

# PWC CONSULTING

## Focus on Retail: Applying Auto-ID to Improve Product Availability at the Retail Shelf

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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...

PwC Consulting, 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.

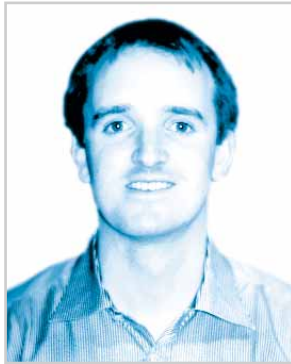
We are confident that you will be excited about Auto-ID and we urge you to consider its power to transform your own organization, as well as those of your trading partners.

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### Biography

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**Keith Alexander**  
Consultant

Keith Alexander, Consultant, Strategy Practice. He has over 6 years of international consulting experience in North America, South America and Europe. Keith works with clients in assessing the impact of supply chain technologies on business operations and shareholder value. He has worked for clients in the Consumer & Industrial Products and Utilities Industries. His key areas of focus include: supply chain strategy, emerging technologies, corporate strategy and performance improvement. Keith received a B.Sc. in Management from Aston Business School (UK), and an M.A. in Organizational Theory from Keele University (UK).



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Director

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**Kathryn Gramling**  
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**Herb Kleinberger**  
Global Retail Leader

Herb Kleinberger, Global Retail Leader. He has over 18 years of experience in process and technology strategy consulting. Specializing in retail business process improvement, Herb works with clients to evaluate and transform their operations to improve customer service and profitability – focusing on supply chain management, performance measurement merchandise planning and distribution and the buying process in retail companies. Herb earned B.A. in Computer Science from the State University of New York, and a MBA from the Wharton School.



**Stephen Leng**  
Principal Consultant

Stephen Leng, Principal Consultant, Consulting Strategic Change Practice. He has spent 20 years working in the Retail Industry, both in Europe and the Americas. He has held senior positions with a leading UK retailer in both supply and demand chain management, and for the last five years has led a number of retail projects in operational and corporate strategy, process improvement and systems implementation. Stephen has an MBA in Strategy, a postgraduate diploma in Marketing and a Dual Honors degree in Philosophy and Politics.

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Principal Consultant

Dhaval Moogimane, Principal Consultant, Technology Strategy Practice. He 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.



**Maurice Woods**  
Principal Consultant

Maurice Woods, Principal Consultant, Corporate and Operations Strategy Practice. He 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.

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## 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?"

PwC Consulting 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, PwC Consulting 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 \$1.75<sup>1</sup>. 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.

[PwC Consulting's 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.](#)

<sup>1</sup> Source: PwC 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.

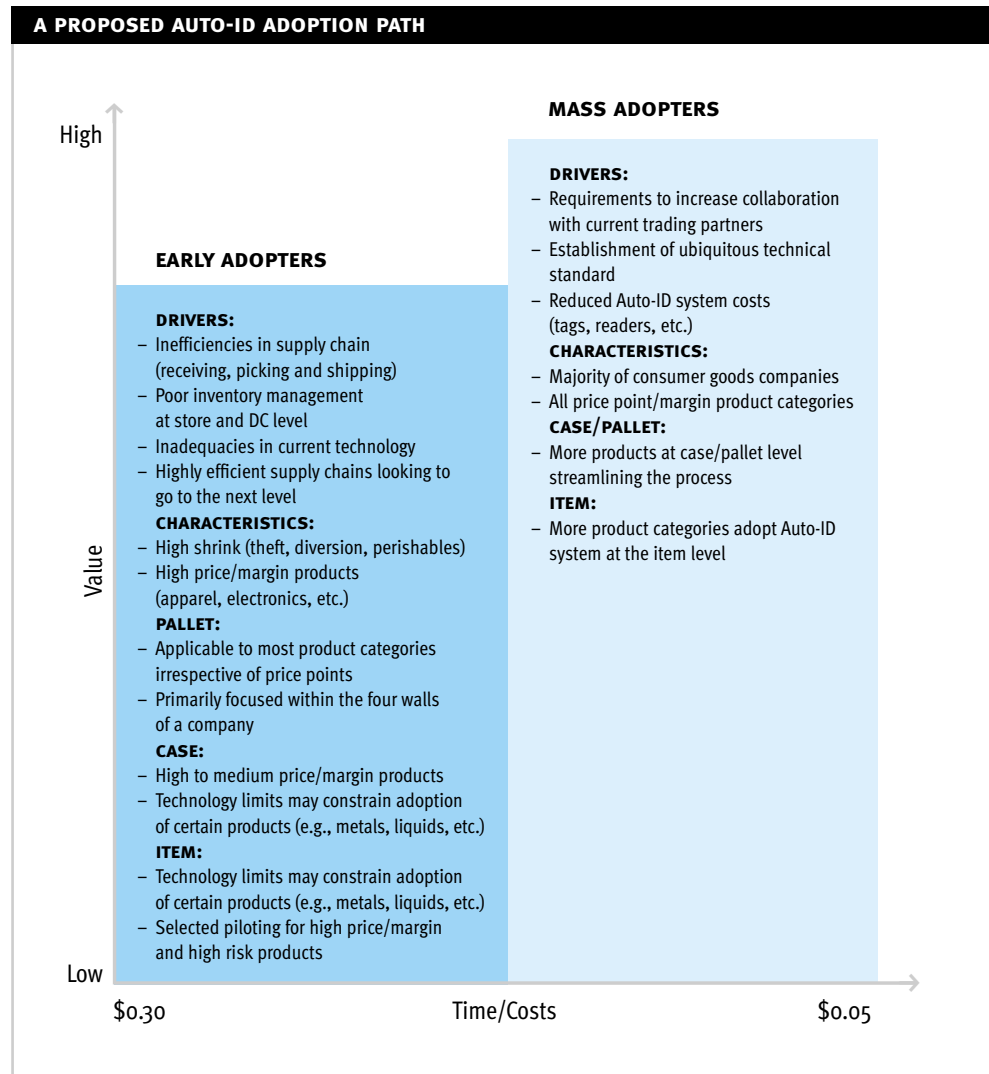
In the subsequent sections of the Auto-ID Prelude, we will introduce:

- PwC Consulting's proposed generic adoption path for Auto-ID technology
- The Business Case for Auto-ID
- The PwC Consulting 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

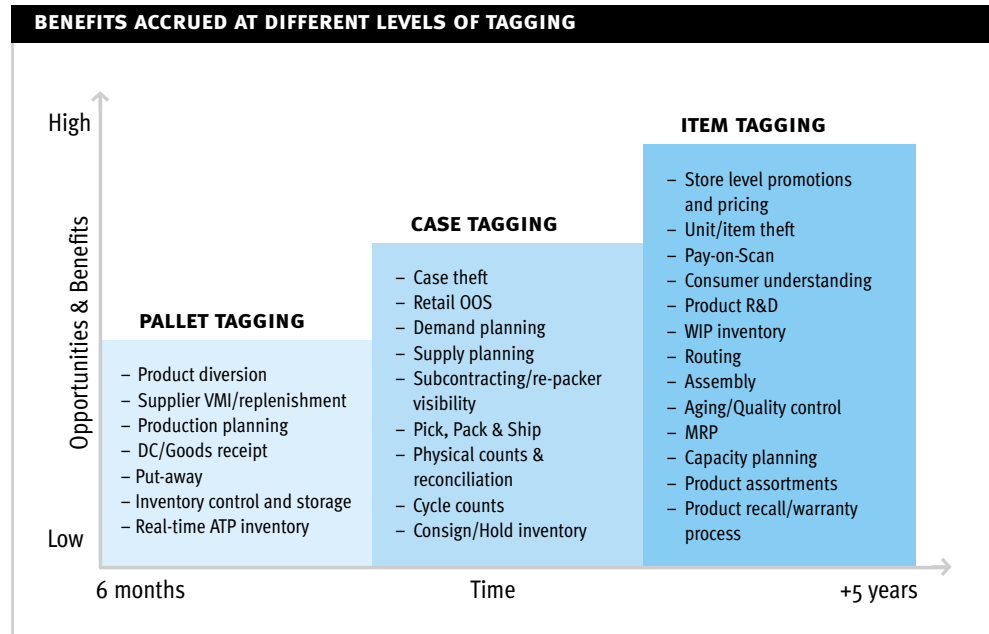


We have identified key company drivers and characteristics that lend themselves to various adoption strategies. In general, early adopters will tend to be those that can improve supply chain efficiency and inventory management by implementing Auto-ID at the pallet and case level within the four walls 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

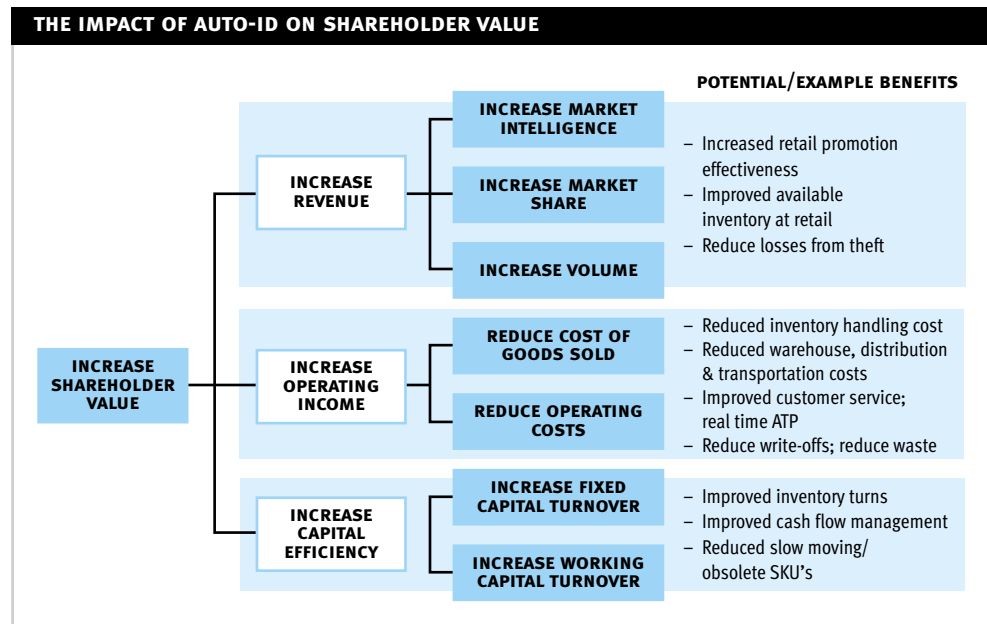


## The Business Case for Auto-ID

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, PwC Consulting surveys such as the Industry Week-Census of Manufacturers Survey, interviews with participant companies, PwC Consulting’s 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 PwC Consulting 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"> <li>– 100 million cases</li> <li>– Average COGS = \$15.55/case</li> </ul>	<ul style="list-style-type: none"> <li>– 40 million cases</li> <li>– 50 dock doors</li> <li>– Average COGS = \$15.55/case</li> <li>– Revenue = \$25.90/case</li> <li>– Inventory value = \$51.8 million</li> </ul>	<ul style="list-style-type: none"> <li>– 80 million cases</li> <li>– 100 dock doors</li> <li>– Average COGS = \$25.90/case</li> <li>– Inventory value = \$138 million</li> </ul>	<ul style="list-style-type: none"> <li>– 500,000 cases/store</li> <li>– 20 items per case</li> <li>– Average sales per case = \$35</li> <li>– Revenue = \$175 million</li> <li>– Inventory value = \$719,500 million</li> <li>– 85% of inventory on shelves, 15% in the back room</li> </ul>
SYSTEMS	<ul style="list-style-type: none"> <li>– 4 plants</li> <li>– Total of 400 million cases</li> <li>– Total COGS = \$6.2 billion</li> <li>– Total revenue = \$10.4 billion</li> <li>– Gross Profit Margin = 40% of sales</li> <li>– 400 employees at each plant</li> </ul>	<ul style="list-style-type: none"> <li>– 10 Mfg DC’s</li> <li>– 70 cases/pallet</li> <li>– 12 turns</li> <li>– Total inventory value = \$518 million</li> </ul>	<ul style="list-style-type: none"> <li>– 5 Retailer DC’s</li> <li>– 15 turns</li> <li>– Total inventory value = \$691 million</li> </ul>	<ul style="list-style-type: none"> <li>– 800 stores</li> <li>– Total sales = \$14 billion</li> <li>– Total COGS = \$10.4 billion</li> <li>– 18 turns</li> <li>– Gross Profit Margin = 26% of sales</li> <li>– Total Inventory = \$575 million</li> </ul>

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 thereafter
- 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 thereafter

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

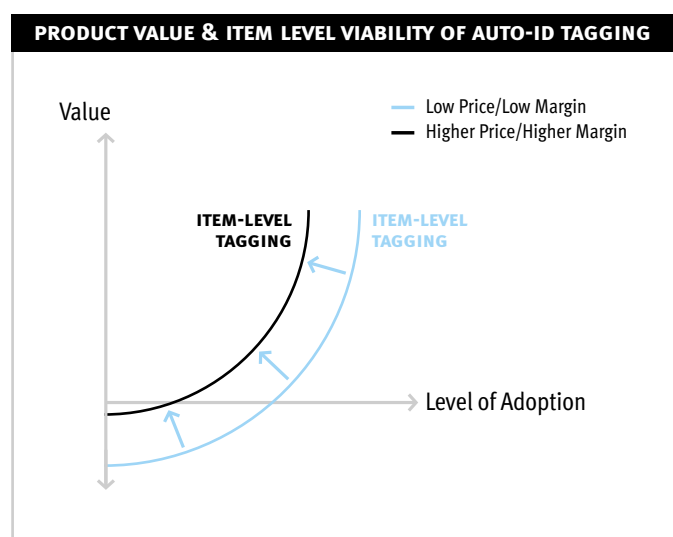
Our analysis indicates that there is a positive NPV of \$4MM for pallet-level tagging using tag estimates provided by Auto-ID. At \$170MM for the same scenario, the business proposition for case-level tagging is even more compelling.

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. PwC Consulting 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, PwC Consulting 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

PwC Consulting 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 PwC Consulting. PwC Consulting 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:

- PwC Consulting's 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 Perennial Problem

<sup>1</sup> Based on various industry studies, company interviews and PwC analysis

<sup>2</sup> "The Retail Problem of Out of Stock Merchandise", The Coca-Cola Retailing Research Council, 1996

<sup>3</sup> "Convenience Store News Out of Stock Study", Convenience Store News

Historically, out of stocks (OOS) have posed a significant challenge for both retailers and consumer goods manufacturers as they seek to maximize product availability and enhance the consumer shopping experience. However, while both sides have devoted considerable effort, technology investments and resources over recent years to solving this perennial problem, out of stocks estimates in the grocery environment, for example, still run between 5 and 10% – resulting in lost sales to the retailer of approximately 3 to 4% <sup>1</sup>.

The value chain model that we have created to support these White Papers is based on the grocery environment. While we acknowledge that out of stocks is an industry-wide issue, our focus is on grocery retailers.

Significantly, out of stocks are not "democratic" in their impact; they do not affect all product lines equally. In grocery stores, the fastest moving 25% of items account for 66% of lost sales <sup>2</sup>, with promotional lines typically the most adversely affected, averaging an out of stock rate on advertised items of 15% <sup>2</sup>. Therefore, for supermarkets that go to market with a high/low pricing strategy, poor availability of promotional products represents a significant weakening of their overall consumer offer. Of concern to all grocery stores though is the fact, highlighted by many of the industry studies reviewed, that product availability at the retail shelf is weakest during weekly peak trading periods.

Unfortunately for both manufacturers and retailers, industry research has shown that consumers are not indifferent to out of stocks. In fact, a survey of consumer "dislikes" rated out of stocks third overall <sup>2</sup>. While actual figures vary by region and product category, consumers refuse to buy an alternative on average 34% of the time <sup>2</sup>. Given that industry trends indicate that consumers are growing more

promiscuous in their shopping habits – with an increasing number of opportunities and choices for purchasing – dissatisfaction can quickly translate into lost consumers for retailers and manufacturers alike. (Previous studies have estimated that out of stocks cost the average grocery retailer between 0.3% and 0.5% of its consumer base each year <sup>2</sup>.) Few studies have been done to date on how many “out of stock” occasions translate to a change in shopping habits. However, a review of consumer behavior conducted by the National Association of Convenience Stores concluded that a consumer would typically stop shopping at a convenience store after encountering an out of stock 2.4 times, on average <sup>3</sup>.

Good product availability has always been one of the cornerstones of successful retailers and achieving it has never been more critical. In a largely mature global retail market, opportunities for growth, outside of acquisition, are proving harder to achieve. Further, the convergence of a wide range of industries all seeking to extend their relationship with the consumer is creating a growing threat to all retailers as they seek to sustain the consumer loyalty that they have traditionally enjoyed.

In response, retailers are engaged in a two-pronged strategy that is focused on their asset base. First, they want to more closely align their offer to the needs of their consumers, wherever and whatever the point of contact. For stores, this increasingly means customizing their offer to suit each individual location. Second, retailers want to squeeze operating costs and inventory levels at all points in the value chain to help drive their bottom line and overall competitiveness. High product availability at the retail shelf is critical to this part of the strategy and is an important “health check” to the effectiveness of the second part.

## 1.2. The Missing Link

To facilitate their strategy, retailers continue to invest in a wide range of technology and process solutions – from new planning and forecasting capabilities, to replenishment systems and computer aided ordering, to space management and more in-depth collaboration with suppliers.

However, there is a missing link between these investments and solving the out of stocks problem. This link is product visibility. Product visibility at all points in the value chain remains fractured to all parties, even when these new technologies and processes have been deployed. Why? Because crucial assumptions – on which retailers base replenishment algorithms and labor allocation – are made about product quantity and location in the absence of accurate and timely knowledge.

Auto-ID radio frequency based solutions seek to provide this missing link by maintaining constant visibility to the individual pallet, case and item, whatever their location in the value chain so that product supply systems can maintain integrity, and order and replenishment processes can be focused on “real-time” requirements.

## 2. WHERE DOES IT HURT?

### 2.1. Out of Stocks Pain Points and Auto-ID Remedies

Industry research, supplemented by our experience as well as many interviews with retailers and manufacturers, shows that, perhaps not surprisingly, there is no single cause of out of stocks on the retail shelf. Instead, there are a number of pain points along the value chain which all contribute, to varying degrees, to out of stocks. However, the majority of these all share a common characteristic – a lack of accurate and timely visibility to product movement.

**A few typical industry quotes demonstrate this point:**

- “I don’t know how my out of stocks are occurring during the day.”
- “I’m not always sure if I’ve actually got the product I ordered or where it is in the store.”
- “Our store managers don’t believe the DCs always send the right products or quantities but they have to accept the transfer anyway.”
- “Even knowing what gets stolen would be a big benefit for me, just in terms of getting my inventory position accurate.”
- “I use automated ordering, but the cycle counts I do to keep the on-hand position up to date often make the situation worse.”

It would not be an exaggeration to suggest that this lack of visibility can negate the impact of sophisticated ordering systems and technologies that are specifically designed to improve replenishment and reduce out of stocks.

Moreover, without confidence in technology and process, the retailer’s ability to track and understand the root causes of out of stocks becomes anecdotal at best. For example, “We think 30–50% of our out of stocks are caused by poor in-store replenishment, but we really aren’t sure.” As a result, the retailer’s ability to address the causes is diminished.

In general terms, there are three root causes of poor product availability on the retail shelf. These causes can be simply described:

1. The product did not get to the store.
2. The product got to the store, but did not get to the shelf.
3. The product got to the shelf, but was not recognized as a sale.

Most studies and PwC Consulting’s experience suggest that upstream supply chain issues only contribute between 12% and 15% of the problem. This figure reflects the successful efforts both retailers and manufacturers have made over recent years in automating the movement of goods between storage facilities. The third root cause relates primarily to internal and external theft issues. This cause will be dealt with separately in a later White Paper.

We believe, therefore, that the majority of the problem is related to the second root cause, often characterized as the “last fifty feet of the value chain”. The processes of “in-store execution” provide the focus of this White Paper and are dealt with in-depth within the following section.

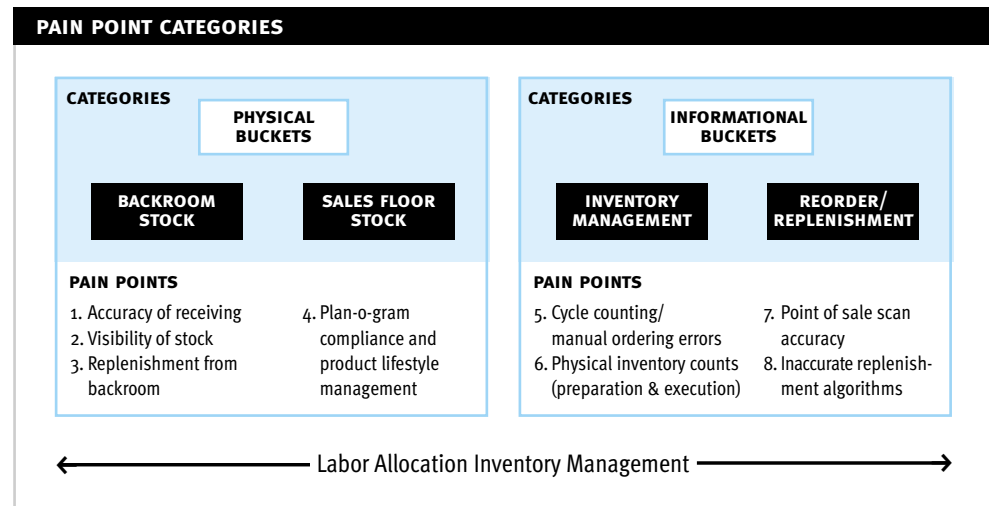
## **2.2. Where Does It Hurt ... Exactly?**

Analysis of in-store execution processes revealed a number of discrete pain points, some of which create out of stocks, while others amplify the impact of these causes through poor communication of stock requirements. These pain points are described as follows:

1. Receiving accuracy
2. On-hand stock visibility
3. Replenishment from the backroom
4. Plan-o-gram compliance/product lifecycle management
5. Cycle counting/manual ordering errors
6. Physical inventory counts (preparation and execution)
7. Point-of-sale scan accuracy
8. Inaccurate replenishment algorithms.

In Figure 6, we have grouped these pain points into four broad categories.

Figure 6



Our research has led us to believe that enhanced visibility throughout the store will directly address, to differing degrees, each of the pain points identified. Moreover, there are significant benefits from reducing the labor expended in these processes and additional benefits in the form of inventory reduction carried in the whole value chain. This will come from a reduction in “safety stock” as both retailers and manufacturers leverage increased visibility of product movement to determine better when product needs to be created, moved or replenished.

### 2.3. How Auto-ID Will Address the Retail Pain Points

Our approach in this white paper is to describe each pain point in turn and identify the specific ways in which Auto-ID solutions will work to alleviate the pain. Two “levels” or “stages” of solution are considered throughout this paper – deployment of case-level tagging, and, at a more granular level, deployment of item-level tagging. Each has its own value proposition, although our analysis has shown that case-level tagging can be characterized as having maximum benefit when the case is the primary unit of product movement, while item-level tagging achieves maximum benefit when the individual item “comes into contact with the consumer,” namely, when it is handled, purchased or returned.

Figure 7

RELATIONSHIP BETWEEN RETAIL PAIN POINTS AND THE LEVEL OF TAGGING APPLIED				
PAIN POINT			LEVEL OF AUTO-ID ADOPTION	
			CASE	ITEM
PHYSICAL BUCKETS	BACKROOM STOCK	1. Receiving Accuracy	X	X
		2. Stock Visibility	X	X
		3. Backroom Replenishment	X	X
	SALES FLOOR STOCK	4. Plan-o-gram Compliance/ Product Life-cycle Management	X	X
INFORMATIONAL BUCKETS	INVENTORY MANAGEMENT	5. Cycle Counting/Manual Ordering	X	X
		6. Physical Inventory Counts		X
	REORDER/REPLENISHMENT	7. Point of Sale Scan Accuracy		X
		8. Replenishment Algorithm Accuracy		X



## 1. Backroom Stock: Receiving Accuracy

### Pain Points

Today, when a store receives product shipped from its distribution center, it will do one of two things: it will either conduct a time consuming and manually intensive process to verify that the product matches the ship list before accepting receipt of the product and adding it to the store's on-hand inventory record, or it will skip this process and automatically receive the shipment "as is." The more time-consuming approach helps to keep inventory accurate and addresses mis-ship problems immediately, which could relieve cycle-count and inventory-adjustment problems later down the line. The downside to this approach, though, is the time and cost incurred in this process.

**"Retailers today must make a trade-off between cost and accuracy."**

The decision to proceed one way or the other is usually a function of the quantity of product received and the value of the product involved. For the majority of the products received by most retailers, the cost of physically checking the accuracy of all the cases delivered is too great. However, in bypassing the verification process, stores accept a certain degree of error, which leads to inventory inaccuracy. Although many of the retailers that we interviewed felt that their accuracy was as high as 99%, even a 1% error rate is significant when you consider the volume of receiving transactions that occur each week at each store.

Retailers will make an exception to the "blind" method of receiving product when dealing with the high-value, single-item product. In this case, high-value items are often picked and shipped in mixed cases but billed as single units, such as health and beauty care products, over the counter drugs, cigarettes and magazines. For these products, many retailers spend a great deal of time on the physical check-in and verification of actual quantities and items at the point of receipt.

In short, retailers today must make a trade-off between cost and accuracy. Most choose to sacrifice accuracy to save on the cost in most circumstances. However, this approach to receiving contributes to perpetual inventory discrepancies at the store level.

### The Auto-ID Remedy

The Auto-ID system essentially eliminates the need to make this difficult trade-off decision; you get accuracy at virtually no cost. For the vast majority of products received, case-level tagging is sufficient to ensure accuracy. The process will work as follows.

As pallets are unloaded from the truck and brought into the back of the store, the RFID reader located at the store's back door reads the pallet tag and all the individual case tags for the cases loaded on that pallet. By reading both the pallet and the case tags, the system automatically verifies that all the cases that should have been loaded on that pallet are indeed there, and that there are no discrepancies due to theft, mis-picks or mis-shipments.

At the same time that the product is scanned and received, the received product quantities are automatically added into the backroom storage on-hand inventory based on what was scanned by the reader, not on what the shipping list indicates. Any discrepancy between the shipping list and what was actually scanned at the back of the store will generate an immediate exception error notification that the store could then act upon and resolve immediately with the distribution center. Discrepancies could be categorized and tracked for root-cause analysis and preventative planning. Product theft, for example, could be quickly identified and addressed.

The use of Auto-ID tags and readers at the case level thus dramatically reduces the need for manual verification. For high-value items shipped as single units, a unit-level application of Auto-ID tags will provide an additional layer of benefit. The ability to read item-level quantities at the time of receipt automates the current, very time-consuming verification process.

Figure 8

RECEIVING ACCURACY				
	TRANSFER STOCK	UNLOAD DELIVERY	CHECK PRODUCT	MOVE TO SHELF OR BACKROOM
CURRENT PROCESS	Automatic on DC dispatch	Manual task	Manual verification	Physical task
AUTO-ID PROCESS	Automatic on receipt	No change	Not required	Automated direction

## 2. Backroom Stock: Visibility of Stock

### Pain Points

Once the product has been received into the back of the store, the next big challenge that retailers face is maintaining visibility of backroom inventory so that when restocking becomes necessary, it can be performed quickly and effectively.

Today, when a retailer approaches, or reaches, an out of stock condition on the sales floor, they face two challenges. First, they need to know if the product that needs restocking is available in the back of the store and, second, if it is available, they need to know where it is located. For example, a retailer may know that it received a shipment of product from the distribution center at 6 a.m. in the morning before opening. However, by later in that same day, when restocking becomes necessary, the store may not know whether all of the product has already been stocked on the shelves. As a result, store personnel may waste time searching the back of the store to locate product that is not even available. The problem of stock visibility increases significantly for those retailers who traditionally store product on racking or overhead above the sales floor. In a do-it-yourself store environment, for example, pallets of product could be located away from the section they are there to replenish – depending on the volume stored and the decisions of the replenishment team. Meanwhile, the time spent looking for non-existent product could have been put to better use locating and stocking product that was available and also needed to be stocked.

[“Using the Auto-ID system for case-level tagging will give retailers the ability to track, in real time, product availability in the backroom and temperature controlled areas.”](#)

The most common response to this problem is to maintain minimum levels of inventory in off-shelf stock locations. With this approach, stores attempt to fine tune their ordering and stocking procedures so that product received from the distribution center bypasses the backroom and is immediately stocked on the shelves. However, based on feedback from our interviews, accomplishing this is much easier said than done. For example, seasonal variations can lead to fluctuating levels of backroom inventory, making it difficult to maintain product visibility that, in turn, can cause greater levels of out of stocks and labor costs. Interestingly, our experience has shown that there is an inverse relationship between levels of inventory carried in the backroom and product availability on the shelf.

As the number of hand-offs necessary to maintain backroom control increases, challenges to sustaining backroom organization pile up and are further complicated by high employee turnover levels in the retail industry. Managing backroom inventory becomes a constant battle as weaknesses in backroom controls directly impact the product availability on the shelf.

### The Auto-ID Remedy

Auto-ID meets this challenge through case-level tagging by placing Auto-ID readers at the doors separating the backroom from the sales floor and at the doors to backroom temperature controlled storage areas.

In an ideal backroom layout, all products would be stacked and stored in a user-friendly fashion that would enable easy visibility of all products. But this is not always the case, particularly during seasonal fluctuations that require larger quantities of backroom safety stock to cover sales between deliveries. Once product is stored in pallet quantities with mixed cases, the visibility is lost, and the degree of difficulty and amount of labor required increase exponentially. This is often true in the walk-in freezers and coolers of supermarkets. Often, mixed cases are shipped on pallets and space constraints do not allow for product to be stacked single-case deep for maximum visibility. Searching for particular product quickly turns into a guessing game.

If each of those storage areas had an Auto-ID reader at their doorway to create a smart cooler or freezer, the ability to maintain a perpetual inventory could become a reality. For example, when a case of product is moved from the backroom to the sales floor for restocking, the reader will capture that product movement and alert replenishment staff to the new backroom stock figure.

In addition, Auto-ID will allow stores to locate the exact position of product in the backroom and temperature controlled areas, although this will require additional readers to cover specific backroom zones. Stock clerks also could use handheld devices to read case Auto-ID tags and quickly find specific cases without line of sight. This approach will also require developing specific processes to define backroom layout and to monitor and maintain backroom organization to provide a fully compliant environment.

Using the Auto-ID system for case-level tagging will give retailers the ability to track, in real-time, product availability in the back storeroom, including temperature-controlled areas. Case-level tagging will reduce problems associated with overstocking on the sales floor or being too reliant on multiple daily shipments from the DC. Case-level Auto-ID will provide much increased product visibility and finally enable store level personnel to distinguish between backroom on-hand quantities and sales-floor quantities on a continuous basis.

When applying Auto-ID at the case level, it is important to minimize partial-case occurrences because of the lack of visibility that results; however, in a typical supermarket, mixed and partial cases of product are a reality. For example, a push to increase the range of products offered on shelves with limited capacity will inevitably result in partial or mixed cases of products being sent back to the typical backroom. This creates a more challenging and costly situation for restocking because once product is stored in less-than-case quantities, it requires multiple handlings before it can be stocked on the shelf. Auto-ID readers will track full cases that are removed from the sales floor and sent from the sales floor to the backroom. To track mixed cases and single units will require individual, item-level Auto-ID tagging. In the area of high-value products such as over-the-counter drugs, batteries and film, this added ability would simplify restocking which is a labor-intensive activity.

Figure 9

BACKROOM VISIBILITY		
	→	
	PUT STOCK AWAY	MANAGE STOCK
CURRENT PROCESS	Fixed location	Manual count
AUTO-ID PROCESS	Random & prioritized location	Traffic management

### 3. Backroom Stock: Replenishment from Backroom

#### Pain Points

Having a complete, real-time picture of the inventory available for restocking does not necessarily reduce the rate of out of stocks if the retailer still does not know which items on the sales floor need to be stocked to begin with. This is the next step in the process that causes retailers considerable pain and, in fact, may be the single greatest cause of out of stocks. Most retailers are simply unable to identify when an item is approaching, or has reached, an out of stock condition until it is too late. Often, the store doesn't know that there is an out of stock problem without a visual check of shelf conditions. Even worse, the first indicator of out of stocks sometimes comes from disgruntled consumers notifying a checkout clerk or store manager that a particular item is unavailable.

“Most retailers are simply unable to identify when an item is approaching, or has reached, an out of stock condition until it is too late.”

#### The Auto-ID Remedy

This pain point will be remedied most effectively with item-level tagging and Auto-ID readers located throughout the store. These readers will continuously monitor sales floor and shelf stocking conditions by reading the tags attached to every unique product available for sale. Readers and the associated antennas could be positioned in a number of ways depending on the level of sophistication of the store environment. A reader could simply be attached to the underside of the shelf, or it could be built into the shelf itself – creating a truly “smart shelf” which adjusts display information according to the product being read and the volume being sold. Every time a consumer removes an item from the shelf, the reader recognizes the movement and adjusts the shelf on-hand quantity. When the shelf on-hand quantity reaches a pre-determined minimum level, an automatic restocking order is sent to the backroom or to the D.C., depending on where the product is available. In this way, stores always know which items are approaching an out of stock condition, and they can react accordingly to prevent it.

Until every individual item has an Auto-ID tag – or if a retailer simply chooses not to invest in placing readers throughout the store – out of stocks conditions can still be monitored more effectively with case-tagging than with current manual processes. This process would involve using software applications that link the automated case tracking capability enabled by Auto-ID with real-time, point-of-sale (POS) data to create a virtual, perpetual inventory tracking system that calculates on-hand quantities down to item level on the sales floor. The inventory count for each cycle would be based on the previous ending inventory on-hand quantity plus the quantity of product that was moved through the backroom door to the sales floor (which is tracked through Auto-ID) minus any sales tracked through point-of-sale activity. This application, combined with item-specific sales rates, would determine which products are approaching an out of stock position.

Regardless of whether item or case-level tagging is in place, the system will have the capability to analyze all the restocking orders and create restocking priorities based on factors such as the availability of product in the backroom, value of the product, urgency of the condition, duration of the out of stock condition and promotional status of the item.

This prioritization could enhance management's ability to keep its scarce labor resources focused on the right restocking needs and prevent the highest-impact, out of stock conditions. For example, at any point, store personnel could call up a list of out of stocks to retrieve from the backroom. This list will automatically eliminate the need to walk the store to determine which items to replenish, and minimize the time spent looking for products that do not exist.

The accurate product visibility that Auto-ID provides to store staff will add even more value for retailers by eliminating a common situation that occurs when a consumer asks a sales clerk about the availability of a product that is not on the shelf. Many times the clerk will disappear into the backroom only to emerge several minutes later to tell the consumer that he or she could not find the product. In an Auto-ID world, clerks could use a hand-held device to determine, in seconds, both if the product is available and where it is located. This degree of certainty could, in many retail operations, be accomplished at the case level, but where product is stored in singles or in partial cases, the tagging application will be most effective at item level.

Figure 10

REPLENISH SHELF				
	WALK STORE	MAKE LIST OUT OF STOCKS	LOCATE PRODUCT IN BACKROOM	MOVE PRODUCT TO SHELF
CURRENT PROCESS	Manual check	Manual check	Manual search	Physical Task
AUTO-ID PROCESS	Not required	Not required	Not required	Not change

#### 4. Sales Floor Stock: Plan-o-gram Compliance and Product Life-cycle Management

##### Pain Points

Plan-o-grams are a constant challenge to maintain, particularly as retailers migrate to more store-specific assortments and wider product offerings. Today, the process for managing plan-o-gram compliance is often manual and very time consuming for both the manufacturer and the retailer. New item and discontinued item execution, whether it is for a single product or an entire line, requires coordination between the manufacturer and the retail buyer, and between the distributor and store manager to ensure proper compliance. Timing must be coordinated throughout the supply chain to ensure that product is available at the store before the reset, or as close to it as possible. However, if there is any lag time between the actual reset at the shelf and the arrival of the new product in the store, an out of stock will occur.

*“Auto-ID applications for plan-o-gram compliance will reduce the labor costs for both manufacturer and retailer in executing resets and monitoring compliance.”*

Retailers use a variety of approaches to minimize this problem. One solution is to ship a case of the new item to each store as a safety net before a reset can be executed but, often, the new items are lost in the backroom of the store, which delays getting the product to the shelf until the next reorder cycle. Another approach is to designate category captains from the manufacturer to execute the resets. This approach requires an even greater level of coordination between the manufacturer and the retail distribution center and stores.

The timely removal of discontinued items in the plan-o-gram reduces the chance for out of stocks, excess inventory and return-to-vendor processing. Retailers approach discontinued items in a variety of ways. One approach is to leave the product on the shelf until it sells out. Another approach is to mark down the price of the product and remove it from the shelf to open up space for new items. Some retailers send discontinued product back to the manufacturer through the reclamation process. For all of these approaches, it is still crucial to get the new product onto the shelf and remove the discontinued product's shelf label; otherwise, an order writer may continue to replenish the discontinued product and not order the new item, thereby creating an out of stock.

Finally, retailers face a challenge in maintaining plan-o-gram compliance in terms of required facings that adhere to minimum stock-level presentations. During the stocking process, product facings often erode – affecting automated reordering algorithms that are based on specific on-hand quantities. The assumed on-hand quantities of each product are based on the depth and height of the shelf capacity multiplied by the number of facings. If a facing is lost, an order could be generated that will create single-unit overstock and reduced shelf capacity. The reduced shelf capacity will affect holding capacity during peak selling periods leading to more out of stocks when stores can least afford them. Category management at the item and category level is based on measuring the effects of specific assortment and merchandising tactics on overall category results. The category manager is basing the results on the assumption that the plan-o-grams are in compliance. Unfortunately, our experience has shown that a few short weeks after a reset, a significant percentage of plan-o-grams are out of compliance. Therefore, in many cases, decisions about assortment and allocation are based on false assumptions and may be effected by execution gaps at store level.

### The Auto-ID Remedy

Auto-ID tagging, at both the case and item level, will provide improved capabilities for managing plan-o-gram compliance. The key advantage Auto-ID will provide is improved visibility. This improved visibility, when combined with specific applications, will provide confirmation of store-specific plan-o-gram compliance.

At the case level, Auto-ID will provide the ability to quickly locate new items in the backroom. This capability will also enable verification that cases of new items were received and transported to the sales floor. The real benefits for this pain point, however, come into play at the item level; Auto-ID will enable real-time monitoring of plan-o-grams and product life-cycle issues at the department, store, district, and total company level. The review of compliance issues and performance gaps could be conducted at store level or from remote locations. The ability to have real-time visibility of the shelves linked to a space management application will confirm new item placements on the shelf and, also, verify that minimum stock levels are being maintained on the shelf. This type of data analysis also will enable an exception reporting process that focuses on specific plan-o-gram compliance problems rather than an attempt to monitor the entire store plan-o-gram. Moreover, at the item level, Auto-ID will provide visibility of discontinued product on-hand quantities and enable retailers and manufacturers to determine the most effective and timely strategy for selling or removing product from the sales floor to make room for new items.

Auto-ID applications for new plan-o-gram executions will reduce the labor costs for both the manufacturer and retailer and support ongoing compliance. In this way, potential sales during the crucial new item introduction period are maximized.

At the case level, Auto-ID will provide the ability to generate exception reports that will minimize the time spent researching problem areas. Moreover, with Auto-ID, category management decisions will now be based on fully compliant plan-o-grams, thus minimizing the number of poor decisions that are currently driven by inconsistent plan-o-gram compliance. Ensuring plan-o-gram compliance down to the level of item-specific facings and minimum stock levels will provide category managers with unprecedented real-time visibility.

Figure 11

PLAN-O-GRAM COMPLIANCE AND PRODUCT LIFE-CYCLE MANAGEMENT				
	REMOVE DIS-CONTINUED ITEM	ADD NEW ITEMS	CHANGE SHELF TAGS	MAINTAIN PLAN-O-GRAM
CURRENT PROCESS	Manual check	Manual check	Manual check	Manual check
AUTO-ID PROCESS	Exception management	Exception management	No change	Exception management

## 5. Inventory Management: Cycle Counting and Manual Ordering Errors

### Pain Points

Today, retailers manage inventory and replenishment either automatically or manually. Each method has its own set of pain points.

Retailers who use an automatic replenishment system to manage inventory and reordering rely on the accuracy of on-hand inventory to minimize out of stocks and on-hand inventory while maximizing sales. This accuracy is based on the use of cycle counts to detect and correct on-hand inventory discrepancies that can erode perpetual inventory integrity. In real life, though, cycle counters are often faced with a choice between completing their audits in the time allotted and spending time to research and correct on-hand inventory discrepancies. When faced with this challenge, cycle counters may short-cut the process and simply adjust the inventory back to the amount visible at the shelf, which inevitably results in more products being ordered and the creation of excess backroom inventory which had been missed in the original count.

[“An Auto-ID-created level of visibility will support moving from a manual ordering process to an automatic replenishment program.”](#)

Meanwhile, the manual ordering process challenges the order writer to rely on memory or a physical check of backroom product inventory. Some retailers use an intelligent order entry capability that tracks backroom inventory on a PDA order device. This application displays for the order writer what products are on order, what products were ordered last and what product is in the backroom. However, this process relies on manually adding and deleting cases from the backroom inventory stored on the PDA order device – a cumbersome process that requires human intervention to maintain accuracy. Based on our research, some retailers use a color-coding system to designate what excess product is in the backroom. This approach requires placing a dot on the order tag at the shelf to indicate that additional cases of product are on-hand in the backroom. It works well when maintained but also requires human intervention; if the dot is not removed when the last case of product is stocked from the backroom to the shelf, the order writer will not order the product and an out of stock will occur.

### The Auto-ID Remedy

A case-level application of Auto-ID will address the pain points for both automatic and manual ordering processes. A more accurate view of on-hand backroom and sales-floor inventory at a case or item level will support more efficient stock management practices, although item-level Auto-ID will give retailers the added benefit of being able to locate and monitor product that has been removed from the case. With real-time visibility of item-specific, on-hand inventories, the human element required to maintain perpetual inventory integrity will be greatly reduced and automation of the process will be within reach. Also, the ability to quickly locate product in multiple locations on the sales floor will reduce the time spent researching discrepancies.

Having a complete, real-time picture of the sales floor and backroom inventory available at the item level while executing cycle counts or during manual re-ordering will improve order accuracy and reduce backroom inventories. Cycle counting based on a correlation of sales patterns, on-hand inventories in the backroom and on the sales floor will enable the automation of cycle counting, and also provide a more focused discrepancy report that will reduce the level of cycle counting required to sustain perpetual inventory data integrity. The visibility provided by Auto-ID will also support moving from a manual ordering process to an automatic replenishment program by minimizing the need for human intervention to maintain inventory integrity.

Figure 12

CYCLE COUNTING/MANUAL ORDERING				
	COUNT STOCK	CHECK SECONDARY LOCATION AND NON-SALES FLOOR STOCK	ADJUST STOCK RECORDS	CREATE ORDER
CURRENT PROCESS	Manual task	Manual task	Automated	Automated
AUTO-ID PROCESS	Not required	Not required	No change	No change

## 6. Inventory Management: Physical Inventory Counts (Preparation and Execution)

### Pain Points

Many retailers still rely on at least one or two complete physical inventories annually. This inventory process has an impact on retail out of stocks to varying degrees. As retailers shift their focus from consumer service, production and restocking to preparing for inventory, out of stocks do increase. Often, store-level management desires to reduce on-hand inventory to make the inventory count simpler but this only leads to additional out of stocks. Moreover, the labor constraints at retail often require management to shift tasks that maintain in-stock levels to tasks such as inventory preparation and counting. This shift in labor resources also contributes to out of stocks before, during and right after the inventory. The cost to execute any physical inventory is extensive, especially if it is verifying not only retail value of the inventory but also the specific item level as well.

[“Item-level Auto-ID systems will allow the readers to instantly read the entire store.”](#)

### The Auto-ID Remedy

With case-level Auto-ID, backroom, full-case, manual inventory counts will be minimized. However, we believe that the greater benefit will come from item-level Auto-ID applications. Item level Auto-ID systems will allow the readers to instantly read the entire store. Reading the inventory real-time will enable a retailer to capture existing inventory levels without manually counting. Based on our experience, prior to taking a physical inventory, retailers shift from a consumer focus to an internal operational focus as they prepare the store for the count. Applying Auto-ID to this pain point will allow retailers to eliminate any disruption to sales and to the consumer shopping experience.

Figure 13

PHYSICAL INVENTORY COUNTS				
	COUNT PREPARATION	LOCATE ALL STOCK	EXECUTE COUNT	RECONCILE COUNTS
CURRENT PROCESS	Manual task	Manual task	Automated	Semi-Automated
AUTO-ID PROCESS	Not required	Not required	Not required	Automated



## 7. Reorder/Replenishment: Point-of-Sale Scan Accuracy

### Pain Points

Many retailers still encounter problems with bar coding quality, which impacts scanning accuracy and causes product to be keyed in manually. When an item will not scan at the point-of-sale, a variety of issues arise, including the time spent resolving the problem, the impact on consumer satisfaction from waiting, the uncertainty of whether the right price ultimately is charged for the product, and the impact on data integrity. When retailers lose the ability to capture item-specific sales data, they sacrifice perpetual inventory accuracy. In an automated replenishment environment, this will result in a high rate of unexpected out of stocks.

“Item-level Auto-ID application will allow readers to identify and ring up items without line of sight to a bar code.”

Another impact occurs when the point-of-sale scan is based on an incorrect scan of multiple items by the cashier. Most retailers in an automatic replenishment environment have attempted to counter this problem by deactivating the multiple keys. But cashiers have found another approach to improve their scan productivity. They simply scan the item they first pick multiple times versus scanning each item individually. For example, the consumer may be purchasing six cans of soup, but the cashier simply scans the first item six times. The consumer is charged the proper retail price and the cashier can execute that task much faster without picking up each individual item, but the practice will reduce the on-hand integrity on multiple items. If this is a high-volume item, such as yogurt, the resulting out of stocks that occur until a cycle count corrects the problem will be extreme.

Manufacturers are aware of these execution issues and often cite them as reasons why initiatives such as “pay on scan” – payment for product as it is sold, as opposed to when it is delivered to the retailer – are not being adopted.

### The Auto-ID Remedy

An item-level Auto-ID application will allow readers to identify and ring up items without line of sight to a bar code. Auto-ID will facilitate near 100% accuracy of items scanned, and dramatically reduce the need for cashiers to pick up items and search for the bar code. Combined with revised checkout processes, the speed of the entire checkout operation could be significantly improved. With the proper configuration, the cashier could literally run multiple items over a read area, leaving tendering the form of payment as the most labor-intensive task. This application of Auto-ID will also create a more user friendly, shelf-checkout environment. Further, when this level of checkout accuracy is achieved and combined with the end-to-end value chain visibility that item tagging will give, the viability of scan-based trading will be enhanced significantly. The details of this concept will be developed in a future White Paper.

Figure 14

POINT-OF-SALE SCAN ACCURACY			
	HOLD PRODUCT	LOCATE BAR CODE	ACTION EXCEPTION POLICY
CURRENT PROCESS	Manual task	Manual task	Manual task
AUTO-ID PROCESS	Not necessary	Not required	Not required

## 8. Reorder/Replenishment: Inaccurate Replenishment Algorithms

### Pain Points

In continuous replenishment environments, a corrupt on-hand inventory file can dilute the benefit of even the most sophisticated replenishment algorithms. Yet there are currently many ways in which the inventory file can become corrupted. Theft alone can have a significant impact on the ordering accuracy of high-value items, while everyday store execution issues, such as incorrect keying during checkout, poor cycle counts and “lost” stock in the backroom, add to the inaccuracy of key data that automated replenishment systems depend on for their effectiveness. The results at the store level include the creation of out of stocks because the system is responding to a high false-inventory figure, insufficient shelf space being allocated because not all sales are being captured, and too much stock being delivered because back room or duplicate display stock has been missed in a cycle count.

“The on-hand inventory figure is constantly tracked and recalculated as the item moves through the store and at the point-of-sale.”

### The Auto-ID Remedy

An item-level application of Auto-ID minimizes the impact of these on-hand integrity issues. The on-hand figure is constantly tracked and recalculated as the item moves through the store and at the point-of-sale. Even at case level, knowing exactly what is in the backroom, verses on the sales floor, will help resolve the more dramatic on-hand inventory imbalances. Moreover, there is an additional business benefit here in that greater accuracy of the base data will allow a more objective evaluation of the effectiveness of the automated replenishment calculations to take place. Improvements to the algorithms could then be made which will further improve shelf availability by having more accurate replenishment quantities delivered to the store. For retailers who have traditionally rejected automated ordering on the basis that manual counting, checking and ordering produces more effective replenishment quantities, the deployment of Auto-ID will represent a powerful argument for automation.

Figure 15

REPLENISHMENT ALGORITHM ACCURACY			
	CALCULATE REQUIREMENT	FACTOR IN ON-HAND AMOUNT	CALCULATE REPLENISHMENT QUANTITY
CURRENT PROCESS	Automated	Based on assumed amount	Automated
AUTO-ID PROCESS	No change	Based on actual stock	No change

### White Paper Assumption

There is a key assumption that runs through our analysis of improving product availability at the retail shelf, namely, that retailers can rely on nearly 100% read accuracy of the combined process and technology system. This will also apply to manufacturers who use the scanning capability of Auto-ID to verify the accuracy of their loads prior to dispatch to the retailer. This is not to say that manual workarounds could not be developed to support RFID readings. Indeed, retailers may want to initiate secondary product verification on the loading bay of the store to allow for the return of damaged or poor quality product. However, such workarounds will directly affect the value of the technology and the streamlining of store processes.

### 3. THE BENEFITS CASE FOR PRODUCT AVAILABILITY

#### 3.1. Articulating the Benefits of Auto-ID in Improving Product Availability at the Retail Shelf

##### Approach

The PwC Consulting 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, 4 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 business case for the application of Auto-ID to improve product availability at the retail shelf references the volume and value assumptions made for the overall value chain business. These high level “system” assumptions are then augmented by more detailed assumptions covering store labor hours and costs, industry research concerning product availability, and assumed rates of sales loss due to out of stocks.

To quantify the benefits of Auto-ID application on product availability, each of the pain points was given a relative value (defined by its individual impact on product availability). For each value, the potential positive impact of Auto-ID application was estimated and, again, expressed as a percentage. From this, a total positive impact was generated in terms of improved sales and gross margin, and reduced store labor requirements.

The business case was developed at both the case and item level to provide insight into the likely adoption path. All detailed assumptions and pain-point valuations are shown in Appendix A. However, it is worth stating here that the assumption of lost sales due to out of stocks on the retail shelf was taken as 3% (although some studies have suggested it could be as high as 4%).

It should be noted that a conservative approach was also taken in estimating impact, and that actual benefits may be significantly higher. Benefits were developed for two areas:

- Sales improvements caused by improved product availability on the shelf, expressed as an increase in gross margin dollars
- Labor improvements from the reduction in manual activity, and elimination of manual processes

##### Benefits Summary

Shown below in Table 2 are the anticipated benefits from implementing Auto-ID at the case and item levels.

Table 2

ANTICIPATED BENEFITS AT THE CASE AND ITEM LEVEL IN \$000'S				
RETAILER BENEFIT	INDIVIDUAL STORE		SYSTEM WIDE (800 STORES)	
	Case-reading	Item-reading	Case-reading	Item-Reading
OOS Margin lift	\$43	\$74	\$34,400	\$59,200
Labor cost reduction	\$55	\$113	\$44,000	\$90,400
<b>TOTAL BENEFIT</b>	<b>\$98</b>	<b>\$187</b>	<b>\$78,400</b>	<b>\$149,600</b>

Benefits from implementing at item level are significantly above those of case level, reflecting the much higher impact of item-level tagging on product availability. Item tagging is estimated to resolve just over 50% of out of stocks caused by store execution issues compared to almost one-third at the case level.

<sup>4</sup> Food Marketing Institute

Likewise, item tagging was estimated to have twice the impact on store labor requirements as case tagging. We estimate that an average grocery store could reduce labor hours by just over 200 hours per week per store with item-level Auto-ID as opposed to just over 100 hours by employing the case-level tagging. Either way, applying Auto-ID will have a significant impact on overall labor costs as a percentage of sales. The industry average puts store labor at 11.2% of sales<sup>4</sup>. Item tagging improves this figure by 0.8%, and case tagging, by 0.5% according to our model.

Included in the labor cost savings at the item level is the elimination of the cost of hiring a third-party company to perform an inventory audit at a store. We estimate that the cost to perform this audit is just under \$3,000 per store and assume that two audits will be performed per year at each store. This translates into extra “labor” savings of more than \$4 million across the 800-store system.

Of course, actual labor savings will vary from retailer to retailer, but it is clear that Auto-ID offers new opportunities in process automation. Even “best-in-class” retailers that may have exhausted all the benefits of traditional approaches to labor optimization will still be able to generate additional savings through the deployment of Auto-ID technology.

Likewise, the actual impact on out of stocks will vary from retailer to retailer, category to category, and geography to geography. However, using the model we have created, an opportunity clearly exists to reduce lost sales due to out of stocks which, given the lack of progress over the last 10 years, will represent a dramatic improvement on previous initiatives.

### Costs Summary

The costs of deployment are shown below in Table 3. The costs exclude the cost of the tags, which are absorbed at the first place of use, typically the manufacturer. A detailed set of technology assumptions underpinning these figures is contained in Appendix B.

**Table 3:**

Note: The total costs shown for the Individual Store reflect the cost of deployment at the first store. The amortized cost per store reflects the average cost per store across all 800 stores in the system. See Appendix B for further explanation.

COST OF DEPLOYMENT IN \$000'S				
COST COMPONENTS	INDIVIDUAL STORE		SYSTEM WIDE (800 STORES)	
	Case-reading	Item-reading	Case-reading	Item-Reading
<b>TOTAL</b>	<b>\$465</b>	<b>\$827</b>	<b>\$49,672</b>	<b>\$282,368</b>
Cost per store (amortized costs)	\$62	\$353		

### Business Case – Payback Summary

Our analysis demonstrates that a business case for adoption at the case level is compelling, with break-even being possible with just a little over a 20% improvement in out of stocks combined with a reduction in a little over 60 hours per week, per store. Both figures are well within the estimated improvement levels we predict a retailer will achieve by adopting Auto-ID in this way.

Moreover, if labor benefits are achieved at the maximum level stated, then the out of stocks reduction will only need to be just over 5% to break even. Conversely, if the full reduction in out of stocks is achieved, then the labor reduction required to break even will need to be less than 40 hours per store per week.

At the item level, the break-even point occurs towards the end of year two, assuming that out of stocks and labor improvements are achieved as projected. It is worth noting, however, that this payback period can be achieved even before the many other item-level benefits of Auto-ID that will apply to the retail store are taken into consideration. For example, the same Auto-ID technology investment that is made to address the problem of product availability also will allow retailers to significantly reduce levels of internal and external theft that generally are estimated to represent approximately one to two percent of sales. Therefore, even a small reduction in theft would represent a meaningful increase to a retailer's gross margin and will dramatically enhance the payback timeframe. Benefits such as these will be examined in future white papers to be published by PwC Consulting and the Auto-ID Center.

#### Manufacturer Benefits

The focus of this paper has been on the benefits that will accrue for the retailer through the deployment of Auto-ID technology. This is based on our belief that upstream benefits alone will not drive retail adoption. However, through the deployment of Auto-ID to reduce out of stocks in the retail store, there are significant benefits that can be gained by the consumer goods manufacturer. In fact, our analysis shows that the manufacturer will achieve an additional \$19 million in benefit at the case level, and \$33 million at the item level (assuming the same system volumes outlined in the wider business case). These benefits are summarized below in Table 4.

Table 4

MANUFACTURER BENEFITS	
OUR MODEL CONSUMER GOODS COMPANY	(\$ AMOUNTS IN MMS)
Margin regained at case level	\$19
Margin regained at item level	\$33

#### Other Benefits of Auto-ID

This paper has focused so far on the hard, quantifiable benefits of deploying Auto-ID capability within the retail store. However, what is harder to quantify as we look forward to this new world, is the potential impact of a different level of value chain capability on overall business performance. These are traditionally classified under the heading of soft benefits, but, in reality, the benefits of Auto-ID are far more transformational in nature.

At one level, the increased accuracy, visibility and integrity of data available will allow the retailer to fundamentally reengineer how the store is organized, redefine labor resource priorities, and set new measures of performance. For example, in terms of product availability, store labor resources could be focused on managing availability, responding to system driven alerts of impending out of stocks, monitoring levels of promotion activity, and reviewing the effectiveness of labor allocation throughout the day. Quantifiable benefits will be driven by this new capability, but, bottom line, it is the consumer who will benefit the most by being able to buy the products they want when they want them.

This type of benefit can only help the retailer to build and retain consumer loyalty. Consumers today are growing more promiscuous in their shopping habits, and the proliferation of loyalty cards in any consumer's wallet or purse only serves to illustrate this fact. Factors such as price and shopping experience will influence consumers' preferences when deciding between competing retailers. However, research has shown that consumers will vote permanently with their feet when product availability is perceived as poor. As mentioned earlier, it has been estimated that that out of stocks cost the average grocery retailer between 0.3% and 0.5% of its consumer base each year<sup>2</sup>. For a retailer, these are consumers that they need not lose once Auto-ID capability is deployed. Indeed, superior product availability will become a competitive advantage and help to drive sales growth for those retailers who embrace this new capability.

At another level, the benefits of Auto-ID can be deployed “system wide”. For example, greater real-time visibility of product movement within the retail store can help both the retailer and manufacturer to better understand the root causes of product availability issues. Together, they can jointly design new processes to support improved product flow throughout the value chain. The enduring benefits will be more effective and more easily verified service level agreements and new value chain performance measures. Moreover, improved visibility creates a “virtuous circle”. As product visibility increases, the ability to hide or disguise issues will be reduced, allowing both retailers and manufacturers to collaborate openly and honestly.

Finally, within the retailer operation itself, the ability to track product movement more accurately and the related amounts of labor hours used will drive the establishment of new internal benchmarks which can then be rolled out to all stores.

**Figure 16:** Blueprint for Implementing the Product Availability Solution (at Case Level) in the Store

### 1. Backdoor Reader System

- Reads pallet-level and case-level tags as product is moved off the truck and into the backroom area
- Verifies match between pallet ID tag and cases on pallet and then updates backroom on-hand inventory quantity
- Eliminates manual steps to enable faster and more accurate receiving process

### 2. Storeroom Reader System

- Reads case tags as product goes on the sales floor
- Updates backroom and “available for sale” inventory quantities
- Real-time visibility of product availability and in-store location enables more efficient restocking to reduce out of stocks

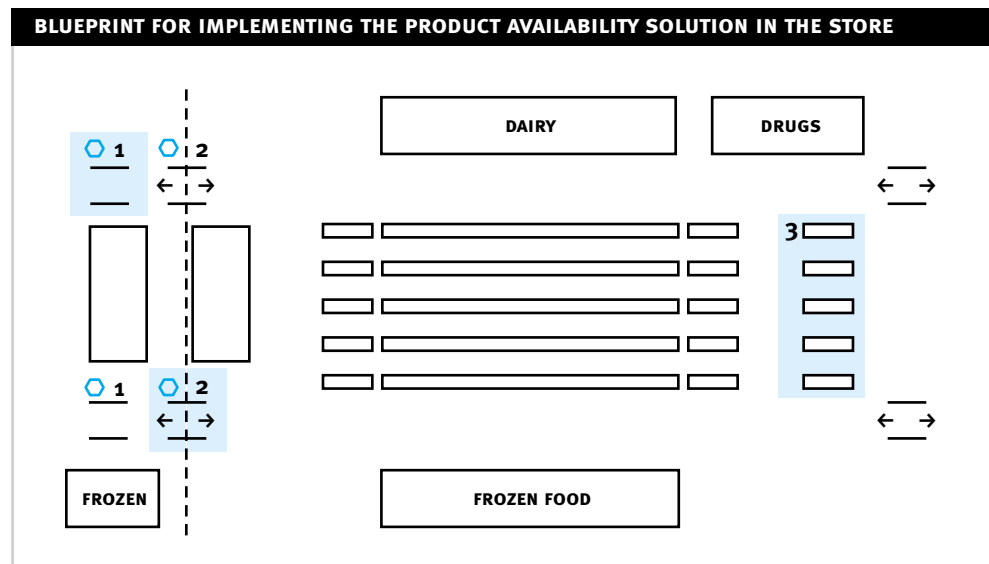
### 3. The Link to POS Data

- Real-time POS activity deducts sold quantity from the amount “available for sale”
- As target on-hand “available for sale” amount hits a pre-set minimum target, an automatic restocking order is created
- Potential OOS conditions identified real-time and restocking labor is allocated to most critical items first

Item level tracking would require implementation of readers on shelves, display aisles and at check-out counter thus increasing the implementation of the number of reader and antennas across the store.

## Technology Insight

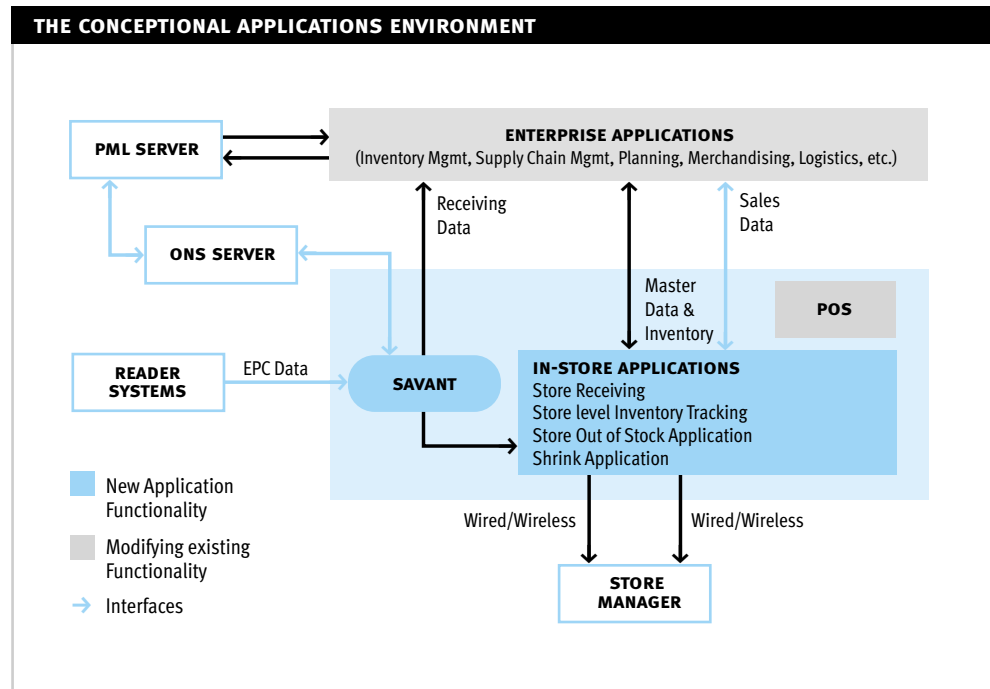
Implementing Auto-ID at the retail store level will require the store to deploy a system of readers, upgrade the infrastructure and implement the necessary software applications. The figure below (see Figure 16) depicts how product availability can be managed using case-level tagging in a retail store with the deployment of the appropriate reader infrastructure.



Item-level tagging will require a more complex network of reader-systems infrastructure to enable reading of individual items on the shelf and display counters, thus increasing infrastructure costs. Providing capabilities for shelf-level reading will further increase inventory visibility plus enable better management of shrinkage and perishables. Additionally, more sophisticated consumer-level application will be enabled with item-level identification.

True benefits of the Auto-ID environment can be obtained only if there is tight integration between the Savant and the other applications within the enterprise. Additionally, availability of near, real-time POS data will be necessary for the calculation of out of stocks at the store level. Modifications to existing systems and the development of new in-store applications will have to be made to support store receiving, inventory tracking, out of stock and shrink applications. The figure below (see Figure 17) depicts the conceptual applications environment.

Figure 17



Therefore, from a technology viewpoint, implementing Auto-ID will require retailers to assess their current technology assets, and to develop a migration and investment plan to move to the new environment. Each retailer will need to carefully design requirements related to reader systems, assess incremental storage and data mining needs, and enhance existing software applications to pave the way for Auto-ID implementation.

## 4. WHERE DO WE START?

### 4.1. Auto-ID and the Route Forward

The business case demonstrates that tagging at case level alone not only creates significant benefits for the retailer, but will pay back the technology investment even if the predicted benefits in gross margin and reduced labor dollars are not fully achieved. Significantly, the business case also demonstrates that tagging at the item level has a very favorable payback period of less than two years, despite the significant increase in infrastructure costs that comes from the addition of shelf-edge readers.

However, as stated earlier, the assumption has been that the manufacturer will bear the initial investment in the tag costs. Therefore, adoption at the item level will also depend on the attractiveness of the tag cost to the manufacturer relative to the benefits they have identified.

Even so, given the newness of the technology, we believe that grocery retailers will drive adoption first at the case level to allow appropriate testing of the technology to occur. Such an approach will also allow the retailer to better understand the requirements for legacy systems of full-scale, item-level deployment.

Case-level tagging will result in a reduction in a number of the pain points and will allow the retailer to reduce labor at a number of hand-off points. Focus on these points alone will facilitate a significant reengineering and streamlining of the manual processes involved. It will also provide the “cultural” benefit of improving store management’s belief in the accuracy of deliveries, both from their own distribution centers and from DSD vendors.

Deployment of case-level tagging is likely to be uneven – by retailer, geography and product category. Much will depend on the local balance of influence between retailers and manufacturers. Those retailers with a high proportion of private label product are likely to be the early adopters because they have greatest control of their supply chains. For example, a United Kingdom retailer is already moving to RFID crate tagging for all of its own label food products. This is a good indication of the probable evolution path for many. For retailers who have not yet embraced RFID tracking in their warehouse and distribution systems, adoption of case-level tagging offers the opportunity to leap frog over current best practice technology, and, therefore, should be their primary focus.

Success with case-level tagging could lead retailers to a “halfway house” solution combining the visibility offered by case-level tagging with replenishment applications that track sales trends and predict when items on the shelf are likely to be in danger of being “off sale.” This combination would replicate some of the visibility benefits of full item-level tagging.

However, this solution will only address the product availability application of Auto-ID, and will still require accurate on-hand inventory balances to be maintained. Item-level tagging offers a number of other applications and it is likely that retailers will vary the evolution path of adoption based on specific needs. For example, for department stores, electronics and apparel retailers, there are potentially significant benefits in terms of theft prevention. For fashion stores, the major benefits could well be in the ability to link, through Auto-ID, fixtures, products and people that improve the consumer experience. In these areas, there may be a greater emphasis on collaboration with primary manufacturers as both sides seek to design the optimum value-chain solution for the product.

## **5. CONCLUSION**

### **5.1. Answering the Challenge**

The investments in time, resources and technology made by retailers to solve the out of stocks problem are considerable. While progress has been made toward reducing the phenomenon, out of stocks continue to eat into retailers’ operating margins and to damage consumer relations.

Clearly, our research demonstrates that Auto-ID technology and processes can go a long way to alleviating the out of stocks problem. The immediate value proposition for Auto-ID tagging at the case level is particularly compelling. Crucially, the longer-term vision of item-level tagging could prove to be nearer to hand than is currently believed, given the business case we have outlined above.

In short, we believe that a foundational investment in Auto-ID is not only timely but imperative, especially to ensure that the necessary experience of Auto-ID deployment can be developed in advance of the likely proliferation of item-level tags. However, implementation will require considerable investment, dedication and cooperation, and the rewards may not be instant. Auto-ID is a recent innovation and some uncertainties related to cost and technical performance do exist, particularly regarding item-level tagging. However, as tag costs decline and system performance improves, as with virtually all technologies, the benefits that follow at every point along the value chain will be tremendous.



One only has to look at the dramatic benefits that the Universal Product Code (UPC) has provided over the past three decades to understand the value of improved tracking and product visibility. Auto-ID represents the next great step in the evolution of product tracking and visibility, and it challenges retailers to jump ahead of the curve and land squarely in the future of “real-time retailing”.

Auto-ID technology is here. The processes and standards of adoption are on the horizon and approaching rapidly. Retailers now have a choice: to stand and wait for change to overtake them or to lead change and be among the first to reap the benefits. Either way, Auto-ID must figure into any retailer’s strategic investment considerations. To ignore Auto-ID and its implications – for both individual retail operations and the entire value chain – is simply not an option.

## **APPENDIX A: BUSINESS CASE ASSUMPTIONS & WORKINGS**

### **Additional Sources**

“A Guide to Efficient Replenishment and Reducing ‘Stock Outs’ within the Grocery Industry,”  
ECR Australia, 2001, Auto-ID Center

Quantification of benefits was based on grocery industry averages.

**Average weekly sales:** \$335,242 (FMI data)

**Average gross margin:** 26.4% (FMI data)

**Average sales loss due to out of stocks:** 3% (Industry studies)

**Average number of SKUs per store:** 49,225 (FMI)

**Sales per consumer transaction:** \$23.04 (FMI)

**Average selling price per item:** \$1.75 (Industry data and PwC Consulting analysis)

**Average hourly wage:** \$10 (FMI and PwC Consulting analysis)

**Average case retail:** \$35 (Industry data and PwC Consulting analysis)

## **APPENDIX B: KEY TECHNOLOGY COST ASSUMPTIONS**

The total costs shown in the table include both non-recurring and recurring costs for a generic retail store. The non-recurring technology costs include the cost of reader systems, infrastructure and application integration. The recurring costs include the cost of maintenance and support for the reader systems and the software applications. The recurring cost of tags, however, has not been included. The assumptions around each of these different cost components are explained below.

- Reader systems costs include estimates for the cost of readers and antennas (including customization) and wiring costs.
  - Estimates have been developed using standard assumptions around the store 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 dramatically 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 store. 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-basic interfaces, modifications and incremental reporting functionality envisioned as part of this implementation. These costs have been developed assuming the retailer 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 each of the stores, and the specific training and change management needs.

- The cost of maintenance and support has been included as a recurring cost. The cost of maintenance and support has been assumed at a percentage of the reader systems and software implementation costs. Additionally, the maintenance and support costs include a reader replacement cost (as a percentage of the original implementation costs) starting in 2005.
- These costs have been developed for the “generic” store as part of the defined supply chain system. Cost of implementing this technology in an actual store environment will vary.

