectives.

While there are applications and considerations for suppliers to consumer goods manufacturers, the focus of our first two papers is on trading relationships between manufacturers and retailers.

Figure 4: The Hypothetical Consumer Goods and Retail Value Chain

	MANUFACTURER	MANUFACTURER DC’S/3PL DC	RETAILER DC’S/3PL DC	RETAILER STORE
SAMPLE	<ul style="list-style-type: none"> - 100 million cases - Average COGS = \$15.55/case 	<ul style="list-style-type: none"> - 40 million cases - 50 dock doors - Average COGS = \$15.55/case - Revenue = \$25.90/case - Inventory value = \$51.8 million 	<ul style="list-style-type: none"> - 80 million cases - 100 dock doors - Average COGS = \$25.90/case - Inventory value = \$138 million 	<ul style="list-style-type: none"> - 500,000 cases/store - 20 items per case - Average sales per case = \$35 - Revenue = \$175 million - Inventory value = \$719,500 million - 85% of inventory on shelves, 15% in the back room
SYSTEMS	<ul style="list-style-type: none"> - 4 plants - Total of 400 million cases - Total COGS = \$6.2 billion - Total revenue = \$10.4 billion - Gross Profit Margin = 40% of sales - 400 employees at each plant 	<ul style="list-style-type: none"> - 10 Mfg DC’s - 70 cases/pallet - 12 turns - Total inventory value = \$518 million 	<ul style="list-style-type: none"> - 5 Retailer DC’s - 15 turns - Total inventory value = \$691 million 	<ul style="list-style-type: none"> - 800 stores - Total sales = \$14 billion - Total COGS = \$10.4 billion - 18 turns - Gross Profit Margin = 26% of sales - Total Inventory = \$575 million

Our analysis indicates a compelling proposition for both pallet-level and case-level tagging for the above value chain. See Table 1.

Table 1: The Value Proposition for Pallet and Case Level Tagging

- *Note:
- 7 Year NPV analysis
 - Scenario 1:
Tag prices are based on Auto-ID estimates @ 30 cents in 2003, 20 cents in 2004, 10 cents in 2005, and 5 cents there after
 - Scenario 2:
Aggressive tag price estimates as quoted by industry players for large volume users:
@ 7.5 cents in 2003, 5 cents in 2004, 2 cents there after

NPV (IN \$MM) FOR MULTIPLE TAG COST SCENARIOS		
LEVEL OF ADOPTION	SCENARIO 1 – BASE CASE	SCENARIO 2 – BEST CASE
Pallet	\$4.0	\$10.0
Case	\$170.0	\$380.0

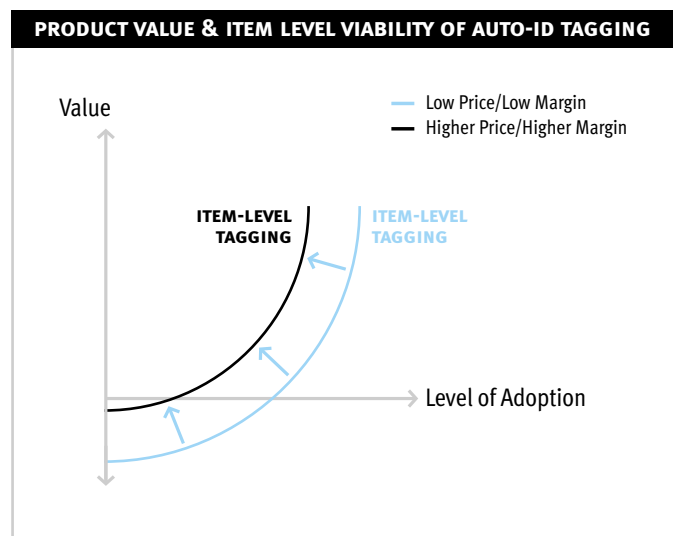
Our analysis indicates that there is a positive NPV of \$4MM for pallet-level tagging using tag estimates provided by Auto-ID. At \$170MM for the same scenario, the business proposition for case-level tagging is even more compelling.

When more aggressive tag cost estimates are applied, the business proposition becomes truly staggering at \$380MM for case level tagging.

Whereas the business proposition for case-level and pallet-level tagging is very clear, the case for item-level tagging is more dependent on the specific characteristics of the product and value chain including price, margin, theft, perishability, etc. Given the tag-price assumptions in the above scenarios, at 30 cents per tag in 2003, it is not surprising that item-level tagging is not viable for our “generalized” consumer goods supply chain with an average retail price of \$1.75.

The analysis indicates that the business proposition is strong at the case and pallet level even for low price/low margin category products. The proposition for item-level tagging for low price/low margin products becomes compelling once the level of adoption increases and the prices of tags drops. Tag prices will depend on the level of adoption and advancements made in tag manufacturing and labeling technology. However, the story changes for higher price/higher margin products such as electronics, apparel, consumer durables and some other consumer goods. For these product categories, not only does pallet and case-level tagging become even more compelling, but a business case for item-level tagging is viable – even at current tag price points. See Figure 5 below.

Figure 5: The relationship between product value and item level viability of Auto-ID tagging



The Auto-ID White Paper Series

The Auto-ID Prelude provides an overview of the impact of the Auto-ID system on the consumer goods and retail value chains. IBM Business Consulting Services is further collaborating with the Auto-ID Center to develop a series of white papers that explore the business opportunities that Auto-ID presents in addressing tangible pain points within the consumer goods and retail value chains. The first two papers in this series are:

- FOCUS ON RETAIL: Improving Product Availability on the Retail Shelf
- FOCUS ON THE SUPPLY CHAIN: Applying Auto-ID within the Distribution Center

Assumptions in developing the business case and the NPV analysis

In developing these white papers, IBM Business Consulting Services makes a number of generalized assumptions about Auto-ID technology adoption and implementation:

- High adoption rates will reduce tag and reader prices over the next decade. Our cost models have been developed using Auto-ID cost estimates for tags and readers outlined in the table below. Changes in the estimates below can have a significant impact to the business case:

	2002	2003	2004	2005	2006
Industry tag sales (millions of units)	200	300	700	3,000	15,000
Tag price to highest volume users	0.40	0.30	0.20	0.10	0.05
Industry reader sales (million units)	0.1	0.2	0.5	1	2
Reader electronics price to volume users	\$500	\$250	\$150	\$100	\$70

- The papers have been developed with a view towards implementing an Auto-ID compliant system including utilization of EPC™, ONS and PML standards. The adoption assumptions, migration paths and economic results are not valid for “proprietary”, non-EPC™ compliant RFID technology.
- The papers have assumed that the technology will work as envisioned by the Auto-ID Center and will provide the accuracy rates and the reliability necessary for wide spread adoption.
- Standards such as EPC™, ONS and PML will be developed and adopted.
- Compatibility among different technology components will be achieved, including the ability to support multiple tag and reader formats and frequencies.
- Technology will be adopted and operated globally.
- Our business case analysis including the NPV analysis in Table 1, specifically applies to the hypothetical supply chain system illustrated in Figure 1 and includes the following assumptions:
 - 100% tagging compliance across the system for each level of adoption.
 - The cost components incorporated in the analysis include tag costs, reader systems cost, infrastructure costs, basic application integration costs, maintenance and support costs and overhead costs.
 - The benefits and the tag costs have been applied on a system-wide basis, i.e., value-chain wide.
 - The benefits have been quantified assuming system-wide adoption and open data/information sharing among trading partners.

ACKNOWLEDGMENT

IBM Business Consulting Services would like to thank the Auto-ID Center and the many companies that contributed to this paper. In particular, we would like to extend special thanks to the following companies whose involvement and insight was instrumental in helping us to shape our point of view:

Alien Technologies, ConAgra Foods, Checkpoint Systems, CHEP, Defense Commissary Agency, Gillette, Intel, J.C. Penney, Johnson & Johnson, Kraft Foods, Kroger, Matrics, Philips Semiconductors, Procter & Gamble, Shaw's, Sensormatic Electronics, Symbol Technologies, Tesco, ThingMagic, Unilever, Wal-Mart

We should note that all proprietary information produced through conversations, workshops and data gathering with participant companies remains confidential to those companies and IBM Business Consulting Services. IBM Business Consulting Services has used these insights only to verify our own knowledge or publicly available information. In a small number of cases, data was blinded and ranged to prohibit the reader from linking any specific data to any specific participant. Figures quoted in this paper, therefore, refer to:

- IBM Business Consulting Services own consumer goods and retail knowledge experience including benchmarking studies, and engagements with a wide range of clients over a number of years
- Publicly available information sources
- The hypothetical value chain model we created to articulate costs and benefits of implementing an Auto-ID solution

1. INTRODUCTION

1.1. A Formidable Challenge

Despite huge strides made in the development and integration of systems and controls at the distribution center (DC), Consumer Products manufacturers and retailers continue to suffer from inefficiencies in receiving, picking, shipping and transferring goods. As a result, today's logistics and distribution executives face a formidable challenge: improve efficiency and customer service, while at the same time reduce costs.

To meet the challenge, many companies monitor key performance indicators, implement continuous improvement programs and perform benchmarking studies. The resulting process changes, vendor and customer collaborations, and new technologies – such as warehouse management systems (WMS), material handling automation and radio frequency technologies – have improved efficiency and communication in DCs. But something more dramatic is needed.

Companies are also focusing on the supply chain itself as a competitive cost advantage, a tactic that savvy corporate executives see as a source of great potential. Since 1998, companies have spent \$14.9 billion on supply chain software. But a great deal of work remains to be done. Even with the latest software technology in place, DC operations continue to be challenged – to cut labor costs, to speed throughput and to increase accuracy. And even those companies adhering strictly to best practices have been unable to systematically eliminate these inefficiencies head-on due to persistent problems associated with volume, human error, product visibility and lack of real-time information.

1.2. The Next Great Leap

Auto-ID, the next great leap in the evolution of product identification and tracking, could be the tool that allows companies to effectively overcome the root problems that, until now, were thought to be inherent in the operation of any DC.

Auto-ID is not “just another technology solution.” Auto-ID is much more. It is a revolutionary shift in product identification and tracking and its universal open standard could transform not only processes within the DC, but also the entire value chain as we know it today. Auto-ID embeds intelligent chips in individual products or cases of products. The information on those chips will give logistics and distribution executives the real-time information and product visibility they need, while Auto-ID’s automated data capture mechanisms will help them reduce labor expense, increase information accuracy and improve product throughput.

Too good to be true? Not really. Long overdue? Absolutely. The business case for the first-wave adoption of Auto-ID radio frequency based solutions – tagging pallets and cases of product as they move into, through and out of the DC – is here. And, as the adoption curve progresses and Auto-ID’s open standard is accepted, the benefits of item-level tagging will be even greater. We believe a foundational investment in Auto-ID technology will drive scalable solutions for companies in the near and long term. In short, Auto-ID is here and no company can afford to ignore it.

This white paper is organized in the following sections:

Section 2

Where Does It Hurt? Outlines the pain points that are currently affecting DCs today and the potential of Auto-ID to improve the area

Section 3

Where Do We Start? Details the adoption path of Auto-ID

Section 4

The Benefits Case for Applying Auto-ID within the DC. Details the cost-benefit analysis of adopting Auto-ID at the pallet, case and item level for a hypothetical manufacturer DC and retail DC as well as their combined benefits

2. WHERE DOES IT HURT?

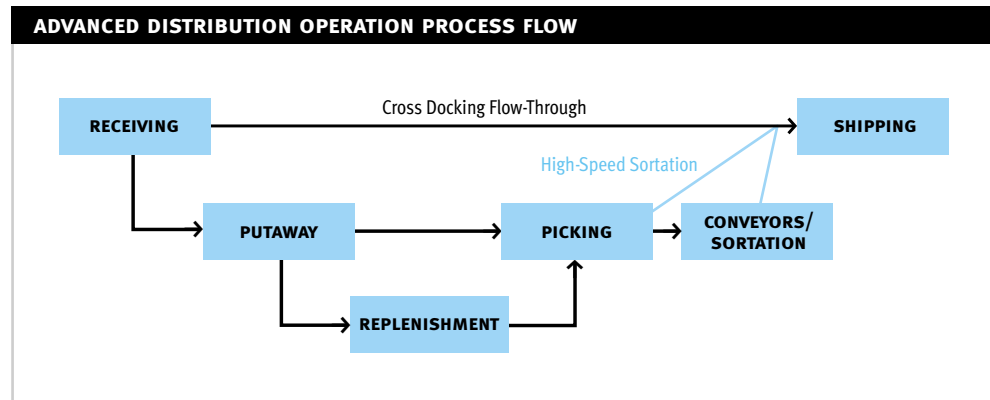
2.1. Warehouse & Distribution Pain Points and Auto-ID Remedies

Relieving the “pain points” of product warehousing and distribution is a key benefit of Auto-ID implementation. Today, DCs suffer the effects of inefficiency in the areas of labor, accuracy and throughput. Auto-ID technology and systems implementation would provide a powerful remedy for each of these critical areas:

1. **LABOR EXPENSE:** Auto-ID reduces the amount of labor and time necessary to complete a task.
2. **ACCURACY:** Auto-ID reduces the need to check, audit or verify that the correct product and quantity is where it should be.
3. **THROUGHPUT:** Auto-ID improves throughput to make products available for customer orders more quickly and promotes on-time delivery.

These challenges are inter-related, and are the focus of our first-wave implementation of Auto-ID in a single warehouse or DC environment. These pain points contribute to other network-wide opportunities as well, such as: excessive inventory; unnecessary claims handling; product visibility; customer service failures; and ultimately loss of sales to the consumer. While this paper does not describe all of these related issues in detail, they are real; and as companies roll out the solution to their entire DC network, and connect to trading partners, they can be addressed effectively.

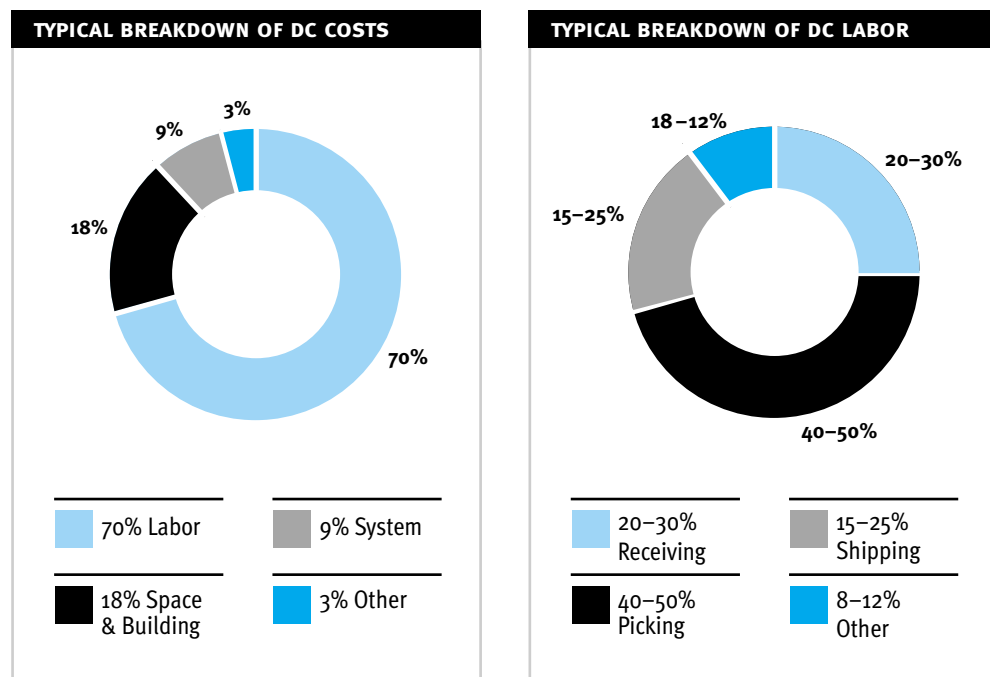
Figure 6



1. Labor Expense

Labor represents a majority of the cost for most DC operations. For manufacturers and retailers, labor costs range from 50–80% of overall DC costs (see Figure 7). Just as the DC or warehouse is an essential part of the supply chain, labor plays an integral role in the operation of these facilities. Process and system inefficiencies, facility layout, lack of skilled labor and human error are all contributors to high labor costs and are controllable variables that can be dramatically affected by technology innovations like Auto-ID.

Figure 7



There are three main labor processes which the Auto-ID system can address immediately: receiving, picking and shipping.

Receiving

When a trailer is backed into a receiving door and unloaded onto the dock for verification, a receiver compares the staged SKUs and quantities against the expected data. The receiver then applies a label to the pallet for tracking throughout the warehouse. When the count or SKU does not match, the receiver double-checks his work to confirm the discrepancy. Often, another associate or manager also becomes involved to collaborate on the receiver's findings. This process is time consuming and subject to human error. Meanwhile, mixed loads and multiple product pallets only compound the problem. Auto-ID will eliminate this verification step from the process, allowing SKUs and quantities to be checked automatically against purchase order expectations reducing check-in time 60 to 93%. In addition, the Auto-ID system will eliminate the need to apply a barcode or pallet label to continue the putaway process.

Supply Chain Executive

“...Over thirty percent of our labor is tied up in receiving...” Reducing checking and verification time is a big win for some companies.

Picking

Picking is extremely labor intensive and prone to human error. Case picking can occupy up to 50% of a DC's staff and often requires additional verification downstream. DCs have implemented sophisticated real-time warehouse management systems (WMS) utilizing radio frequency (RF) technology to maintain production levels while increasing picking integrity. For many companies, order pickers move to a pick location, scan the UPC on the case or location check digit (to confirm correct location or product), associate the case to the master pallet, put the RF unit down, pick up the case, and place the case on the pallet. Auto-ID can help cut out subtle steps such as scanning, handling of an RF unit or applying a case label, saving up to 36% in order picker labor.

Shipping

Many Consumer Product DCs shipping to key retail customers verify 100% of outbound orders. Verification is needed because of errors in receiving inbound product, picking customer orders and high customer claim rates. Auditors check pallets on the shipping dock in order to verify outgoing shipments. In some cases, process changes have driven companies to spend more time checking selected quantities during the picking process in order catch the error at the source. These verification processes lead to high customer service levels. However, the labor cost of maintaining those levels is ripe for improvement. Auto-ID can help achieve up to a 90% reduction in verification costs, and boost service to a broader range of customers.

Preparing Advance Shipment Notices (ASNs) for customers requires additional labor expenditure in shipping. Today, many companies have a separate process to capture data and create ASNs for a subset of their customers. However, their ability to do this for all customers is hampered by extra steps such as labeling each case and associating these cases to a master container or trailer, which decreases throughput and extends delivery cycles. Companies that create electronic ASNs for their customers will collect the data effortlessly and with more accuracy using Auto-ID. And when simply passing product through the shipping doors allows shippers to collect data, they will be able to provide that information to all customers real time. This advance notice drives efficiency throughout the supply chain.

2. Accuracy

Receiving

The incorrect receipt of product creates problems throughout the warehouse and leads to a direct loss of money when product is paid for but not received. Companies following best practices already know the importance of getting a receipt correct the first time. In fact, with each step into the warehouse product flow, receiving errors cause greater and greater damage to inventory accuracy and time management. Therefore, it is not surprising that companies with challenging receiving environments (e.g., many sources, multiple SKU pallets) spend a significant amount of time in receiving to achieve 99% accuracy. With Auto-ID, we assume a near 100% accuracy is attainable while still reducing labor from current levels.

Picking

Even when receiving goes well, the opportunity for error is always present in environments where case picking is prevalent because of the additional handling required. Pickers can verify and verify again the quantity and product picked, but there is no way to guarantee the accuracy of their reported counts against what they actually selected. Auto-ID remedies this problem by providing absolute identification of exact products and quantity, and will virtually eliminate errors in picking, which, in turn, will greatly increase shipping accuracy and customer service levels. All of this increase in accuracy ultimately leads to consumer shelf availability and a stronger ROI on marketing and promotions.

* Assumes 40 million cases selected annually and 70 cases per pallet

[A one-percent increase in case pick volume translates to an additional 394,000 touches – and 394,000 more opportunities for error.*](#)

Accurate receipt and picking also increases slot inventory accuracy. Accurate inventory levels ensure that each location is replenished at the right time. Right now, replenishment drivers bring pallets to locations based on expected inventory levels. Sometimes the location inventory is too low, leading to out of stock situations. As a result, the order picker must wait for the replenishment or proceed and, ultimately, have another picker go back and pick up the cases. This task can take between 3 and 5% of some retail DC's labor. Plus, there are additional hidden costs because this work is unproductive and duplicative.

On the other hand, sometimes the location inventory is too high, making it difficult to replenish the location. Inflated inventory levels in the pick location force the replenishment driver to spend more time stacking additional cases, and sometimes even prevent the driver from completing the replenishment at all. Inaccurate inventory levels can also lead to a product or quantity being scratched from an order. When the order is processed, the inventory level for a product shows zero, causing the product to be back ordered even though the location may have enough units to fill its order.

Supply Chain Executive

[“Increasingly our shipments are mixed SKUs on a pallet – that increases my time in picking and my customer’s time in receiving – and we both make errors.”](#)

Inaccurate inventory levels force DCs to spend additional, unproductive time cycle counting and performing wall-to-wall inventories. Counters are dispatched to count locations based on exceptions or normal cycle counting procedures. If the physical count in the location does not match the system count, a re-count is performed. Moreover, DCs often shut down their facility to count, which requires all deliveries to be made in a shortened time frame. For example, if you operate five days a week, then you have to ship five days worth of customer orders in four days due to a pending count, all the while prepping for the inventory. Needless to say, the count process often leads to heavy overtime hours and reduced customer service levels because the compressed timeline reduces the accuracy of the entire process.

Shipping

Shipping the perfect order is a goal of every DC. But deliveries that are on time, free of damage, and that contain the correct quantities, products and shipping documentation arrive to customers only 40 to 60% of the time, according to our research. These imperfect orders lead to increased customer claims, increased time to investigate those claims, inaccurate inventory levels, increased customer returns, and, most grievously, customer and consumer dissatisfaction. To increase the chance of shipping the perfect order, companies try to verify loads prior to shipment, but verification consumes time, space (additional dock space and shipping doors) and labor (associates need to verify orders) – leaving some companies enough time and space to audit only a small portion of their loads. Despite these extreme measures, many orders still contain errors.

* Assumes 40 million cases shipped annually

An increase in shipping accuracy from 95% to 99.9% means an additional 1,960,000 cases will ship correctly each year.*

These errors result in claims and returns – pain points that are felt by shippers and customers. Both parties must carry labor that spends time researching, verifying and settling claims that result from inaccurate shipping or receiving. Additional problems arise for shippers and customers when product is shorted because it translates into lost sales and consumer dissatisfaction. Overages result in returns cost (labor and transportation) or simply product that goes out the door without generating corresponding revenue. With product actually matching the shipping documentation virtually every time, savings will result. Although damage and theft after shipping will still occur, the Auto-ID system will provide greater visibility and certainty to companies, allowing them to focus precious resources on other issues.

At least one company has put claims reduction at the top of its list, with the total current costs at a staggering \$40 million.

3. Throughput

Receiving

Over 75% of inbound loads for a Consumer Products company and often less than 10% of those for a retailer have electronic Advance Ship Notices (ASNs) that are fully utilized. Companies that can rely on the vendor sending the ASN use the electronic information to expedite significantly the receiving process. Studies have shown companies reduce receiving time by 67% on loads that use electronic ASNs. Because retail DCs have a much greater number of vendors and SKUs than Consumer Product company DCs, products often sit too long in receiving and remain unavailable for shipping. Auto-ID facilitates quicker receipt of inbound freight into inventory. It increases the ability to turn doors and the opportunity to cross-dock receipts directly to shipping, bypassing the putaway, retrieval and picking processes. With Auto-ID, companies will achieve greater throughput from the improved dock-to-stock time as well as the improved ability to identify and take advantage of cross docking.

Picking

With the push for smaller, more frequent deliveries, full-pallet shipments are almost non-existent for retailers, and it is dwindling for manufacturers (currently 40–60% of total cases shipped for Consumer Products manufacturers and less than 5% for retailers). Case level picking is fast becoming the method of necessity. Unfortunately, picking cases rather than pallets decreases the ability to move through large quantities of product quickly. The cases must be handled individually, whether picking product to a pallet or picking to belt. Auto-ID allows pickers to pick with confidence when the quantities they handle are automatically registered and verified against customer orders. Efficiency is gained from eliminating the time required for scanning the product or location check digit, applying case labels (if applicable), handling “no reads”, and recording picked quantities, while increasing customer service levels and creating stronger trading partner relationships.

* Assumes 24 million cases selected per year at an initial rate of 200 cases per hour

Every 15 case per hour improvement can increase case selection throughput by 1.8 million cases annually.*

Shipping

The exclusion of product verification on the shipping dock eliminates the need for staging. Instead of order pickers dropping the pallets in a staging area for auditing, the order picker now directly loads the pallet into the trailer. This eliminates the need for auditors and loaders, improves throughput and reduces congestion on the shipping dock. Shippers that need to send ASNs need do little more than format the data automatically captured in the loading process. Auto-ID eliminates the extra steps traditionally involved with creating and sending ASNs and promotes increased data sharing between trading partners, leading to more opportunities around vendor managed inventory, collaborative planning, forecasting and replenishment, and other advanced collaborative efforts.

2.2. Other Direct and Indirect DC Challenges

An Auto-ID system at a single DC, a DC network or an entire supply chain, can resolve many challenges like those described previously. Still other benefits that Auto-ID could provide within the DC network include:

Inventory Planning

Increased visibility and improved information accuracy can result in reduced inventory-carrying costs and transportation costs. Inventory cost can be further reduced as cooperation with trading partners improves through Auto-ID implementation and the resulting progress in areas such as forecasting accuracy.

Yard Management

Tags on each tractor and trailer, combined with readers placed at the entry and exit of the trailer yard, and throughout the yard, quickly relay the location of the equipment, their internal yard movements, and details about product contained in the trailer. Yard labor and assets will be reduced and visibility to trailer contents upon arrival will improve order fill and flow-through capabilities.

Theft Control

Readers placed at all egresses prevent the casual theft of product tagged at the unit level. In addition to the direct loss, reducing shrinkage contributes to lower inventory levels and improves order-fill capabilities.

Asset Utilization

Tags placed on material handling equipment track its movement, use and placement. Improved asset utilization will require fewer assets and free up capital.

Labor Movement Tracking

Readers connected to labor tracking system determine travel distance, travel time, number of cases picked, number of stops made, delays, etc. Having the productivity data at this level and in real time allows for quicker decisions by management to improve process and information flows, as well as productivity.

Days Sales Outstanding (DSO)

Readers placed at trading partners' receiving docks allow for proof of delivery and a drastic reduction in claims and claims handling. With increased invoice accuracy and shipping accuracy, shippers can expect to be paid more quickly, which can reduce DSO and improve cash flow.

3. WHERE DO WE START?

3.1. The Route Forward for Auto-ID Adoption

Worldclass logistics operations have already invested much time, expense, labor and technology to address the various pain points that they feel, but more resources and creativity are necessary to prevent these issues from affecting the bottom line. Auto-ID technology provides a mechanism to leap frog to the next level of significant gain. Improving the speed at which product is received, and the added visibility provided by Auto-ID, should allow shippers to make great strides toward maximizing flow by reducing asset utilization, improving product availability and boosting customer responsiveness. In the near-term when trading partners across the value chain are utilizing Auto-ID in tandem, mundane and time-consuming tasks such as pallet and case labeling will be eliminated. Auto-ID's common standards will allow the same RFID tag and EPC™ to be read universally.

Determining when and where to start will vary based on the type of operation you have, the type of technology you currently use, the relative importance of key metrics, and, as always, the drive to “get ahead of the competition”. But implementation of Auto-ID at the pallet level is the logical place to start. The cost of tagging each pallet is cheaper than tagging each case. Of course, starting with pallet-level tagging is not for all companies. Many have already implemented technologies that accurately capture and track information at the pallet level. In order to achieve incremental improvement using pallet EPC™ tags only, the operation would have to deal primarily with full-pallet movements in receiving, shipping and picking to a majority of its customers.

Once pallet-level adoption has been successful, the next logical step for manufacturer and retailer DCs is tagging at the case level. Manufacturers and retailers that handle significant case quantity volumes will see a jump in benefits. The fact that retail stores begin to derive benefit at the case level drives greater benefit to the entire value chain. Realized benefits at the DC are reduced labor, reduced theft and reduced claims. Reduced inventory levels, carrying costs and one-time transportation cost reductions are value-chain-wide benefits resulting from store participation.

The final step of the Auto-ID lifecycle will be tagging at item level. Item-level tagging will have little impact on many DCs (the exception being break-pack facilities) but will have profound effects on retail stores and enhance communication throughout the value chain (see the IBM Business Consulting Services white paper titled “Focus on Retail: Improving Product Availability on the Retail Shelf” for more information on this topic). For retailers, break-pack operations use 15–25% of DC labor. But for retailers such as drug store chains, the level of break pack can exceed 75% of labor costs, so tagging at the item level will have tremendous impact for these operators. Tagging at the item level also gives trading partners visibility further down the value chain. This kind of detailed information shared between the retail outlets and the manufacturers will lead to better planning and forecasting, product visibility and, ultimately, better asset utilization.

3.2. Final Thoughts on Auto-ID Implementation

The ability of the WMS to utilize the real-time data collected by Auto-ID is a major key to the successful implementation of Auto-ID. Integrating Auto-ID to WMS should prove to be a quick win since 75% of manufacturers with revenue over \$1 billion have already implemented or plan to implement a warehouse management system². Companies that have yet to implement a WMS should consider the effect of integrating Auto-ID as part of the overall implementation.

² 2001 Census of Manufacturers

Unlike its ultimate benefits, this initial implementation of Auto-ID at the pallet level is evolutionary not revolutionary, adding more technology to a company with advanced systems and solid processes. This may mean pallet tagging for some, and pallet and case tagging for others. Process changes to the DC will be minimal, but labor savings, efficiencies and accuracy in receiving, picking and shipping will improve. And make no mistake, revolutionary changes will occur as adoption of Auto-ID progresses and DCs achieve their ultimate goal of moving product from receiving to shipping with no idle time in between.

NB. Figures in this section based on IBM Business Consulting Services Value Chain

4. THE BENEFITS CASE FOR WAREHOUSE & DISTRIBUTION

IBM Business Consulting Services created a hypothetical value chain to fully describe the economic benefits of implementing Auto-ID at the pallet, case, and item levels for retail and manufacturing distribution networks. Other assumptions are based on our interviews, reports, industry best practices and benchmarking data.

The IBM Business Consulting Services White Paper series does not constitute an Auto-ID business case for any one company. Benefits and costs are presented at the “system level”, or value-chain level. We conducted our analysis for a generalized consumer products value-chain system with the following broad characteristics: 8 billion items, 4 manufacturing plants, 10 manufacturing DC’s, 5 retail DC’s, 800 retail stores and an average retail price per item of \$1.75. Developing your own strategy, migration path and business case must reflect the specific characteristics of your value chain, products, current performance and capabilities, as well as overall business objectives.

The benefits detailed in the following sections are based on the assumptions made in Table 2.

Table 2: Assumptions for ABC Manufacturer and XYZ Retailer’s DC Networks

CHARACTERISTIC (PER DC UNLESS NOTED)	ABC MANUFACTURER	XYZ RETAILER
Number of DCs in network	10	5
Number of Associates	140	470
Hourly Rate (includes 5% OT and benefits)	\$17	\$17
Total inventory value (Network wide)	\$518 million	\$691 million
Cases Received	40,000,000	80,000,000
Cases Shipped	40,000,000	80,000,000
DC square footage	600,000	1,200,000
Dock Doors (Receiving and Shipping)	50	100
Average Warehouse Cost (\$ per case)	\$0.25	\$0.35
Average COGS per case	\$15.55	\$25.90
Revenue per Case	\$25.90	\$35.00
Labor as a Percentage of Total DC Cost	50%	60%
Cases per pallet (shipping and receiving)	70	70
Annual inventory turns	12	15
Retail Outlets Serviced	N/A	160

4.1. Collaborative Value Chain Benefits for ABC Manufacturer & XYZ Retailer within their DC Networks

While each dollar of benefit is significant to each of the individual networks, the total value generated for the two DC networks with the adoption of Auto-ID is staggering, especially at the case and item level (see Table 3).

Table 3: Total Distribution Benefits for ABC Manufacturer and XYZ Retailer's DC Networks*

- * Recurring benefit unless noted
 1. One-time benefit of \$7.8 million
 2. One-time benefit of \$10.5 million
 3. One-time benefit of \$15.5 million
 4. One-time benefit of \$21.0 million

ADOPTION LEVEL	ABC MANUFACTURER (IN \$M)	XYZ RETAILER (IN \$M)	TOTAL (IN \$M)
PALLET	\$2.70	\$3.80	\$6.5
CASE	\$20.1 ¹	\$33.5 ²	\$53.6
ITEM	\$39.8 ³	\$60.3 ⁴	\$100.1

At a pallet level, \$6.5 million is saved after adoption, with the savings coming from labor expense, theft, and claims/returns reductions. At the case level, a drastic increase in benefits is received. A one-time transportation savings of \$18.3 million makes up a large portion of the benefits. Finally, at the item level, ABC Manufacturer and XYZ Retailer's distribution networks stand to put \$51.5 million towards reducing direct operating expense, another \$36.5 million towards one-time transportation benefits, and \$12.1 million in reduced inventory carrying costs. These benefits total just over \$100 million in savings through this portion of the value chain. The total inventory carrying costs reductions and the reduction in transportation costs achieved at the case and item level can only be obtained when collaboration between trading partners exists. Depending on the company and their internal processes, there could be additional benefits related to avoided costs like pallet labels. Those benefits are not calculated in our business case.

4.2. Benefits for ABC Manufacturer's DC Network

Each level of Auto-ID implementation yields benefits to ABC Manufacturer's distribution network. At the pallet level, ABC Manufacturer receives \$2.7 million in benefits (see Table A in Appendix). These benefits arise from a reduction in labor in receiving, picking, inventory control and shipping, as well as a reduction in theft and claims/returns.

At the case level, the rewards jump substantially (see Table B in Appendix). There is a 10% reduction in theft, a 10% reduction in labor, a 2–3% reduction in claims and returns, and a 20% reduction in inventory carrying costs, resulting in a \$12.3 million annual savings. Also, as a result of permanently lower inventory there is an additional one-time reduction in transportation costs totaling \$7.8 million.

The financial reward achieved by adopting at the item level is almost double that of case level adoption (see Table C in Appendix). ABC Manufacturer would stand to receive \$39.8 million in benefits from its distribution network. Each area that achieved benefit at the case level remains the same, or is even greater at the item level. Another large benefit derived from item-level tagging is the reduction in transportation costs. The one-time benefit of a reduction in transportation based on item-level tagging is \$15.5 million.

4.3. Benefits for XYZ Retailer’s DC Network

While the gains from Auto-ID adoption for ABC Manufacturer’s distribution network are tremendous, the gains to XYZ Retailer’s distribution network are even more attractive. At the pallet level, XYZ Retailer stands to reduce labor expense by \$2.9 million (see Table D in Appendix). This benefit is gained by streamlining the receiving, picking and shipping process. Slight gains in theft and claims-return control add almost \$1 million in savings.

With case-level adoption, the distribution network for XYZ Retailer gains an annual reduction in costs of \$19.5 million (see Table E in Appendix). That is over double the savings of the manufacturer’s network. This amount is achieved with even greater savings in labor expense, theft and claims reduction. Additionally, a one-time transportation cost reduction of \$10.5 million and \$3.5 million in annual carrying cost reductions are also possible because of the accurate inventory levels in the DCs and the lower safety stock levels in the stores and DCs.

Finally, for item-level adoption, the benefits received by XYZ Retailer’s DC network exceed \$60.3 million annually. The one-time transportation plus annual inventory reduction carrying costs for tagging at the item level are \$27.9 million (see Table F in Appendix).

4.4. Technology Insight

To adopt Auto-ID, warehouses need to implement a system of readers, upgrade existing infrastructure, and modify software applications. Figure 8 illustrates the application of Auto-ID within the four walls of an illustrative DC.

Figure 8: (illustrative DC*)

* Coverage areas in the diagram result from a combination of readers and antennas. This concept closely resembles the set up in place for the phase II Auto-ID field tests.

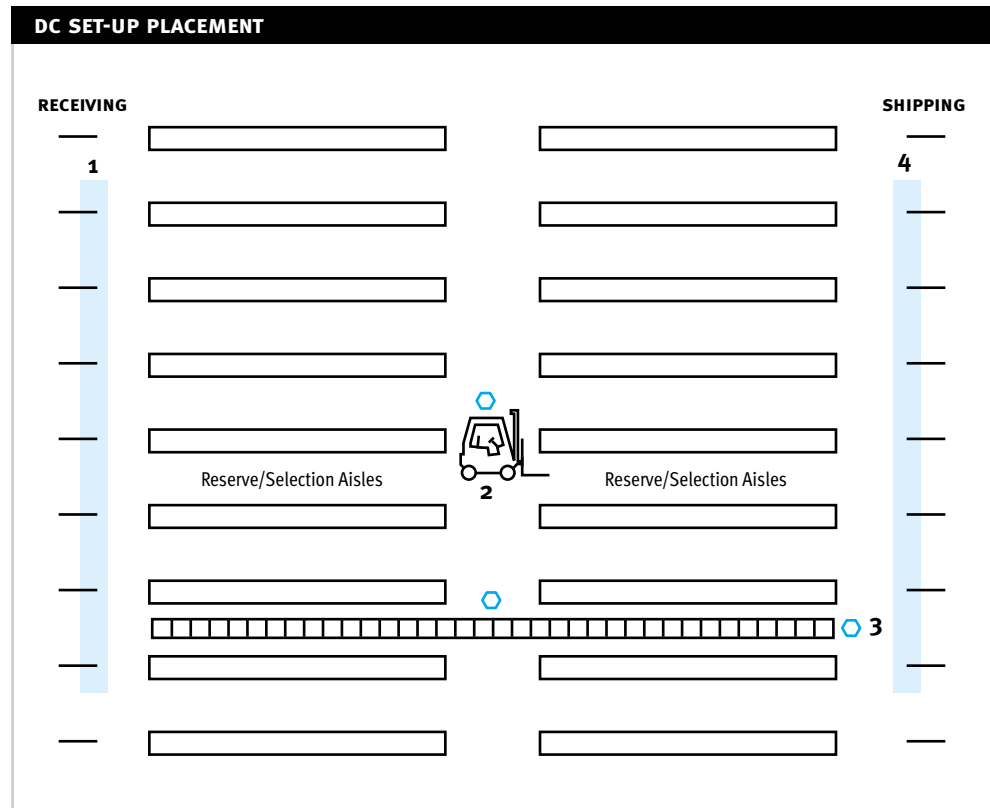


Table 4

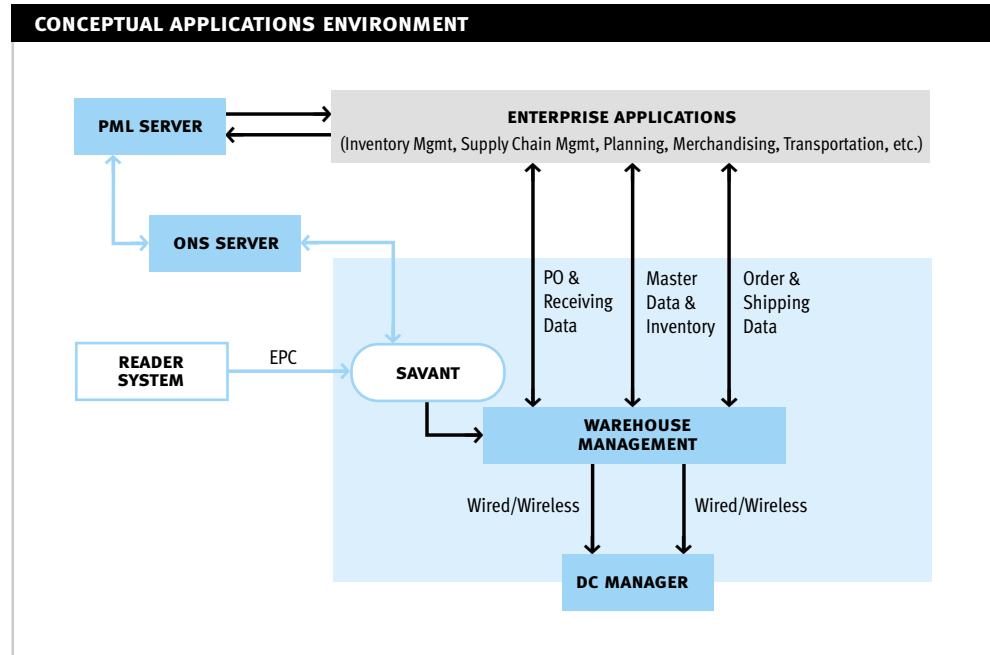
COVERAGE AREA	HOW IT WORKS	BENEFITS	RESULTS
1. RECEIVING	<ul style="list-style-type: none"> – Reads pallet-level and case-level tags as product is moved off the truck and into the receiving area – Verifies match between pallet ID tag and cases on pallet, and source of product and purchase order – confirms receipt 	<ul style="list-style-type: none"> – Eliminates manual steps to enable faster and more accurate receiving process 	<ul style="list-style-type: none"> – Less labor – Better information accuracy – Improved throughput – Higher asset utilization – Reduces returns/claims – Improves customer service levels
2. FORKLIFT/ ORDER PICKER	<ul style="list-style-type: none"> – Reads case tags as product is taken from location and placed on a pallet or belt (case picking) – Integrates with WMS to validate product and picking quantities, updates inventory 	<ul style="list-style-type: none"> – Eliminates manual steps to count and record picks – Eliminates time spent correcting error – Improves order line fill rate 	
3. CONVEYOR	<ul style="list-style-type: none"> – Reads case tags as product passes reader on belt – Integrates with WMS and conveyor control to divert product and record transaction 	<ul style="list-style-type: none"> – Does not require line of sight – Eliminates time spent correcting no reads 	
4. SHIPPING	<ul style="list-style-type: none"> – Reads pallet-level and case-level tags as product is onto the truck moved – Integrate with the WMS to confirm product, customer, truck, load sequence 	<ul style="list-style-type: none"> – Eliminates manual steps to enable faster and more accurate loading – Enables direct loading from pick 	

It is assumed that the layout applies to both manufacturer and retailer warehouses. However, for the cost assumptions we assumed larger retail warehouse dimensions and capacity in comparison to the manufacturer warehouse. Consequently, the number of readers, antennas and the extent of storage required will be greater in the retail warehouse. It is assumed that the reader system investments in a warehouse do not differ significantly for item and case-level tagging.

Table G in the Appendix provides estimates for non-recurring fixed technology implementation costs for the typical single manufacturing and retail DC and for the entire system of 10 manufacturing and five retail DCs. The costs are estimated for case-level implementation. As mentioned above, the costs do not vary significantly for item-level tagging. See Table H in the Appendix for key cost assumptions.

True benefits of the Auto-ID system can only be obtained if there is tight integration between the Savant™ and other applications within the enterprise. Modifications of existing systems and development of new functionality would be necessary to support additional receiving, picking and shipping functionality. Figure 9 depicts the Auto-ID conceptual applications environment in a DC setting.

Figure 9



From a technology viewpoint, implementing an Auto-ID system will require the DCs to assess their current technology assets, and develop a migration and investment plan to move to the new environment. Each DC must carefully design requirements related to reader systems, assess incremental storage and data mining needs, and enhance or implement software applications to provide true Auto-ID enabled capabilities.

5. CONCLUSION

5.1. Answering the Challenge

Adopting Auto-ID provides a tremendous opportunity for companies to improve labor efficiencies, increase throughput, and increase accuracy in all areas of their distribution network. At the pallet and case level, the business case is compelling for our “representative supply chain”, and therefore, likely to be equally compelling for most consumer goods and retail companies. Many companies will find strong cases for item level tagging as well, even at today’s current cost of ownership for the technology.

Current processes, systems, disciplines, capabilities, and the specific characteristics of the value chain and its products all play a role in the migration path, the business case and the timing of the adoption decision. Benefits that are obtained through increased trading partner collaboration are “icing on the cake”.

Auto-ID has the promise of even greater transformational power. As the open standards become available, adoption accelerates, costs decline and information is shared throughout the value chain, this promise will become a reality.

APPENDIX

Table A: Total Distribution Benefits of Pallet Level Auto-ID Implementation for ABC Manufacturer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
PALLET	Theft Reduction	\$0.1
	Claims/Returns Reduction	\$0.8
	Labor Reduction	\$1.8
TOTAL SAVINGS		\$2.7

Table B: Total Distribution Benefits of Case Level Auto-ID Implementation for ABC Manufacturer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
CASE	Theft Reduction	\$0.8
	Labor Reduction	\$5.0
	Claims/Returns Reduction	\$3.9
	Annual Carrying Cost Reduction	\$2.6
	One-time Transportation Reduction	\$7.8
TOTAL SAVINGS		\$20.1

Table C: Total Distribution Benefits of Item Level Auto-ID Implementation for ABC Manufacturer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
ITEM	Theft Reduction	\$2.3
	Labor Reduction	\$5.0
	Claims/Returns Reduction	\$11.8
	Annual Carrying Cost Reduction	\$5.2
	One-time Transportation Reduction	\$15.5
TOTAL SAVINGS		\$39.8

Table D: Total Distribution Benefits of Pallet Level Auto-ID Implementation for XYZ Retailer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
PALLET	Theft Reduction	\$0.1
	Claims/Returns Reduction	\$0.8
	Labor Reduction	\$2.9
TOTAL SAVINGS		\$3.8

Table E: Total Distribution Benefits of Case Level Auto-ID Implementation for XYZ Retailer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
CASE	Theft Reduction	\$1.3
	Labor Reduction	\$14.3
	Claims/Returns Reduction	\$3.9
	Annual Carrying Cost Reduction	\$3.5
	One-time Transportation Reduction	\$10.5
TOTAL SAVINGS		\$33.5

Table F: Total Distribution Benefits of Item Level Auto-ID Implementation for XYZ Retailer's DC Network

	BENEFIT DESCRIPTION	DOLLAR BENEFIT TO OUR MODEL (IN \$M)
ITEM	Theft Reduction	\$3.9
	Labor Reduction	\$16.8
	Claims>Returns Reduction	\$11.7
	Annual Carrying Cost Reduction	\$6.9
	One-time Transportation Reduction	\$21.0
TOTAL SAVINGS		\$60.3

Table G: Non-recurring technology fixed costs (Cost in \$M)*

COST COMPONENTS	INDIVIDUAL DC		SYSTEM WIDE	
	ABC MANUFACTURER	XYZ RETAILER	ABC MANUFACTURER DC NETWORK (TEN DCS)	XYZ RETAILER DC NETWORK (FIVE DCS)
READER SYSTEMS, INFRASTRUCTURE, SOFTWARE INTEGRATION	\$0.8	\$1.3	\$4.3	\$4.9

Table H: Key Cost Assumptions

- The total costs shown in Table G include non-recurring costs for a generic manufacturing and retail DC. The non-recurring technology costs included are cost of reader systems, infrastructure and application integration. The assumptions around each of these different cost components are explained below.
- Reader systems costs include estimates for the cost of readers & antennas (including customization) and wiring costs.
 - Estimates have been developed using standard assumptions around the DC layout.
 - Reader/antenna costs are based on discussions and estimates provided by Auto-ID Center for Year 2003.
- Infrastructure costs include costs of implementing the Savant™ network and the cost of incremental data storage.
 - It is assumed that the Savant™ network will be available as freeware; the cost estimates will change if the software is licensed or sold by a third-party.
 - The Savant™ infrastructure needs and the storage requirements have been based on the volumes of cases transacted through the DC. However, the estimates can vary significantly based on the type of implementation, the data storage policies and current infrastructure.
 - No incremental internet/intranet related bandwidth costs have been included as a consequence of this implementation; the cost model will change if additional bandwidth investments need to be made.
- Software integration costs include the cost of basic interfaces, modifications and incremental reporting functionality envisioned as part of this implementation. These costs have been developed assuming the DC has a fairly sophisticated systems environment in place. These costs can vary dramatically based on existing information systems capabilities, the degree of integration required, effort required to roll-out the implementation to other DCs in the network, and the specific training and change management needs of individual companies
- These costs have been developed for the generic DC as part of the defined supply chain system. Cost of implementing this technology in an actual DC environment will vary.

